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RESULTS AND CODE PREDICTIONS FOR ABCOVE AEROSOL CODE VALIDATION -- TEST AB5

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Hanford Engineering Development Laboratory

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Prepared for the U.S. Department of Energy
Assistant Secretary for Nuclear Energy
Office of Breeder Technology Projects
under Contract No. DE-AC06-76FF02170
B&R No. AF-15-40-20-5

Printed in the United States of America
Available from
DOE Technical Information Center
P.O. Box 62
Oak Ridge, TN 37830

NTIS price codes
Printed Copy: A15
Microfiche copy: A01

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R.K. Hilliard
J.D. McCormack
A.K. Postma

November 1983

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ABSTRACT

A program for aerosol behavior code validation and evaluation (ABCOVE) has been developed in accordance with the LMFBR Safety Program Plan. The ABCOVE program is a cooperative effort between the USDOE, the USNRC, and their contractor organizations currently involved in aerosol code development, testing or application. The first large-scale test in the ABCOVE program, AB5, was performed in the 850-m^3 CSTF vessel using a sodium spray as the aerosol source. Seven organizations made pretest predictions of aerosol behavior using seven different computer codes (HAA-3, HAA-4, HAARM-3, QUICK, MSPEC, MAEROS and CONTAIN). Three of the codes were used by more than one user so that the effect of user input could be assessed, as well as the codes themselves. Detailed test results are presented and compared with the code predictions for eight key parameters.

ACKNOWLEDGMENTS

The work covered by this report represents the cooperative efforts of many people in a number of organizations. Computer code predictions were made by U.S. Department of Energy contractor organizations (General Electric Co, Hanford Engineering Development Laboratory and Rockwell International) and by Nuclear Regulatory Commission contractors (Battelle Columbus Laboratories, Oak Ridge National Laboratory, and Sandia National Laboratories). Valuable advice on planning the experiment was provided by the multilaboratory participants. The test was performed and reported by the Safety Systems Development group at HEDL, L. D. Muhlestein, Manager. Test performance was sponsored by the U.S. Department of Energy, Office of Reactor Research and Technology, Safety and Physics Division, under the coordination of the Fast Reactor Safety Technical Management Center at Argonne National Laboratory.

The successful completion of the planning, pretest code predictions, test performance and analyses and post-test code predictions on a timely schedule was possible because of the excellent cooperation and adherance to schedules exhibited by all the program participants. The authors wish to express particular appreciation to the following individuals:

H. Alter	U.S. Department of Energy
L. Baker	Fast Reactor Safety/Technical Management Center
E. Gluekler	General Electric Company
H. Jordan	Battelle Columbus Laboratories
J. Larkins	U.S. Nuclear Regulatory Commission
K. Murata	Sandia National Laboratories
J. Otter	Rockwell International, Energy Systems Group
M. Piepho	Hanford Engineering Development Laboratory
M. Tobias	Oak Ridge National Laboratory

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1.0 INTRODUCTION

A program for aerosol behavior code validation and evaluation (ABCOVE) has been developed in accordance with the LMFBR Safety Program Plan. The ABCOVE program is a cooperative effort between the U.S. Department of Energy, the U.S. Nuclear Regulatory Commission, and their contractors currently involved in nuclear aerosol code development, testing or application. A series of large-scale confirmatory tests are to be performed in the 850-m^3 Containment Systems Test Facility (CSTF) vessel covering a range of aerosol source release rates, source duration times, and complexity of aerosol composition. The procedure for each test will be carried out in three stages: planning and pretest computer code predictions, test performance and analysis, and comparison of code predictions with the experimental measurements.

There is no substitute for experimental validation of computer codes. However, when experiments cannot be performed under the full range of plant accident conditions postulated for analysis (including size scale), the experiments must demonstrate that all the controlling aerosol behavior mechanisms have been properly modeled and that assumptions used in the modeling are valid. A considerable body of experimental data on aerosol properties and behavior in closed vessels is already available, much of which was generated in the LMFBR technology program. A state-of-the-art report by an international group of experts of the Nuclear Energy Agency, Committee on the Safety of Nuclear Installations (CSNI), Organization for Economic Cooperation and Development(1) gives a good summary of the data base, most of which was obtained in small vessels. Some of the conclusions and recommendations of the CSNI group, relative to experimental confirmation of aerosol codes, were:

- pre-test predictions should be made of selected ongoing tests,
- the validity of the aerosol coagglomeration assumption should be verified experimentally,

- experimental confirmation of models for behavior of aerosol from several overlapping sources is not yet adequate. Data should be provided for large containment volumes with sources of different nature and duration in the same test, and

- experimental studies of high mass concentration aerosols in containments are needed.

Gieseke et al.,[2] concluded from dimensional analysis that models which properly account for all important physical processes can account for size scale. This is an encouraging finding, since, if verified, it gives confidence in scaling experiments performed in practically sized facilities to full-sized reactor plants. Gieseke et al.,[2] also concluded that aerosol behavior under postulated severe LMFBR accident conditions is controlled by agglomeration and settling. Therefore, confirmatory experiments should be performed under conditions where those mechanisms are controlling.

Jordan et al.,[3,4] compared an aerosol code (HAARM-3)[5] which uses the simplifying assumption of a log-normal particle size distribution with a more rigorous code (QUICK)[6] which uses discrete particle size groups and concluded that for a very intense aerosol source (high mass concentration), codes which use the assumption of log-normal particle size distribution predict very different (and not necessarily conservative) results from those of discrete codes. They concluded that future tests should include very intense source terms.

This report describes the first confirmatory test in the ABCOVE program, test AB5, and compares the computer code predictions with the experimental measurements. The primary objective of test AB5 was to provide experimental data on aerosol behavior for use in validating aerosol behavior computer codes for the case of a moderate duration, strong aerosol source generated by a sodium spray in an air atmosphere. A secondary objective was to provide experimental data on the temperature and pressure response of the containment vessel and its atmosphere, for use in validating containment response codes such as SPRAY[7] and SOMIX.[8]

2.0 SUMMARY AND CONCLUSIONS

The first test in the ABCOVE series (AB5) was performed by spraying sodium into an air atmosphere in the 850-m^3 Containment Systems Test Facility (CSTF) vessel. Two hundred twenty three (223) kg of sodium were sprayed over a period of 872 seconds, with all of the sodium being converted to a Na_2O_2/NaOH aerosol. The maximum containment pressure and mean atmospheric temperature attained was 214 kPa absolute (31.0 psia) and 280°C (534°F), with local temperatures reaching 570°C (1058°F). The maximum suspended mass concentration measured was 170 g/m^3, attained at 383 seconds after initiation of sodium spray. The suspended concentration then decreased to a steady-state value of 110 $\pm$ 17 g/m^3 for the duration of the spray period. These conditions are conducive to high aerosol agglomeration and settling rates.

Pretest computer code predictions were made by seven ABCOVE program participants representing USDOE and USNRC contractor organizations. The codes used were HAA-3,(9) HAA-4,(10) HAARM-3,(5) QUICK,(6) MSPEC,(11) MAEROS,(12) and CONTAIN.(13) Each of these codes has unique differences in its modeling of physical processes, approach used for solution of the integro-differential aerosol agglomeration equation, capability of accounting for multiple aerosol species, and stage of development. Each code has its advantages and limitations. Three of the codes were used by more than one user so that the effect of user-selected input data could be assessed.

The actual test conditions deviated slightly from the test plan on which the pretest predictions were based. Therefore, an interim report was sent to the participants stating the actual conditions, and "blind" post-test predictions were made based on the actual sodium spray rate and thermal conditions. The blind post-test predictions were made without knowledge of the test measurements of aerosol behavior. No effort was made to improve the agreement of code and test results by post-test adjustment of input parameters, such as particle shape factors and source particle size.

Each code user reported the predicted magnitude of eight output parameters which describe aerosol behavior. The reported parameters include: suspended mass concentration, aerodynamic mass median diameter of suspended aerosol, geometric standard deviation of particle size distribution, settling mean diameter, leaked mass, settled mass, plated mass, and instantaneous combined removal rate.

Specific conclusions and summary statements supported by the reported work are as follows:

1) All eleven code cases resulted in predictions of leaked mass that were within a factor of 2.3 of the experimental value. Leaked mass is an important parameter because it relates to the release of radionuclides and thus to offsite radiological consequences for accident cases where the containment building integrity is maintained. By this measure, all of the code cases were reasonably realistic and usable for accident analyses.

2) Codes which represent the particle size distribution by a discrete distribution over a number of size channels (often termed discrete codes) generally predicted the test AB5 aerosol behavior more accurately than codes which assume a log-normal size distribution. This was especially true for times after cessation of the aerosol source.

3) Different users of the same code arrived at significantly different predictions for the same given test conditions. This was possible because certain code input parameters (e.g., shape factors) were not specified in the test plan, but were left to the discretion of the code user. This is illustrated by differences in suspended mass concentrations predicted by three different users of the HAARM-3 code at 2000 seconds. The highest and lowest predictions differ by a factor of 2.6×10^5. The high estimate overpredicts the test measurement by a factor of 3.9 and the low

estimate underpredicts the experiment by a factor of 1.5×10^{-5}. A third HAARM-3 case falls between these extremes. A second graphical illustration of differences due to user-selected input is the plated mass predicted by the QUICK code. The high estimate was 8.7 times greater than the experimental value and the low estimate was only 0.02 of the measured value. It is suggested that each user tune the code by comparison with available test data to correct for improper input and to detect the presence of "bugs" before attempting to predict new cases.

4) The measured suspended mass concentration peaked at 170 g/m^3 at $\sim$400 seconds and then decreased to 110 g/m^3 during the remainder of the source release period. Only two codes (HAA-3 and CONTAIN/MAEROS) predicted this type of behavior. At the end of the source period, the ratio of predicted to measured concentration varied from a minimum value of 0.49 to a maximum of 3.1. After the source termination, the measured concentration decreased rapidly and monotonically to a value of 1.5×10^{-4} g/m^3 at 4×10^5 seconds. Only the discrete codes were able to predict the concentration with reasonable accuracy during the period after termination of source. For example, the CONTAIN code agreed within 5% at the end of the source period and was within 70% at 4×10^5 seconds, an excellent agreement.

5) Particle size distributions measured by cascade impactors showed that the aerodynamic mass median diameter (AMMD) reached a maximum value of 7.3 μm at $\sim$200 s and then decreased to a steady-state value of 5.5 μm for the remainder of the source period. Following source termination, the measured AMMD quickly increased to $\sim$20 μm and then decreased with time. The discrete codes, as a group, underpredicted the AMMD, whereas the log-normal codes mostly overpredicted the AMMD for times >300 s. The discrete codes generally yielded more accurate estimates of particle size throughout the test than did the log-normal codes.

6) Sedimentation was by far the dominant aerosol depletion process in test AB5. Settled mass was 24 times greater than plated mass, even though plating wall area was 8.5 times greater than upward facing horizontal surface area. Deposited mass surface concentration on upward facing surfaces was 180 times greater than on vertical wall and ceiling surfaces at the end of the test. Although all of the codes showed that sedimentation was dominant, the predicted mass plated varied from 0.02 to 10 times the measured value. The overprediction of plated mass appeared to result from an overprediction of thermophoretic deposition. Reasons for the underpredictions have not been explored. Predictions of plated mass by the CONTAIN code agreed best with the test results, being within 7% at the end of the test.

7) An apparent generic limitation with all seven codes was their inability to predict the agglomeration which occurs in the high concentration plume near the burning sodium. All the codes assume that the particles are instantaneously and homogeneously mixed throughout the containment volume as they are generated. Agglomeration that occurs in the region of formation is apparently not negligible. For example, at 100 s, the measured AMMD was 4.0 μm, whereas the closest code prediction (QUICK) was 1.9 μm. While this early agglomeration did not govern the longer term aerosol behavior in test AB5, such agglomeration may be significant for other cases.

8) Test AB5 did not provide information on the capability of the codes to account for more than one aerosol species. Although all of the codes in general adequately predicted the behavior of the sodium combustion product aerosol, their adequacy for predicting multiple species, e.g., fission product elements in the presence of burning sodium, was not tested. Future ABCOVE tests are planed to address this problem.

9) Data on containment thermal response are reported in sufficient detail for use in validating containment response codes such as SPRAY and SOMIX-2. However, the sodium burning rate was not measured because the sodium spray drops were small and they burned to completion before impacting structural surfaces. A comparison of experiments with containment response codes was beyond the scope of the present work.

10) The comparisons of aerosol code predictions with experimental results of a single test, such as test AB5, are not sufficiently comprehensive to allow one to judge the inherent capabilities of the codes employed in the ABCOVE program. Additional comparisons with past and future experiments and a consideration of how the code is to be used and for what purpose are required for such an evaluation. However, test AB5 provides an important checkpoint for validating aerosol codes under conditions representative of a severe accident involving a high aerosol generation rate.

3.0 EXPERIMENTAL FACILITY AND PROCEDURE

3.1 FACILITY DESCRIPTION

The test was performed in the Containment Systems Test Facility (CSTF). The chief feature of the CSTF is the model containment vessel which is located within a ventilated concrete building. Other features include a sodium supply system, instrumentation systems, control room and data acquisition system, data reduction and analysis systems, chemical laboratory rooms, utility services, maintenance shop and offices.

3.1.1 Containment Vessel

The CSTF containment vessel (CV) is a 850-m^3 (30,000-ft^3) carbon steel vessel with a design pressure of 0.517 MPa gauge (75 psig). It is installed in a concrete pit with the top half extending above the elevation of the main building working area, as shown by the schematic elevation view in Figure 1. All interior surfaces are coated with a modified phenolic paint, and exterior surfaces are covered with a 25.4-mm layer of fiberglass insulation with an outer aluminum vapor barrier. Additional details of the containment vessel are provided in Table 1.

3.1.2 Sodium Spray System

Commercial grade sodium, procured in 400-lb solid pack drums, was melted in a portable clam shell heater and charged into the sodium supply tank. The properties of the sodium supply tank are listed in Table 2. The supply tank was suspended from a load cell so that the combined weight of tank and sodium could be measured. Approximately 31 m of Schedule 40 1/2-in. pipe connected the tank to the spray nozzle, as shown in Figure 1. Two valves and a magnetic flowmeter were located in the sodium line.

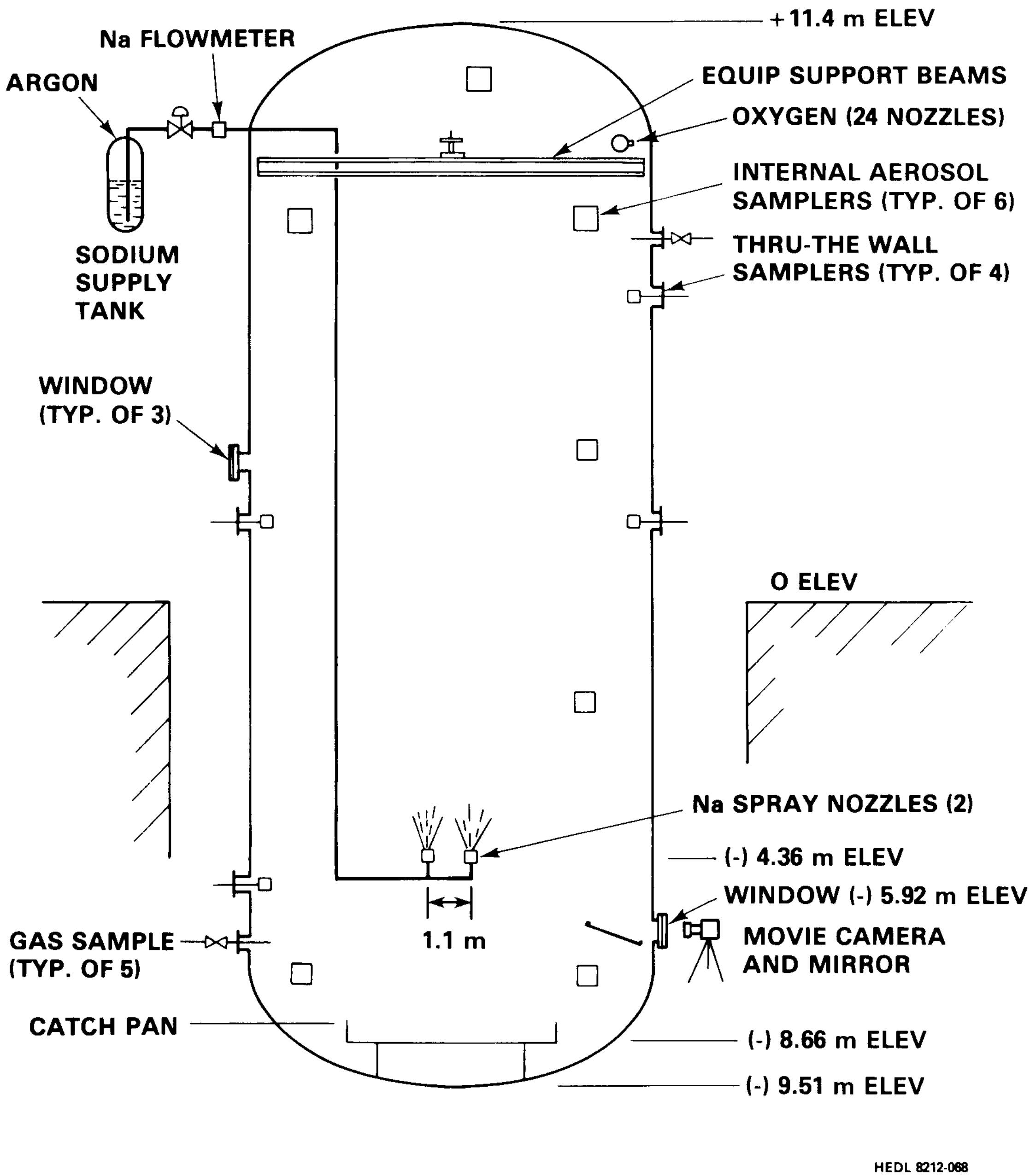

FIGURE 1. Schematic Elevation View of the CSTF Containment Vessel Arrangement for Test AB5.

TABLE 1

CSTF CONTAINMENT VESSEL PROPERTIES

General		
Code	ASME Section VIII, 1962	
Material	Carbon Steel, SA 212-B	
Interior paint (phenolic)	0.51 mm (0.020 in.)	
Exterior thermal insulation	Fiberglass, 25 mm thick, k = 0.0467 W/m°C @ 100°C	
Design pressure	0.517 MPa at 160°C (75 psig at 320°F)	
Nominal leak rate	1.0% per day	
Dimensions		
Diameter (ID)	7.62 m	(25.0 ft)
Overall height	20.3 m	(66.7 ft)
Cylinder height	16.5 m	(54.0 ft)
Enclosed volume	852 m^3	(30,086 ft^3)
Weight, kg (lb)		
Top head	8,753	(19,300)
Bottom head	8,753	(19,300)
Cylinder	69,390	(153,000)
Penetrations and doubler plates	10,295	(22,700)
Catch pan	500	(1,000)
Internal components	5,580	(12,300)
Total Weight	103,260	(227,700)
Surface Areas for Heat Transfer, m^2 (ft^2)		
Top head	63.0	(678)
Bottom head	63.0	(678)
Cylinder	394	(4242)
Total area for heat transfer to environs	520	(5598)
Internal components	232	(2500)
Surface Areas for Aerosol Settling, m^2 (ft^2)		
Bottom head	36.7	(395)
Catch pan	11.1	(120)
Personnel deck	4.2	(45)
Internal components	36.2	(390)
Total	88.3	(950)
Surface Areas for Aerosol Plating, m^2 (ft^2)		
Vessel shell	520	(5598)
Internal components	232	(2500)
Total	752	(8098)

TABLE 1 (Cont'd)

Thickness for Heat Transfer, mm (in.)

(Average lumped values)*		
Top head	18.1	(0.712)
Bottom head	18.1	(0.712)
Cylinder	22.9	(0.901)
Internal components	3.4	(0.134)

$$\text{*Average Thickness} = \frac{\text{Weight}}{\text{(area) (density of steel)}}$$

TABLE 2

PROPERTIES OF CSTF SODIUM SUPPLY TANK

Code	*ASME B&PV Code, Section VIII, 1976
Design pressure	0.517 MPa gauge at 650°C
Material	SS 304 H
Wall thickness	12.7 mm (0.5 in.)
Weight	953 kg (2105 lb)
Volume	1.89 m^3 (500 gal)
Diameter	914 mm (36 in.)
Overall height	2990 mm (9.8 ft)
Orientation	Vertical
Heating	60 kw band heaters
Insulation	200 mm Kaowool® blanket

*Built to intent of code.

®Registered trademark of Babcock & Wilcox Refractories Division, Augusta, GA.

Two sodium spray nozzles were installed in the containment vessel at the -4.36 m elevation (4.2 m above the catch pan). The nozzles were hollow cone type* oriented to spray in the upward direction. Additional details of the sodium spray system are listed in Table 3.

TABLE 3

SODIUM SPRAY SYSTEM CHARACTERISTICS

Number of nozzles	2
Nozzle orientation	upward
Sodium temperature	563°C
Pressure drop across nozzle	200 kPa (29 psi)
Sodium spray rate	265 g/s
Nozzle distance above catch pan	4.2 m
Nozzle orifice diameter	5.51 mm
Spray angle	72°

3.2 EXPERIMENTAL MEASUREMENTS

The methods and instrumentation for the experimental measurements used in this work have been described previously.[14] The measurements are summarized in Table 4.

3.2.1 Aerosol Characterization

The careful characterization of the test aerosol was an important part of the present work. The suspended mass concentration, the particle size distribution, and the chemical composition were measured periodically by direct sampling at various times and locations throughout the tests. In addition, some information on shape and size was obtained by electron microscopy.

*Spraying Systems Co., Wheaton, IL 60187, Catalog No. 3/8BA15.

TABLE 4

EXPERIMENTAL MEASUREMENTS AND ACCURACY

Measurement	No. of Locations	No. of Times	Standard Error	Method
Suspended aerosol mass concentration	6	1	± 25%	In-vessel filter clusters
Suspended aerosol mass concentration	4	52	± 15%	Through-the-wall samplers
Aerosol particle size and σ_g	3	16	± 20%	Cascade impactor
Aerosol particle size (actual)	1	2	N/A	Electron microscopy, sizing
Aerosol particle shape	1	2	N/A	Electron microscopy
Aerosol chemical composition	1	5	N/A	Various; Chemistry Lab.
Aerosol instantaneous deposition rate	1	9	± 20%	Through-the-wall coupons
Integral settled mass/unit area	23	1	± 10%	Fall-out pans
Integral plated Na on vessel walls per unit area	7	1	± 20%	Vessel wall smears
Aerosol settled/unit area during Na spray period	1	2	± 25%	Special samplers
Na mass deposited in catch pan	1	1	± 10%	Wash and analyze for Na
Total settled Na mass	1	1	± 10%	Wash vessel floor
Total Na wall plateout	1	1	± 30%	Wash vessel walls
Temperature of containment atmosphere	28	(a)	± 2%	Thermocouples
Temperature of vessel surface	18	(a)	± 2%	Thermocouples
Temperature of Na sprayed	2	(a)	± 2%	Thermocouples
Containment pressure	1	(a)	± 1%	Pressure Transducer
Containment O_2 concentration	5	(a)	± 2%	On-line O_2 analyzer
Containment H_2 concentrations	5	(a)	± 20%	On-line H_2 analyzer
Containment moisture concentration	2	(a)	± 30%	On-line humidity analyzer
Convection velocity	1	5	Unknown	Anemometer
Sodium Spray mass flow rate	1	(a)	± 10%	Magnetic flowmeter and load cell
Overall Na mass balance	N/A	1	± 10%	Weighing, washing, volume, chem. analysis, calculation

(a) Continuous

The mass concentration of suspended particles was measured as a function of time by periodically passing a measured quantity of gas through small filters located directly in the containment atmosphere and subsequently analyzing the material collected on the filter for total mass and for Na. Two types of sampling techniques were used: in-vessel filter clusters located at different elevations and radii, and through-the-wall samplers inserted and retrieved through air locks on the vessel wall. The locations of the six in-vessel clusters and the four through-the-wall sampling stations are given in Table 5.

TABLE 5

FILTER SAMPLE LOCATIONS

Station No.	CV Nozzle No.	Elevation (m)	Azimuth (deg)	Radius (m)
Through-the-wall				
T1	N2A	+ 6.1	255	3.73
T2	N3A	+ 1.5	290	3.73
T3	N33	+ 1.37	135	3.73
T4	N17A	- 5.8	85	3.73
In-vessel Clusters				
C1	--	+ 9.45	240	1.43
C2	--	+ 6.70	270	2.74
C3	--	+ 3.66	270	2.74
C4	--	+ 0.30	180	2.74
C5	--	- 3.05	180	2.74
C6	--	- 6.70	180	2.74

The aerodynamic size distribution was determined by sampling with cascade impactors inserted through the wall. Two types of cascade impactors were used: Andersen Mark III 8-stage* and Sierra model 225 6-stage.** Previous tests have shown that these instruments give good agreement when proper calibration data are applied. Glass fiber collection surfaces provided by the manufacturers were used.

Chemical identification of the aerosol was determined at various times during each test by collecting aerosol on a membrane filter paper*** at a wall station and analyzing for various chemical species by x-ray diffraction and wet chemistry. The sample was protected from ambient atmosphere to minimize chemical changes that might occur after the sample was taken.

The instantaneous deposition rate of particles was measured by exposing coupons in a horizontal orientation for brief periods at a through-the-wall station. The top surface of the coupon was washed and the rinse water analyzed for sodium. The deposition rate was calculated as a total mass flux of particles. No information was obtained on settling as a function of particle size by this technique. The "deposition velocity" was calculated by dividing the flux by the airborne concentration.

Additional information regarding the CSTF aerosol characterization methods is provided in Reference (14).

3.2.2 Temperature Measurements

All temperatures were measured by calibrated Chromel-Alumel® thermocouples with stainless steel sheaths. Readout was in parallel on strip chart recorders, magnetic tape, and paper tape. The locations of the thermocouples are listed in Appendix A.

---

*Andersen Samplers, Inc., Atlanta, GA.
**Sierra Instruments Co., Inc., Carmel Valley, CA.
***Mitex, manufactured by the Millipore Corp., Bedford, MA.
®Chromel-Alumel is a registered trademark of Richmond Machine Products Corp., Staten Island, NY.

3.2.3 Pressure Measurement

The absolute and gauge pressure in the containment vessel was measured by a pressure transducer and a Heise gauge. In addition, the differential pressure between the cover gas in the sodium supply tank and the containment atmosphere was measured by a differential pressure transducer.

3.2.4 Oxygen Injection System

A flow diagram of the oxygen injection system is shown in Figure 2. It consisted of 10 standard 1A gas bottles manifolded to a 1-in. pipe line leading to a 360° manifold located at the top of the containment vessel. The CV manifold had 24 equally spaced nozzles approximately 0.5 m from the CV wall and oriented so that flow was directed horizontally toward the CV wall. A recording turbine flowmeter measured the oxygen flow rate.

3.2.5 Gas Analysis System

The composition of the containment gas was measured continuously at five locations by pulling samples through tubing to on-line analyzers located ex-vessel. Filters were provided at the tube inlet to prevent aerosol from entering the analyzers. The locations of the gas sample points are shown in Table 6. A few grab samples were taken for subsequent analysis by mass spectrometry.

3.2.6 Data Acquisition System

Many of the key experimental measurements were made manually and periodically, e.g., filter samples, cascade impactor-samples, electron microscope samples, and samples for chemical analyses. The data associated with these manual samples were logged by technicians onto data sheets or recorded in notebooks.

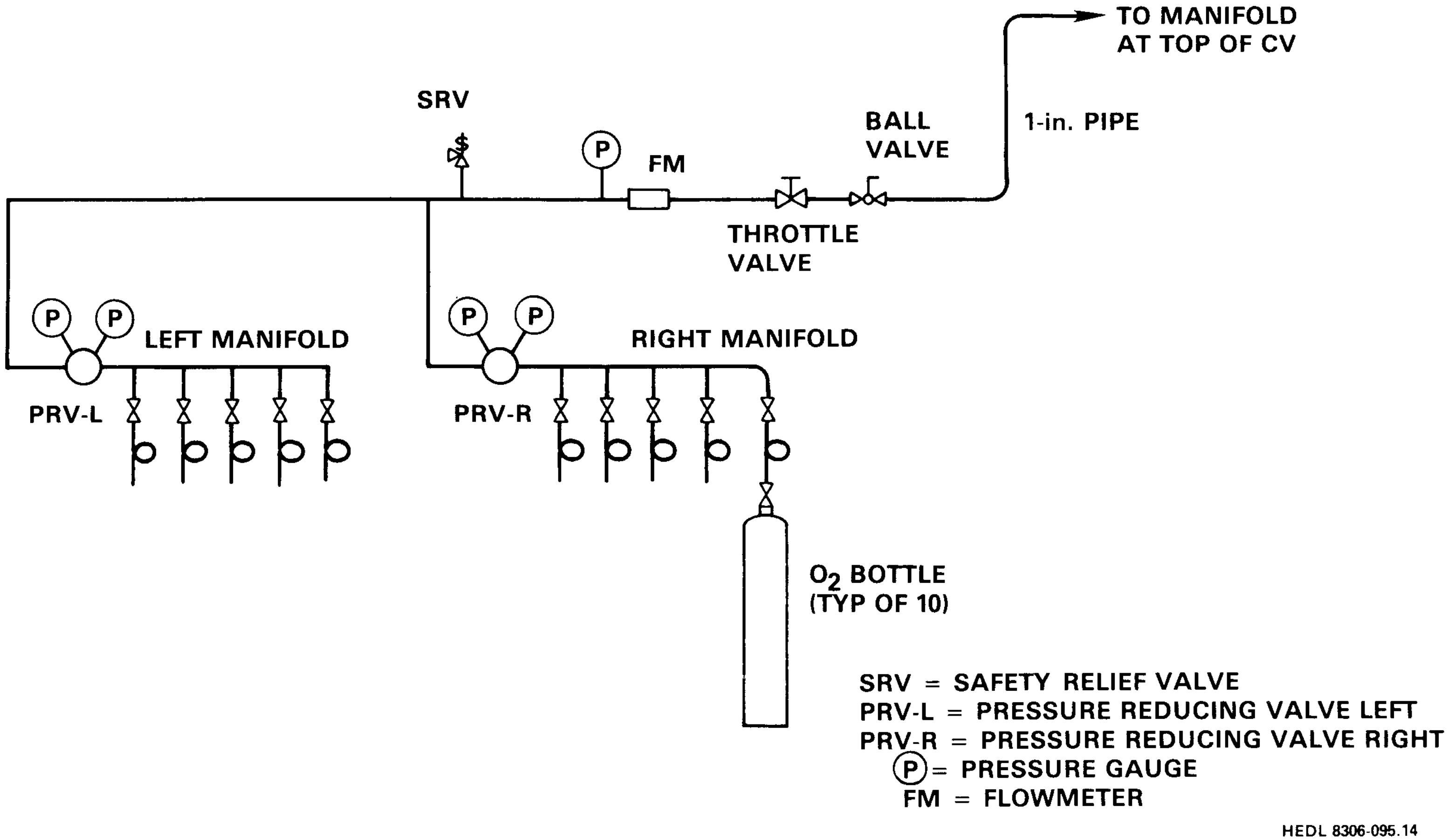

FIGURE 2. Schematic Diagram of Oxygen Injection System.

TABLE 6

GAS SAMPLE LOCATIONS

Gas Sample Point No.	Elev (m)	Aximuth (deg)	Radius (m)	Gas Analyzed
G1	+ 6.1	255	3.5	O_2, H_2, dew point
G2	- 6.7	10	3.5	O_2, H_2, dew point
G3	- 4.9	CL*	CL	O_2, H_2
G4	- 0.9	CL	CL	O_2, H_2
G5	+ 8.8	CL	CL	O_2, H_2

*CL = centerline of containment vessel

The on-line instrumentation included thermocouples, pressure transducers, sodium flowrate meter, sodium supply tank load cell, and gas analyzers for O_2, H_2 and water vapor. The output of these sensors was recorded in parallel on strip chart recorders and on a 120-channel digital data acquisition system (DAS)*. For test AB5, 108 channels were recorded on magnetic tape every 9.0 seconds initially, with decreasing frequency at later times. Information on identification of data recorded on each DAS channel is provided in Appendix A. Digital output for all channels for the initial 90 minutes is presented in Appendix B. For times greater than 90 minutes, the measured parameters changed more slowly, and summary tables of temperature and pressure data extending to 6 days are presented in Appendix C.

3.3 CHEMICAL ANALYSES

Filter papers from cascade impactors, through-the-wall aerosol concentration samplers, and in-vessel filter clusters were analyzed for sodium by either acid titration or emission spectrometry. Appropriate blank corrections were

*John Fluke Manufacturing Co., Inc., Mountlake Terrace, WA 98043, Datalogger Model 2240.

made to account for background sodium in the filter paper and demineralized water. Approximately half of the filter papers were weighed before and after exposure to aerosol to determine the total mass of aerosol on the paper. Chemical forms of aerosol were determined by performing a combination of chemical techniques, including x-ray diffraction, chromatography, and wet chemistry for metallic Na, Na_2O_2 and CO_2 content.

3.4 EXPERIMENTAL PROCEDURE

The following key activities were performed during test AB5:

- Preparation of a Test Plan describing the intended test conditions.
- Pretest computer code predictions.
- Preparation of detailed Test Operating Procedures.
- Installation and calibration of instruments and sodium spray systems.
- Pretest photography.
- Drying of the CV to constant, normal humidity.
- Sealing the vessel so that it was essentially leak-tight.
- Inject oxygen to 23.3% O_2.
- Inject air to establish desired pretest pressure (0.122 kPa absolute).
- Charge sodium to sodium supply tank and preheat to test temperature (564°C).
- At time zero (t_0), initiate sodium flow to spray nozzles by opening isolation valve in sodium line.
- Motion picture of sodium spray by camera located ex-vessel looking through window.
- Maintain constant pressure drop across spray nozzles by adjusting the sodium supply tank cover gas pressure.
- Inject oxygen throughout the sodium spray period.

- Test measurements made according to Section 3.2.
- Sodium spray terminated by closing isolation valve in sodium line.
- Continue to make test measurements for six days.
- At t = 1740 minutes, 13 m^3 (STP) of air injected to keep CV pressure positive.
- At t = 3200 minutes, 42 m^3 (STP) of air injected.
- At t = 4582 minutes, the containment atmosphere was recirculated through a filter at 0.9 m^3/s for 24 minutes to measure resuspended aerosol mass.
- At t = 4625 minutes, 20 m^3 of air injected.
- At t = 8560 minutes, CV door opened and samples of floor deposit were taken.
- At t = 8565 minutes, a purge of the CV with 54% R.H. air was started.
- At t = 8630 minutes, personnel entered the CV for photography and sampling.
- At t = 8710 minutes, end of post-test examination and beginning of cleanup and material balance operations.
- Chemical analyses of samples performed.
- Data reduction and engineering analyses performed. Interim report of test conditions issued.
- Blind post-test computer code predictions performed.
- Comparisons made of code predictions with experimental results.

3.5 TEST CONDITIONS

The test conditions for test AB5 are summarized in Table 7.

TABLE 7

SUMMARY OF TEST CONDITIONS FOR TEST AB5

Test Condition	Value
Initial Containment Atmosphere	
Oxygen concentration	23.3 $\pm$ 0.2 vol %
Temperature, mean	29.1°C (84.5°F)
Pressure	0.122 kPa (17.7 psia)
Dew point	16 $\pm$ 2°C (61°F)
Nominal leak rate	1% per day at 10 psig
Sodium Spray	
Sodium spray rate	256 $\pm$ 15 g/s
Spray start time	13 s
Spray stop time	885 s
Total Na sprayed	223 $\pm$ 11 kg
Sodium temperature	563°C
Spray drop size, MMD	1030 $\pm$ 50 μm
Spray size geom. std. dev.	1.4
Oxygen Concentration	
Initial O_2 concentration	23.3 $\pm$ 0.2 vol %
Final O_2 concentration	19.4 $\pm$ 0.2 vol %
Oxygen injection start	t = 1 minute
Oxygen injection stop	t = 14 minutes
Total O_2 injected	47.6 std. m^3
Containment Conditions During Test	
Maximum average atmosphere temperature	279°C (534°F)
Maximum average temperature of steel vessel	93.5°C (200°F)
Maximum pressure (absolute)	213.9 kPa (31.0 psia)
Final dew point	-1.5°C (29°F)
Aerosol Generation	
Generation rate, g/s as aerosol	445
Mass ratio, total to Na	1.74
Material density, g/cm^3	2.50
Initial suspended concentration	0

4.0 EXPERIMENTAL RESULTS

4.1 GENERAL OBSERVATIONS

Zero time for test AB5 was defined as the instant that the isolation valve in the sodium spray line began to open. It occurred at 10:20:00 on September 14, 1982. Sodium begin to exit the spray nozzles 13 seconds later. Figure 3 was taken from a motion picture film. It is a view of the two spray nozzles 0.5 s after the first appearance of drops, showing that both nozzles started spraying essentially instantly after arrival of sodium at the nozzles. The sprays were fully developed within one second after beginning of spray.

Compressed air was injected at several times late in the test to make up for sampling losses and to prevent the containment pressure from going negative. The injection times and quantities are listed in Section 3.4.

The containment vessel was kept sealed until t = 8560 minutes when the personnel access door was opened for sampling of the floor deposit. Figure 4 is a view of the entry port showing the undisturbed deposited aerosol. The can in Figure 4 is one of the many deposition trays located at various locations throughout the vessel. Aerosol was deposited on all surfaces, but the deposit thickness on upward facing horizontal surfaces was much greater than on horizontal surfaces. Figure 5 shows a sample of floor deposit being scooped from the personnel entry, where the aerosol had settled to a depth of ~6.5 mm. The color of the deposited aerosol was generally light tan, but a thin white layer was at the top surface. Vertical surfaces of interior structures, e.g., ladders, railing and deposition trays, were not coated uniformly, but were mottled, with closely packed spots of 3 to 10 mm diameter which extended 2 to 3 mm away from the surface. The space between the spots was covered by a thin film of deposited aerosol. The pattern of the deposit on vertical surfaces was similar to that observed in previous tests,[15,16] and is indicative that a deposition mechanism other than Brownian diffusion or thermophoresis was important in this experiment.

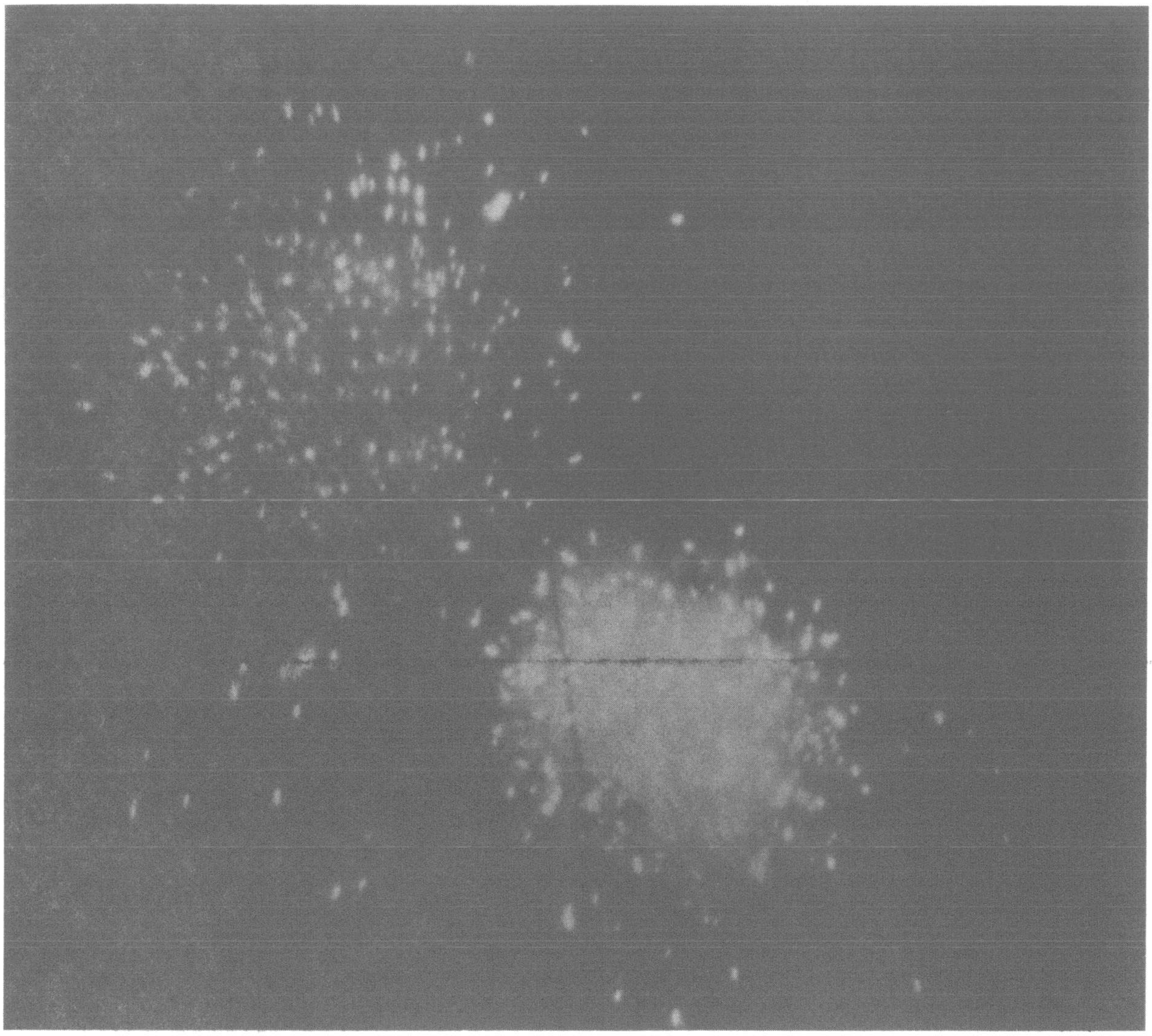

FIGURE 3. View of Sodium Spray Nozzle 0.5 Second after Beginning of Spray. Neg 8208239-8

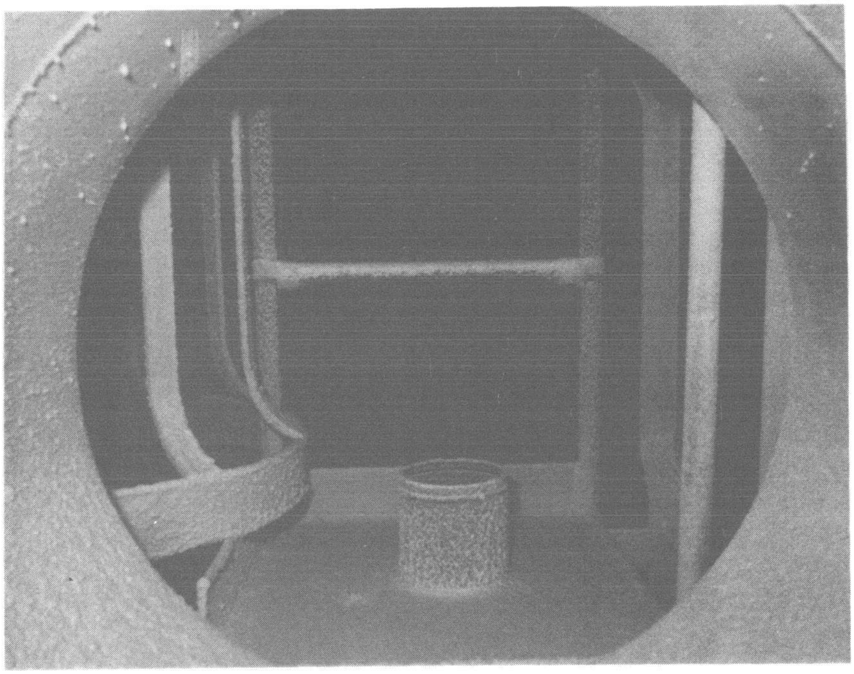

FIGURE 4. View of Personnel Entry Port Immediately after Opening Containment Vessel Door. Neg 8206326-13cn

FIGURE 5. View Showing Floor Deposit Being Sampled. Neg 8206326-15cn

The general post-test appearance of the interior surfaces of the containment vessel was that the aerosol deposit was much thicker on all horizontal upward facing surfaces than on vertical surfaces. This can be seen in Figures 6 and 7, which show views of the bottom and top domes, respectively. It was noted that the visual appearance of surfaces which had been coated with a very thin layer of aerosol changed after exposure to humid air, with the deposit becoming nearly invisible. Surfaces with a thicker deposit did not change appearance as rapidly. This phenomenon was probably caused by adsorption of water vapor and conversion to sodium hydroxide solution.

The data logger output for the first 90 minutes is listed in Appendix B in digital form. Data for longer time periods are given in Appendix C and in the text.

4.2 SODIUM SPRAY OPERATIONS

4.2.1 Spray Timing

As discussed in Section 4.1, time zero (t_0) was defined as the instant that the sodium supply line isolation valve began to open. Sodium spray began 13 seconds later and full flow was established within the next second. The isolation valve was closed at 885 seconds after t_0, terminating the sodium spray at that time.

4.2.2 Spray Rate

The sodium spray rate averaged 256 g/s throughout the 872-s spray period, as determined by calibrated load cell measurements of the weight of the sodium supply tank. The load cell readings are shown as a function of time in Figure 8. The momentary high flowrate at the beginning of the flow period was caused by rapid filling of the empty downstream pipe. Some of the irregularity of the measurement shown in Figure 8 is believed to be due to hysteresis. The data of Figure 8 show that the sodium flow rate was essentially linear.

FIGURE 6. Post-test View of Bottom Head of Containment Vessel Showing Floor Deposit. Neg 8206326-3cn

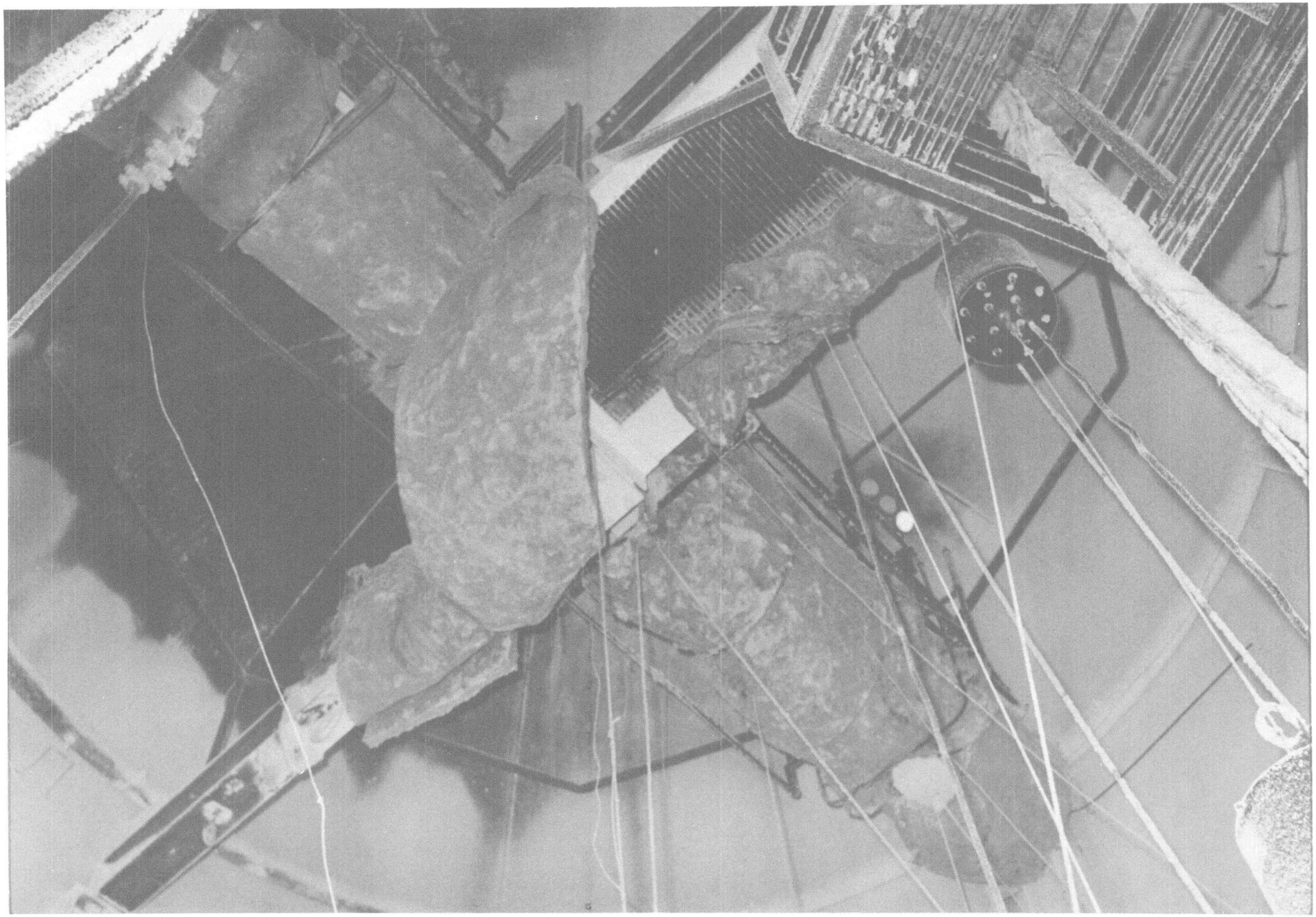

FIGURE 7. Post-test View Looking Upward Toward Top Dome. Neg 8206326-2cn

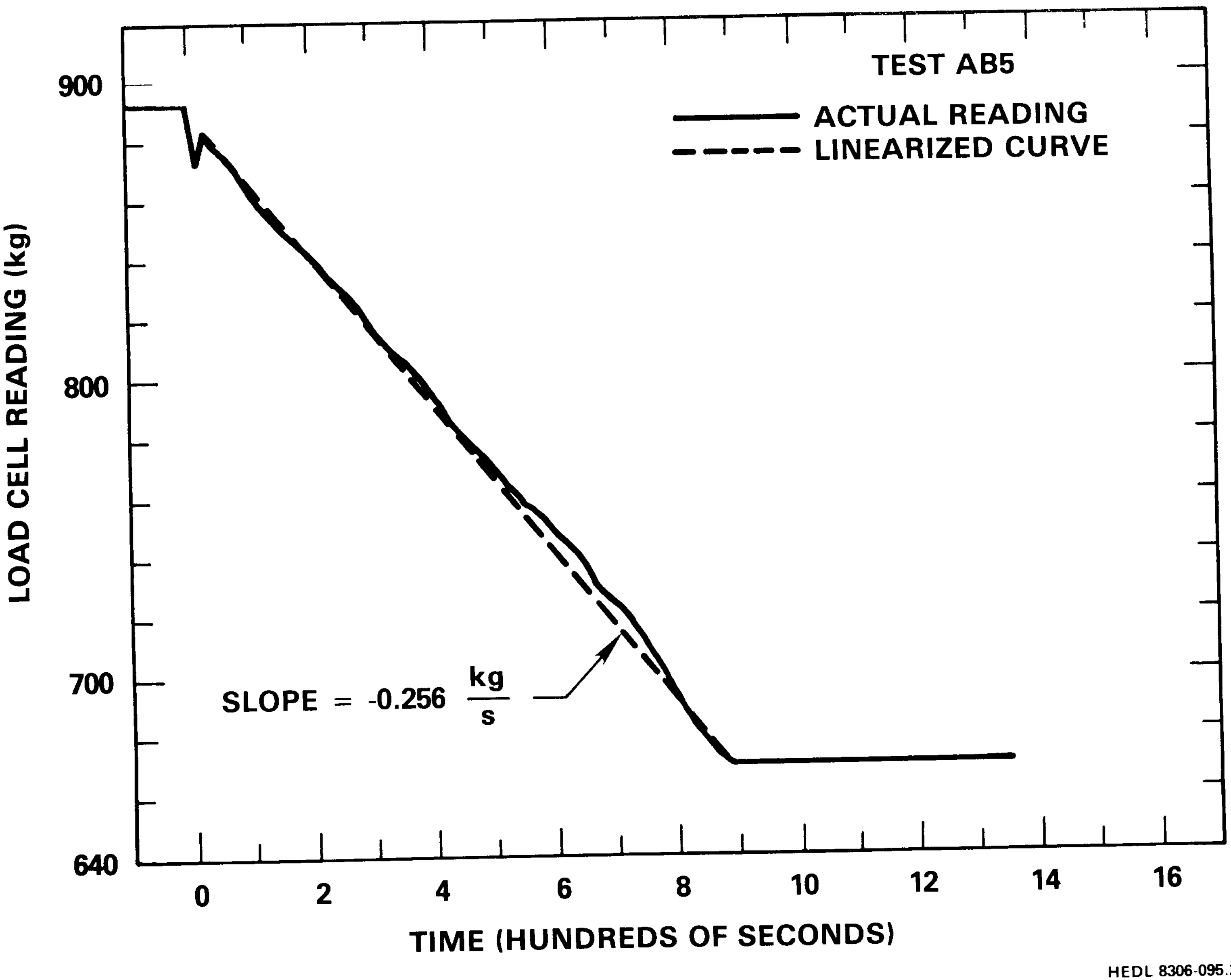

FIGURE 8. Weight of Sodium Remaining in Supply Tank as a Function of Time.

The linearity of the sodium spray rate is further demonstrated by the output of the magnetic flowmeter, shown in Figure 9. The data of Figure 9 were recorded every 9 seconds by the data acquisition system. The initial high rate was due to rapid filling of the empty downstream pipe and probably is not indicative of actual flow through the spray nozzle. A single low-flow data point occurred at 40 seconds, suggesting that a gas bubble passed through the flowmeter at that time.

It is concluded that, for the purpose of code predictions, the spray flow rate can be considered to be constant throughout the spray period.

4.2.3 Spray Drop Size Distribution

The size distribution of sodium drops generated by a spray nozzle identical to that used in test AB5 was measured by collecting the drops in kerosene during an inert atmosphere spray test. The pressure drop across the spray nozzle was 276 kPa (40 psi) during the inert atmosphere test and the resulting spray drops had a mass median diameter (MMD) of 980 $\pm$ 30 μm and a geometric standard deviation of 1.4 $\pm$ 0.1. In test AB5, the pressure drop across the nozzle was 200 kPa (29 psi). Data obtained by the nozzle manufacturer, using water at room temperature as the flow medium, indicate that the MMD of spray drops generated by the AB5 spray nozzle operating at 200 kPa pressure drop is 5% larger than the same nozzle operating at 276 kPa. Assuming that the water data apply to sodium, the MMD for test AB5 was 5% greater than the value of 980 μm measured in the intert atmosphere test, or 1030 $\pm$ 50 μm.

4.2.4 Sodium Mass Balance

After all the aerosol measurements had been completed, the containment vessel surfaces were washed with water to recover the deposited sodium. Portions of the vessel surfaces were washed selectively to obtain information on distribution of deposited material. A mass balance, based on sodium, is presented in Table 8.

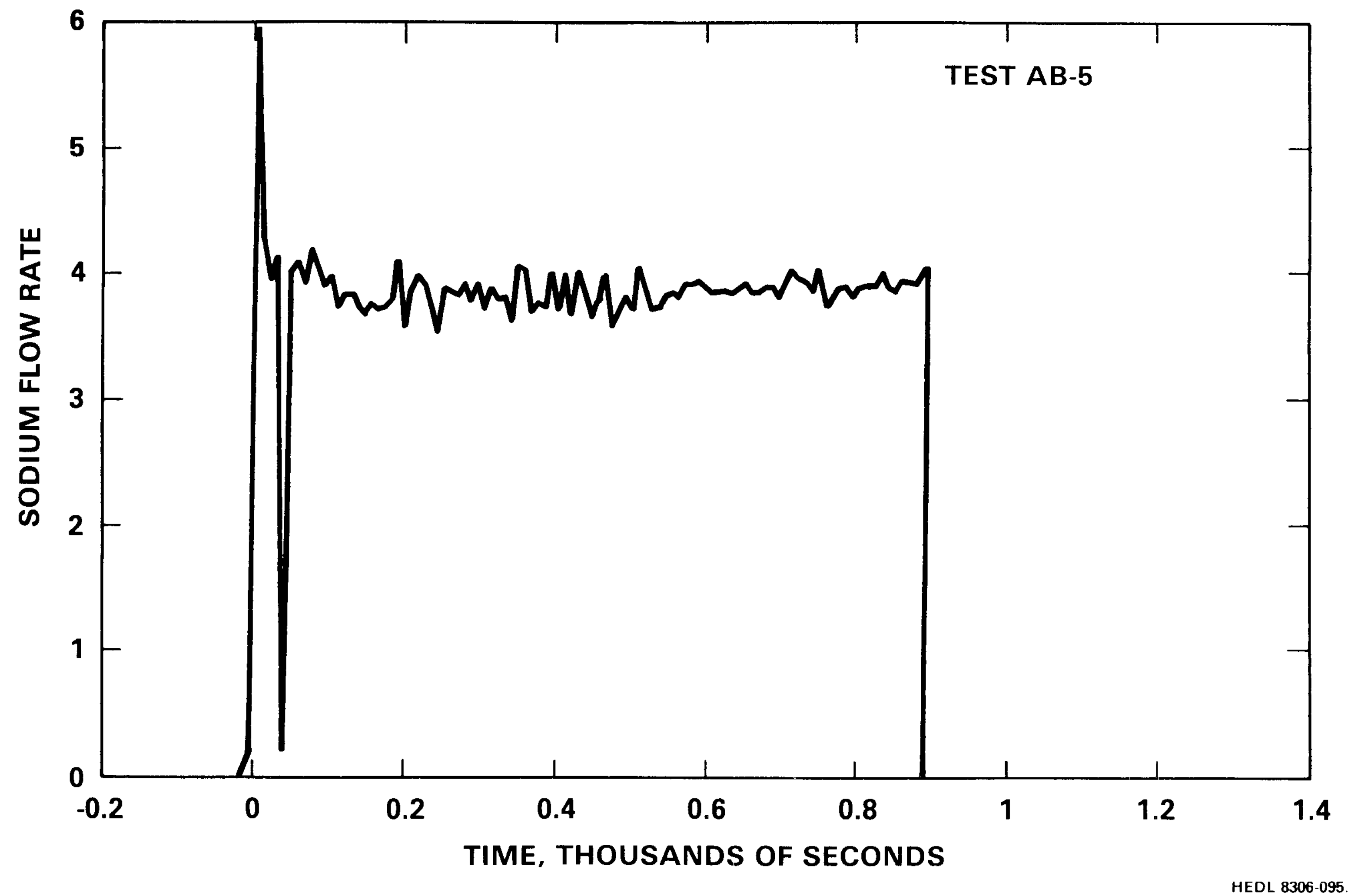

FIGURE 9. Sodium Flow Rate as Measured by Magnetic Flowmeter.

TABLE 8

SODIUM MASS BALANCE

	m^2	kg Na	kg Na/m^2
Delivered to Containment[a]		222.8	
Recovered from Containment[b]			
Bottom Head	36.7	117.2	3.19
Catch Pan	11.2	42.8	3.81
Personnel Platform	4.2	15.4	3.68
All other Surfaces[c]		67.4	
Total CV Washes		242.8	
Samples		2.2	
Total Accounted For		245.0	
Difference		22.2 gain	

[a] Measured by load cell on Na supply tank.
[b] Measured by water wash volume and Na concentration.
[c] Vertical walls, top dome and internal components.

It was not possible to differentiate vertical from horizontal surfaces during the vessel wash because invariably small areas of horizontal surfaces were cleaned along with the vertical surfaces. Because the aerosol deposit on horizontal surfaces greatly exceeded that on vertical surfaces on a unit area basis (>100 to 1), the wash data for vertical surfaces was seriously impaired. However, the converse was not true, and the horizontal surface data for bottom head, catch pan and personnel platform are believed to be accurate within ± 10%.

Table 8 shows that the recovered sodium mass exceeded the delivered mass by 10%. The value for delivered mass is believed to be accurate to ±2%. The recovered mass is biased toward the high side by the procedure used for washing the vessel. Twenty-four washes were made, beginning with high deposition areas, e.g., the bottom head, and progressing to cleaner surfaces.

Small heels of concentrated solution from previous washes were carried over to subsequent lower level rinses. In view of this bias, the 10% error in closure is considered to be good.

4.3 CONTAINMENT RESPONSE

4.3.1 Containment Temperature and Pressure

The containment atmosphere temperature was measured by 28 thermocouples located at various elevations and radial positions. The coordinates of each thermocouple are given in Appendix A. Nineteen of these thermocouples were selected for averaging to give a bulk average temperature for the entire 850-m^3 gas volume. The average gas temperature determined by this method is plotted as a function of time in Figure 10 and listed in Table C-1 in Appendix C. The average gas temperature increased at a rate of 95°C/minute during the initial minute of spraying. The rate of increase slowed to 5°C/min near the end of the spray period, when a maximum temperature of 308°C was obtained. The maximum temperature recorded by an individual thermocouple was 570°C, attained at 616 seconds by a thermocouple located on the containment vessel centerline at 3.5 m above the spray nozzles. Higher temperatures probably occurred at locations closer to the nozzles, but three thermocouples in that zone failed and their data were lost.

Accurate measurement of the bulk average gas temperature, sometimes referred to as the cup-mixing temperature, by the thermocouple method depends on proper placement of thermocouples so that a true average is attained. For a vessel with large and rapidly changing thermal gradients, as in test AB5, this would require a very large number of thermocouples. Furthermore, experimental measurement of gas temperature in the sodium spray region is biased toward the high side by impaction of burning sodium on the thermocouple hot junction. A more accurate method of determining the average gas temperature is to calculate it from pressure measurements by use of the perfect gas law. This method requires knowledge of the number of moles of gas contained in the vessel. During the spray period, the number of gas moles

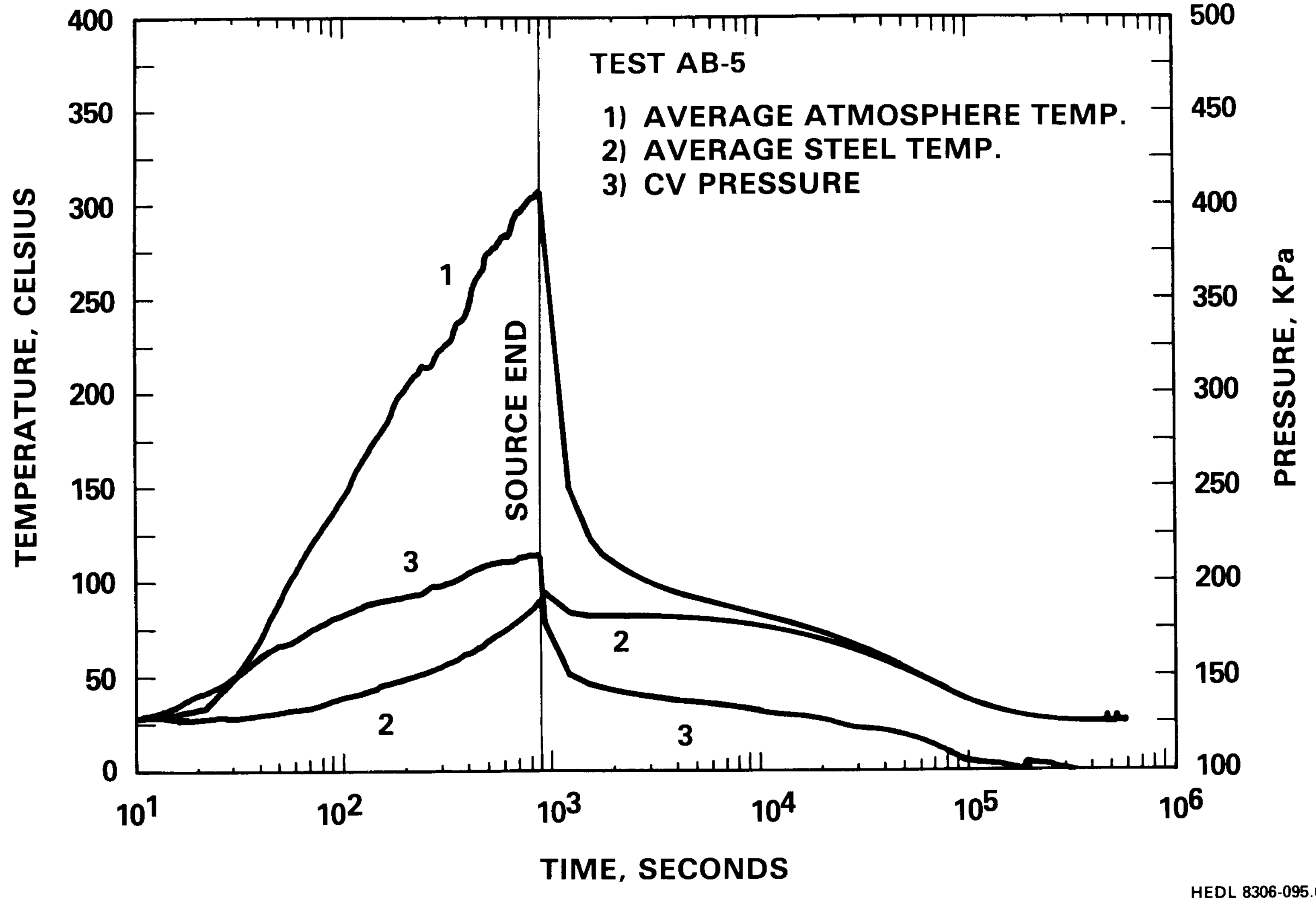

FIGURE 10. Containment Temperature and Pressure as a Function of Time.

probably changed in an uncertain manner as oxygen was consumed, even though an attempt was made to keep the oxygen concentration constant by injecting oxygen during the spray. However, the oxygen concentration at the end of the spray period is known accurately, and by use of the perfect gas law and the measured peak pressure of 213.9 kPa, a value of 279°C is calculated for the average gas temperature. This is believed to be more accurate than the value of 308°C obtained by the thermocouple method.

Temperature gradients in the containment bulk atmosphere are depicted by isotherms in Figures 11 through 14 for four selected times. As expected, the highest isotherm encircles the location where the sodium spray nozzle was located. It is of interest to note the rapid decrease of temperature with elevation above the spray nozzles, showing the cooling effect caused by mixing of cooler gas with the hot central plume. Figure 14 shows that at ∿5 minutes after the end of the sodium spray, most of the radial gradient had disappeared, but that there remained ∿150°C difference from top to bottom.

The average temperature of the containment vessel steel shell is also shown in Figure 10. Eighteen thermocouples attached to the surface of the steel shell at various locations inside and outside were averaged and the results are presented in digital form in Appendix C. The thermocouple coordinates are listed in Appendix A. The maximum value for the average steel shell temperature was 93.5°C, attained 35 seconds after the end of the sodium spray. The maximum temperature recorded by an individual surface temperature was 164°C, attained at 680 seconds by a thermocouple attached to the top dome near the vessel centerline.

Figure 10 also shows the containment pressure as a function of time. The same data are presented in digital form in Appendix C. The pressure increased monotonically to a maximum value of 213.9 kPa (31.02 psia), attained near the end of the spray period.

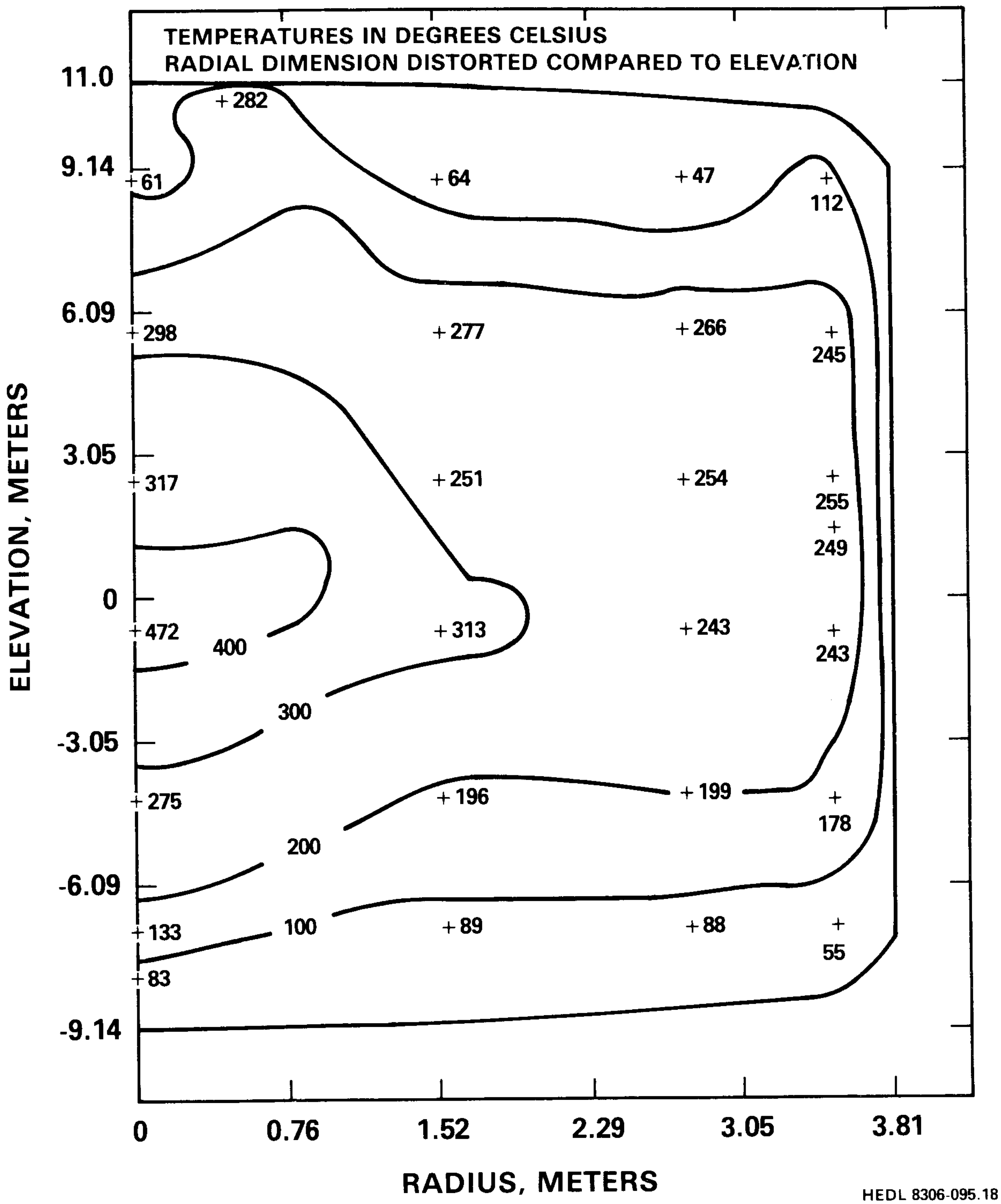

FIGURE 11. Containment Atmosphere Isotherms at Time 155 Seconds.

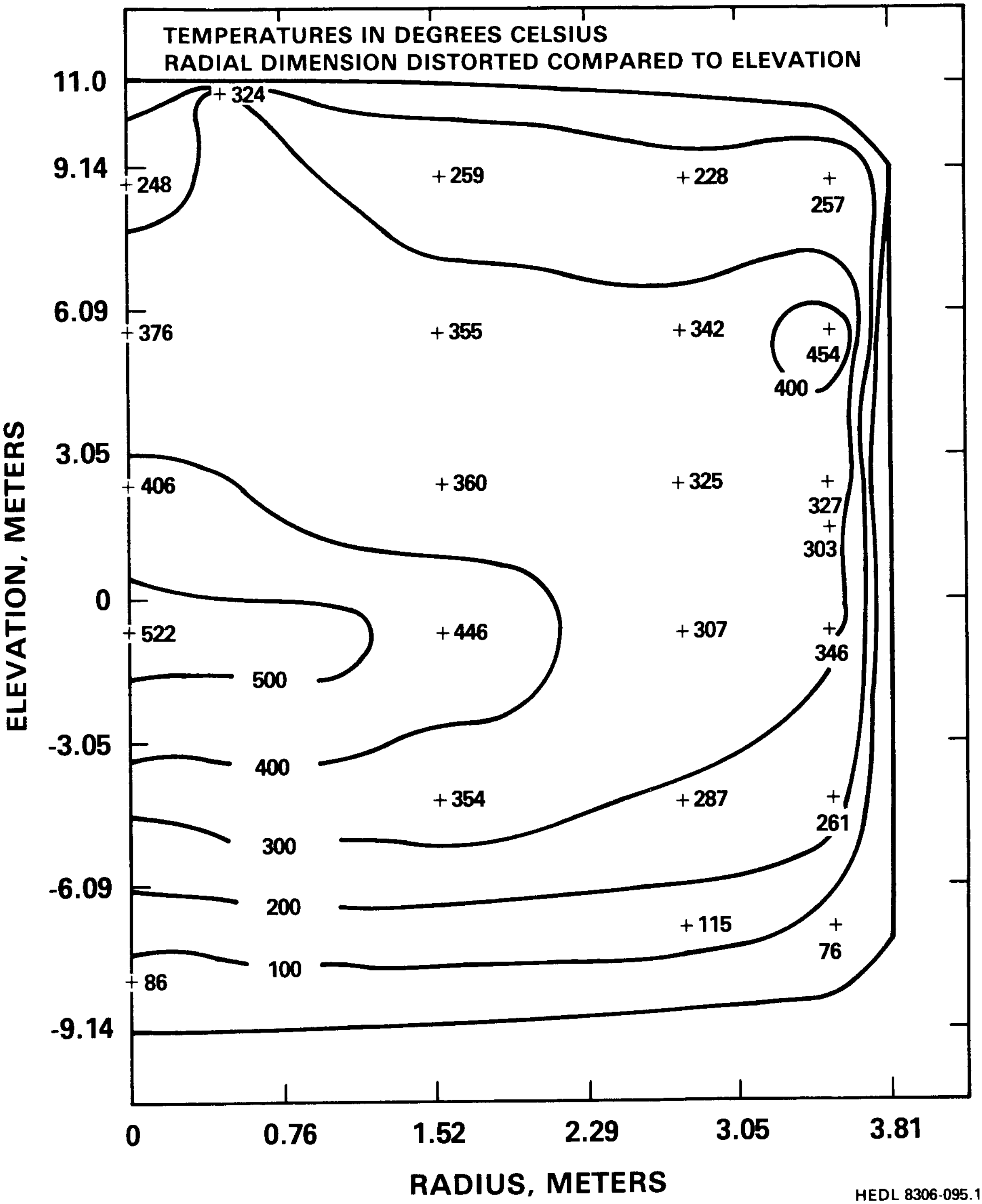

FIGURE 12. Containment Atmosphere Isotherms at Time 483 Seconds.

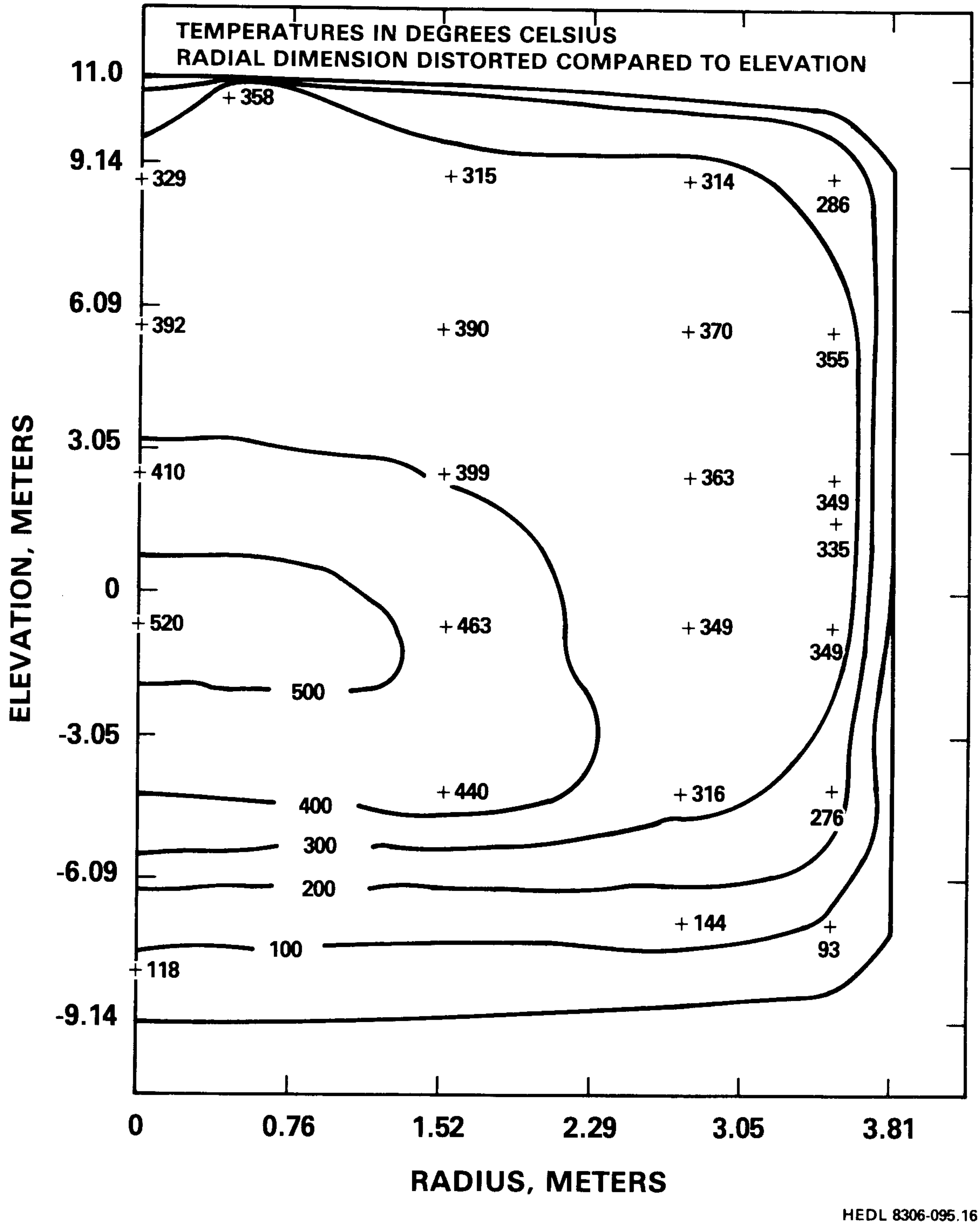

FIGURE 13. Containment Atmosphere Isotherms at Time 813 Seconds.

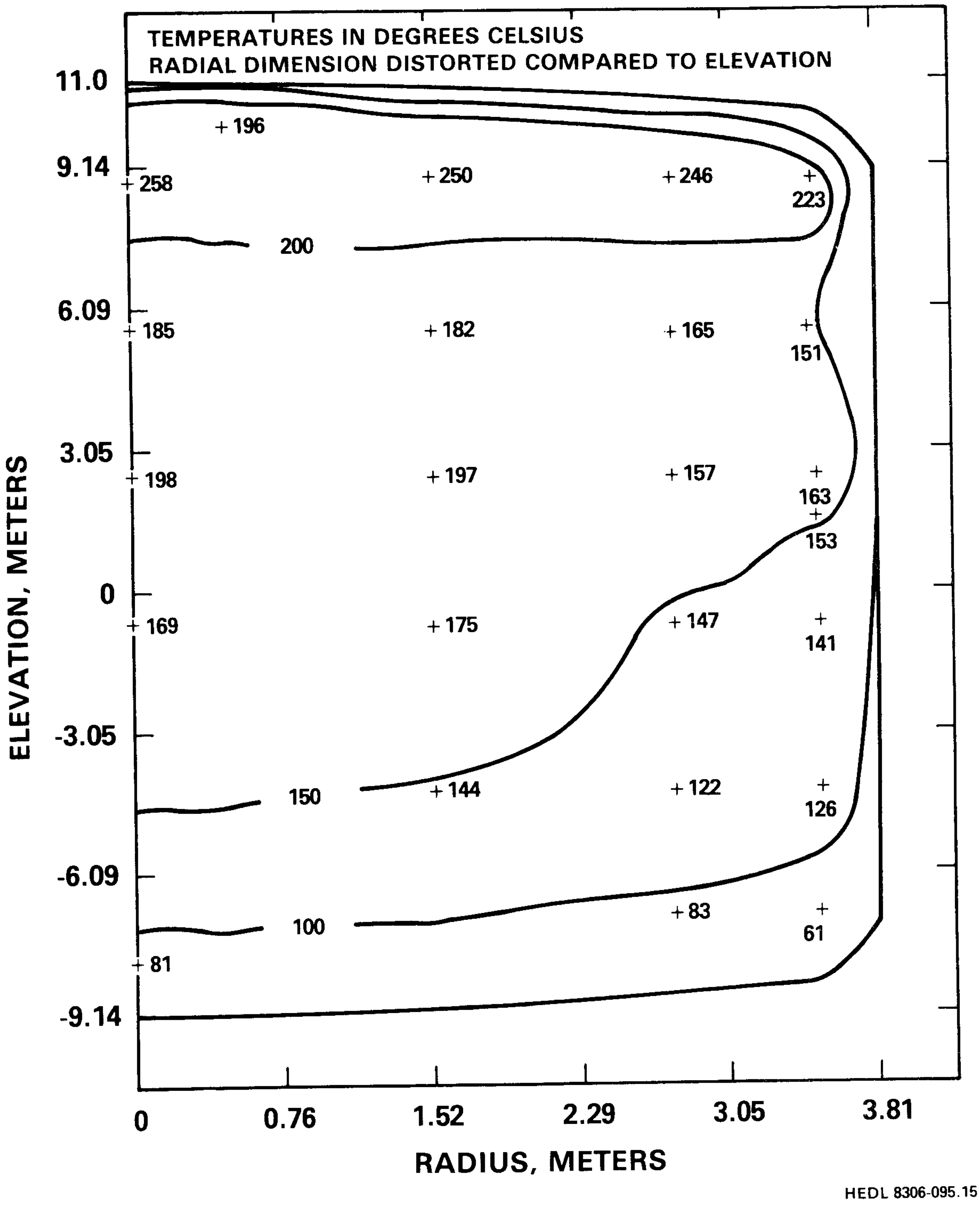

FIGURE 14. Containment Atmosphere Isotherms at Time 1220 Seconds.

4.3.2 Energy Balance

An energy balance was made by computing the sensible heat gained by the containment vessel and the contained atmosphere and comparing this with the computed energy release from chemical reactions based on the chemical analysis of deposited reaction products listed in Table 10 of Section 4.4.2. Heat loss from the steel shell to the thermal insulation was neglected, because it was believed to be negligible for the short (15-min) spray period.

The total sensible heat gain was calculated to be 3.46 GJ, compared to 3.19 GJ released by chemical reaction. This is considered to be good agreement and supports the validity of the temperature measurements and the chemical analyses of reaction products.

4.3.3 Temperature Gradient Near Wall and Ceiling

The temperature gradients near the containment vessel wall and ceiling were measured by five thermocouples located in an array normal to each surface. One thermocouple was touching the surface and was covered by a thin film of adhesive. The other four thermocouples were located at various distances from the surface. The coordinates of the thermocouples are listed in Appendix A (TC 61 through 65 for the vertical wall, TC 38 through 42 for the ceiling).

Figure 15 is a plot of the temperature profiles near the surface at a time near the end of the sodium spray period. It is obvious that most of the temperature difference between gas and surface occurs within a few millimeters of the surface. The atmosphere temperature is essentially uniform at distances greater than 5 cm.

More thermocouples at closer spacing near the surface would be required in order to define the temperature gradient accurately. However, approximate gradients were calculated by using the surface thermocouple and the thermocouple located nearest the wall. The gradients calculated by this method

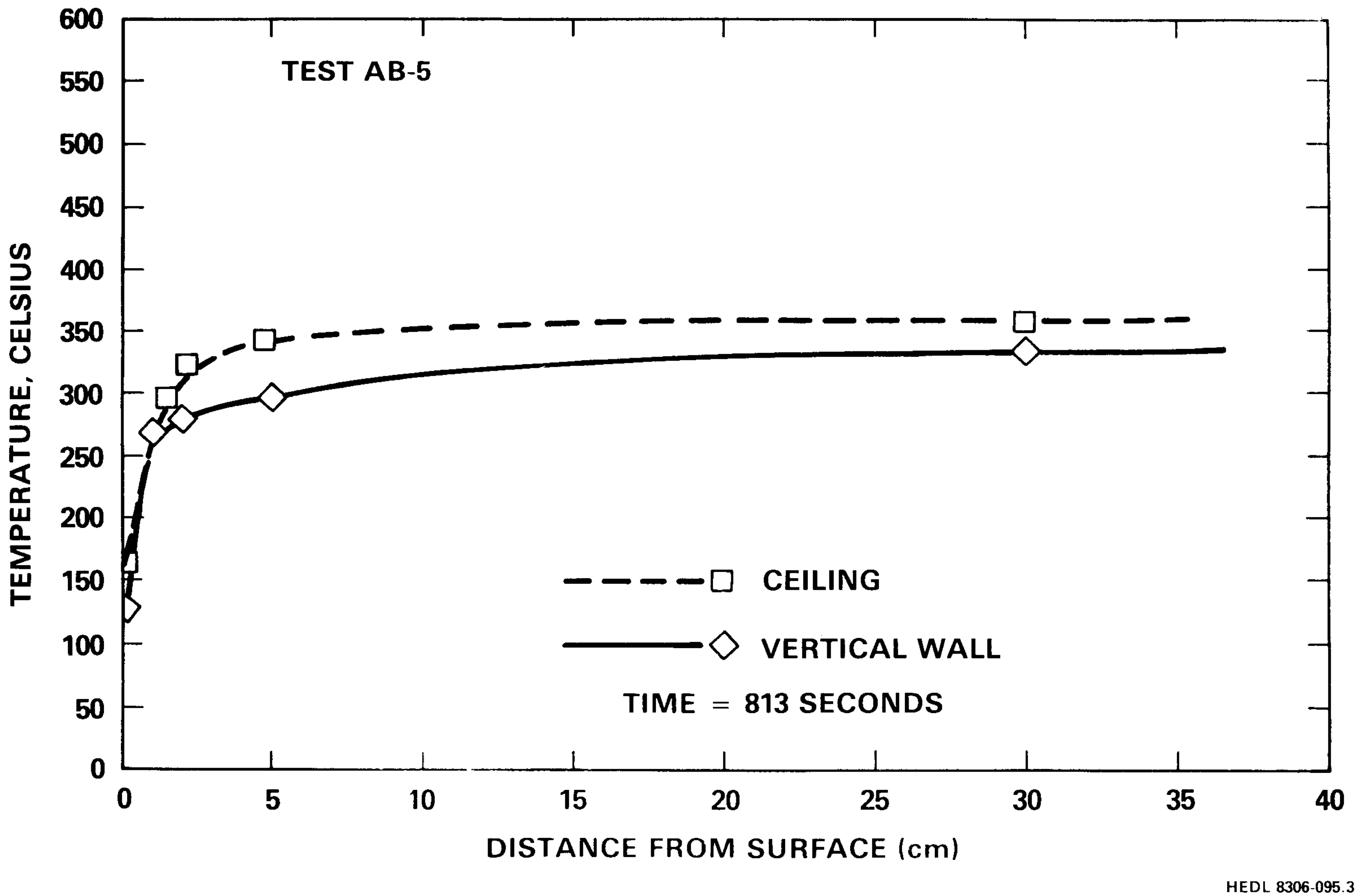

FIGURE 15. Temperature Profiles Near Surfaces in Containment Atmosphere.

are listed in Appendix C and plotted in Figure 16. A fairly steady-state condition was established within 200 seconds, with a gradient of ∿150 °K/cm at the vertical wall and ∿100 °K/cm at the centerline of the top dome. The calculated values for temperature gradients are believed accurate within ±50%.

4.3.4 Containment Atmosphere Composition

The gaseous composition of the containment atmosphere was determined continuously by monitoring flowing gas streams extracted from the vessel at five different locations. The coordinates of the sample line inlets are listed in Table 6. The gas streams were analyzed for oxygen,* hydrogen,** and water vapor dew point;*** and, in addition, periodic grab samples were analyzed by mass spectrometry. The on-line measured concentrations are reported in volume percent for oxygen and hydrogen and the dew point in °C for water vapor in Tables B-6 and B-7 in Appendix B. The mass spectrometric analyses are given in Table 9.

The average reading of 5 on-line analyzers gave 22.7% O_2 before the sodium spray and 19.3% O_2 after the spray. The mass spectrometric analyses agreed nearly exactly with these values. No hydrogen was detected during the test.

The pretest dew point averaged 17.3°C, as measured by the on-line hygrometer. At time 70 minutes, the hygrometers averaged 1.0°C. Samples of containment atmospheres were withdrawn through prefiltered and preweighed desiccant tubes and the dew point was calculated based on weight gain. The gravimetric method gave a value of 14.2°C before the sodium spray started and 2.1°C at 70 minutes. These values are in good agreement with the hygrometer readings. Based on these moisture analyses, a total of 8 kg of water was removed from

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*Beckman Instruments, Inc., Fullerton, CA Model 7003.
**Teledyne Analytical Instruments, San Gabriel, CA Model 102.
***General Eastern Instrument Corp., Watertown, MA, Model 1100A.

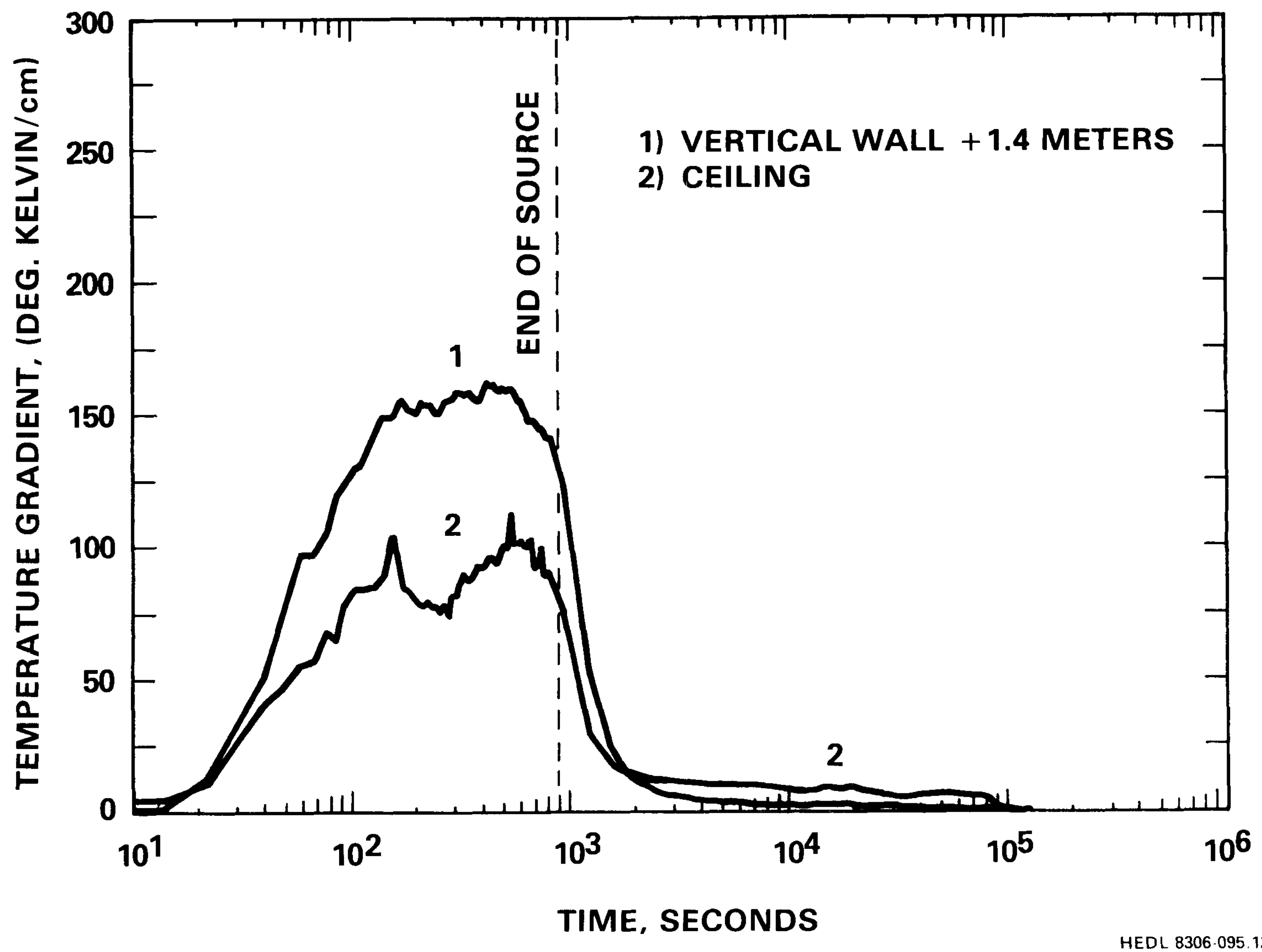

FIGURE 16. Temperature Gradients Near Surface as a Function of Time.

TABLE 9

MASS SPECTROMETRIC ANALYSES OF GRAB SAMPLES
FROM CONTAINMENT ATMOSPHERE

	Vol % on Dry Basis at Specified Time and Location							
	-45 min	17 min		120 min		1440 min		
Gas	+6.1 m	+6.1 m	-6.7 m	+6.1 m	-6.7 m	+6.1 m	-6.7 m	-4.9 m
O_2	22.7	18.3	20.7	19.3	19.4	19.3	19.7	19.4
H_2	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
N_2	76.3	80.6	78.3	79.7	79.5	79.6	79.2	79.6
CO_2	0.09	0.05	0.07	0.06	0.07	0.06	0.07	0.07
A	0.93	1.00	0.97	0.99	0.99	1.00	1.00	1.00
CH_4	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
CO	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

the containment atmosphere, presumably reacting with sodium oxide to form NaOH. This is not enough water to account for the quantity of NaOH found in the deposited aerosol after the test (see Section 4.4.2). This behavior is similar to that observed in previous experiments in the CSTF and can be explained by desorption of water from the vessel surfaces and thermal insulation. Thermal insulation was installed on the sodium spray line and also on two large internal I-beams.

4.3.5 Convection Currents

An attempt was made to measure the convection current velocity near the wall by means of a thermopile anemometer* inserted near the vessel mid-elevation. A maximum vertical velocity of $\sim$2 m/s was measured at a distance of 50 mm from the wall at 4 minutes after the start of the sodium spray. Difficulty was experienced in making this measurement due to deposition of aerosol on the anemometer probe. Very frequent clearing was required. The probe overheated and failed 4 minutes after initiation of the spray.

4.3.6 Conversion Factors for Standard to Actual Containment Conditions

The volume occupied by a given molar quantity of gas in the containment atmosphere varied throughout the test as the gas temperature and pressure varied. Aerosol sampling was performed with rotameters calibrated for standard conditions (1 atm, 0°C). The ratio of standard to actual volumes in the containment atmosphere are listed in Table C-1, Appendix C.

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*Hastings Air-Meter Co., Hampton, VA, Model AB-27.

4.4 AEROSOL SOURCE TERM

4.4.1 Aerosol Source Timing

Zero time was defined as the instant that the isolation valve in the sodium supply line began to open. The spray and aerosol release began 13 seconds later. The sodium isolation valve was closed at t = 885 seconds, effectively reducing the aerosol source to zero at that time.

4.4.2 Aerosol Chemical Form

Chemical analyses were performed on two types of aerosol samples: settled bulk aerosol, and suspended aerosol. The settled aerosol samples were collected in two special samplers (called drop collectors) which collected settled aerosol during the sodium spray period. The first sampler (DCA) was exposed from time zero to 150 seconds; the second from 0 to 840 seconds. The samplers were sealed in-containment to prevent additional aerosol or moisture from entering. The results are listed in Table 10, along with the results of a sample removed from the personnel platform 6 days later. Sample DCB is believed to be the best representative of the aerosol formed during the entire spray period. It showed that the aerosol was approximately 60% Na_2O_2 and 40% NaOH.

The compositions of suspended aerosol at various times are given in Table 11. The samples were collected on nonreacting membrane* filters protected from exposure to ambient atmosphere, and analyzed in an inert atmosphere glove box. Table 11 shows that the suspended aerosol was largely Na_2O_2 at early times, but was gradually converted to hydrated forms and was completely converted to NaOH at 416 minutes. The reader should bear in mind that the suspended mass concentration was very low at later times, so that not much water was needed to convert the suspended mass to hydroxide.

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*Mitex™ membrane, manufactured by the Gelman Co, Ann Arbor, MI, 48106.

TABLE 10

CHEMICAL COMPOSITION OF SETTLED AEROSOL

Compound	Mass Fraction: Sample DCA 0-150 s	Sample DCB 0-840 s	Sample D80A Floor Deposit 0-6 d
Na_2O_2	0.104	0.587	0.488
$Na_2O_2 \cdot 2\ H_2O$	0.200	0.032	0.049
NaOH	0.250	0.374	0.390
Na_2O	0.400	0.000	0.000
H_2O	0.046	0.007	0.073
Total Aerosol	1.000	1.000	1.000
Total Na	0.581	0.574	0.532

TABLE 11

CHEMICAL COMPOSITION OF SUSPENDED AEROSOL AT VARIOUS TIMES

Compound	Mass Fraction: Sample S2 25.5 min	Sample S3 53 min	Sample S4 177 min	Sample S5 416 min
Na_2O_2	0.675	0.350	0.133	0.000
$Na_2O_2 \cdot 2\ H_2O$	0.000	0.131	0.350	0.000
NaOH	0.282	0.500	0.500	0.870
Na_2O	0.000	0.000	0.000	0.000
H_2O	0.043	0.019	0.017	0.130
Total Aerosol	1.000	1.000	1.000	1.000
Total Na	0.560	0.547	0.507	0.500

4.4.3 Sodium Mass Fraction in Suspended Aerosol

As discussed in the previous sections of this report, the suspended aerosol continuously adsorbed water vapor, which reduced the sodium mass fraction and increased the ratio of total mass to sodium mass. Figure 17 is a plot of the sodium mass fraction as a function of time. The sodium mass fraction decreased from 0.574 during the sodium spray to 0.47 at 10^5 seconds. Conversely, the ratio of total mass to sodium increased from 1.74 to 2.13 during the same time period.

4.4.4 Source Particle Size

Techniques for measuring the aerosol source particle size distribution were not available for test AB5, but indirect information was obtained by two different methods. First, electron microscope photographs of aerosol particles settled directly onto carbon-coated grids were analyzed visually. An effort was made to neglect agglomerates and to select only single particles for sizing. Approximately 100 particles were sized and the results were plotted on log-probability paper, as shown in Figure 18. The sample on which Figure 18 is based was taken from the containment atmosphere near the wall of the vessel at 1140 seconds. Assuming that the images in the electron photomicrographs represented spherical particles, the count median diameter of the settled aerosol, CMD_{set}, was 0.17 ± 0.02 μm and the geometric standard deviation, σ_g, was 2.25 ± 0.25. Although the data points in Figure 18 do not form a perfectly straight line, the aerosol was assumed to be log-normal and a CMD for suspended aerosol was calculated to be 0.088 ± 0.016 μm by Equation (1).

$$CMD_{susp} = CMD_{set} \left[\exp(\ln^2 \sigma_g)\right]^{-1} \qquad (1)$$

Equation (1) relates the settling mean diameter to the suspended mean and hence is applicable to the extent that particles were deposited on the EM grid by sedimentation.

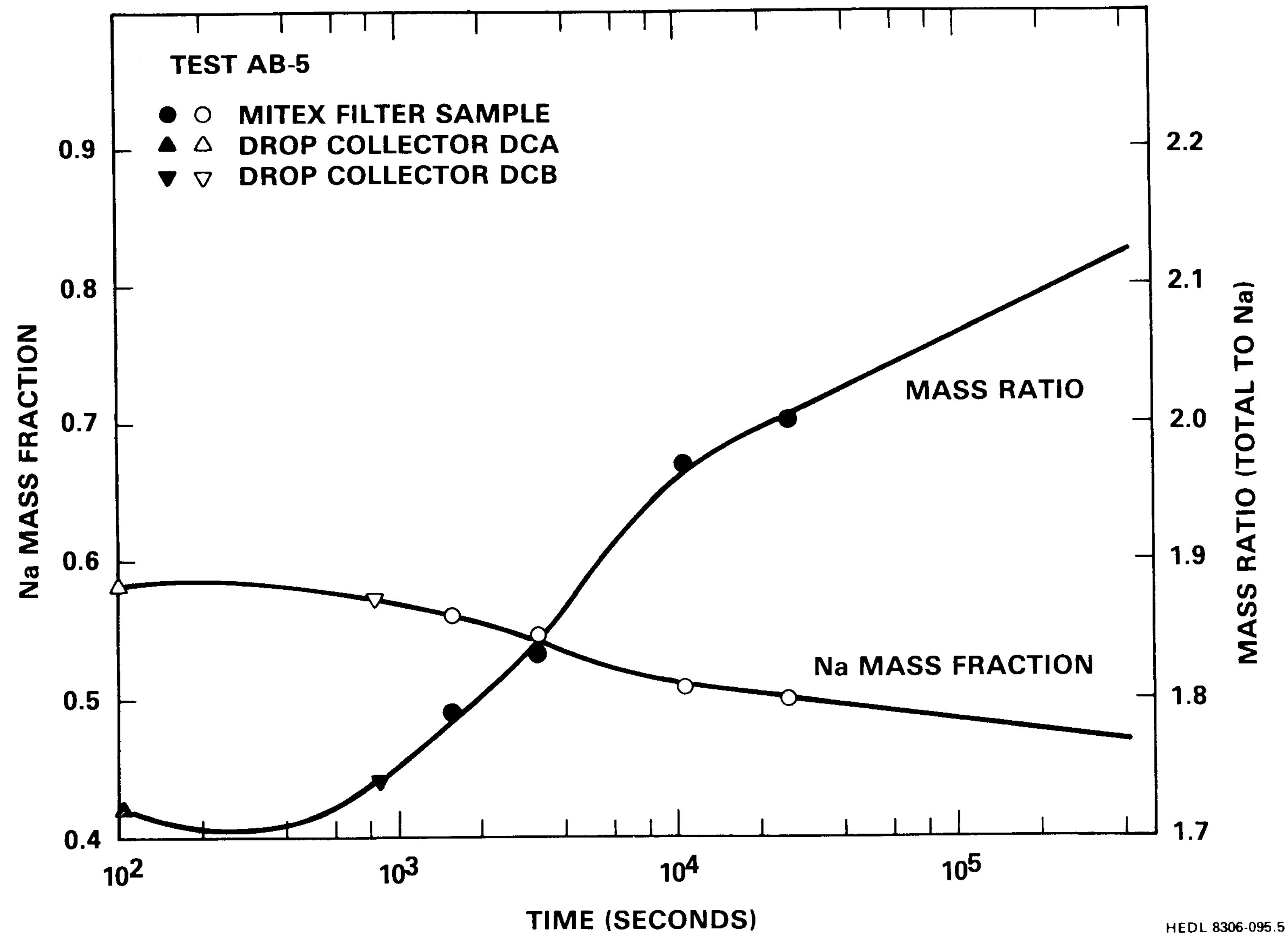


FIGURE 17. Sodium Mass Fraction as a Function of Time.

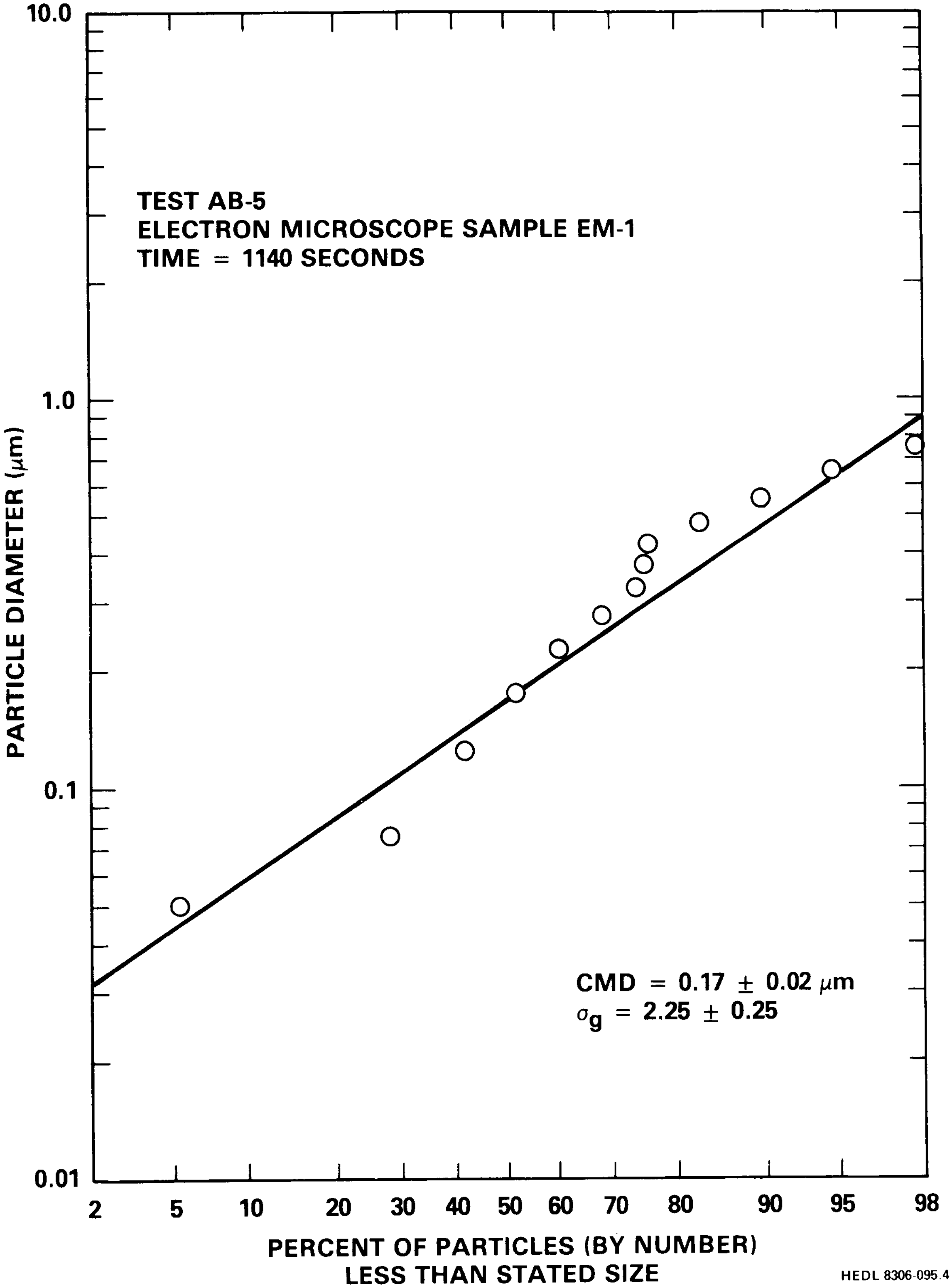


FIGURE 18. Log-Probability Plot of Primary Particle Size Distribution.

Again assuming a log-normal distribution, the mass median diameter of the suspended particles, MMD, was calculated to be $0.63 ^{+0.55}_{-0.27}$ μm by the use of Equation (2). Since the EM sample was taken 255 seconds after the source

$$MMD = \exp\left[3 \ln^2 \sigma_g + \ln CMD\right] \qquad (2)$$

cutoff, most of the smaller particles had undoubtedly been removed by agglomeration. Also, some agglomerates may have been erroneously counted as single particles. Both of these effects cause the calculated value of 0.63 μm for the MMD to be high.

A second method of measuring the source particle size was by use of a cascade impactor taken from the containment atmosphere at 63 seconds (50 seconds after start of source). The measured value for the aerodynamic mass median diameter (AMMD) was 2.55 $\pm$ 0.10 μm and the geometric standard deviation, σ_g, was 1.9 $\pm$ 0.2. If the dynamic shape factor and agglomerate density correction factor had unit values, and the material density is 2.5 g/cm^3, a value of 1.6 $\pm$ 0.07 μm is calculated for the MMD. The aerosol sampled for this measurement was undoubtedly agglomerated to some extent by the brief exposure to the very high particle concentration in the vicinity of the burning sodium spray drops.

The information on source particle size is summarized in Table 12. Based on the knowledge that the two experimental methods yielded high results, it is concluded that the test plan values of 0.5 μm MMD and 1.5 σ_g are reasonable estimates for the primary particle size distribution.

4.5 AEROSOL SUSPENDED MASS CONCENTRATION

The suspended mass concentration was measured periodically by withdrawing samples of the containment atmosphere and measuring the mass of sodium collected on sample filter papers, as discussed in Section 3.2.1. Samples were taken from four through-the-wall sampling stations throughout the entire

TABLE 12

SUMMARY OF INFORMATION ON AEROSOL SOURCE PARTICLE SIZE

	Method	MMD (μm)	σ_g
1.	Electron microscope sample at 1140 s. Optical sizing.	$0.63^{+0.55}_{-0.27}$	2.25 ± 0.25
2.	Cascade impactor sample taken at 63 s.	1.6 ± 0.07	1.9 ± 0.2
3.	Test plan assumed, based on literature.	0.5	1.5

6-day test period. In addition, six filter cluster samplers, hanging at various radii and elevations within the containment atmosphere, yielded one successful sample at time 312 seconds. High temperature in the containment atmosphere caused a failure of the electrical lines leading to the filter cluster solenoid valves, and subsequent sampling efforts with this system failed. The high aerosol deposition rate during the source release period also caused one of the through-the-wall station push rods to jam and be inoperable for a portion of the test. Fortunately, the three remaining locations (T1, T3 and T4 of Table 5) covered high, middle and low elevations and the experimental measurements that were obtained are adequate for accurately defining the suspended concentration.

The average suspended mass concentrations are listed in Table 13. The values listed in Table 13 were obtained by averaging the concentrations measured at the four through-the-wall stations. After the first 3 minutes, the concentration was essentially uniform, as indicated by the relatively small values for the standard error (1σ) shown in column 4 of Table 13. The data of Table 13 are plotted in Figure 19.

TABLE 13

SUSPENDED AEROSOL CONCENTRATION -- DIGITAL DATA FROM ABCOVE TEST AB5

Time (Sec)	Na Conc. ($g Na/m^3$)[a]	Na Mass Fraction[b]	Aerosol Conc. ± Std. Error (g Aerosol/m3)[a]
1.35 (2)[c]	2.31 (1)	0.580	3.98 (1) ± 1.20 (1)
1.65 (2)	4.49 (1)	0.583	7.70 (1) ± 2.30 (1)
1.90 (2)	3.79 (1)	0.583	6.50 (1) ± 2.60 (1)
3.12 (2)	8.39 (1)[d]	0.582	1.44 (2) ± 2.2 (1)[d]
3.96 (2)	9.78 (1)	0.579	1.69 (2) ± 2.5 (1)
5.58 (2)	6.43 (1)	0.578	1.11 (2) ± 1.7 (1)
7.80 (2)	6.33 (1)	0.572	1.11 (2) ± 1.7 (1)
1.02 (3)	3.96 (1)	0.567	6.98 (1) ± 1.1 (1)
1.26 (3)	1.46 (1)	0.563	2.59 (1) ± 3.9 (0)
1.50 (3)	6.84 (0)	0.560	1.22 (1) ± 1.8 (0)
1.80 (3)	5.74 (0)	0.558	1.03 (1) ± 1.5 (0)
2.40 (3)	2.77 (0)	0.552	5.02 (0) ± 7.5 (-1)
2.70 (3)	1.99 (0)	0.550	3.62 (0) ± 5.4 (-1)
3.12 (3)	1.34 (0)	0.548	2.45 (0) ± 3.7 (-1)
3.60 (3)	1.19 (0)	0.544	2.19 (0) ± 3.3 (-1)
4.86 (3)	7.02 (-1)	0.534	1.31 (0) ± 2.0 (-1)
5.76 (3)	5.19 (-1)	0.527	9.85 (-1) ± 1.5 (-1)
6.72 (3)	3.80 (-1)	0.522	7.28 (-1) ± 1.1 (-1)
9.78 (3)	2.04 (-1)	0.510	4.00 (-1) ± 6.0 (-2)
1.10 (4)	1.64 (-1)	0.509	3.22 (-1 ± 4.8 (-2)

(a) Average suspended concentration in $850\text{-}m^3$ containment atmosphere, at containment T, P conditions.
(b) From Figure 17
(c) Numbers in parenthesis are exponents of ten.
(d) Averages of 6 locations by filter clusters. All other data are averages of 2 to 4 through-the-wall samples.

TABLE 13 (Cont'd)

Time (Sec)	Na Conc. (g Na/m3)[a]	Na Mass Fraction[b]	Aerosol Conc. ± Std. Error (g Aerosol/m3)[a]
1.21 (4)[c]	1.46 (-1)	0.507	2.88 (-1) ± 4.3 (-2)
1.39 (4)	1.13 (-1)	0.505	2.24 (-1) ± 3.4 (-2)
1.41 (4)	1.10 (-1)	0.505	2.18 (-1) ± 3.3 (-2)
1.45 (4)	9.98 (-2)	0.505	1.98 (-1) ± 3.0 (-2)
1.80 (4)	9.50 (-2)	0.502	1.89 (-1) ± 2.8 (-2)
2.07 (4)	5.80 (-2)	0.501	1.16 (-1) ± 1.7 (-2)
2.38 (4)	3.94 (-2)	0.500	7.88 (-2) ± 1.2 (-2)
2.76 (4)	3.11 (-2)	0.499	6.23 (-2) ± 9.3 (-3)
3.12 (4)	2.25 (-2)	0.498	4.52 (-2) ± 6.8 (-3)
3.90 (4)	1.44 (-2)	0.496	2.90 (-2) ± 4.4 (-3)
4.62 (4)	1.16 (-2)	0.495	2.34 (-2) ± 3.5 (-3)
5.22 (4)	8.36 (-3)	0.493	1.70 (-2) ± 2.6 (-3)
5.46 (4)	7.54 (-3)	0.492	1.53 (-2) ± 2.3 (-3)
5.94 (4)	6.28 (-3)	0.491	1.28 (-2) ± 1.9 (-3)
6.32 (4)	5.20 (-3)	0.491	1.06 (-2) ± 1.6 (-3)
6.81 (4)	4.49 (-3)	0.491	9.14 (-3) ± 1.4 (-3)
7.68 (4)	3.89 (-3)	0.490	7.94 (-3) ± 1.2 (-3)
8.28 (4)	2.98 (-3)	0.489	6.09 (-3) ± 9.1 (-4)
8.94 (4)	2.47 (-3)	0.488	5.06 (-3) ± 5.8 (-4)
9.47 (4)	2.15 (-3)	0.488	4.40 (-3) ± 6.6 (-4)

(a) Average suspended concentration in 850-m^3 containment atmosphere, at containment T, P conditions.
(b) From Figure 17.
(c) Numbers in parenthesis are exponents of ten.

TABLE 13 (Cont'd)

Time (Sec)	Na Conc. (g Na/m3)[a]	Na Mass Fraction[b]	Aerosol Conc. ± Std. Error (g Aerosol/m3)[a]
9.99 (4)[c]	1.95 (-3)	0.488	4.00 (-3) ± 6.0 (-4)
1.04 (5)	1.50 (-3)	0.488	3.08 (-3) ± 4.6 (-4)
1.67 (5)	6.37 (-4)	0.487	1.32 (-3) ± 2.0 (-4)
1.72 (5)	5.40 (-4)	0.483	1.12 (-3) ± 1.7 (-4)
1.80 (5)	4.90 (-4)	0.482	1.02 (-3) ± 1.5 (-4)
1.86 (5)	4.58 (-4)	0.482	9.50 (-4) ± 1.4 (-4)
2.53 (5)	2.16 (-4)	0.480	4.50 (-4) ± 6.8 (-5)
2.62 (5)	1.79 (-4)	0.479	3.74 (-4) ± 5.6 (-5)
2.70 (5)	1.65 (-4)	0.478	3.45 (-4) ± 5.2 (-5)
2.75 (5)[d]	2.28 (-2)	0.478	4.77 (-2) ± 1.4 (-2)
3.63 (5)	6.19 (-6)	0.476	1.30 (-5) ± 3.9 (-6)
5.10 (5)	8.66 (-6)	0.472	1.83 (-5) ± 5.5 (-6)

(a) Average suspended concentration in 850-m^3 containment atmosphere, at containment T, P conditions.
(b) From Figure 17
(c) Numbers in parenthesis are exponents of ten.
(d) Sampled at one location (+1.8 m elevation) during filtered recirculation period, which lasted 24 minutes, starting at 4582 minutes.

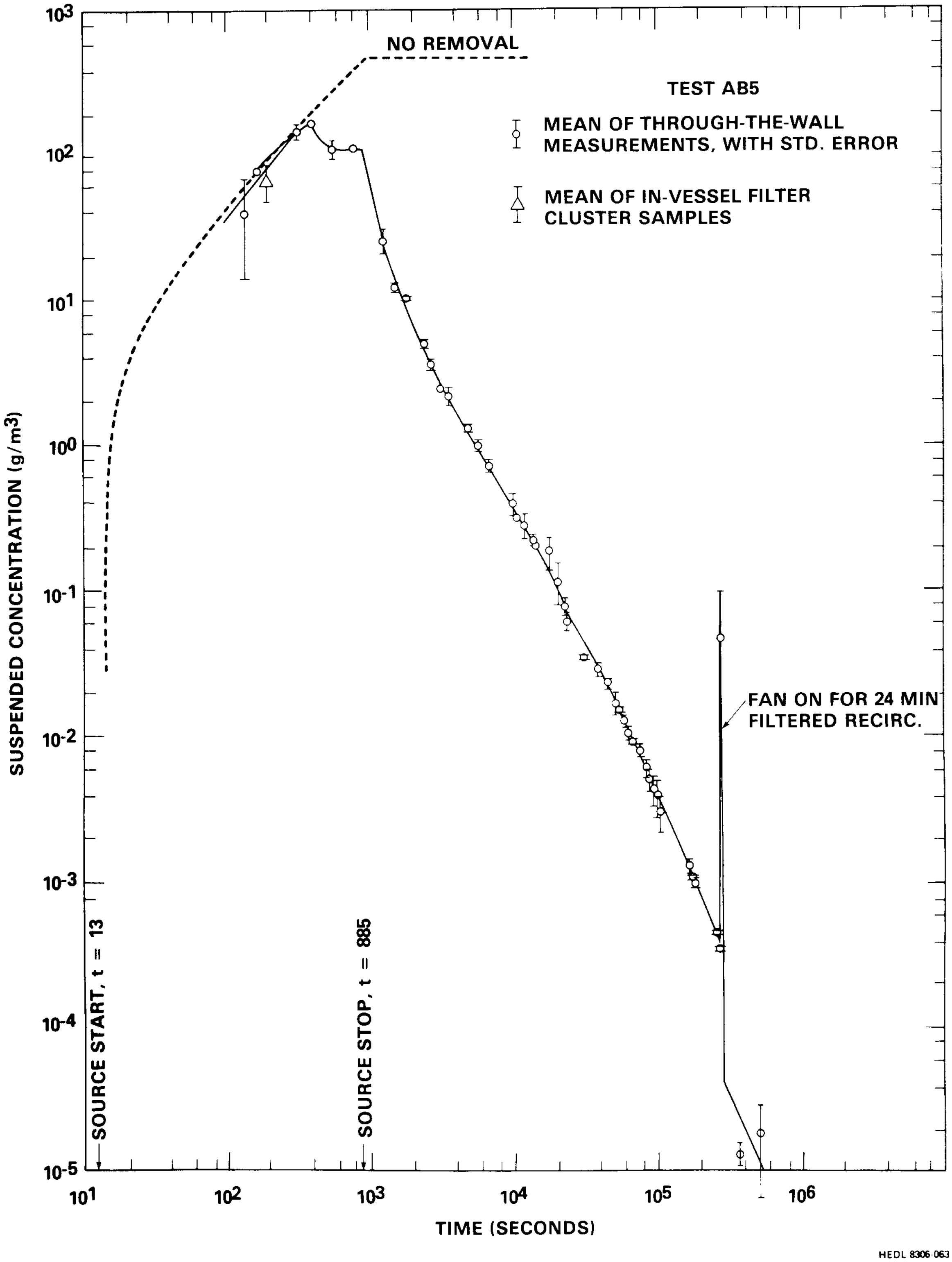


FIGURE 19. Suspended Mass Concentration in the Containment Atmosphere.

The apparent anomaly at 2.75×10^5 seconds was caused by a small quantity of deposited aerosol being resuspended when a recirculation blower was operated. The resuspended aerosol was material that had settled in the recirculation line and in the immediate vicinity of its discharge point. No general resuspention from the walls or floor was observed. The resuspended material consisted of large particles and quickly settled. A cascade impactor sample taken during the recirculation period showed the AMMD to be 13.5 μm and σ_g to be 3.2. The abrupt permanent decrease in concentration during the recirculation period was due to aerosol removal by a filter in the recirculation line. The only time the recirculation blower was operated was from 4582 minutes to 4606 minutes.

Errors in the determination of the average suspended mass concentration result from two causes. The first is inherent error in the sampling method. As discussed in Reference (14), reproducibility of instrument, operator action and chemical analysis is ± 5% for sodium and ± 11% for total mass. The larger error for total mass is due to greater uncertainty of chemical composition and sodium mass fraction. The second source of error is the variation of concentration at different locations within the containment atmosphere. The error band listed in Table 13 is our best judgement of the combined error for the average suspended concentration.

4.6 AEROSOL DEPOSITION ON FLOORS AND WALLS

Aerosol deposition on the containment vessel walls and ceiling were measured post-test by wiping a measured area of the painted wall with a series of damp cloths and analyzing for sodium. The results of sampling in this manner at seven different locations are listed in Table 14. The results are scattered, with an approximately ± 25% standard deviation. There appears to be a trend of higher concentration at lower elevations, though this is not definite.

The distribution of settled mass within the containment vessel was determined from analyses of settling trays located at 23 different locations and exposed to the containment atmosphere throughout the test. Each tray had 266 cm^2 of upward-facing surface. After the test, the trays were retrieved and the

TABLE 14

WALL AND CEILING SURFACE CONCENTRATIONS

Sample No.	Wall Elevation (m)	Sample Area (cm^2)	Mass of Na Sampled (g Na)	Surface Concentration (g Na/cm^2)
W1	Ceiling	930	0.814	8.75 (-4)
W2	+ 6.1	930	1.54	1.65 (-3)
W3	+ 3.0	930	1.21	1.30 (-3)
W4	+ 1.5	970	0.913	9.41 (-4)
W5	- 1.5	816	1.23	1.51 (-3)
W6	- 3.0	930	1.46	1.57 (-3)
W7	- 6.1	930	1.73	1.86 (-3)
Average (all samples)				1.39 (-3)
σ				3.67 (-4)
				(+ 26%)
Average ceiling concentration				8.75 (-4)
Average wall concentration				1.47 (-3)

sodium content of the deposited material was determined by washing and titration. The results are presented in Table 15. The individual samples listed in Table 15 are arranged into four groups according to their general location within the containment environment. The average surface concentration of each group is then multiplied by the upward facing surface area of that portion of the containment vessel. By this method, a total of 220 kg of sodium was computed to have settled during the test. Dividing this mass by the total settling area of 88.1 m^2 gives a weighted mean surface concentration of 2500 g Na/m^2. Table 15 shows that the settled concentrations ranged from a low value of 1080 g Na/m^2 for internal components to a high value of 5520 g Na/m^2 for the catch pan. This is more variation than noted in previous CSTF tests[9,10] and may indicate a localized high settling rate in the central region under the sodium spray nozzles.

TABLE 15

INTEGRAL SETTLED MASS BY DEPOSITION TRAYS

Sample No.	Location	Settled conc. (g Na/m^2)	Area Represented (m^2)	(kg Na)
D50	Personnel Platform at -1.7 m	1030		
D51	Personnel Platform at -1.7 m	600		
D52	Personnel Platform at -1.7 m	1900		
D53	Personnel Platform at -1.7 m	1260		
Avg Personnel Platform		1200	4.2	5.04
D54	Bottom Head	3880		
D55	Bottom Head	3100		
D56	Bottom Head	5080		
D57	Bottom Head	6520		
D64	Bottom Head	2170		
D65	Bottom Head	2350		
D66	Bottom Head	2690		
D67	Bottom Head	2170		
Avg Bottom Head		3120	36.7	114.5
D58	Catch Pan at -8.66 m	6920		
D59	Catch Pan at -8.66 m	6710		
D60	Catch Pan at -8.66 m	3480		
D61	Catch Pan at -8.66 m	7970		
D62	Catch Pan at -8.66 m	4660		
D63	Catch Pan at -8.66 m	3440		
Avg Catch Pan		5520	11.2	61.8
D68	Internal Components	790		
D69	Internal Components	2630		
D70	Internal Components	1070		
D71	Internal Components	357		
D72	Internal Components	526		
Avg Internal Components		1080	36.0	38.9
Overall Total			88.1	220.2

A comparison of the aerosol plateout on containment vessel walls and ceiling with settled mass on horizontal surfaces is given in Table 16. The average settled mass concentration was 180 times greater than the average wall and ceiling plated mass concentration. The plating surface area was 8.85 times greater than the settling surface area, giving an overall result of ∿4.6% of the aerosol plated on vertical and downward facing surfaces; 95.4% onto upward facing horizontal surfaces.

TABLE 16

COMPARISON OF AEROSOL DEPOSITION ON HORIZONTAL AND VERTICAL SURFACES[a]

	Vertical and Ceiling	Horizontal
Surface Area (m^2)	753	88.1
Avg Surface Conc. (g Na/m^2)	13.9[b]	2500
Mass Deposited (g Na)	1.06×10^4	2.20×10^5[c]
wt % Deposited	4.56	95.4

[a] Based on post-test sampling.
[b] From Table 14.
[c] From Table 15.

4.7 BULK DENSITY OF SETTLED AEROSOL

The bulk density of aerosol deposited by settling onto horizontal surfaces was calculated by weight and volume measurements on samples from various locations. The average density of aerosol collected in 23 settling traps (see Table 15) was 0.362 g/cm^3, with a standard deviation of 0.121 g/cm^3. Separate measurements made on three samples scooped from the personnel platform when the vessel was first opened (t = 8570 min) averaged 0.333 g/cm^3, with a standard deviation of 0.026 g/cm^3. No measurements were made with freshly settled aerosol, but previous information[4] showed that the bulk density increases slowly with time.

4.8 AEROSOL PARTICLE SIZE

4.8.1 Cascade Impactor Data

The chief particle size measurement technique used in test AB5 employed cascade impactors. The impactors were inserted directly into the containment atmosphere at three elevations. Two types of multi-jet impactors were used, an Andersen Mark III* circular jet sampler and a Sierra Model 226** rectangular slit sampler. Precut figerglass paper furnished by the manufacturers was used as the stage collection surface. The samplers were used in a horizontal position, and the aerosol which deposited in the inlet portion of the impactor body was analyzed and the mass was added to that collected on the stage collection papers to give the total mass sampled. The particle size of the mass deposited in the inlet portion was considered to be greater than the cut size of the first stage. A description of the technique and discussion of errors has been provided.[14] The standard error ($\pm$ 1σ) is believed to be $\pm$20%.

The cascade impactor showed that the aerosol generally had a log-normal distribution, but that significant deviations from log-normal occurred from time to time. One data set that typifies the cascade impactor results is shown in Figure 20. The aerodynamic mass median diameter (AMMD) and geometric standard deviation, σ_g, obtained from plots similar to Figure 20 are listed in Table 17. A plot of the AMMD as a function of time is given in Figure 21 and a plot of σ_g as a function of time is presented in Figure 22. The raw data are presented in Appendix D in tables and on log-probability plots.

*Manufactured by Andersen 2000, Inc., Atlanta, GA.
**Manufactured by Sierra Instrument Co., Carmel Valley, CA.

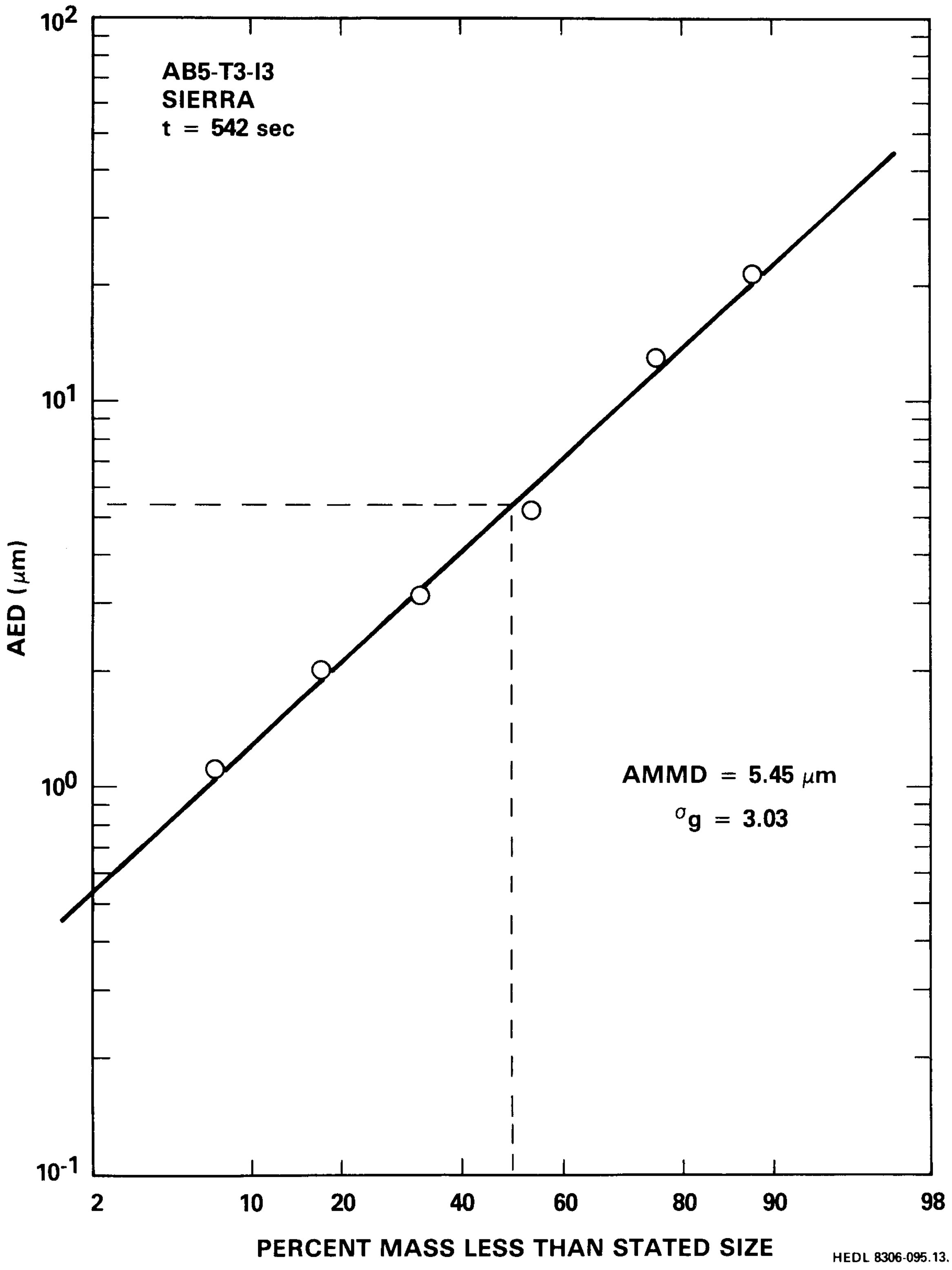


FIGURE 20. Typical Cascade Impactor Data Plotted on Log-Probability Paper.

TABLE 17

CASCADE IMPACTOR DATA FOR TEST AB5

Time (s)[a]	Time (min)	AMMD (μm)	σ_g	Sample Elevation (m)	Type of Impactor[b]
6.30 (1)	1.05 (0)	2.55	1.90	+ 1.4	S
3.02 (2)	5.04 (0)	7.21	3.66	+ 1.4	S
5.42 (2)	9.04 (0)	5.45	3.03	+ 1.4	S
1.26 (3)	2.10 (1)	20.0	3.85	+ 1.4	S
2.16 (3)	3.61 (1)	7.74	3.20	+ 1.4	A
5.11 (3)	8.52 (1)	5.24	3.13	+ 1.4	A
1.05 (4)	1.75 (2)	4.98	2.03	+ 1.4	S
1.88 (4)	3.13 (2)	3.84	2.30	+ 6.1	S
1.99 (4)	3.31 (2)	6.25	1.83	- 5.8	S
2.54 (4)	4.23 (2)	4.2	1.95	- 5.8	S
3.14 (4)	5.24 (2)	2.8	2.21	+ 1.4	S
4.19 (4)	6.98 (2)	3.35	1.94	- 5.8	S
1.00 (5)	1.67 (3)	1.8	2.1	+ 1.4	A
1.73 (5)	2.88 (3)	2.6	1.51	- 5.8	A
2.62 (5)	4.36 (3)	2.27	1.95	+ 6.1	A
2.76 (5)[c]	4.594 (3)	20.0	5.0	+ 1.4	A

(a) Number in parenthesis is exponent of 10.
(b) S = Sierra Model 226; A = Andersen Mark III.
(c) Sample taken during operation of recirculation fan.

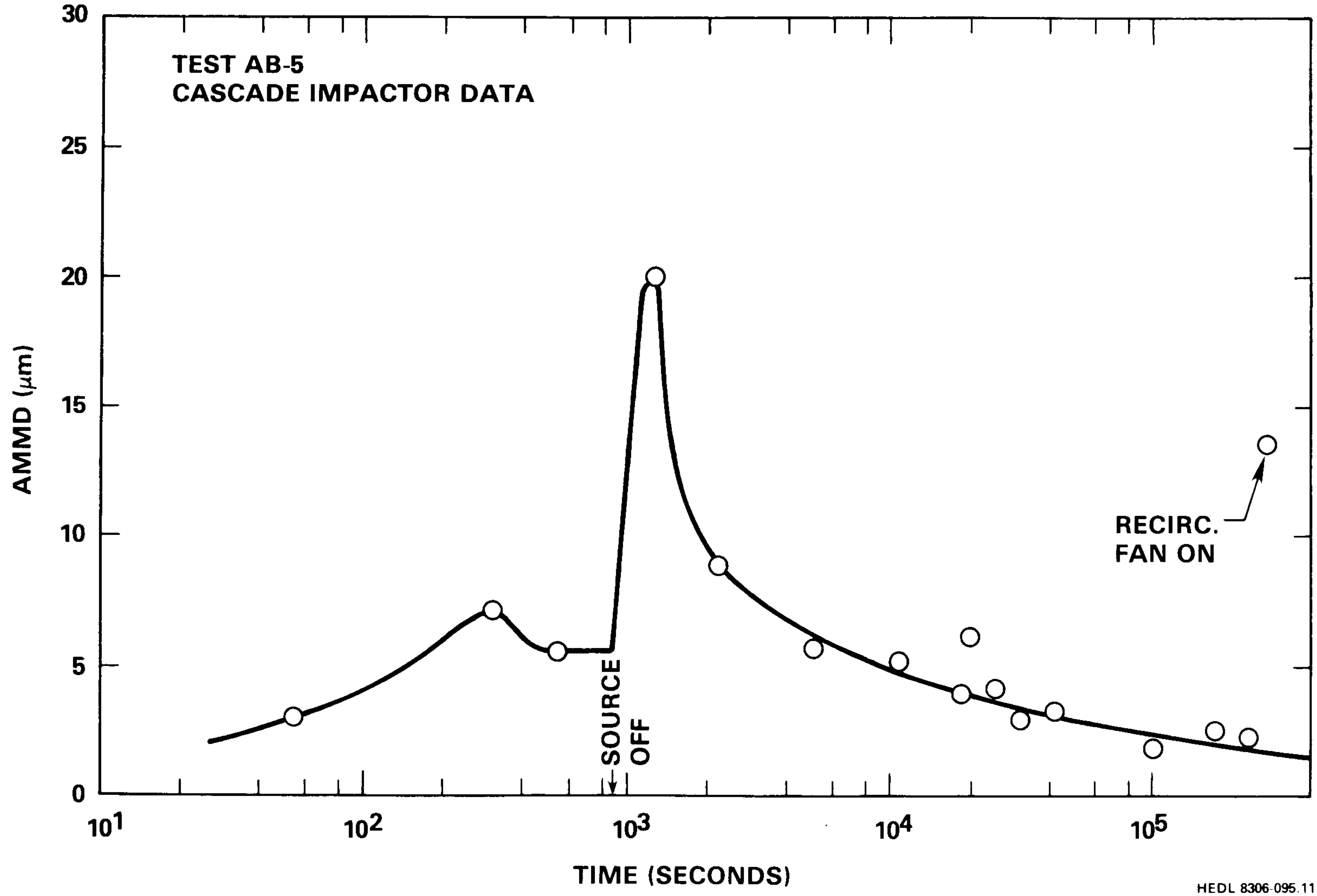


FIGURE 21. Plot of AMMD as a Function of Time.

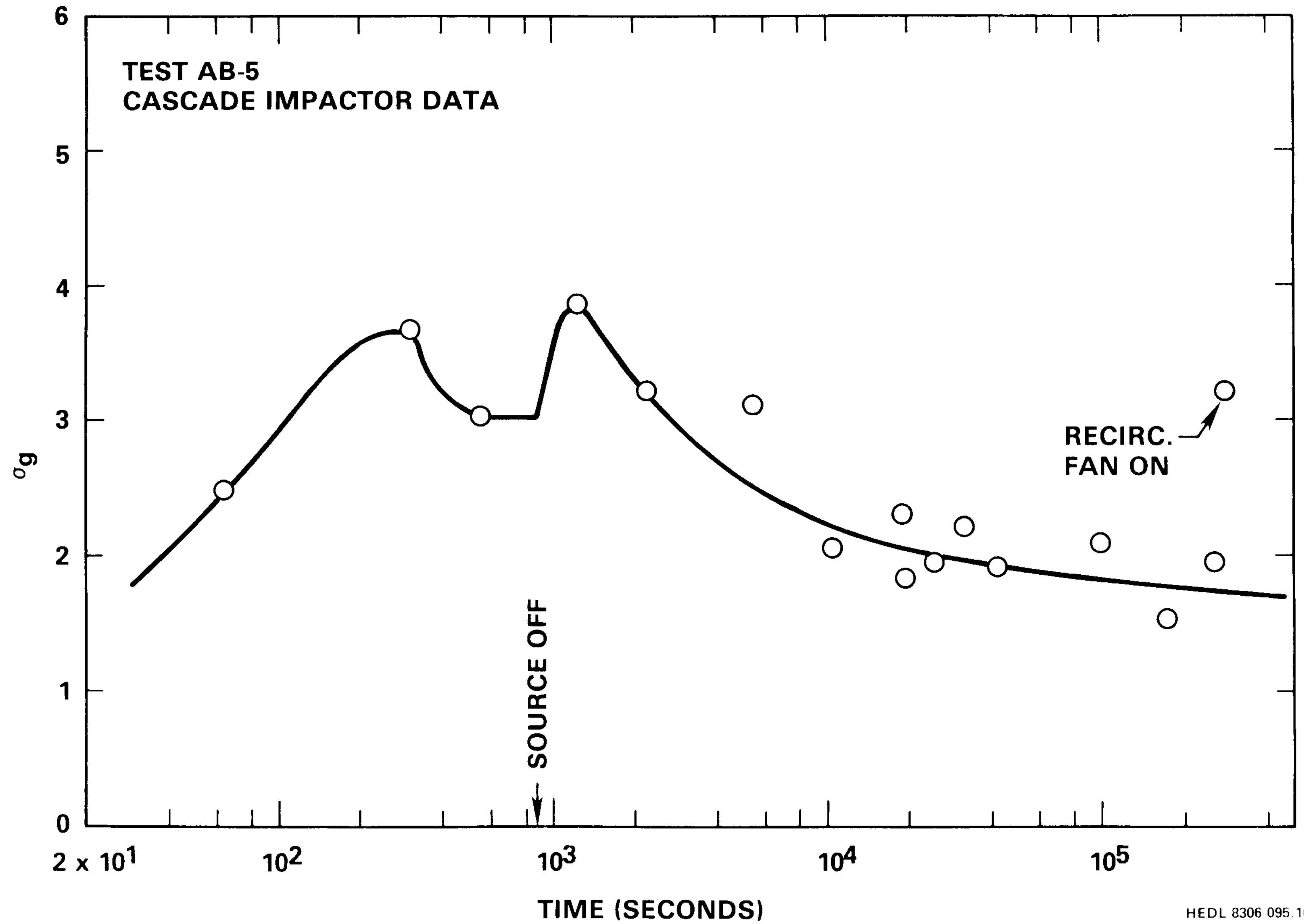
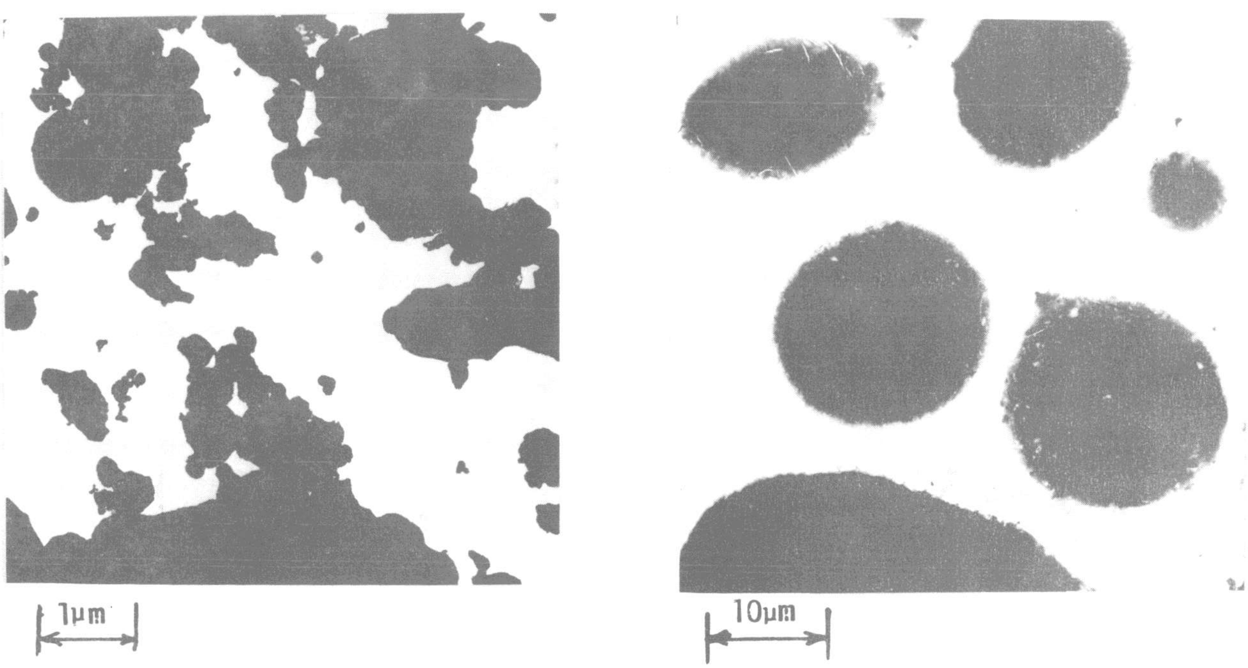


FIGURE 22. Plot of Geometric Standard Deviation as a Function of Time.

4.8.2 Electron Microscopy

Information on aerosol shape and size was obtained by transmission electron microscopy. Figure 23 shows some typical EM photographs of carbon-coated grids exposed to gravity settling in the containment atmosphere. The sample in Figure 23a was exposed at 1140 seconds, while the sample in Figure 23b was exposed at 2760 seconds. The earlier sample is seen to be irregular shaped agglomerates over 30 μm in diameter, while particles in the later sample were more spherical and somewhat smaller.



(a) t = 1140 s (b) t = 2760 s

FIGURE 23. Electron Microscope Photographs.

4.8.3 Deposition Coupon Data

Differential deposition rates were obtained by inserting stainless steel coupons (19.3 cm^2 upward horizontal surface) into the containment atmosphere for short periods of time. The aerosol deposited on the upper surface was washed off and analyzed for sodium. Based on exposure time and suspended mass concentration, a deposition velocity, u_t, was calculated from Equation (3).

$$u_t = \frac{\text{Na deposition flux}}{\text{Na suspended mass concentration}} \tag{3}$$

Assuming that gravity settling greatly exceeds plate-out by diffusion (see Section 4.6), the settling mean diameter was calculated from Stokes' law:

$$d_s = \left(\frac{18 \mu_f \, u_t}{g \, \rho_p} \right)^{0.5} \tag{4}$$

where:

d_s = settling mean diameter (cm)
μ_f = fluid viscosity (g/cm s)
g = acceleration due to gravity (cm/s^2)
ρ_p = effective particle density (g/cm^3)

In order to compare the data with the aerodynamic data obtained with the cascade impactors, the particle density was assigned a value of unity. The values for the settling mean diameter calculated from deposition coupons are listed in Table 18.

TABLE 18

DEPOSITION COUPON DATA

Time (s)	Sample No.	Sample Elevation (m)	Deposition Velocity (cm/s)	Settling Mean Diameter (μm)
2.07 (3)	T1D1	+ 6.1	0.531	14.7
2.09 (3)	T4D1	- 5.8	2.07	27.1
3.18 (3)	T3D2	+ 1.4	0.090	18.9
4.02 (3)	T3D3	+ 1.4	0.510	14.2
5.25 (3)	T4D2	- 5.8	1.05	19.2
5.34 (3)	T1D2	+ 6.1	0.459	13.4
1.07 (4)	T1D3	+ 6.1	0.274	10.2
1.61 (4)	T1D4	+ 6.1	0.199	8.66
1.61 (4)	T3D4	+ 1.4	0.190	8.46
1.63 (4)	T4D3	- 5.8	0.657	15.7
3.49 (4)	T1D5	+ 6.1	0.029	3.23
3.50 (4)	T4D4	- 5.8	0.677	15.4
3.51 (4)	T3D5	+ 1.4	0.129	6.86

4.8.4 Size Calculated from Mass Balance on Containment Atmosphere

A mass balance on the containment atmosphere during a constant source release period in a well-mixed containment gives:

$$\lambda_t = \frac{I - V\frac{dC}{dt}}{VC} \qquad (5)$$

where:

λ_t = overall removal rate constant at time t, s^{-1}
I = aerosol release rate, g/s
V = containment volume, m^3
C = suspended aerosol concentration, g/m^3
t = time, s

For short time steps, Equation (5) can be approximated by:

$$\lambda_t = \frac{1}{C_{avg}} \left[\frac{I}{V} - \frac{\Delta C}{\Delta t} \right] \tag{6}$$

where:

C_{avg} = average value for conc. during time step Δt
ΔC = change in conc. during time step Δt

After the aerosol source cutoff, Equation (6) simplifies to:

$$\lambda_t = - \frac{\Delta C}{C_{avg} \Delta t} \tag{7}$$

The overall removal rate constant, λ_t, is equal to the sum of the removal rate constants for the three removal processes of importance:

$$\lambda_t = \lambda_s + \lambda_\rho + \lambda_\ell \tag{8}$$

where:

λ_s = rate constant due to gravity settling
λ_ρ = rate constant due to plating
λ_ℓ = rate constant due to leakage.

For test AB5, it can be shown that, for $t > 100$ s,

$$\lambda_s >> \lambda_\rho + \lambda_\ell \tag{9}$$

so that λ_s is approximately equal to the overall rate constant for times > 100 s.

The removal rate constant due to settling is related to the deposition velocity, u_t, by Equation (10):

$$u_t = \frac{\lambda_s V}{A_s} \tag{10}$$

where:

A_s = surface area available for settling.

Finally, the settling mean diameter, d_s, can be computed from Stokes' law (Equation 4) when u_t is known.

The data presented in Table 19 were computed for λ_t, u_t and d_s, using Equations (4), (6), (7) and (10) by numerically differentiating the curve in Figure 19 for the suspended mass concentration.

4.8.5 Comparison of Particle Size Measurements

The output of the cascade impactor measurements is the AMMD and σ_g (Section 4.8.1), while the settling mean diameter, d_s, is the output of the deposition coupon and mass balance computations. In order to compare the three methods, the cascade impactor data were converted to settling mean diameters. If the particle size distribution is log-normal, the aerodynamic settling mean diameter can be calculated from the cascade impactor data by Equation (11):

$$d_s = \text{AMMD} \exp(\ln^2 \sigma_g) \tag{11}$$

The settling mean diameters calculated from cascade impactor data, deposition coupon data, and from a mass balance on the containment atmosphere are listed in Table 20. The ratios of d_s measured by the various methods averaged near unity for the entire test period, showing that the methods are in general agreement. However, a significant discrepancy is noted between the cascade impactor measurement and the mass balance method for the time period just preceding and following the source cutoff. Whereas the impactor

TABLE 19

REMOVAL RATE CONSTANT, DEPOSITION VELOCITY, AND SETTLING MEAN DIAMETER COMPUTED FROM MATERIAL BALANCE ON CONTAINMENT ATMOSPHERE

Time (s)	λ_t [a] (s^{-1})	u_t [b] (cm/s)	Settling Mean[c] Diameter (μm)
3.00 (2)	1.30 (-3)	1.25	25.0
4.00 (2)	7.38 (-3)	7.11	60.5
5.00 (2)	4.76 (-3)	4.58	49.6
7.10 (2)	4.76 (-3)	4.58	49.6
8.85 (2)	4.76 (-3)	4.58	49.6
9.42 (2)	4.55 (-3)	4.38	48.2
1.00 (3)	4.34 (-3)	4.18	46.1
1.26 (3)	2.70 (-3)	2.60	33.8
1.55 (3)	1.62 (-3)	1.56	25.5
2.00 (3)	1.11 (-3)	1.07	20.9
2.90 (3)	5.56 (-4)	0.535	14.6
5.00 (3)	3.50 (-4)	0.337	11.5
7.50 (3)	2.19 (-4)	0.211	9.04
1.00 (4)	1.67 (-4)	0.160	7.86
1.35 (4)	1.25 (-4)	0.120	6.78
2.02 (4)	9.89 (-5)	0.0952	5.98
3.00 (4)	5.74 (-5)	0.0553	4.52
4.00 (4)	5.15 (-5)	0.0495	4.25
5.00 (4)	4.10 (-5)	0.0395	3.77
6.75 (4)	3.17 (-5)	0.0305	3.29
1.00 (5)	2.17 (-5)	0.0209	2.69
1.45 (5)	1.43 (-5)	0.0138	2.17
2.05 (5)	1.20 (-5)	0.0116	1.98

[a] Computed from Equations (6) and (7).
[b] Computed from Equation (10).
[c] Computed from Equation (4).

TABLE 20

COMPARISON OF AEROSOL SIZE IN CONTAINMENT ATMOSPHERE AS MEASURED BY VARIOUS METHODS

Time (s)	d_s, Settling Mean Diam. (μm)			Ratio of d_s Measured		
	Cascade Impactor(a)	Dep. Coupon(b)	Mass Balance(c)	Coupon To Imp.	Mass Bal. To Imp.	Mass. Bal. To Coupon
3.00 (2)[d]	37.1		25.0		0.67	
4.00 (2)	24.3		60.5		2.49	
5.00 (2)	19.4		49.6		2.55	
8.85 (2)	18.4		49.6		2.55	
1.00 (3)	66.2		46.1		0.70	
1.26 (3)	129.		33.8		0.26	
2.08 (3)	33.8	20.9[e]	20.7	0.62	0.61	0.99
3.18 (3)	23.8	18.9	14.5	0.79	0.61	0.77
5.30 (3)	14.6	16.3[e]	11.3	1.12	0.77	0.69
7.50 (3)	9.84		9.04		0.92	
1.07 (4)	8.32	10.2	7.82	1.22	0.94	0.77
1.62 (4)	6.98	10.9[e]	6.45	1.56	0.92	0.59
3.50 (4)	5.07	8.5[e]	4.39	1.68	0.87	0.52
5.00 (4)	4.65		3.77		0.81	
1.00 (5)	3.65		2.69		0.74	
2.05 (5)	2.88		1.98		0.69	
Mean				1.17	1.07	0.72

(a) Calculated by Equation (11) using Figures 21 and 22.
(b) From Table 18.
(c) From Table 19.
(d) Numbers in parenthesis are exponents of ten.
(e) Average of multiple measurements.

method showed that the particle size increased to very large values immediately after source cutoff, the size calculated by mass balance on the containment atmosphere showed that the particle size decreased steadily after source cutoff. One explanation is that the impactor data for the time immediately after source cutoff are based heavily on one sample (T3I6) in which 53% of the aerosol mass was greater than the first stage cutoff diameter. Thus, no information is available concerning the distribution of particles larger than ∿20 μm and the assumption of log-normality may be faulty for this sample. Particle growth immediately after source cutoff should be carefully studied in future tests.

The deposition coupon data agree well with the other methods except for the samples taken at longer times when the suspended concentration was low. Contamination of the coupons by small quantities of resuspended aerosol would bias the measurement toward larger sizes.

4.9 LEAKED MASS

The actual quantity of aerosol leaked from the containment vessel was not measured directly. However, the containment vessel was enclosed in a large ventilated room and the inlet and outlet ventilation air was sampled continuously for aerosol throughout the test. From this measurement, a total of 4.8 g Na (∿8.4 g aerosol) was found to have been vented from the room. The quantity of aerosol deposited on surfaces in the room was estimated at <0.5 g Na (<1.0 g aerosol) for a total of ∿5 g Na (∿10 g aerosol) released to the room air. Most of this material is believed to have been released from the four through-the-wall sampling stations during intentional venting of the airlock chambers, and not from leak paths in the vessel itself.

For the purpose of comparing leaked mass with code predictions, a calculation was made using the same assumption used in the computer code cases--that aerosol leaked at a constant 1% of the suspended mass per day. The data of Table 21 were computed by Equation (12).

TABLE 21

LEAKED MASS COMPUTED FROM SUSPENDED CONCENTRATION AND ASSUMED 1% PER DAY LEAKAGE

Time (s)	Leaked Mass (g) Na	Aerosol
1.30 (1)[a]	0	0
5.00 (1)	2.78 (-2)	4.79 (-2)
1.00 (2)	1.19 (-1)	2.04 (-1)
2.00 (2)	5.19 (-1)	8.91 (-1)
3.00 (2)	1.17 (0)	2.00 (0)
5.00 (2)	2.86 (0)	4.95 (0)
8.85 (2)	5.49 (0)	9.50 (0)
1.00 (3)	6.10 (0)	1.05 (1)
1.20 (3)	6.69 (0)	1.16 (1)
1.60 (3)	7.18 (0)	1.24 (1)
2.00 (3)	7.40 (0)	1.28 (1)
3.00 (3)	7.64 (0)	1.33 (1)
4.00 (3)	7.75 (0)	1.35 (1)
5.00 (3)	7.83 (0)	1.36 (1)
1.00 (4)	7.99 (0)	1.39 (1)
1.50 (4)	8.05 (0)	1.41 (1)
3.00 (4)	8.13 (0)	1.42 (1)
1.00 (5)	8.19 (0)	1.43 (1)
1.50 (5)	8.20 (0)	1.43 (1)

(a) Numbers in parenthesis are exponents of ten.

$$M_\ell = \sum_{0}^{n} L\, V\, C_{avg}\, \Delta t \qquad (12)$$

where:

M_ℓ = mass of aerosol leaked, g
L = leak rate, s^{-1}
V = containment volume, m^3
C_{avg} = average suspended conc. during time step, g/m^3
Δt = duration of time step, s

The data of Table 21 are plotted in Figure 24. Table 21 and Figure 24 show that 67% of the computed leaked mass had occurred by the end of the source release period; 95% at 1 hr after the source cutoff. It should be reemphasized that the data of Table 21 and Figure 24 are not based on actual measurement, but on calculations based on experimentally measured suspended concentration and the assumption of a constant 1%/day leakage rate.

4.10 SETTLED MASS

The settled mass was measured by placing 23 deposition trays at various locations throughout the containment vessel, as discussed in Section 4.6. Each tray had 266 cm^2 of upward-facing surface area available for settling. After the test, the content of each tray was analyzed for sodium and the surface deposition at that location was calculated by dividing the sodium mass by the tray surface area. The settled mass for the entire vessel was calculated by dividing the vessel upward-facing surfaces into four categories as shown in Tables 15 and 22.

This parameter was measured only at the end of the test.

4.11 PLATED MASS

For the purpose of making experimental measurements, plated mass is defined as the mass of aerosol deposited on vertical and downward facing surfaces and remaining on these surfaces at the end of the test. The method used to

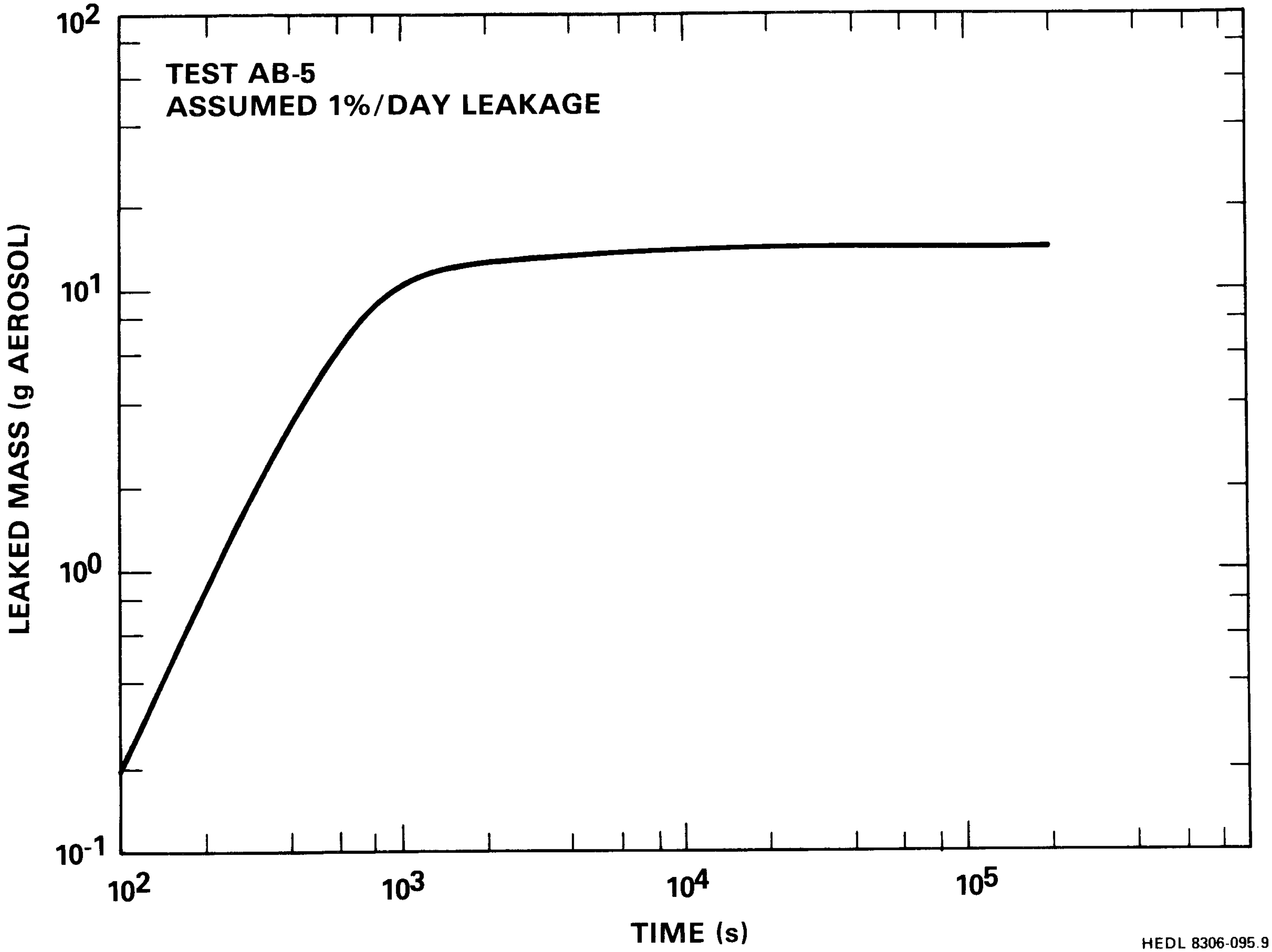


FIGURE 24. Leaked Aerosol Mass Computed with Assumption of Constant 1%/day Leakage.

TABLE 22

EXPERIMENTAL MEASUREMENT OF SETTLED MASS

Type of Surface	Surface Deposition (g Na/cm^2)	Area (cm^2)	Deposited Mass (g Na)
Catch Pan	0.552[a]	1.12 (5)[e]	6.18 (4)
Bottom Head	0.312[b]	3.67 (5)	1.15 (5)
Personnel Platform	0.120[c]	4.2 (4)	5.04 (3)
Internal Components	0.108[d]	3.6 (5)	3.89 (4)
Total Na		8.81 (5)	2.20 (5)
Total Aerosol Mass			3.82 (5)

[a] Average of 6 deposition cans.
[b] Average of 8 deposition cans.
[c] Average of 4 deposition cans.
[d] Average of 5 deposition cans.
[e] Numbers in parenthesis are exponents of ten.

measure the plated mass was to wipe a measured area of vessel wall and ceiling with a series of damp cloths and analyzing for sodium, as discussed in Section 4.6. The surface concentration of sodium at seven different locations is presented in Table 14. The total plated mass on vertical walls and ceiling of the containment vessel was calculated as shown in Table 23.

TABLE 23

PLATED MASS CALCULATION

Type of Surface	Area (cm^2)	Surface Concentration (g Na/cm^2)	Deposited Mass (g Na)
Ceiling	6.3 (5)	8.75 (-4)	5.51 (2)
Wall	6.91 (6)	1.47 (-3)	1.02 (4)
Total Na Mass			1.06 (4)
Total Aerosol Mass			1.83 (4) $\pm$ 3.7 (3)

4.12 INSTANTANEOUS COMBINED REMOVAL RATE

The instantaneous combined removal rate constant, λ_t, was calculated by differentiating the suspended mass concentration curve of Figure 19, as discussed in Section 4.8.4. The computed values of λ_t are listed in Table 19 and plotted in Figure 25 as a function of time. Figure 25 shows that λ_t attained a maximum value of 7.4×10^{-3} s^{-1} at about 400 seconds, then decreased to a steady-state value for the duration of the source release period. After the source cutoff, λ_t decreased continuously for the rest of the test.

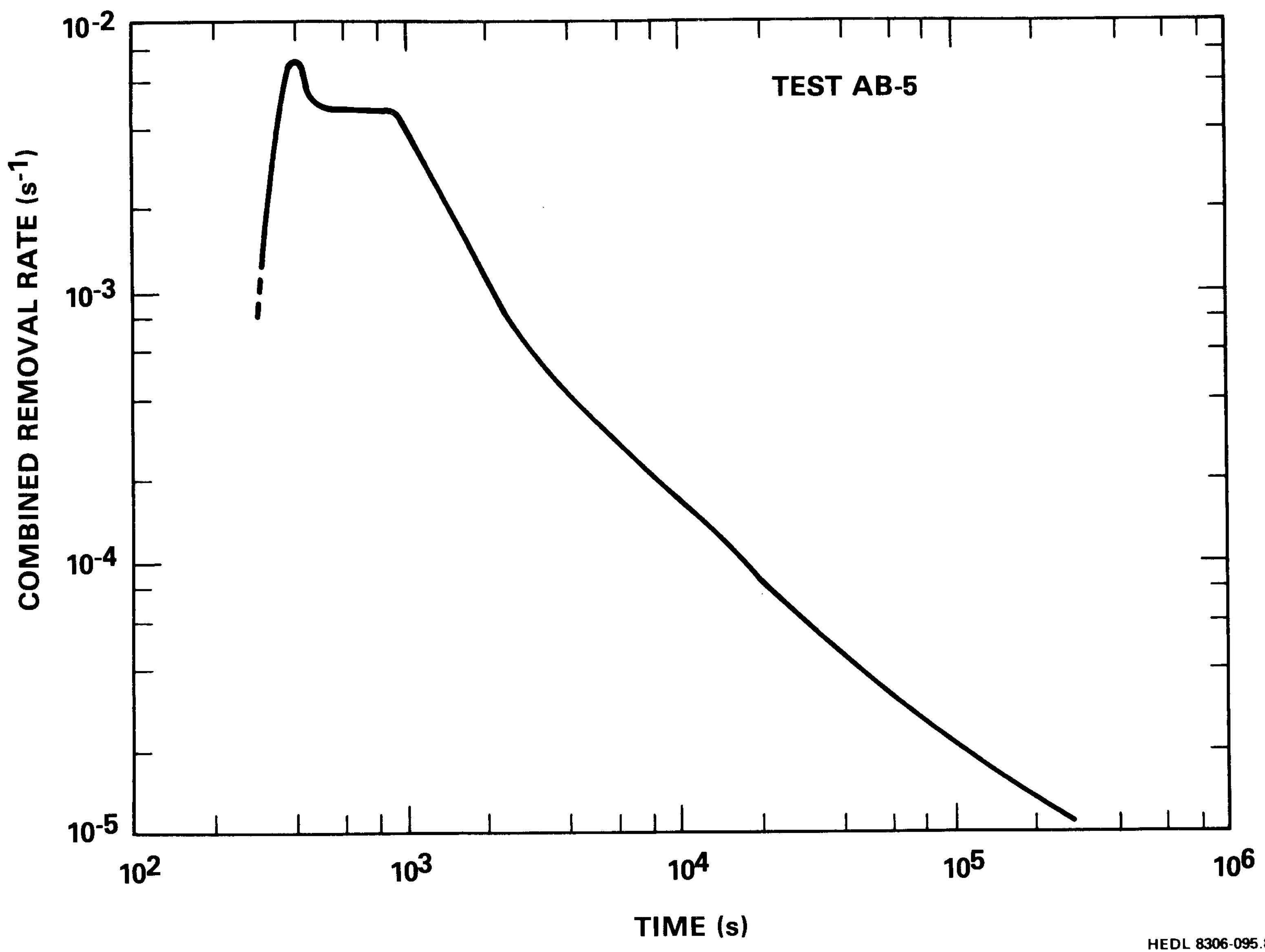


FIGURE 25. Combined Removal Rate Constant as a Function of Time.

5.0 COMPARISON OF EXPERIMENTAL RESULTS WITH COMPUTER CODE PREDICTIONS

5.1 IDENTIFICATION OF CODES AND USERS

Seven individuals were designated as participants in the ABCOVE program prior to the performance of test AB5. These people, their affiliations, and mailing addresses are listed in Table 24.

The aerosol codes used to predict aerosol behavior, along with the participants, are identified in Table 25. As noted in Table 25, some codes were exercised by more than one participant, allowing comparisons of both codes and users.

Eleven individual code cases were run both prior to the test and after the test. The post-test runs were done "blind" in that no experimental data on aerosol behavior per se was made available; only information on thermal conditions and aerosol mass generation was made available to reflect the actual conditions. The code case identification numbers are listed in Table 26.

5.2 CODE INPUTS

Pretest predictions were made by users on the basis of a test plan supplied by the test performer and inputs chosen by the user. Inputs that were related to the conditions of test AB5 were transmitted to code users prior to the test. These data are presented in Table 27 and in Figure 26.

After the test was completed, test data related to aerosol generation and thermal conditions were transmitted to the participants. Key test parameters are summarized in Table 28. Thermal conditions in the CSTF vessel were supplied in tabular digital form as described in Section 4.3.

Numerical values of code input parameters that were actually used in the code cases have been obtained from each user and are listed in Tables 29-31. In some instances, the input parameters listed in Tables 29-31 are equivalent

TABLE 24

LIST OF PARTICIPANTS FOR ABCOVE TEST AB5

Participant	Affiliation	Address
Emil Gluekler	General Electric Company	P.O. Box 5020 310 DeGuigne Drive Sunnyvale, CA 94086
R. K. Hilliard	Hanford Engineering Development Laboratory Safety Systems Development	P.O. Box 1970 Richland, WA 99352
Hans Jordan	Battelle Columbus Laboratories	505 King Avenue Columbus, OH 43201
T. S. Kress	Oak Ridge National Laboratory	P.O. Box X Oak Ridge, TN 37830
K. K. Murata	Sandia National Laboratories	P.O. Box 5800 Albuquerque, NM 87115
J. M. Otter	Rockwell International Energy Systems Group	8900 De Soto Avenue Canoga Park, CA 91304
M. G. Piepho	Hanford Engineering Development Laboratory Containment Systems Analysis	P.O. Box 1970 Richland, WA 99352

TABLE 25

COMPUTER CODE AND PARTICIPANTS FOR TEST AB5

Participants	HAA-3 Ref. 9	HAA-4 Ref. 10	HAARM-3 Ref. 5	QUICK Ref. 6	MSPEC Ref. 11	MAEROS Ref. 12	CONTAIN Ref. 13
Rockwell Atomics International		X					
Battelle Columbus Laboratories			X	X	X		
General Electric	X						
HEDL Containment Systems Analysis						X	
HEDL Safety Systems Development	X		X				
Oak Ridge National Laboratory			X	X			
Sandia National Laboratories							X

TABLE 26

CODE CASES FOR TEST AB5

Code Case No.	Code	User
1	HAA-3B	GE
2	HAA-3C	HEDL/SSD
3	HAA-4	ROCKWELL/ESG
4	HAARM-3	HEDL/SSD
5	HAARM-3	BCL
6	HAARM-3	ORNL
7	QUICK	BCL
8	QUICK	ORNL
9	MSPEC	BCL
10	MAEROS	HEDL/CSA
11	CONTAIN	SNL

TABLE 27

PRETEST INPUT PARAMETERS TRANSMITTED TO CODE USERS BY THE TEST PERFORMER

Parameter	Value
Source rate, g/s cm^3	6.8×10^{-7}
Source 50% radius, μm	0.25
Source sigma, σ_g	1.5
Initial aerosol concentration	0
Source cutoff time, sec.	900
Maximum time, days	5
Leakage rate, %/day	1.0 (constant)
Settling area, cm^2	8.8×10^5
Plating area, cm^2	7.5×10^6
Volume, cm^3	8.5×10^8
Density of aerosol, g/cm^3	2.72
Temperature of atmosphere	Figure 26
Temperature of CV walls	Figure 26
Pressure	Figure 26

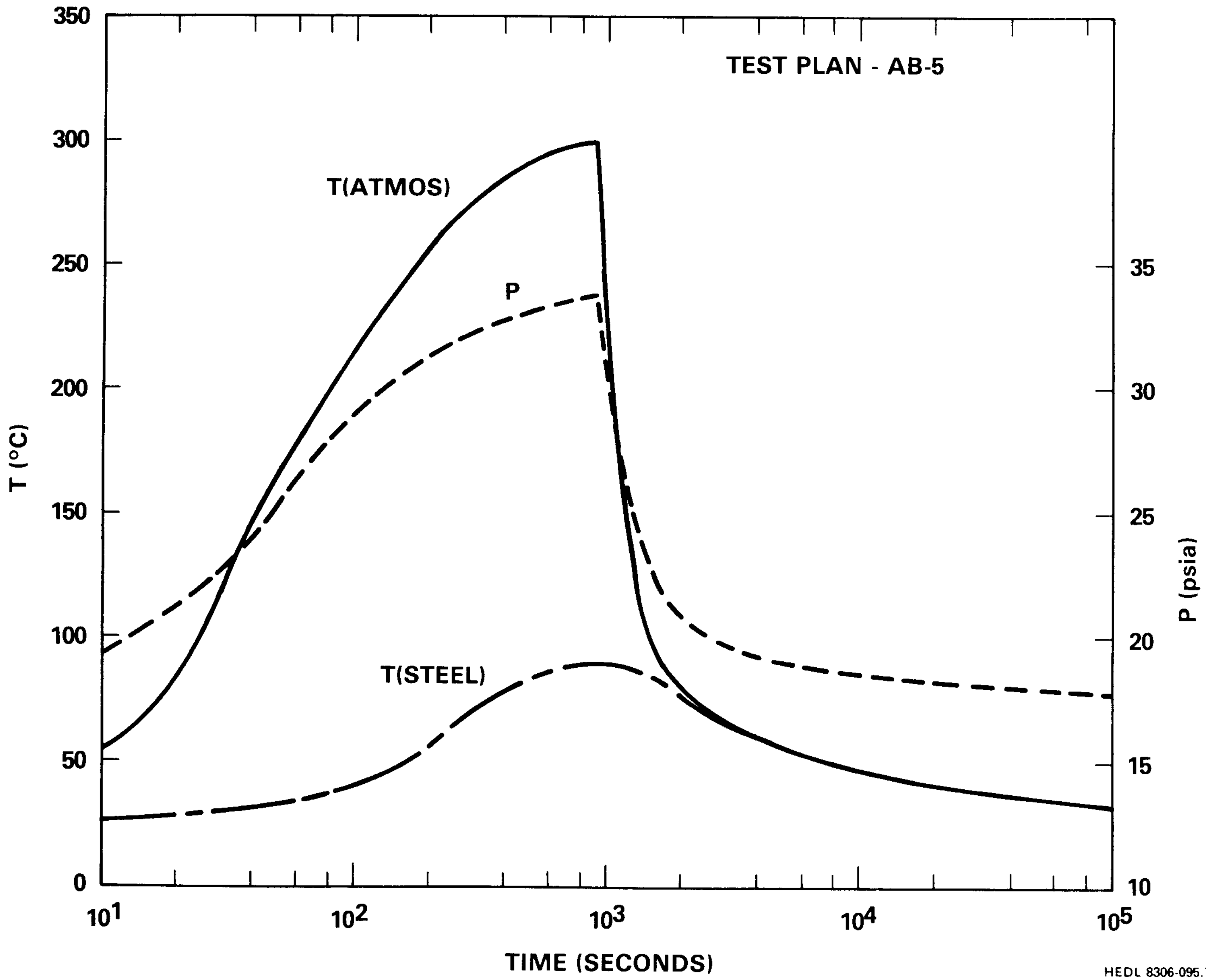


FIGURE 26. Pretest Estimates of Temperature and Pressure Provided by the Test Performer.

TABLE 28

TEST CONDITIONS TRANSMITTED TO CODE USERS
FOR USE IN MAKING BLIND POST-TEST PREDICTIONS

Parameter	Pretest Test Plan	Post-Test Measured or Estimated
Pressure Drop Across Spray Nozzle (psi)	40	29
Sodium Spray		
Sodium Spray Rate (g/s)	340	256
Spray Start Time (s)	0	13
Spray Stop Time (s)	900	885
Total Na Sprayed (kg)	306	223
Sodium Temperature (°C)	560	563
Spray Drop Size, MMD (μm)	980	1030
Spray Size Std. Dev. (σ_g)	1.4	1.4
Aerosol Generation		
Mass Ratio, Total to Na	1.70	1.74
Generation Rate (g/s)	578	445
Material Density (g/cm^3)	2.72	2.50
Initial Time (s)	0	13
Cutoff Time (s)	900	885
Initial Conc.	0	0
Source Mass Median Radius (μm)	0.25	0.25
Source Sigma	1.5	1.5

ones derived from the actual ones. Parameters related to the aerosol source are listed in Table 29. Pretest and post-test values (in parenthesis) are given for material density, source size, geometric standard deviation, and particle source rate. Inspection of the listed inputs indicates that most of the code cases used identical or very similar numerical values. The notable exception is the source size employed in the MAEROS case performed by HEDL/CSA. The MAEROS cases used discretized distributions, and for the post-test case, all of the particles were placed in the bin whose diameter limits ranged from 0.1809 μm to 0.2599 μm. The use of the one size bin simplified the setup of the code case. The version of MAEROS used by HEDL/CSA is not particularly "user friendly." As will become obvious, this difference in source size did not have a great impact on predicted aerosol behavior.

Code input parameters that are related to the behavior of agglomerated particles are listed in Table 30. Because of differences in modelling, the same input parameters for different codes may not infer the same calculations. The parameters listed in Table 30 are defined as follows.

CHI

CHI is a dynamic shape factor that allows the particle drag to be related to Stokes' law for spheres. CHI is a denominator factor in Stokes' law, and because non-spherical agglomerates settle more slowly than spherical agglomerates, CHI is equal to or larger than unity.

GAMMA

GAMMA is a factor which relates the effective collision radius of a particle to the actual particle radius. Because non-spherical agglomerates are able to collide more effectively, GAMMA is equal to or larger than unity.

ALPHA

ALPHA is a density modification factor used to account for the reduced settling velocity of agglomerates compared to solid spheres. Generally, it is a numerator factor in Stokes' law and its value is less than or equal to unity.

TABLE 29

CODE INPUT PARAMETERS RELATED TO THE AEROSOL SOURCE

Code	User	Material Density (g/cm^3)	Source Size d_{50} (μm)	Source Size σg	Source Rate (No./s cm^3)	Source Rate (g/s m^3)
HAA-3B	GE	2.72 (2.5)[a]	0.5 (0.5)	1.5 (1.5)	8.0 E6 (6.69 E6)[b]	
HAA-3C	HEDL/SSD	2.72 (2.5)	0.5 (0.5)	1.5 (1.5)	8.0 E6 (6.69 E6)	
HAA-4	RI/ESG	2.72 (2.61)	0.5 (0.5)	1.5 (1.5)	8.0 E6 (6.69 E6)	
HAARM-3	HEDL/SSD	2.72 (2.5)	0.5 (0.5)	1.5 (1.5)	8.0 E6 (6.69 E6)	
HAARM-3	BCL	2.72 (2.5)	0.5 (0.5)	1.5 (1.5)	8.0 E6 (6.16 E6)	
HAARM-3	ORNL	2.72 (2.72)	0.5 (0.5)	1.5 (1.5)	8.0 E6 (6.16 E6)	
QUICK	BCL	2.72 (2.5)	0.5 (0.5)	1.5 (1.5)		0.68 (0.52)
QUICK	ORNL	2.72 (2.72)	0.5 (0.5)	1.5 (1.5)		0.68 (0.52)
MSPEC	BCL	2.72 (2.5)	0.5 (0.5)	1.5 (1.5)		0.68 (0.52)
MAEROS	HEDL/CSA	2.72 (2.5)	~1.5 (0.21)	H[c] (1.0)		0.68 (0.52)
CONTAIN	SNL	2.72 (2.5)	0.5 (0.5)	1.5 (1.5)		0.68 (0.52)

(a) Ex-parenthesis numbers are pretest; numbers within parenthesis are post-test.
(b) 8.0 E6 means 8.0×10^6.
(c) A histogram distribution was used.

TABLE 30

CODE INPUT PARAMETERS RELATED TO AGGLOMERATE BEHAVIOR

Code	User	CHI	GAMMA	ALPHA	EPSILON	KLYACHKO
HAA-3B	GE	---	---	0.2 (0.2)	1.0 (1.0)	YES (YES)
HAA-3C	HEDL/SSD	---	---	0.2 (0.2)	1.0 (1.0)	YES (YES)
HAA-4	RI/ESG	---	---	0.2 (0.25)	0.1 (0.1)	YES (YES)
HAARM-3	HEDL/SSD	1.0 (1.0)[a]	1.0 (1.0)	---	---	YES (YES)
HAARM-3	BCL	1.3 (1.3)	5.0 (5.0)	---	---	YES (YES)
HAARM-3	ORNL	1.0 (1.3)	1.0 (5.0)	---	---	NO (NO)
QUICK	BCL	1.3 (1.3)	5.0 (5.0)	---	---	---
QUICK	ORNL	1.0 (1.3)	1.0 (5.0)	---	---	---
MSPEC	BCL	1.3 (1.3)[b]	(15.0) (15.0)[b]	---	---	---
MAEROS	HEDL/CSA	1.3 (1.3)	2.0 (2.0)	---	---	---
CONTAIN	SNL	2.5 (1.5)	2.5 (2.25)	---	---	---

(a)Ex-parenthesis numbers are pretest; numbers within parenthesis are post-test.
(b)Maximal values MSPEC models shape factors as function of particle size.

EPSILON

EPSILON is a gravitational collision efficiency used in the HAA codes. It relates to the fraction of particles in a swept volume that is captured by a falling particle.

KLYACHKO

The KLYACHKO parameter allows deviations from Stokes' drag that occur at high Reynolds numbers to be taken into account. This factor becomes important for particles larger than ∿100 μm. The dashes in Table 30 indicate that the parameter is not used in the code, or else is computed internally.

The numerical values for aerosol parameters listed in Table 30 were not specified by the test performer. They were selected by the code user, based on the user's experience. Most users had selected the parameters on the basis of code fits with earlier large-scale sodium fire aerosol tests in the CSTF.

Code input parameters related to atmosphere temperatures, diffusional deposition, and thermophoretic plating are summarized in Table 31. Inspection of the data of Table 31 shows that the variables selected by the users covered a significant numerical range. Diffusional plating boundary layer thickness was assigned values from 1×10^{-4} m to 1.6×10^{-7} m, a variation of three orders of magnitude. The small value for delta used in the HAA-3 code results from the assumption that all plateout is caused by diffusion, and delta is assigned an empirical value to match previous experiments. The wall temperature gradient values ranged from 4.7×10^{2} °K/m to 1.6×10^{5} °K/m, a range again of almost three orders of magnitude. The assigned values of the ratio of gas to particle thermal conductivity varied from 0.001 to 0.11, or two orders of magnitude.

As will become evident later, the parameters that had the greatest effect on plateout were those related to thermophoresis. Parameters selected by BCL caused predicted thermophoretic deposition to be higher than predicted by other participants.

TABLE 31

CODE INPUT PARAMETERS RELATED TO ATMOSPHERE TEMPERATURE AND WALL DEPOSITION MECHANISMS

Code	User	Atm. Temp. Var. or Const.	Diffusion Delta, m	Wall Gradient (°K/m)	Gas/Particle Conductivity Ratio
HAA-3B	GE	Const. (Const.)[a]	1.6 E-7 (1.6 E-7)	---	---
HAA-3C	HEDL/SSD	Const. (Var.)	1.6 E-7 (1.6 E-7)	---	---
HAA-4	RI/ESG	Var. (Var.)	1.25 E-4 (1.5 E-4)	1.2 E5 (4.7 E2)[b]	0.05 (0.05)
HAARM-3	HEDL/SSD	Const. (Const.)	1.0 E-7 (1.6 E-7)	1.0 E3 (1.5 E4)	0.03 (0.03)
HAARM-3	BCL	Const. (Const.)	1.0 E-4 (1.0 E-4)	1.0 E5 (1.6 E5)[b]	0.11 (0.11)
HAARM-3	ORNL	Var. (Var.)	1.0 E-5 (1.0 E-5)	4.2 E4 (1.6 E4)	0.001 (0.001)
QUICK	BCL	Const. (Const.)	1.0 E-4 (1.0 E-4)	2.4 E4[b] (1.6 E5)[b]	0.11 (0.11)
QUICK	ORNL	Const. (Const.)	1.0 E-4 (1.0 E-4)	4.2 E4 (1.6 E4)	0.05 (0.05)
MSPEC	BCL	Const. (Const.)	1.0 E-4 (1.0 E-4)	2.4 E4[b] (1.6 E5)[b]	0.11 (0.11)
MAEROS	HEDL/CSA	Const. (Const.)		1.0 E3 (1.0 E3)	
CONTAIN	SNL	Var. (Const.)	(2.0 E-5)	(5.6 E4)	(0.05)

(a)Ex-parenthesis refers to pretest; parenthesis to post-test.
(b)Peak value at end of sodium spray.

5.3 PRETEST PREDICTIONS

Pretest predictions submitted by each participant are listed in Appendix E. The calculated results submitted by the various participants were not of identical format and for this reason the tables in appendix E are not of uniform format. Also, several participants submitted graphical plots rather than tabular data; for these cases HEDL personnel extracted data from the curves and prepared tables for key predicted parameters.

5.4 BLIND POST-TEST PREDICTIONS

Blind post-test predictions submitted by each participant are tabulated in Appendix F. These predictions were made with the benefit of test data on thermal conditions and aerosol mass generation rate. No information or aerosol behavior per se was made available, hence the predictions were "blind" to aerosol behavior data.

5.5 COMPARISON OF CODE PREDICTIONS WITH EACH OTHER AND WITH TEST RESULTS

Predictions of key aerosol behavior parameters are compared with each other and with test results in the following sections by listing numerical values of parameters at eleven discrete times. Tables of code predictions and experimental results are provided in Appendices G through N.

As tools for evaluating the accuracy of individual code case predictions, two indices are listed in the tables in Appendices G through N for each code case. The first is the ratio of the individual code prediction to the average of all codes. This index has only marginal value in assessing a code, but does show how it relates to the other code cases. The second index is the ratio of the individual code prediction (based on blind post-test prediction only) to the experimental value. It should be noted that experimental measurements were not always made at the precise times reported by the code users. In these instances, the experimental values listed in the tables were obtained by plotting the experimental data, drawing a smooth curve through the data points and interpolating. This index is useful for comparing the code prediction with the experimental measurement.

An effort is made to quantify the overall performance of each code case by tabulating the number of times the code predicted the experimental value within specified limits.

5.5.1 Suspended Mass Concentration

The suspended mass concentration predicted for the 11 code cases (blind post-test) are plotted in Figure 27 for the full time period of the experiment (4×10^5 seconds). The experimental data are also plotted for comparison with the code predictions. Curve 7 is an anomaly caused by improper input, as discussed in Section 5.6.3. The large number of curves in Figure 27 makes it difficult to distinguish individual codes, but it is apparent that the concentration predicted by log-normal codes (curves 2-7) decreased more rapidly than the experiment after the end of the source, while the discrete codes (curves 8-12) gave good agreement with experiment after the end of source.

The suspended concentrations during the source release period are plotted in Figure 28 for easier visualization for the high concentration period. All codes agreed with the experiment within a factor of $\sim$2 for this important time period.

Detailed information on the suspended mass concentration predicted for the eleven code cases is listed in Appendix G. Each table in Appendix G relates to one of the 11 specified code reporting times. Both the pretest and blind post-test predictions are listed, and the arithmetic average value for the code predictions are shown in the tables.

Experimental measurements of suspended mass concentration were extracted from the data presented in Section 4.5 and listed as footnotes in the Appendix G tables. The ratio of the code prediction (blind post-test) to the experimental result is given in the last column of the Appendix G tables.

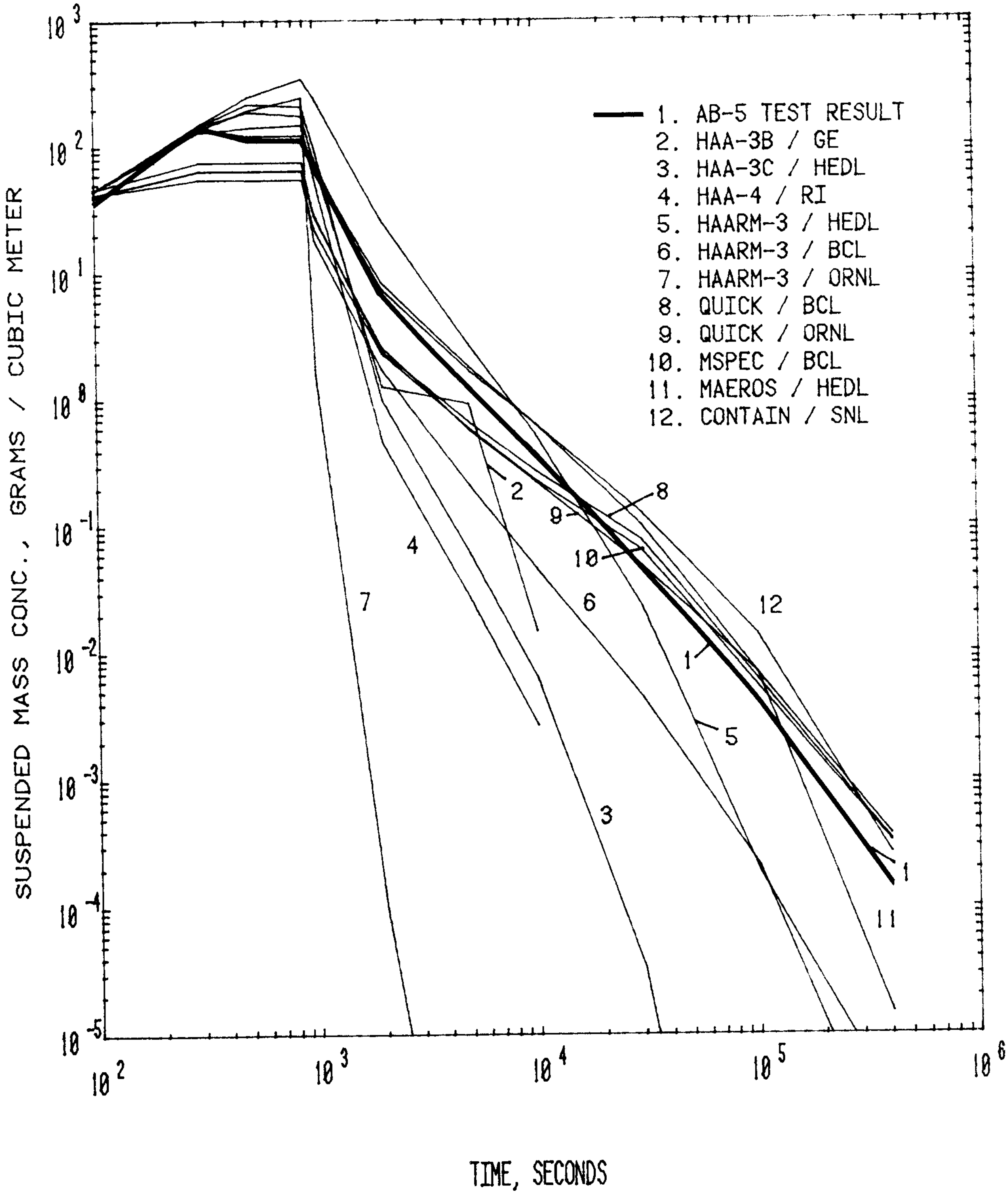


FIGURE 27. Plot of Code Predictions of Suspended Mass Concentrations for the Entire Test Period.

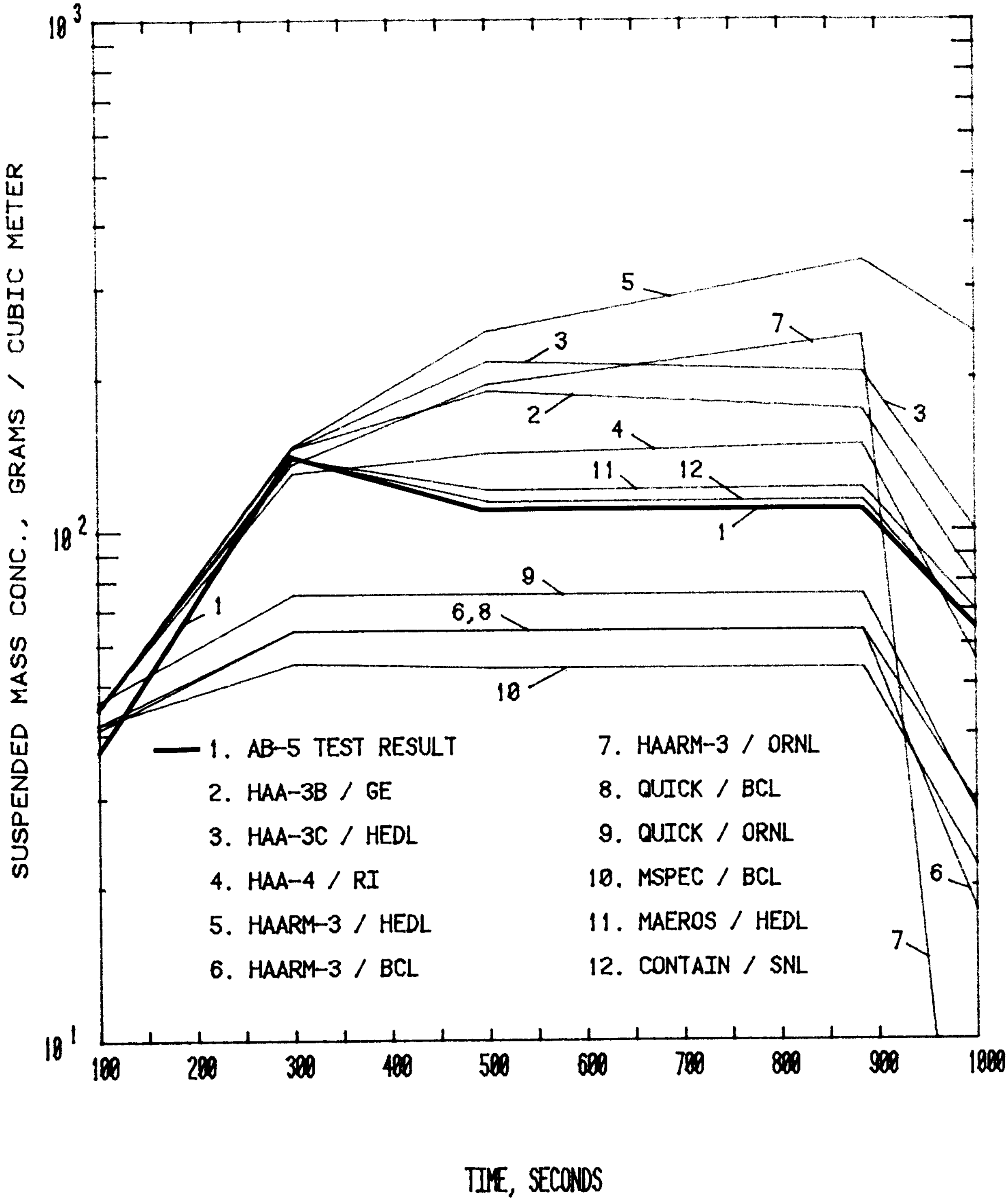


FIGURE 28. Plot of Code Predictions of Suspended Mass Concentrations During Source Period.

The number of times that each code case predicted the experimental value within a factor of two is tabulated in Table 32. The factor of two should not be inferred as a universally accepted criterion for adequate code validation, but is believed to provide a reasonable basis for the present study.

5.5.2 Aerodynamic Mass Median Diameter

The aerodynamic mass median diameter (AMMD) predicted by the codes are plotted in Figure 29. The log-normal codes (curves 2-7) generally overpredicted the AAMD, while the discrete codes (curves 8-12) underpredicted the AMMD. For the first few hundred seconds, all codes underpredicted the AMMD, which suggests that the code input values for source particle size were too small.

Detailed information on the AMMD predicted by each code case is presented in Appendix H for the 11 specified reporting times. The AMMD was not reported by the MAEROS code user. The values for MAEROS were calculated by the test performer by plotting the size distribution reported by MAEROS on log-probability paper. The mass median diameter (MMD) obtained from this plot was converted to AMMD by the use of Equation (13).

$$\text{AMMD} = \text{MMD} \left(\frac{\rho}{\chi}\right)^{1/2} \qquad (13)$$

where:

ρ = material density of aerosol particle

χ = dynamic shape factor

The experimental values listed as footnotes in Appendix H tables were obtained from cascade impactor measurements reported in Section 4.8.1. Since the impactor measurements were not made precisely at the times reported by the computer codes, the measured values were extracted from Figure 21, which is a plot of experimental AMMD as a function of time.

TABLE 32

CODE CASES WITH CORRECT PREDICTIONS
FOR SUSPENDED MASS CONCENTRATION

Time (sec)	Code Case[a,d]										
	1	2	3	4	5	6	7	8	9	10	11
100	X[c]	X	X	X	X	X	X	X	X	X	X
300	X	X	X	X		X		X	X	X	X
500	X	X	X		X	X	X	X	X	X	X
885	X	X	X		X		X	X	X	X	X
1(3)[b]	X	X	X							X	X
2(3)										X	X
5(3)	X						X			X	X
1(4)				X			X	X	X	X	X
3(4)	--		--			--	X	X	X		
1(5)	--		--			--	X	X	X	X	
4(5)	--	--	--			--					X
TOTAL CORRECT	6	5	5	3	3	3	7	7	6	9	9

(a) Refer to Table 26 for identification of code cases.
(b) Number in parenthesis is exponent of 10.
(c) An X indicates that code predicted within a factor of 2 for the indicated time.
(d) A dash indicates that no data were submitted by the code user.

TABLE 33

CODE CASES WITH CORRECT PREDICTIONS
FOR AERODYNAMIC MASS MEDIAN DIAMETER

Time (sec)	Code Case[a,d] 1	2	3	4	5	6	7	8	9	10	11
100											
300						X[c]				X	X
500				X				X		X	X
885								X		X	X
1(3)[b]				X		X					
2(3)				X	X					X	X
5(3)					X		X	X		X	X
1(4)				X	X		X	X		X	X
3(4)	--		--	X	X	--	X	X	X	X	X
1(5)	--		--	--	X	--	X	X	X	X	X
4(5)	--	--	--	--	X	--	X	X	X	X	X
TOTAL CORRECT	0	0	0	5	6	1	5	7	3	9	9

(a)Refer to Table 26 for identification of code cases.
(b)Number in parenthesis is exponent of 10.
(c)An X indicates that code predicted within a factor of 1.5 for the indicated time.
(d)A dash indicates that no data were submitted by the code user.

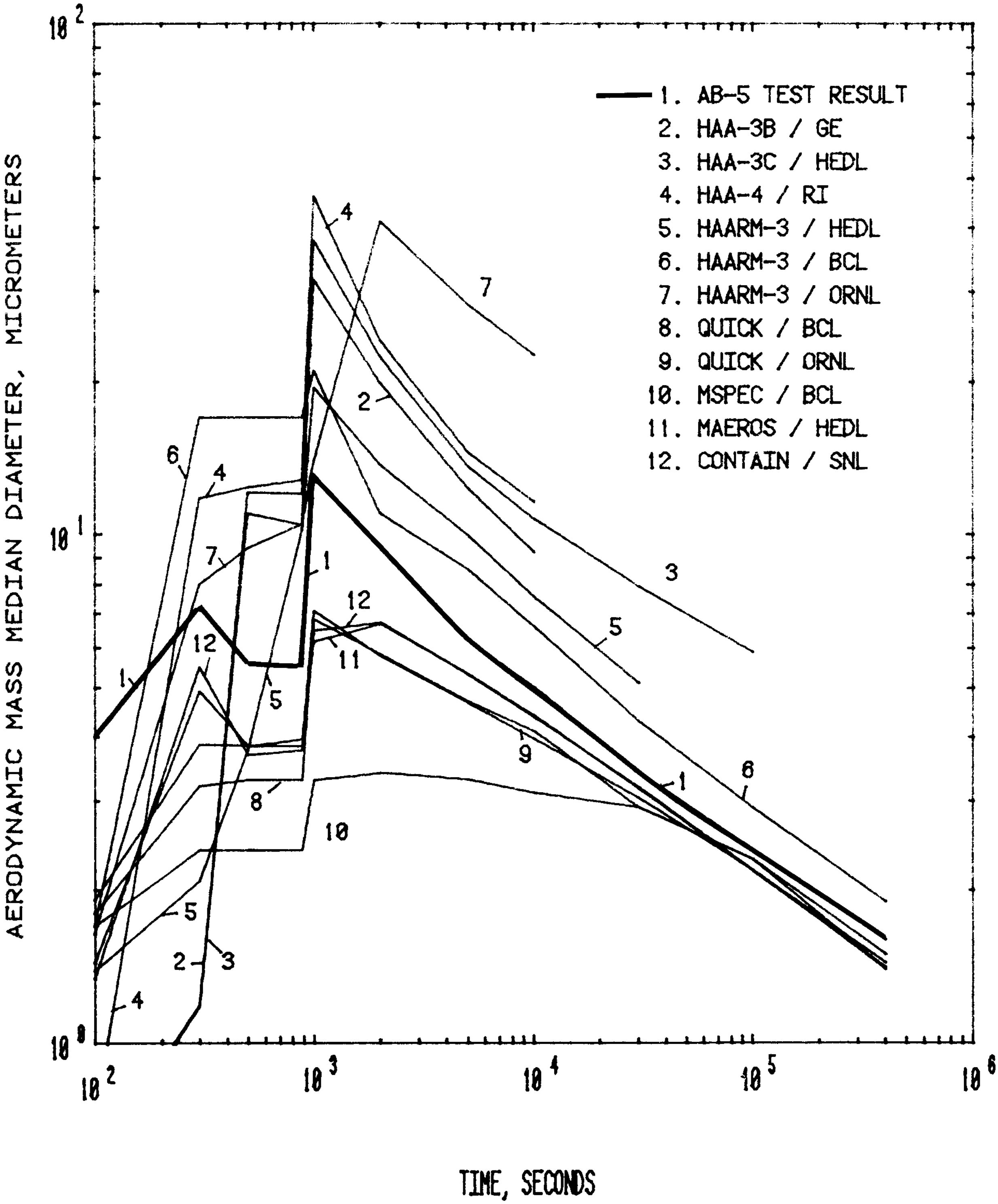


FIGURE 29. Plot of Code Predictions of Aerodynamic Mass Median Diameter.

The number of times that individual code cases predicted the experimental value within a factor of 1.5 are shown in Table 33. Note that a factor of 1.5 is used for evaluating particle size parameters, rather than a factor of two as is done for other parameters. Particle sizes and standard deviations do not vary over as wide a range as other parameters and, for this reason, the error band was assigned a value of 1.5, rather than 2.0.

5.5.3 Geometric Standard Deviation

The code predictions for geometric standard deviation of the aerosol particle size, σ_g, are plotted in Figure 30. As a group, the log-normal codes (curves 2-7) underpredicted σ_g, compared with cascade impactor test measurements. The discrete codes (curves 8-12) were generally better, but overpredicted σ_g during the source release period and underpredicted σ_g slightly after the source ended. Values for σ_g were not reported by the MAEROS and CONTAIN users. The values for MAEROS and CONTAIN were calculated by the test performer by plotting the reported size distributions on log-probability paper and using the relationship defined by Equation (14) to determine an approximate value for σ_g.

$$\sigma_g = \frac{84.1\% \text{ size}}{50\% \text{ size}} \tag{14}$$

Although this method is not rigorous for size distributions that are not log-normal, it is believed to give a reasonable basis for comparison with cascade impactor measurements.

Detailed information on the geometric standard deviation of the aerosol size distribution predicted by each code case is presented in Appendix I for the 11 specified reporting times. The experimental values listed in the tables were obtained from cascade impactor measurements, as reported in Section 4.8.1. Since the experimental measurements were not made at precisely the times reported for the computer codes, the measured values for σ_g were plotted as a function of time in Figure 22 and the experimental values were picked from this curve for the desired times.

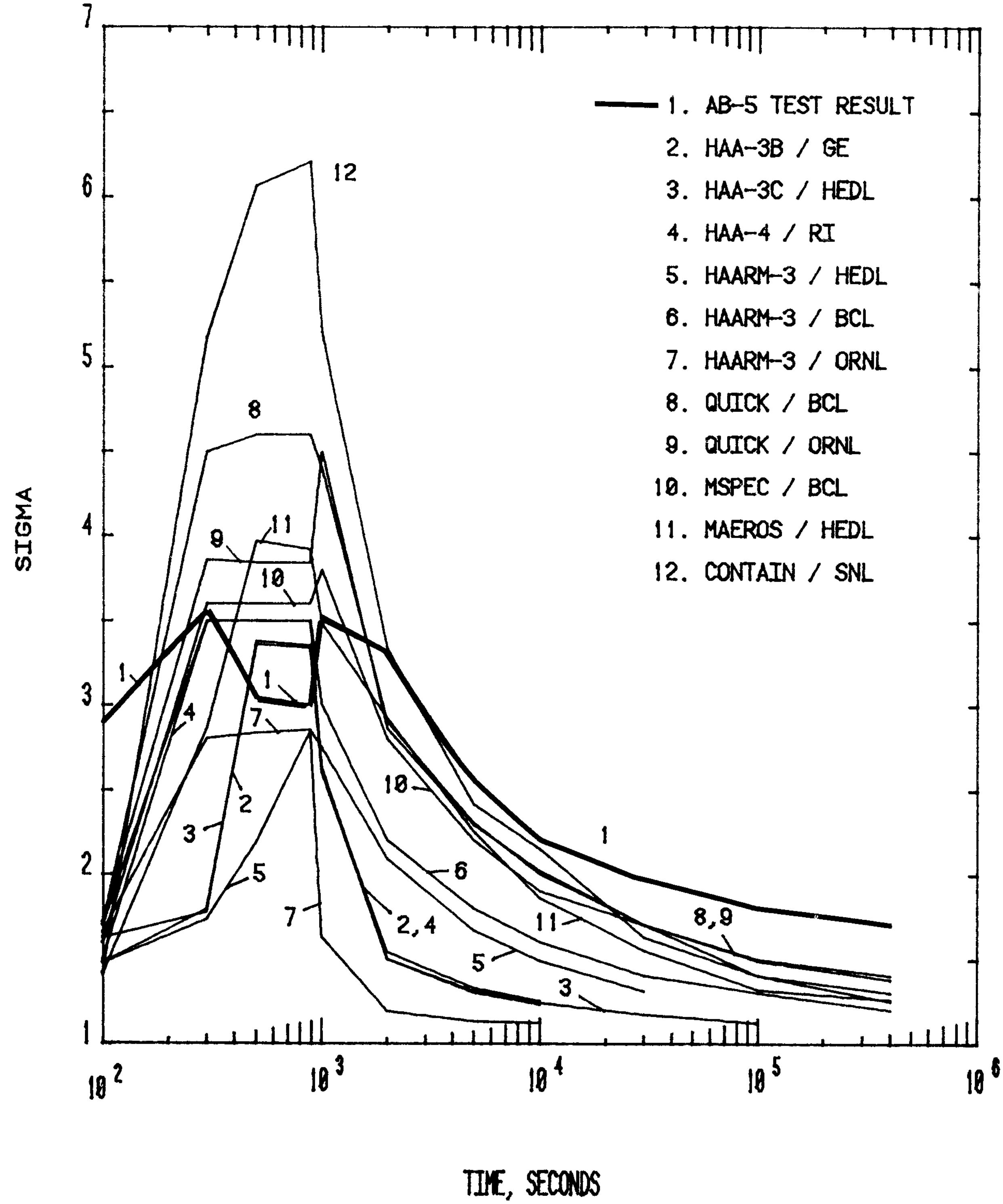


FIGURE 30. Plot of Code Predictions of Geometric Standard Deviation.

The number of times that individual code cases predicted the experimental value within a factor of 1.5 is shown in Table 34. It is recognized that these comparisons may not be highly significant for the discrete codes, because the distribution is not usually log-normal, and a well-defined σ_g may not exist.

5.5.4 Aerodynamic Settling Mean Diameter

The aerodynamic settling mean diameter, d_{sa}, is defined as the diameter of a particle which has a settling velocity equal to the sedimentation velocity for the whole aerosol. The term "aerodynamic" refers to unit density spherical particles.

The code predictions for d_{sa} are plotted in Figure 31. The experimental data in Figure 31 were calculated from the rate of change of suspended mass concentration, a knowledge of the source release rate, and the use of Stokes' law for settling of unit density spheres, as discussed in Section 4.8.4. The assumption was made that wall plating was insignificant compared with sedimentation, an assumption shown to be valid in Section 4.6.

Inspection of Figures 29 and 31 show that all of the codes were generally able to predict d_{sa} better than AMMD. The reason for this can be seen by comparing Figures 29 and 30, which show that codes which underpredict AMMD overpredict σ_g and vice versa. Since the settling mean diameter is proportional to both AMMD and σ_g, the errors in predicting AMMD and σ_g tend to compensate, resulting in a reasonably good prediction of d_{sa}.

Detailed information on the predicted values of d_{sa} are presented in Appendix J for the 11 specified code reporting times.

The number of times that individual code cases predicted the experimental value with a factor of 1.5 is shown in Table 35.

TABLE 34

CODE CASES WITH CORRECT PREDICTIONS FOR GEOMETRIC STANDARD DEVIATION

Time (sec)	Code Case(a,d) 1	2	3	4	5	6	7	8	9	10	11
100											
300			X		X	X	X	X	X	X	X
500	X(c)	X	X	X		X	X	X	X	X	
885	X	X	X	X	X	X	X	X	X	X	
1(3)(b)	X	X	X	X	X		X	X	X	X	X
2(3)					X		X	X	X	X	X
5(3)					X		X	X	X	X	X
1(4)				X	X		X	X	X	X	X
3(4)	--		--		X	--	X	X	X	X	X
1(5)	--		--	--	X	--	X	X	X	X	X
4(5)	--	--	--	--	X	--	X	X	X	X	X
TOTAL CORRECT	3	3	4	4	10	3	10	10	10	10	8

(a)Refer to Table 26 for identification of code cases.
(b)Number in parenthesis is exponent of 10.
(c)An X indicates that code predicted within a factor of 1.5 for the indicated time.
(d)A dash indicates that no data were submitted by the code user.

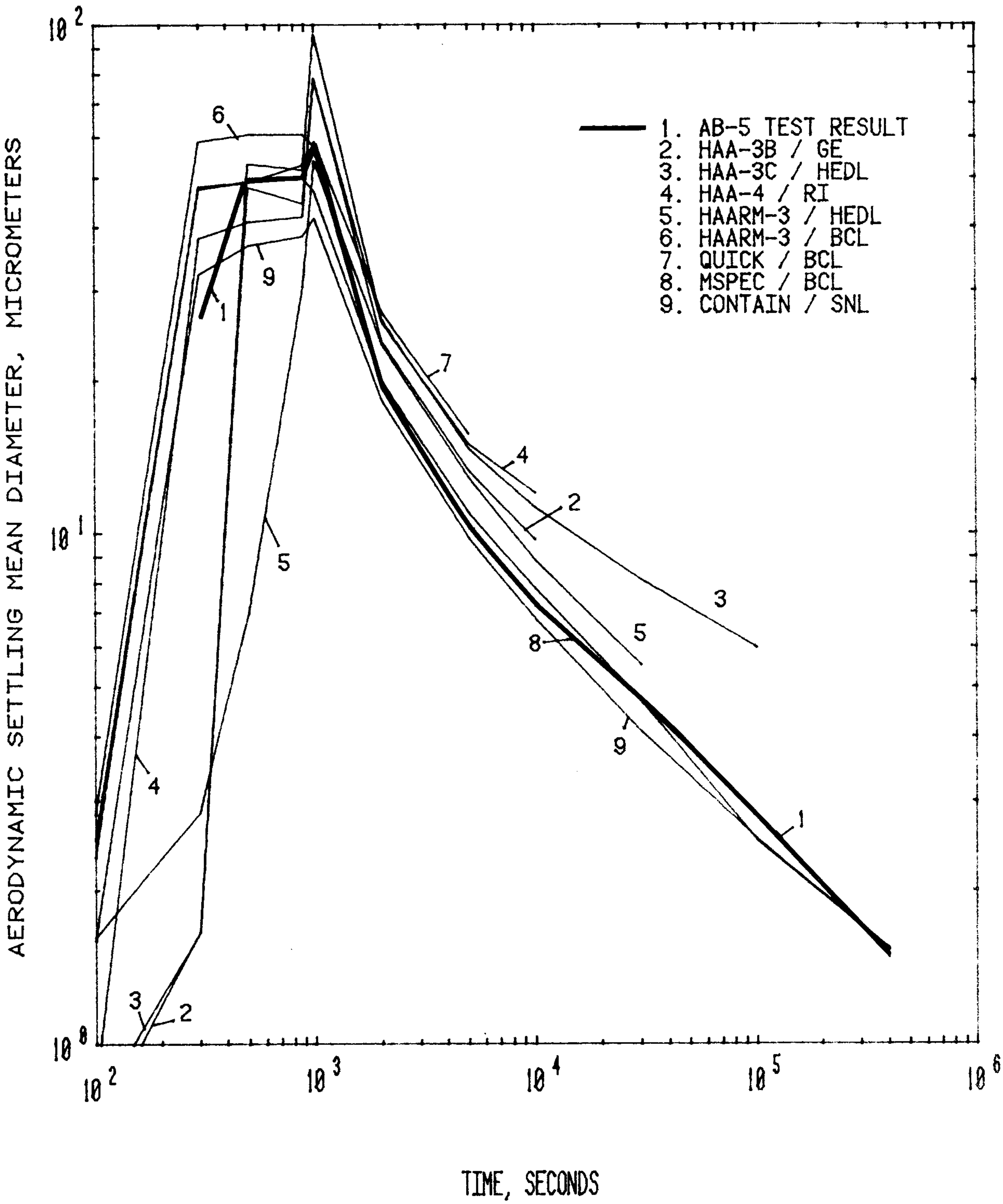


FIGURE 31. Plot of Code Predictions of Aerodynamic Settling Mean Diameter.

TABLE 35

CODE CASES WITH CORRECT PREDICTIONS
FOR AERODYNAMIC SETTLING MEAN DIAMETER

Time (sec)	Code Case[a,e] 1	2	3	4	5	6	7	8	9	10	11
100											
300			X[c]			--		--		--	X
500	X	X	X		X	--	X	--	X	--	X
885	X	X	X		X	--	X	--	X	--	X
1(3)[b]				X	X	--	X	--	X	--	X
2(3)	X	X	X	X	X	--	X	--	X	--	X
5(3)	X	X	X	X	--	--	X	--	X	--	X
1(4)	X	X		X	--	--		--	X	--	X
3(4)	--	--	--	X	--	--		--	X	--	X
1(5)	--	--	--	--	--	--		--	X	--	X
4(5)	--	--	--	--	--	--		--	X	--	X
TOTAL CORRECT	5	5	5	5	4	(d)	5	(d)	9	(d)	10

(a)Refer to Table 26 for identification of code cases.
(b)Number in parenthesis is exponent of 10.
(c)An X indicates that code predicted within a factor of 1.5 for the indicated time.
(d)Not reported.
(e)A dash indicates that no data were reported at that time.

5.5.5 Leaked Mass

The code predictions for the mass of aerosol leaked from the containment vessel are plotted as a function of time in Figure 32. An estimate of leaked mass was not provided by the MAEROS code. The experimental values from which curve 1 was drawn were calculated, using the same assumption as used in the code cases - that aerosol leaked at a constant 1% of the suspended mass per day. A discussion of the experimental results for leaked mass is provided in Section 4.9.

Detailed information on the mass of aerosol predicted to have leaked from the containment vessel at the eleven specified times is listed in Appendix K.

The number of times that individual code cases predicted within a factor of two the experimental value for leaked mass is shown in Table 36. It is of interest to note that the codes were generally more accurate in predicting leaked mass than they are in predicting suspended mass concentration at discrete times.

5.5.6 Settled Mass

The code predictions for the mass of aerosol collected on horizontal surfaces by gravitational settling are plotted in Figure 33. This parameter was measured experimentally only at the end of the experiment. The method of determining settled mass is discussed in Section 4.10. Figure 33 shows that all of the codes predicted settled mass very well, with nine of the 11 cases predicting within 10% of the test result.

Detailed information on the predicted values for settled mass is presented in Appendix L for the 11 code reporting times. Since all the codes showed that settling was complete by 10^4 seconds, the end-of-test result is reported for times 10^4 and later.

The number of times that individual code cases predicted the experimental value within $\pm 15\%$ is shown in Table 37.

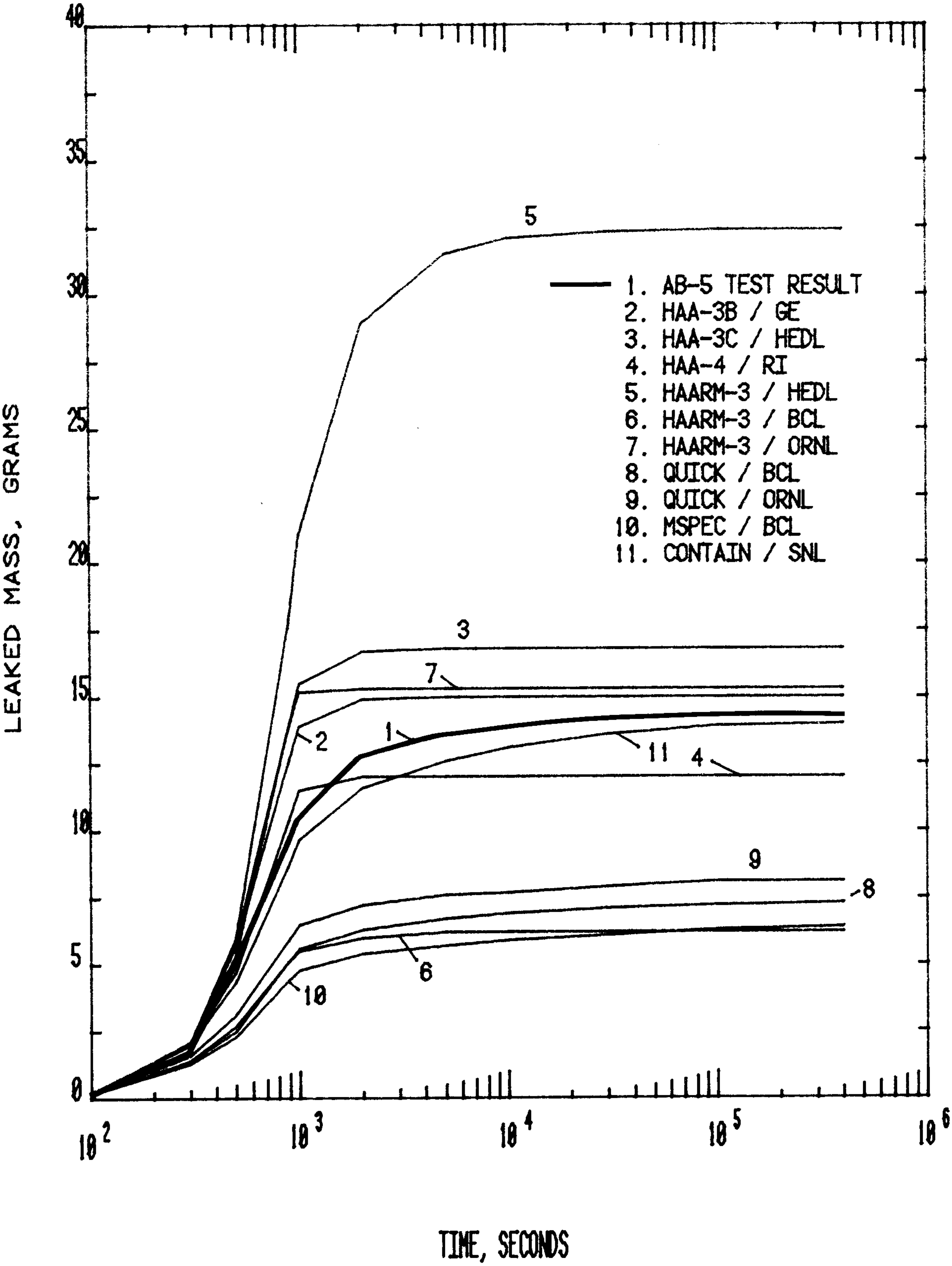


FIGURE 32. Plot of Code Predictions of Leaked Mass.

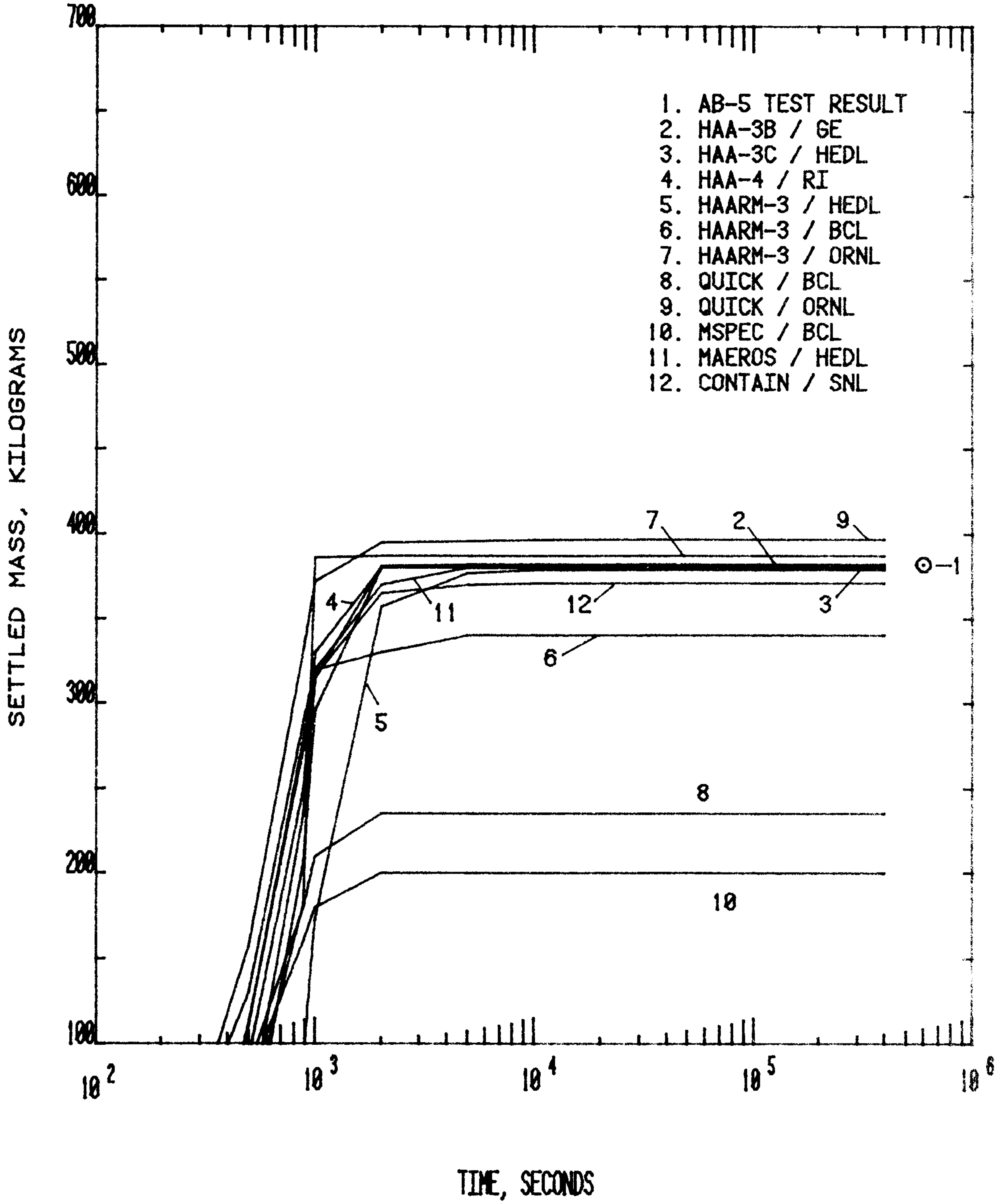


FIGURE 33. Plot of Code Predictions of Settled Mass.

TABLE 36

CODE CASES WITH CORRECT PREDICTIONS
FOR LEAKED MASS

Time (sec)	Code Case[a]										
	1	2	3	4	5	6	7	8	9	10	11
100	X[c]	X	X	X	X	X	X	X	X		X
300	X	X	X	X	X	X	X	X	X		X
500	X	X	X	X	X	X	X	X			X
885	X	X	X	X	X	X	X	X			X
1(3)[b]	X	X	X		X	X	X	X			X
2(3)	X	X	X			X	X	X			X
5(3)	X	X	X			X	X	X			X
1(4)	X	X	X			X	X	X			X
3(4)	X	X	X			X	X	X			X
1(5)	X	X	X			X	X	X			X
4(5)	X	X	X			X	X	X			X
TOTAL CORRECT	11	11	11	4	5	11	11	11	2	(d)	11

(a)Refer to Table 26 for identification of code cases.
(b)Number in parenthesis is exponent of 10.
(c)An X indicates that code predicted within a factor of 2 for the indicated time.
(d)Not reported.

TABLE 37

CODE CASES WITH CORRECT PREDICTIONS
FOR SETTLED MASS

Time (sec)	Code Case[a] 1	2	3	4	5	6	7	8	9	10	11
1(4)[b,c]	X[d]	X	X	X	X			X		X	X
3(4)	X	X	X	X	X	X		X		X	X
1(5)	X	X	X	X	X	X		X		X	X
4(5)	X	X	X	X	X	X		X		X	X
TOTAL CORRECT	4	4	4	4	4	4	0	4	0	4	4

(a)Refer to Table 26 for identification of code cases.
(b)Number in parenthesis is exponent of 10.
(c)Experimental result not available at $t < 10^4$.
(d)An X indicates that code predicted within $\pm 15\%$ for the indicated time.

5.5.7 Plated Mass

The code predictions for plated mass are plotted in Figure 34. This parameter was measured only at the end of the test, as discussed in Section 4.11. The code predictions ranged from 1.7% to 1000% of the measured value. Detailed information on the predicted values for plated mass are presented in Appendix M.

Table 38 shows that four of the code cases predicted the experimental value within a factor of two. There was more scatter among the code predictions for plated mass than for any other parameter except suspended mass concentration.

5.5.8 Instantaneous Combined Removal Rate

The predicted values for the combined instantaneous removal rate of suspended aerosol are plotted in Figure 35. Detailed information is provided in Appendix N. The experimental values were calculated from the rate of change of suspended mass concentration and a knowledge of the source release rate by the use of a mass balance on the containment atmosphere, as discussed in Section 4.12.

For several of the code cases, the removal rate was reported in terms of mass rate rather than fractional rate. For these cases, the mass rate was converted to fractional removal by Equation (15).

$$\lambda_t = \frac{R}{VC} \qquad (15)$$

where:

λ_t = removal rate, s^{-1}
R = mass removal rate, g/s
V = 852 m^3
C = suspended mass conc, g/m^3

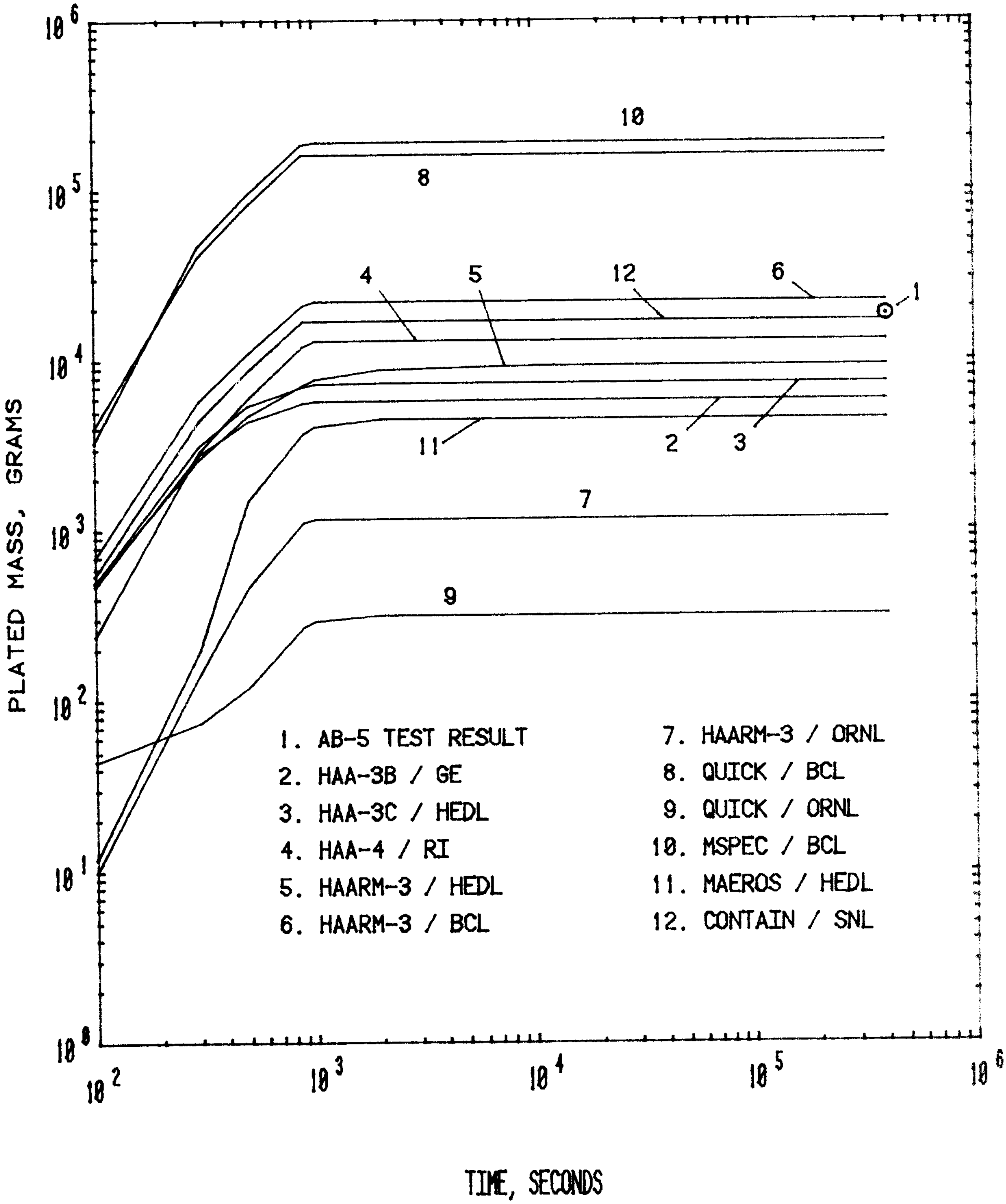


FIGURE 34. Plot of Code Predictions of Plated Mass.

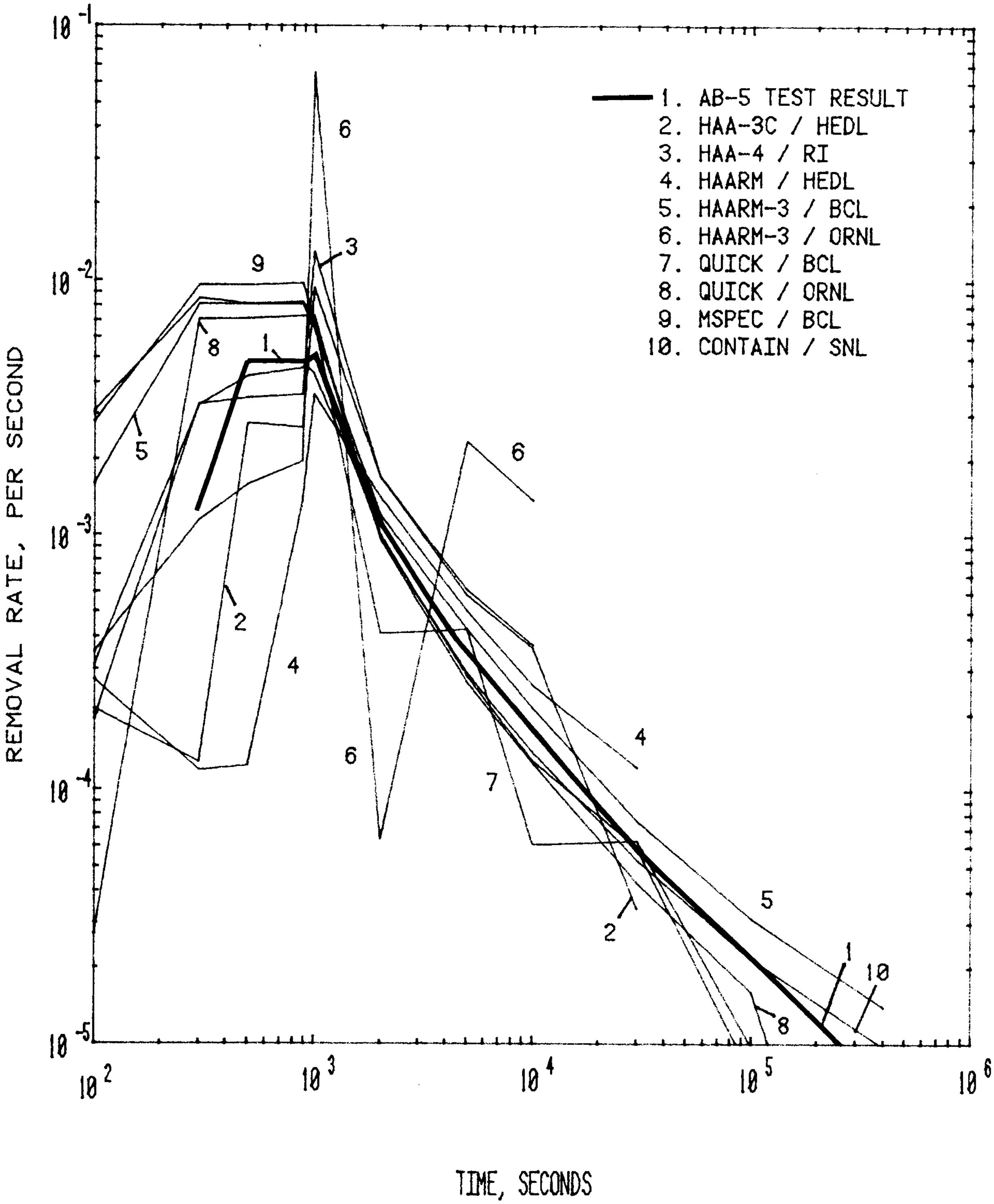


FIGURE 35. Plot of Code Predictions of Overall Removal Rate.

TABLE 38

CODE CASES WITH CORRECT PREDICTIONS FOR PLATED MASS[b]

Code Case[a]	Predicted Plated Mass Within Factor of 2	
	YES	NO
1		X
2		X
3	X	
4	X	
5	X	
6		X
7		X
8		X
9		X
10		X
11	X	

(a)Refer to Table 26 for identification of code cases.
(b)For end-of-test conditions.

The number of times that individual code cases predicted the experimental value within a factor of two is shown in Table 39.

5.6 DISCUSSION OF CODE PREDICTIONS

This discussion highlights some of the more significant aspects of code predicions for test AB5. No attempt is made to arrive at value judgments on the goodness of any of the codes. What is given here is intended to assist the reader in reviewing some of the results of the ABCOVE Program for test AB5.

5.6.1 Single Species Aerosol

Test AB5 used just one aerosol material and thus did not require analyses of co-agglomeration. Only three of the code cases (MSPEC/BCL, MAEROS/HEDL, CONTAIN/SNL) used codes that mechanistically track more than one aerosol specie. This capability was not tested in the present test. The next test, AB6, will use two aerosol species to provide such a challenge.

5.6.2 Leaked Mass Prediction

For accident cases where containment integrity is maintained, offsite consequences would be governed mainly by leaked mass. Hence, the suitability of any aerosol code hinges on its ability to realistically predict leaked mass. This important parameter was predicted quite well by all of the codes. Leaked mass predictions are summarized in Table 40.

Two aspects of the data of Table 40 are worth noting. First, the average of the code to test ratios is 0.937, within 7% of unity, the perfect fit. Thus, as a group, the codes lead to realistic predictions of leaked mass. Second, the highest ratio (2.26) and the lowest ratio (0.43) were obtained from the same code, HAARM-3. The fact that the extremes were obtained by different users of the same code illustrate the importance of user-supplied

TABLE 39

CODE CASES WITH CORRECT PREDICTIONS
FOR REMOVAL RATE

Time (sec)	Code Case[a,e] 1	2	3	4	5	6	7	8	9	10	11
100											
300						X					
500		X[c]	X		X		X	X	X		X
885		X	X		X		X	X	X		X
1(3)[b]				X	X		X	X	X		X
2(3)		X	X	X	X			X	X		X
5(3)		X	X	X	X		X	X	X		X
1(4)				X	X			X	X		X
3(4)		X	--		X	--	X	X	X		X
1(5)		--	--	--	X	--		X			X
4(5)		--	--	--	X	--	X		X		X
TOTAL CORRECT	(d)	5	4	4	9	1	6	8	8	(d)	9

(a)Refer to Table 26 for identification of code cases.
(b)Number in parenthesis is exponent of 10.
(c)An X indicates that code predicted within a factor of 2 for the indicated time.
(d)Not reported.
(e)A dash indicates that data on removal rate were not reported at this time.

TABLE 40

SUMMARY OF LEAKED MASS PREDICTIONS

Code	User	Ratio: Code to Test
HAA-3B	GE	1.05
HAA-3C	HEDL/SSD	1.17
HAA-4	RI/ESG	0.84
HAARM-3	HEDL/SSD	2.26
HAARM-3	BCL	0.43
HAARM-3	ORNL	1.07
QUICK	BCL	0.51
QUICK	ORNL	0.56
MSPEC	BCL	0.45
MAEROS	HEDL/CSA	--
CONTAIN	SNL	0.98
AVERAGE		0.937

inputs. This suggests that the code capabilities can not be determined by one or just a few test cases. The CONTAIN code prediction is notable by its accurate prediction (within 2%) of the experimental result.

5.6.3 HAARM-3 Post-Test Prediction by ORNL

The blind post-test HAARM-3 run supplied by ORNL exhibited what appeared to be anomalous behavior. As is evident from Figure 27 and the data of Appendix G, the airborne concentration decayed extremely fast compared to both the experiment and the other codes. For example, at 10,000 seconds (2.5 hr after source termination), the predicted concentration was $\sim 1 \times 10^{-11}$ of the measured value. Discussion with the participant revealed that an error had existed in the code. The error was cured and the case was re-run with identical inputs except that KLYACH was set equal to 1 rather than 0. Results of the second post-test run are exhibited in Table 41.

The data of Table 41 agree much better with test results and predictions by other users than did the original blind post-test case. For example, at 10,000 seconds, the predicted concentration is 0.058 g/m^3, or roughly 10 orders of magnitude higher than the original prediction.

TABLE 41

SECOND POST-TEST RUN WITH HAARM-3 BY ORNL

Time (s)	Suspended Mass concentration μg/cm³	AMMD μm	σ_g	Leaked Mass g	Settled Mass g	Plated Mass g	Combined Removal Rate g/s
100	45.52	1.639	1.662	0.1948	12.91	9.977	17.3
300	79.76	21.74	3.624	1.705	5.987E4	59.76	460.3
500	79.63	21.90	3.622	3.265	1.489E5	129.0	400.2
885	80.28	22.52	3.629	6.305	3.196E5	247.3	400.2
900	68.62	38.90	3.601	6.415	3.295E5	250.1	804.2
1000	24.31	27.18	3.116	6.819	3.671E5	258.9	149.4
2000	2.204	12.114	2.248	7.456	3.859E5	272.0	2.21
5000	2.678E-1	9.250	1.803	7.685	3.876E5	273.3	9.96E-2
10000	5.803E-2	7.166	1.596	7.747	3.877E5	273.5	1.08E-2
30000	5.238E-3	4.578	1.395	7.782	3.878E5	273.7	3.32E-4
1×10^5	2.117E-4	2.966	1.268	7.791	3.878E5	273.7	5.46E-6
4×10^5	5.725E-8	1.900	1.206	7.792	3.87E5	273.7	6.95E-9

The discovery of a code error and the resulting reasonable prediction after its correction illustrates the pitfalls that may await the user of any aerosol code. An adequate experimental data base against which code runs can be compared would help uncover code errors that are not outwardly obvious.

5.6.4 HAA-4 Post-Test Prediction With No Turbulent Agglomeration

The pretest and blind post-test predictions made by the HAA-4 code and reported in Section 5.5 and Appendices G through N, included a turbulent agglomeration mechanism with an input value of 1000 cm^2/sec^3. Only one other code (CONTAIN) included a turbulent agglomeration mechanism, and the input turbulent energy dissipation rate was only 10 cm^2/sec. The Rockwell International participant submitted a blind post-test prediction for HAA-4 without turbulent agglomeration to provide a comparison without the complication of a difference in turbulence effects. The case specifications were identical to the original case otherwise. Results of the case without turbulent agglomeration are given in Table 42.

A comparison of the data of Table 42 with the HAA-4 predictions reported in Appendices G through N show that turbulence effects were not important for these experimental conditions. All parameters for the case without turbulence were within 10% of those with turbulence. Turbulent energy dissipation rate was not measured experimentally.

5.6.5 Log-Normal Versus Discrete Codes

The codes in the ABCOVE program which use the log-normal assumption are HAA-3, HAA-4, and HAARM-3. The codes using discrete particle size groups are QUICK, MSPEC, MAEROS and CONTAIN. Each type of code has its advantages and disadvantages. Discrete codes are generally considered to be more accurate, whereas log-normal codes are generally more efficient. No comparison of efficiencies is attempted for test AB5 code cases, but some comparisons of accuracy are made in the following paragraphs.

TABLE 42

HAA-4A CODE BLIND POST-TEST ANALYSIS OF TEST AB5 WITH NO TURBULENCE

Time (sec)	Suspended Concentration (g/m^3)	AMMD (μm)	σg	Settling Mean Diameter (μm)	Leaked Mass (g)	Settled Mass (g)	Plated Mass (g)	Removal Rate (g/s)
100	4.5E+1	6.6E-1	1.5	7.6E-1	1.9E-1	1.8E+0	2.4E+2	7.4E+0
300	1.47E+2	1.6E+0	1.9	2.3E+0	2.1E+0	8.2E+1	3.5E+3	2.4E+1
500	1.62E+2	1.3E+1	3.5	4.2E+1	5.3E+0	7.3E+4	7.5E+3	4.9E+2
885	1.57E+2	1.3E+1	3.5	4.1E+1	1.14E+1	2.4E+5	1.4E+4	4.6E+2
1000	5.7E+1	4.9E+1	2.5	8.2E+1	1.26E+1	3.3E+5	1.5E+4	6.7E+3
2000	4.1E-1	2.4E+1	1.5	2.6E+1	1.31E+1	3.8E+5	1.5E+4	6.2E-1
5000	2.3E-2	1.5E+1	1.3	1.5E+1	1.31E+1	3.8E+5	1.5E+4	1.3E-2
10000	2.1E-3	1.2E+1	1.22	1.2E+1	1.31E+1	3.8E+5	1.5E+4	7.0E-4

Test AB5 used a high sodium spray rate for a sufficiently long time that high aerosol concentrations were achieved, where agglomeration was important. Previous studies carried out by the ABCOVE participant from Battelle-Columbus had indicated that the log-normal assumption caused overestimates of agglomeration and the resulting concentration decay rate for sufficiently intense aerosol sources. The high aerosol source rate used in test AB5 was chosen to explore this apparent limitation of log-normal codes.

An examination of the code predictions reported in Appendices G through N reveals that there is a wide spread in results from codes within each type of code. This fact causes difficulty in making a comparison between the two code types without considering differences in input parameters, which is beyond the scope of the present report. In spite of the inadequacy of comparing average values of parameters for the two types of codes, this is done in Tables 43 and 44 for suspended concentration and particle size parameters, respectively. The second post-test HAARM-3 prediction from ORNL (Table 41) was used to avoid an erroneous distortion of the mean for log-normal codes.

Inspection of Table 43, together with individual code behavior exhibited in Figures 27 and 28, reveal the following tendencies for suspended concentration:

- Discrete codes tend to be in close agreement or low during the source release period in comparison with test results. They decay at a slightly lower rate than test measurements after source termination.
- Log-normal codes tended to be high during the source period and to give a more rapid decay rate after the source termination, compared with measurements.

The geometric mean values of particle size parameters (AMMD, σ_g, and d_{sa}) for the log-normal and discrete code groups are presented in Table 44, along with the test measurements. Inspection of Table 44 reveals the following tendencies:

TABLE 43

COMPARISON OF SUSPENDED CONCENTRATIONS PREDICTED BY LOG-NORMAL AND DISCRETE CODES

Time (s)	Geometric Mean Concentration (g/m^3) Log-Normal Codes	Geometric Mean Concentration (g/m^3) Discrete Codes	Measured Concentration (g/cm^3)
100	4.4 (1)	4.4 (1)	3.7 (1)
300	1.1 (2)	8.7 (1)	1.4 (2)
500	1.4 (2)	8.1 (1)	1.1 (2)
885	1.4 (2)	8.2 (1)	1.1 (2)
1000	6.0 (1)	3.8 (1)	6.5 (1)
2000	9.0 (-1)	3.9 (0)	6.8 (0)
5000	2.5 (-1)	9.3 (-1)	1.2 (0)
10000	2.7 (-2)	3.5 (-1)	3.8 (-1)
30000	2.1 (-3)	7.9 (-2)	4.7 (-2)

TABLE 44

COMPARISON OF PARTICLE SIZE PARAMETER
PREDICTED BY LOG-NORMAL AND DISCRETE CODES

Time	Geometric Mean of AMMD (μm)			Geometric Mean σ_g			Geometric Mean of Aerodynamic Settling Mean Diameter (μm)		
(sec)	Log-N	Discrete	Test	Log-N	Discrete	Test	Log-N	Discrete	Test
100	1.10	1.64	4.0	1.58	1.57	2.9	1.34	2.02	--
300	9.16	3.97	7.2	2.66	4.00	3.55	20.6	42.7	26.
500	13.0	3.41	5.6	3.26	4.42	3.05	42.0	45.0	50.
885	14.2	3.46	5.5	3.36	4.43	3.00	45.9	47.1	50.
1000	30.5	5.97	13.0	2.78	4.28	3.50	72.8	52.6	47.
2000	17.2	5.67	9.4	1.85	2.96	3.3	23.9	21.7	20.
5000	11.4	4.65	6.2	1.54	2.29	2.55	14.0	11.9	11.
10000	8.81	3.99	5.0	1.40	1.99	2.2	10.4	7.0	7.8
30000	5.47	3.03	3.4	1.27	1.42	1.97	6.8	4.4	4.7

- The log-normal codes tended to overpredict the AMMD at all times and underpredict the σ_g for all except the latter stages of the source release period, compared with test measurements.

- The discrete codes tended to underpredict the AMMD at all times and overpredict σ_g during the source period, compared with test measurements.

- Both code types predicted the aerodynamic settling mean diameter reasonably well during the source period compared with test results, with the discrete codes being best after termination of the source.

Overall, the discrete codes appear to more accurately reflect aerosol behavior both during the source period and after source termination. It should be noted that the discrete codes would compare even more favorably with the test if plateout had not been overpredicted by two cases involving discrete codes. The overprediction of plateout caused an underprediction of concentration during the source period and a slower decay after source termination. Of course, improvements in other code results could also be obtained by use of other input parameters.

While the more rapid concentration decay predicted by the log-normal codes does not significantly affect the leaked mass calculation (at constant leak rate), it could be important for accident cases where containment failed after source termination. For example, at 30,000 sec (8.3 hr) the mean of the log-normal codes underpredicted the concentration by a factor of 22. However, the concentration at 30,000 sec was only 0.0004 that of the maximum value during the source period, and the consequences of release at this time would be low.

5.6.6 Wall Plateout

Wall plateout was modeled to occur by Brownian diffusion and by thermophoresis. For the HAA-3 codes, thermophoresis is not included as a deposition mechanism, so diffusion is the only plateout mechanism for these two codes. Predicted values of plated mass varied by several orders of magnitude, as is illustrated in Table 45, where predictions are compared for three time periods. Predicted values of plated mass varied from 3.17×10^2 g (QUICK, ORNL)

TABLE 45

COMPARISON OF PREDICTIONS OF PLATED MASS

Code	User	Plated Mass at Specified Time (g)		
		885 Seconds	2000 Sec	End of Test
HAA-3B	GE	5.61 (3)[a]	5.76 (3)	5.77 (3)
HAA-3C	HEDL/SSD	7.01 (3)	7.32 (3)	7.33 (3)
HAA-4	RI/ESG	1.2 (4)	1.3 (4)	1.3 (4)
HAARM-3	HEDL/SSD	7.20 (3)	8.76 (3)	9.27 (3)
HAARM-3	BCL	2.1 (4)	2.2 (4)	2.2 (4)
HAARM-3	ORNL	1.12 (3)	1.17 (3)	1.17 (3)
QUICK	BCL	1.6 (5)	1.6 (5)	1.6 (5)
QUICK	ORNL	2.72 (2)	3.15 (2)	3.17 (2)
MSPEC	BCL	1.85 (5)	1.9 (5)	1.9 (5)
MAEROS	HEDL/CSA	3.7 (3)	4.5 (3)	4.5 (3)
CONTAIN	SNL	1.70 (4)	1.70 (4)	1.70 (4)
AB5 EXPERIMENT		--	--	1.83 (4)

(a)Numbers in parenthesis are exponents of 10.

to 1.9 x 10^5 g (MSPEC, BCL). Part of the discrepancy between these two extremes is due to differences in input values of thermal gradient. The data of Table 31 show that the input values for peak gradients varied by a factor of 10 between the two cases. This difference in gradient would be expected to cause as much as an order of magnitude difference, but not the observed difference of a factor of 600. It is apparent that other differences must also exist. Another observation of interest is the difference in BCL predictions which ostensibly used the same inputs. Whereas HAARM-3 predicted a plated mass of 2.2 x 10^4 g, QUICK and MSPEC predicted plated masses ∿8 times larger.

5.6.7 Comparison of Pretest and Post-Test Predictions

The pretest predictions were made on the basis of a test plan provided by the test performer. Although the test was performed essentially as intended, some deviations from the test plan did occur, requiring blind post-test predictions to be made. The most notable change from the test plan was the aerosol source rate, which was 0.770 of the test plan value. Other deviations were: the start time was 13 s rather than 0, the stop time was 885 s rather than 900 s, the sodium fraction in the aerosol was 0.574 rather than 0.588, the material density was 2.50 rather than 2.72, and the containment temperature and pressure were slightly lower than planned. The total mass of aerosol released was 0.746 of the test plan value. It is of interest to learn if these changes had a significant effect on the code predictions.

Table 46 gives a comparison of pretest and post-test predictions, expressed as ratios of the geometric means for the eight parameters reported in Appendices G through N. It should be noted that some of the variation in Table 46 is due to the different source start and stop times and also to the fact that some of the codes did not predict for the entire 4 x 10^5 second period, so that the number of codes being averaged changed with time (after 10^4 sec).

Table 46 shows that the post-test predictions for suspended concentration, leaked mass, settled mass and plated mass averaged ∿70% of the pretest values. This shows that the post-test predictions were necessary so that an

TABLE 46

COMPARISON OF PRETEST AND BLIND POST-TEST PREDICTIONS

Time (s)	Geometric Mean of All Codes, Ratio of Post-Test/Pretest							
	Susp. Conc.	AMMD	σ_g	ASMD	M_L	M_S	M_P	R
1(2)	0.67	0.77	0.81	1.16	0.58	0.49	0.44	0.96
3(2)	0.76	1.00	1.00	2.08	0.70	0.69	0.62	0.96
5(2)	0.75	0.93	1.02	1.45	0.72	0.84	0.56	0.99
8.85(2)	0.73	0.93	1.09	1.43	0.70	0.80	0.64	1.06
1(3)	0.64	0.87	1.02	1.19	0.72	0.86	0.62	1.89
2(3)	0.68	1.11	1.03	0.92	0.69	0.55	0.61	0.70
5(3)	0.70	1.11	1.03	0.97	0.68	0.77	0.61	1.33
1(4)	0.54	1.24	1.00	0.89	0.68	0.77	0.61	1.58
3(4)	0.75	0.93	1.05	1.07	0.68	0.77	0.61	0.95
1(5)	0.80	0.94	1.03	1.00	0.68	0.77	0.61	0.95
4(5)	1.41	0.89	1.06	1.60	0.68	0.77	0.61	1.28

accurate comparison with test measurements could be made. It is of interest to note that the 70% figure is very close to the 77% value for the source release rate and the 74.6% value for total aerosol mass released in the pretest versus post-test code calculations.

An argument can be made that pretest predictions are unnecessary as long as blind post-test predictions are needed. The merit of performing the analyses prior to test performance is that this process eliminates any question as to whether the code user had beneficial knowledge of test results when he made his predictions.

6.0 REFERENCES

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A P P E N D I X   A

DATA ACQUISITION SYSTEM CHANNEL IDENTIFICATION

APPENDIX A

DATA ACQUISITION SYSTEM CHANNEL IDENTIFICATION

The identification and location of each data acquisition system (DAS) channel is given in Table A-1. Coordinates used to define the thermocouple locations cited in Table A-1 are illustrated in Figure A-1.

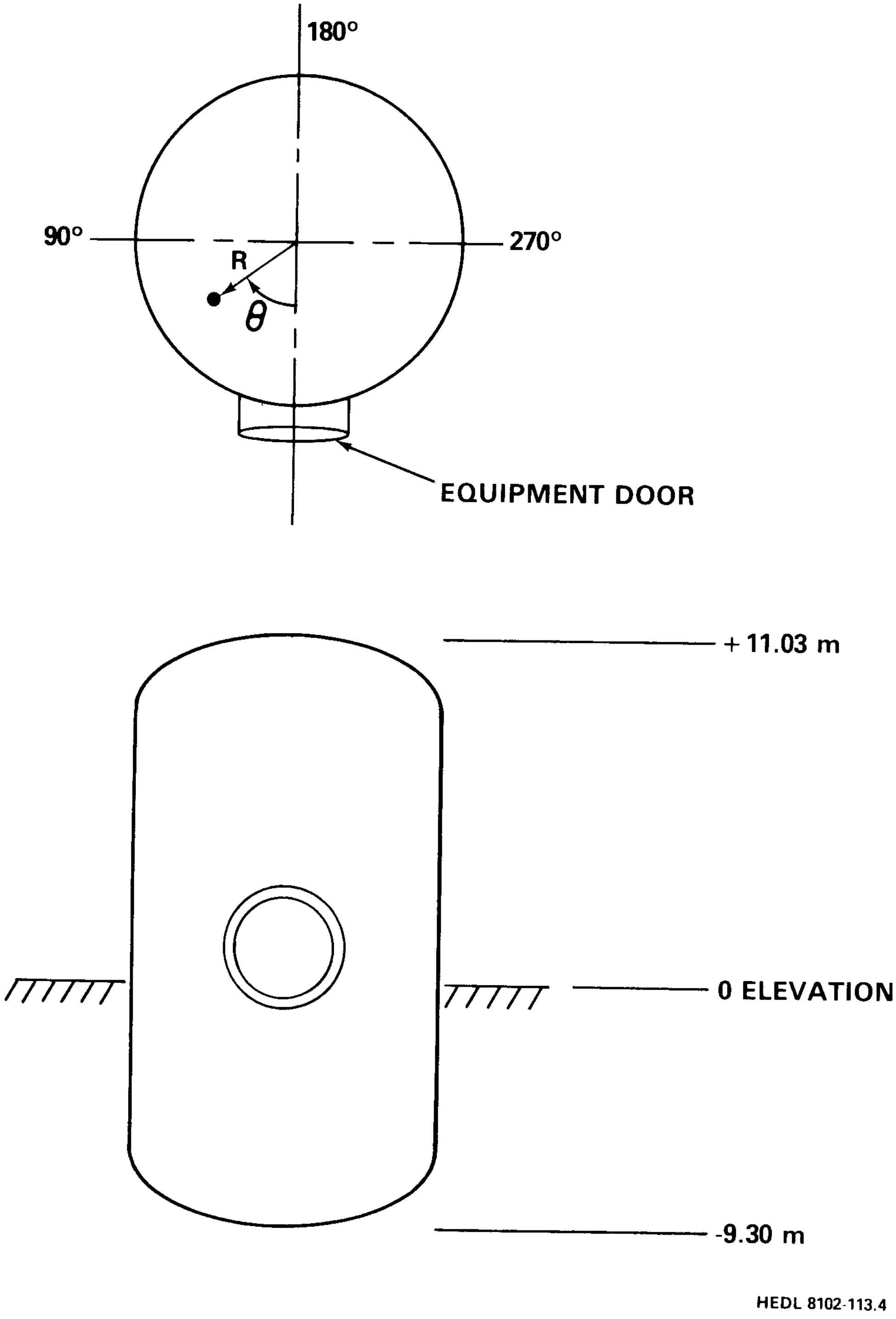

FIGURE A-1. Spatial Coordinates Used to Define Thermocouple Locations in Table A-1.

TABLE A-1

DATA ACQUISITION SYSTEM CHANNEL IDENTIFICATION

DAS No.	Recorder & Point	Measurement	Output	Description and Location
0	-	std temp	°F	Set at 100°F
1	3-1	CV atmos temp	°F	+8.84 m elev, 0 Radius, centerline
2	3-2	CV atmos temp	°F	+5.61 m elev, 0 Radius, centerline
3	3-3	CV atmos temp	°F	+2.44 m elev, 0 Radius, centerline
4	3-4	CV atmos temp	°F	-0.73 m elev, 0 Radius, centerline
5	3-5	CV atmos temp	°F	-4.27 m elev, 0 Radius, centerline
6	3-6	CV atmos temp	°F	-7.01 m elev, 0 Radius, centerline
*7	3-7	CV atmos temp	°F	+8.84 m elev, 1.52 Radius, 180° azimuth
*8	3-8	CV atmos temp	°F	+5.61 m elev, 1.52 Radius, 180° azimuth
*9	3-9	CV atmos temp	°F	+2.44 m elev, 1.52 Radius, 180° azimuth
*10	3-10	CV atmos temp	°F	-0.73 m elev, 1.52 Radius, 180° azimuth
*11	3-11	CV atmos temp	°F	-4.27 m elev, 1.52 Radius, 180° azimuth
12	3-12	CV atmos temp	°F	-7.01 m elev, 1.52 Radius, 180° azimuth
*13	3-13	CV atmos temp	°F	+8.84 m elev, 2.74 Radius, 0° azimuth
*14	3-14	CV atmos temp	°F	+5.61 m elev, 2.74 Radius, 0° azimuth
*15	3-15	CV atmos temp	°F	+2.44 m elev, 2.74 Radius, 0° azimuth
*16	3-16	CV atmos temp	°F	-0.73 m elev, 2.74 Radius, 0° azimuth
*17	3-17	CV atmos temp	°F	-4.27 m elev, 2.74 Radius, 0° azimuth
*18	3-18	CV atmos temp	°F	-7.01 m elev, 2.74 Radius, 0° azimuth
*19	3-19	CV atmos temp	°F	+8.84 m elev, 3.51 Radius, 180° azimuth
*20	3-20	CV atmos temp	°F	+5.61 m elev, 3.51 Radius, 180° azimuth
*21	3-21	CV atmos temp	°F	+2.44 m elev, 3.51 Radius, 180° azimuth
*22	3-22	CV atmos temp	°F	-0.73 m elev, 3.51 Radius, 180° azimuth
*23	3-23	CV atmos temp	°F	-4.27 m elev, 3.51 Radius, 180° azimuth
*24	3-24	CV atmos temp	°F	-7.01 m elev, 3.51 Radius, 180° azimuth

*Used in averaging to obtain mean atmospheric temperature.

TABLE A-1 (Cont'd)

DAS No.	Recorder & Point	Measurement	Output	Description and Location
**25	6-1	CV steel temp	°F	Inside surface, +8.84 m elev, 180° azimuth
**26	6-2	CV steel temp	°F	Inside surface, +8.84 m elev, 0° azimuth
27	6-3	CV steel temp	°F	Inside surface, +4.27 m elev, 30° azimuth
28	6-4	CV steel temp	°F	Inside surface, +4.27 m elev, 210° azimuth
29	6-5	CV steel temp	°F	Inside surface, -0.91 m elev, 30° azimuth
**30	6-6	CV steel temp	°F	Inside surface, -0.91 m elev, 210° azimuth
**31	6-7	CV steel temp	°F	Inside surface, -3.66 m elev, 130°
**32	6-8	CV steel temp	°F	Inside surface, -3.66 m elev, 210°
33	6-9			Spare
34	6-10			Spare
35	6-11	18-in I-beam	°F	Embed in flange, 0.46 m radius, 180° azimuth
36	6-12			Spare
*37	6-13	CV atmos temp	°F	0.41 m above catch pan center, -8.25 m elev
**38	6-14	CV steel temp	°F	Top dome surface, 0.31 m radius
39	6-15	CV atmos temp	°F	0.015 m from dome surface, 0.31 m radius
40	6-16	CV atmos temp	°F	0.022 m from dome surface, 0.31 m radius
41	6-17	CV atmos temp	°F	0.048 m from dome surface, 0.31 m radius
42	6-18	CV atmos temp	°F	0.300 m from dome surface, 0.31 m radius

*Used in averaging to obtain mean atmospheric temperature.

**Used in averaging to obtain mean temp. of CV steel.

TABLE A-1 (Cont'd)

DAS No.	Recorder & Point	Measurement	Output	Description and Location
**43	6-19	CV steel temp	°F	Inside surface -5.79 m elev, 225° azimuth
44	6-20	CV steel temp	°F	Inside surface -9.15 m elev, 300° azimuth
45	6-21	CV steel temp	°F	Inside surface -8.54 m elev, 180° azimuth
**46	6-22	CV steel temp	°F	Inside surface -9.45 m elev, 300° azimuth
47	6-23	CV atmos temp	°F	-5.79 m elev, 3.51 m radius, 95° azimuth
**48	6-24	CV steel temp	°F	Inside surface, +10.7 m elev, 1.22 m radius, 285° azimuth
49	11-1	CV steel temp	°F	Outside surface, top dome center, 11.0 m elev
**50	11-2	CV steel temp	°F	Outside surface, +6.10 m elev, 180° azimuth
**51	11-3	CV steel temp	°F	Outside surface, +1.22 m elev, 180° azimuth
**52	11-4	CV steel temp	°F	Outside surface, -3.05 m elev, 180° azimuth
**53	11-5	CV steel temp	°F	Outside surface, bottom head, -8.8 m
54	11-6	Outside air	°F	+9.15 m elev, 0.30 m from CV, 260° azimuth
55	11-7	Outside air	°F	+2.13 m elev, 0.30 m from CV, 180° azimuth
56	11-8	Outside air	°F	-6.10 m elev, 0.30 m from CV, 180° azimuth
57	11-9	Outside air	°F	Ex-CV room ventilation exhaust
58	11-10	Waste Liquid	°F	TK-1 waste tank
59	11-11	Steam Temp	°F	Steam superheater outlet

**Used in averaging to obtain mean temp. of CV steel.

TABLE A-1 (Cont'd)

DAS No.	Recorder & Point	Measurement	Output	Description and Location
60	11-12	Steam temp	°F	Sat'd steam at orifice
61	11-13	CV atmos temp	°F	0.010 m from wall, +1.52 m elev, 100° azimuth
62	11-14	CV atmos temp	°F	0.020 m from wall, +1.52 m elev, 100° azimuth
63	11-15	CV atmos temp	°F	0.050 m from wall, +1.52 m elev, 100° azimuth
64	11-16	CV atmos temp	°F	0.030 m from wall, +1.52 m elev, 100° azimuth
**65	11-17	CV steel temp	°F	Inside surface, +1.52 m elev, 100° azimuth
**66	11-18	CV steel temp	°F	Inside surface, +4.27 m elev, 180° azimuth
**67	11-19	CV steel temp	°F	Inside surface, +1.22 m elev, 345° azimuth
**68	11-20	CV steel temp	°F	Inside surface, +5.79 m elev, 30° azimuth
69	11-21	CV insulation	°F	Outer surface, +6.10 m elev, 108° azimuth
70	11-22			Spare
71	11-23			Spare
72	11-24			Spare
73	5-1	Na Temp	°F	TK-3 bottom head
74	5-2	Na Temp	°F	TK-3, 0.91 m above bottom
75	5-3	Na Temp	°F	TK-3 top head
76	5-4	Na Spray Nozzle A	°F	-4.33 m elev, 0.55 m radius, 0° azimuth
77	5-5	Na Spray Nozzle B	°F	-4.33 m elev, 0.55 m radius, 180° azimuth
78	5-6	TK-2 Temp	°F	TK-2 bottom head
79	5-7	Catch pan temp	°F	Top surface, center

**Used in averaging to obtain mean temp. of CV steel.

TABLE A-1 (Cont'd)

DAS No.	Recorder & Point	Measurement	Output	Description and Location
80	5-8	Steel ladder	°F	Surface of cage 4.8 mm thick, +1.52 m elev
81	5-9	18-in. I-Beam	°F	Embed in flange, 3.54 m radius, 180° azimuth
82	5-10			Spare
83	5-11			Spare
84	5-12			Spare
85	7-1	Dew point	°F	G1, 100 mV = 100°F
86	7-2	Dew point	°F	G2, 100 mV = 100°F
87	7-3	O_2 conc	%	G1, 100 mV = 25%
88	7-4	O_2 conc	%	G2, 100 mV = 25%
89	7-5	H_2 conc	%	G1
90	7-6	H_2 conc	%	G2
91	7-7	O_2 conc	%	G3, 100 mV = 25%
92	7-8	O_2 conc	%	G4, 100 mV = 25%
93	7-9	O_2 conc	%	G5, 100 mV = 25%
94	7-10			Spare
95	7-11			Spare
96	7-12	volts	V	Dial-a-volt set at 1 volt
97	FR-3	Flowrate	SCFM	Main CV exhaust duct, 15 V = 1500 SCFM
98	FR-4	Flowrate	SCFM	Bypass air flow, 15 V = 1500 SCFM
99	FR-5	Flowrate	GPM	Pump P-5, 6 V = 60 GPM
100	FR-6	Flowrate	GPM	Pump P-6, 100 V = 100 GPM
101	FR-7	Flowrate	GPM	Pump P-7, 6 V = 6 GPM
102	DPR-1	Pressure Drop	In. water	EACS total, 5 V = 50 in. water
103	DPR-2	Pressure Drop	In. water	Fiber bed, 10 V = 25 in. water
104	PR-2	CV Pressure	In. water	Gauge pressure, 10 V = 20 in. water

TABLE A-1 (Cont'd)

DAS No.	Recorder & Point	Measurement	Output	Description and Location
105	8-red	CV pressure	psia	Absolute pressure, 600mV = 60 psia
106	8-blue	Na tank wt.	lb	Load cell on TK-3, 600 mV = 6000 lb
107	4-red	Na flowrate	mV	Spray line, 1 mV = 63 g/s
108	4-blue	O_2 flowrate	mV	Oxygen line to CV
109	9-red	Pressure drop	psi	TK-3 to CV atmos, 10 V = 200 psi
110	9-green			Spare
111	10-red			Spare
112	10-green			Spare
113	20-1	H_2 conc	%	G-3
114	--			Spare
115	20-3	H_2 conc	%	G-4
116	--			Spare
117	20-5	H_2 conc	%	G-5
118	--			Spare
119	--			Spare
120	--			Spare

A P P E N D I X   B

DIGITAL OUTPUT FOR INITIAL 90 MINUTES FOR ALL CHANNELS

APPENDIX B

DIGITAL OUTPUT FOR INITIAL 90 MINUTES FOR ALL CHANNELS

All the digital data recorded on magnetic tape during the initial 90 minutes of test AB5 are listed in Tables B-1 through B-7. After 90 minutes, temperatures were fairly uniform throughout the vessel and the average values given in Appendix C can be used.

Identification of each data acquisition system (DAS) channel is provided in Appendix A.

The contents of Tables B-1 through B-7 are as follows:

Table	Channels
B-1	DAS1 through DAS12
B-2	DAS13 through DAS24
B-3	DAS25 through DAS41
B-4	DAS42 through DAS55
B-5	DAS57 through DAS74
B-6	DAS76 through DAS91
B-7	DAS92 through DAS117

TABLE B-1

DIGITAL OUTPUT FOR CHANNELS 1 THROUGH 12 --TEST AB5
(REFER TO TABLE A-1 FOR CHANNEL DESCRIPTIONS)

TIME MINUTES	DAS 1 DEG C	DAS 2 DEG C	DAS 3 DEG C	DAS 4 DEG C	DAS 5 DEG C	DAS 6 DEG C	DAS 7 DEG C	DAS 8 DEG C	DAS 9 DEG C	DAS 10 DEG C	DAS 11 DEG C	DAS 12 DEG C
-2.87	31.0	30.9	30.5	29.5	31.7	27.2	31.6	30.9	30.4	29.1	28.3	26.8
-2.72	31.1	30.9	30.5	29.5	31.7	27.3	31.5	31.0	30.5	29.1	28.4	26.8
-2.57	31.2	31.1	30.5	29.5	31.8	27.4	31.6	31.1	30.5	29.1	28.4	26.8
-2.42	31.2	31.1	30.5	29.4	31.9	27.4	31.6	31.0	30.5	29.1	28.4	26.8
-2.27	31.1	31.0	30.6	29.4	31.9	27.3	31.4	31.0	30.5	29.1	28.3	26.8
-2.13	31.2	31.1	30.5	29.4	32.0	27.3	31.4	31.1	30.5	29.2	28.4	26.9
-1.98	31.1	30.8	30.5	29.5	32.1	27.3	31.6	30.9	30.5	29.2	28.4	26.9
-1.83	31.1	31.1	30.6	29.4	32.2	27.3	31.4	31.0	30.5	29.1	28.4	26.8
-1.68	31.2	31.1	30.6	29.4	32.2	27.4	31.6	31.0	30.5	29.1	28.4	26.8
-1.53	31.2	31.1	30.6	29.4	32.3	27.3	31.6	31.0	30.5	29.1	28.4	26.8
-1.38	31.1	31.0	30.6	29.4	32.2	27.4	31.5	31.1	30.5	29.1	28.4	26.9
-1.25	31.2	31.1	30.6	29.4	32.3	27.3	31.5	31.1	30.5	29.1	28.4	26.9
-1.10	31.0	31.1	30.6	29.4	32.2	27.3	31.4	31.1	30.4	29.0	28.4	26.8
-0.95	31.0	31.0	30.5	29.4	32.1	27.3	31.5	31.1	30.4	29.0	28.4	26.8
-0.80	31.2	31.1	30.6	29.5	32.1	27.3	31.6	31.1	30.5	29.1	28.4	26.8
-0.65	31.2	31.1	30.6	29.4	32.1	27.4	31.5	31.1	30.5	29.2	28.4	26.8
-0.52	31.2	31.1	30.6	29.4	32.0	27.3	31.5	31.1	30.5	29.2	28.4	26.9
-0.37	31.1	31.0	30.5	29.6	31.9	27.3	31.6	31.1	30.4	29.0	28.3	26.8
-0.22	31.2	31.2	30.7	29.6	32.1	27.4	31.6	31.1	30.6	29.2	28.4	26.8
-0.07	31.2	31.2	30.5	29.4	32.3	27.4	31.6	31.0	30.5	29.2	28.4	26.8
0.08	31.2	31.2	30.5	29.5	32.3	27.3	31.6	31.1	30.6	29.1	28.4	26.8
0.23	31.1	31.1	30.6	29.7	32.1	27.4	31.6	31.0	30.5	29.1	28.3	26.9
0.37	30.9	97.6	78.1	117.3	43.9	33.0	31.6	57.4	39.2	40.7	31.4	30.1
0.52	31.1	112.4	106.6	182.4	49.8	37.1	31.8	97.4	60.8	67.3	34.7	34.8
0.67	31.3	131.6	120.5	257.8	57.4	44.6	31.9	122.5	83.8	116.4	39.5	40.1
0.82	31.6	149.2	132.6	272.6	71.9	71.4	32.2	151.4	109.1	183.6	46.2	46.0
0.97	31.9	168.0	158.1	298.9	91.3	106.2	32.6	179.7	135.7	183.5	61.2	52.7
1.12	32.3	190.7	174.7	334.4	112.3	115.9	33.3	188.2	149.9	190.0	77.8	58.6
1.27	32.8	223.9	208.7	373.6	134.9	159.3	34.3	207.4	165.7	196.2	94.4	62.8
1.42	33.8	237.8	227.1	380.9	155.5	161.8	35.7	221.4	179.1	207.7	109.2	66.8
1.55	35.1	246.9	246.0	421.6	175.4	166.8	37.4	224.8	184.6	216.4	124.2	69.2
1.70	37.1	265.5	269.9	453.5	194.4	160.0	39.2	233.3	199.0	263.7	135.3	73.1
1.85	39.4	270.6	271.3	419.9	210.6	143.7	41.4	248.2	211.7	293.0	147.8	75.2
2.00	42.4	278.3	277.2	412.7	226.9	146.9	44.6	260.4	223.0	292.8	159.2	78.8
2.15	45.9	276.9	282.2	426.7	240.9	142.1	48.6	265.4	236.5	302.9	169.3	80.5

TABLE B-1 (CONT.)

DIGITAL OUTPUT FOR CHANNELS 1 THROUGH 12 --TEST AB5
(REFER TO TABLE A-1 FOR CHANNEL DESCRIPTIONS)

TIME MINUTES	DAS 1 DEG C	DAS 2 DEG C	DAS 3 DEG C	DAS 4 DEG C	DAS 5 DEG C	DAS 6 DEG C	DAS 7 DEG C	DAS 8 DEG C	DAS 9 DEG C	DAS 10 DEG C	DAS 11 DEG C	DAS 12 DEG C
2.30	50.0	293.4	298.7	445.7	250.8	131.4	53.6	276.8	243.1	305.1	180.2	83.1
2.45	54.9	297.9	303.7	447.8	260.3	129.4	59.3	276.7	246.0	308.6	187.7	86.4
2.58	60.7	298.2	317.2	471.8	274.8	132.6	64.4	276.9	251.2	313.0	195.6	89.3
2.73	67.0	303.1	323.9	448.1	284.7	115.7	69.6	293.3	262.8	347.9	203.8	88.6
2.88	73.1	325.1	330.8	442.2	296.8	122.5	75.2	294.7	269.3	398.8	211.7	88.4
3.03	78.6	308.5	329.5	459.9	309.2	157.9	81.4	304.2	281.8	401.2	217.9	89.4
3.18	84.6	307.6	332.0	479.3	315.9	165.9	87.6	302.3	288.9	401.1	223.2	89.8
3.33	90.7	298.4	326.3	474.9	323.0	170.4	94.1	302.7	315.4	414.0	229.4	90.2
3.48	96.9	298.8	324.7	471.9	332.0	(a)	100.8	298.3	341.2	414.2	236.6	92.7
3.63	103.1	299.8	319.9	469.0	343.2	(a)	107.8	299.3	341.4	418.8	239.4	96.7
3.77	109.3	297.2	315.4	461.0	356.7	(a)	114.2	303.2	340.7	422.6	243.2	100.3
3.92	115.3	293.7	308.5	445.6	361.6	(a)	120.5	301.1	337.8	461.7	245.7	94.1
4.07	121.6	290.2	309.0	440.0	372.2	(a)	121.3	294.3	330.2	429.2	251.6	95.2
4.22	127.7	295.3	313.2	452.1	377.1	(a)	127.7	295.7	325.7	409.9	255.6	98.1
4.37	133.9	307.7	319.2	447.9	375.6	(a)	139.2	300.5	319.3	390.9	258.2	98.3
4.52	139.6	307.2	322.9	446.9	381.7	(a)	145.4	301.2	318.7	400.1	261.4	100.3
4.67	145.5	312.8	324.4	435.3	387.9	(a)	151.5	317.6	326.7	404.4	269.1	98.3
4.80	151.0	312.0	323.9	429.9	396.6	(a)	156.6	315.3	327.3	406.8	274.5	91.4
4.95	156.4	322.7	334.1	441.4	402.4	(a)	161.4	319.4	327.0	412.3	278.9	95.8
5.10	161.5	317.3	329.4	452.7	405.7	(a)	166.2	316.2	326.8	416.7	285.1	(a)
5.25	166.4	325.5	339.8	468.1	406.0	(a)	171.3	317.3	326.6	407.5	290.1	(a)
5.40	171.2	331.1	345.3	464.6	408.8	(a)	176.4	321.3	327.7	400.4	295.4	(a)
5.55	175.9	334.1	346.8	451.7	412.5	(a)	180.8	319.5	326.1	402.9	302.1	(a)
5.70	180.4	327.3	341.9	444.7	418.4	(a)	184.9	334.5	335.9	433.5	307.1	(a)
5.83	184.3	327.3	341.9	449.8	421.9	(a)	188.9	339.8	339.5	432.5	311.1	(a)
5.98	188.0	326.0	339.1	455.1	429.9	(a)	193.4	341.7	340.4	435.6	312.1	(a)
6.13	191.6	329.6	338.8	457.1	430.7	(a)	198.8	330.9	334.4	419.7	313.3	(a)
6.28	195.6	334.3	345.7	464.8	430.8	(a)	204.8	334.8	332.3	421.2	316.7	(a)
6.43	199.2	343.1	359.7	483.8	421.3	(a)	210.7	335.2	335.0	412.4	320.4	(a)
6.58	202.8	355.5	366.1	470.5	(a)	(a)	216.3	334.4	336.2	429.7	324.1	(a)
6.73	206.7	405.2	365.3	470.4	(a)	(a)	221.6	337.6	339.3	420.3	329.2	(a)
6.88	210.9	372.8	362.9	470.5	(a)	(a)	226.0	344.4	350.1	428.4	333.4	(a)
7.02	214.8	362.1	363.9	475.8	(a)	(a)	230.2	355.4	357.9	437.7	335.7	(a)
7.17	218.6	359.3	363.7	476.9	(a)	(a)	234.3	357.5	363.9	458.3	339.6	(a)
7.32	222.1	356.4	363.1	471.3	(a)	(a)	238.2	355.2	366.6	464.7	341.2	(a)

(a) THERMOCOUPLE FAILED

TABLE B-1 (CONT.)

DIGITAL OUTPUT FOR CHANNELS 1 THROUGH 12 --TEST AB5
(REFER TO TABLE A-1 FOR CHANNEL DESCRIPTIONS)

TIME MINUTES	DAS 1 DEG C	DAS 2 DEG C	DAS 3 DEG C	DAS 4 DEG C	DAS 5 DEG C	DAS 6 DEG C	DAS 7 DEG C	DAS 8 DEG C	DAS 9 DEG C	DAS 10 DEG C	DAS 11 DEG C	DAS 12 DEG C
7.47	225.8	352.2	363.4	474.8	(a)	(a)	242.3	353.9	366.6	467.8	340.6	(a)
7.62	229.7	360.8	370.6	481.7	(a)	(a)	246.4	352.2	364.7	446.6	342.6	(a)
7.77	233.2	369.5	384.0	500.6	(a)	(a)	250.7	352.2	363.2	434.5	345.3	(a)
7.92	236.9	376.2	397.0	517.4	(a)	(a)	255.0	350.4	359.5	429.7	347.1	(a)
8.05	240.3	375.8	406.4	522.3	(a)	(a)	258.5	354.7	359.6	445.8	353.7	(a)
8.20	243.7	385.4	411.6	531.6	(a)	(a)	261.5	358.9	363.7	459.2	358.4	(a)
8.35	246.8	383.9	408.2	528.6	(a)	(a)	264.0	367.9	363.9	460.9	362.6	(a)
8.50	249.7	378.6	402.3	509.7	(a)	(a)	266.4	369.3	366.7	464.3	363.8	(a)
8.65	252.3	376.4	403.3	521.3	(a)	(a)	269.4	371.5	366.8	456.9	363.4	(a)
8.80	254.7	372.8	398.1	512.3	(a)	(a)	272.2	371.4	367.7	449.2	363.0	(a)
8.95	257.4	369.8	396.3	520.3	(a)	(a)	274.9	372.2	366.6	443.8	363.7	(a)
9.10	260.1	369.4	398.9	525.4	(a)	(a)	277.2	375.6	370.2	449.1	365.4	(a)
9.25	262.9	373.7	402.8	547.1	(a)	(a)	279.8	374.3	370.2	446.7	364.5	(a)
9.38	265.6	372.2	401.7	532.8	(a)	(a)	282.6	369.1	370.1	446.4	364.1	(a)
9.53	268.4	375.5	403.4	521.9	(a)	(a)	285.5	364.9	368.7	444.2	362.3	(a)
9.68	271.7	375.8	401.6	523.6	(a)	(a)	288.4	365.1	367.6	438.5	362.8	(a)
9.83	275.3	385.8	409.3	543.3	(a)	(a)	291.1	373.8	369.2	456.3	370.3	(a)
9.98	278.6	390.8	414.6	538.7	(a)	(a)	293.5	371.8	369.6	447.9	369.9	(a)
10.13	281.7	387.2	417.4	563.4	(a)	(a)	295.8	366.0	366.1	439.7	371.9	(a)
10.28	284.9	387.9	424.6	570.3	(a)	(a)	298.0	361.2	363.6	435.4	372.6	(a)
10.43	287.9	393.0	424.8	566.1	(a)	(a)	300.2	363.2	362.9	436.1	368.6	(a)
10.57	291.0	387.8	423.8	557.3	(a)	(a)	302.6	365.4	364.6	435.3	369.6	(a)
10.72	294.2	392.0	425.7	548.1	(a)	(a)	304.6	369.2	365.3	438.5	373.8	(a)
10.87	297.4	392.1	428.4	547.4	(a)	(a)	306.5	370.3	367.2	445.7	372.7	(a)
11.02	300.4	392.1	428.2	555.5	(a)	(a)	308.1	382.3	372.6	447.7	374.6	(a)
11.17	303.3	390.3	425.6	553.9	(a)	(a)	309.2	388.7	377.8	458.1	375.8	(a)
11.32	306.0	384.3	414.7	535.2	(a)	(a)	308.2	390.9	385.7	461.9	374.8	(a)
11.47	309.4	381.7	404.7	523.3	(a)	(a)	311.3	389.0	387.8	461.2	376.3	(a)
11.62	312.8	381.8	400.6	507.8	(a)	(a)	312.1	386.2	390.9	484.2	376.2	(a)
11.75	316.3	381.7	397.8	513.0	(a)	(a)	312.9	385.4	390.8	475.4	373.9	(a)
11.90	319.4	384.0	401.3	527.1	(a)	(a)	313.5	390.4	392.6	469.0	369.1	(a)
12.05	322.1	386.4	403.9	520.2	(a)	(a)	313.9	387.2	392.7	470.0	371.1	(a)
12.20	324.1	388.3	407.2	519.7	(a)	(a)	311.5	387.3	393.9	477.4	374.5	(a)
12.35	325.7	389.7	411.4	530.4	(a)	(a)	302.9	393.9	396.8	480.2	378.1	(a)
12.50	326.7	393.2	417.3	536.2	(a)	(a)	307.1	392.9	396.8	479.2	381.6	(a)

(a) THERMOCOUPLE FAILED

TABLE B-1 (CONT.)

DIGITAL OUTPUT FOR CHANNELS 1 THROUGH 12 --TEST AB5
(REFER TO TABLE A-1 FOR CHANNEL DESCRIPTIONS)

TIME MINUTES	DAS 1 DEG C	DAS 2 DEG C	DAS 3 DEG C	DAS 4 DEG C	DAS 5 DEG C	DAS 6 DEG C	DAS 7 DEG C	DAS 8 DEG C	DAS 9 DEG C	DAS 10 DEG C	DAS 11 DEG C	DAS 12 DEG C
12.65	327.5	393.3	419.4	551.5	(a)	(a)	312.9	392.8	399.3	479.6	392.4	(a)
12.80	328.0	390.8	417.2	554.4	(a)	(a)	314.4	397.7	403.9	477.1	320.5	(a)
12.95	328.2	391.3	419.9	549.8	(a)	(a)	314.5	402.2	405.3	468.4	240.8	(a)
13.08	328.4	387.7	415.8	532.6	(a)	(a)	314.8	396.8	402.7	467.9	143.8	(a)
13.23	328.6	385.8	409.1	509.2	(a)	(a)	314.8	396.6	403.9	472.7	304.8	(a)
13.38	328.9	387.3	407.4	522.9	(a)	(a)	315.1	394.2	404.3	469.6	196.3	(a)
13.55	329.1	391.7	409.5	520.3	(a)	(a)	315.4	389.8	398.7	462.9	440.3	(a)
15.33	330.5	358.8	376.9	399.9	(a)	(a)	320.7	354.1	365.2	384.5	351.2	(a)
20.33	256.0	184.7	198.3	168.8	(a)	(a)	249.8	182.3	197.0	174.8	144.1	(a)
25.33	220.1	141.8	142.9	129.3	(a)	(a)	210.7	140.8	140.9	130.1	108.4	(a)
30.00	203.9	129.8	126.8	116.3	(a)	(a)	192.7	127.6	124.2	115.9	96.6	(a)
32.50	197.8	125.9	122.0	112.4	(a)	(a)	185.8	123.8	119.3	111.7	93.2	(a)
35.00	192.4	122.8	118.3	109.6	(a)	(a)	179.7	121.1	115.9	108.6	90.9	(a)
37.50	187.6	120.7	115.6	106.9	(a)	(a)	174.5	119.1	113.3	106.4	89.6	(a)
40.00	183.1	118.9	113.6	104.9	(a)	(a)	170.0	117.3	111.3	104.6	87.7	(a)
42.50	179.1	117.6	111.8	103.3	(a)	(a)	166.0	116.0	109.8	102.9	85.7	(a)
45.00	175.2	116.3	110.3	101.8	(a)	(a)	162.2	114.9	108.5	101.4	84.1	(a)
47.50	171.8	115.1	108.9	100.6	(a)	(a)	159.1	113.8	107.4	100.4	82.8	(a)
50.00	168.4	114.2	107.6	99.3	(a)	(a)	156.1	112.9	106.4	99.2	81.7	(a)
52.50	165.4	113.3	106.8	98.4	(a)	(a)	153.4	112.2	105.6	98.3	80.7	(a)
55.00	162.4	112.5	105.9	97.6	(a)	(a)	150.9	111.6	104.9	97.4	80.0	(a)
57.50	159.9	111.8	105.1	96.7	(a)	(a)	148.6	110.8	104.2	96.7	79.4	(a)
60.00	157.3	111.2	104.5	96.0	(a)	(a)	146.7	110.3	103.6	96.1	78.8	(a)
62.50	154.9	110.7	103.9	95.4	(a)	(a)	144.8	109.8	103.1	95.4	78.2	(a)
65.00	152.6	110.1	103.3	94.7	(a)	(a)	143.0	109.3	102.7	94.8	77.6	(a)
67.50	150.4	109.6	102.8	94.1	(a)	(a)	141.4	108.7	102.1	94.1	77.2	(a)
70.00	148.4	109.0	102.3	93.7	(a)	(a)	139.7	108.4	101.7	93.6	76.7	(a)
72.50	146.5	108.6	101.8	93.1	(a)	(a)	138.4	107.9	101.3	93.1	76.3	(a)
75.00	144.7	108.2	101.5	92.6	(a)	(a)	137.1	107.5	100.9	92.7	76.0	(a)
77.50	143.0	107.7	101.1	92.2	(a)	(a)	135.8	107.2	100.6	92.2	75.6	(a)
80.00	141.3	107.3	100.7	91.6	(a)	(a)	134.7	106.7	100.1	91.7	75.3	(a)
82.50	139.7	106.8	100.3	91.3	(a)	(a)	133.5	106.3	99.8	91.3	75.0	(a)
85.00	138.2	106.6	100.0	90.9	(a)	(a)	132.5	105.9	99.4	90.9	74.6	(a)
87.50	136.9	106.2	99.7	90.5	(a)	(a)	131.6	105.6	99.1	90.6	74.4	(a)
90.00	135.6	105.8	99.3	90.1	(a)	(a)	130.6	105.3	98.8	90.2	74.1	(a)

(a) THERMOCOUPLE FAILED

TABLE B-2

DIGITAL OUTPUT FOR CHANNELS 13 THROUGH 24 --TEST AB5
(REFER TO TABLE A-1 FOR CHANNEL DESCRIPTIONS)

TIME MINUTES	DAS 13 DEG C	DAS 14 DEG C	DAS 15 DEG C	DAS 16 DEG C	DAS 17 DEG C	DAS 18 DEG C	DAS 19 DEG C	DAS 20 DEG C	DAS 21 DEG C	DAS 22 DEG C	DAS 23 DEG C	DAS 24 DEG C
-2.87	30.9	30.6	30.0	29.1	28.3	26.9	31.1	29.8	30.7	29.1	28.3	25.5
-2.72	30.9	30.8	30.1	29.0	28.3	26.9	31.0	29.9	30.8	29.2	28.4	25.6
-2.57	30.9	30.8	30.1	28.9	28.3	26.9	31.0	29.9	30.8	29.2	28.4	25.4
-2.42	30.9	30.8	29.9	29.0	28.4	26.9	31.0	29.9	30.8	29.3	28.4	25.4
-2.27	30.9	30.8	30.0	29.0	28.4	27.1	31.0	29.9	30.8	29.2	28.4	25.6
-2.13	30.9	30.8	30.0	29.1	28.4	26.9	31.1	30.1	30.8	29.2	28.4	25.5
-1.98	31.0	30.7	30.1	29.1	28.4	26.9	31.1	29.9	30.8	29.2	28.3	25.6
-1.83	30.9	30.8	30.0	29.1	28.4	26.9	31.0	29.9	30.8	29.3	28.4	25.4
-1.68	30.9	30.8	29.9	29.1	28.4	26.9	31.0	29.9	30.8	29.2	28.4	25.4
-1.53	30.9	30.8	29.9	29.1	28.4	26.9	31.0	29.9	30.8	29.3	28.4	25.4
-1.38	30.9	30.8	30.0	29.0	28.4	26.9	31.0	29.9	30.8	29.2	28.4	25.5
-1.25	30.9	30.8	29.9	29.0	28.4	26.9	31.0	30.0	30.8	29.2	28.4	25.4
-1.10	30.9	30.8	29.9	29.1	28.4	26.8	31.1	30.1	30.9	29.2	28.3	25.5
-0.95	31.0	30.7	29.9	29.1	28.4	26.8	31.1	30.0	30.8	29.3	28.3	25.4
-0.80	30.9	30.8	30.0	29.0	28.4	26.9	31.1	29.9	30.8	29.2	28.4	25.5
-0.65	30.9	30.9	30.0	29.1	28.5	26.9	31.1	29.9	30.7	29.2	28.4	25.4
-0.52	30.9	30.9	30.0	29.1	28.4	26.9	31.1	30.0	30.8	29.2	28.4	25.4
-0.37	31.1	30.7	30.0	29.2	28.4	26.9	31.2	30.0	30.8	29.2	28.2	25.4
-0.22	30.9	30.8	30.1	29.1	28.4	26.9	31.1	30.0	30.7	29.3	28.4	25.4
-0.07	31.0	30.8	29.9	29.1	28.4	26.9	31.0	29.9	30.7	29.2	28.4	25.4
0.08	31.0	30.8	29.9	29.1	28.4	26.9	31.0	29.9	30.8	29.3	28.3	25.4
0.23	31.0	30.7	30.1	29.1	28.4	27.0	31.1	30.0	30.9	29.3	28.3	25.6
0.37	30.9	41.2	35.1	32.4	33.0	29.2	31.3	38.4	42.9	32.3	30.3	26.3
0.52	30.7	82.9	65.7	54.8	40.2	33.1	32.0	59.8	76.3	46.6	36.5	28.6
0.67	30.7	115.8	107.3	91.5	48.4	38.7	35.5	85.0	109.9	82.1	56.1	30.2
0.82	31.2	136.2	135.5	137.1	68.4	45.4	39.9	121.7	138.9	109.7	75.4	31.6
0.97	31.5	157.2	165.6	162.0	85.1	53.6	43.7	157.8	161.7	147.7	90.9	33.7
1.12	31.9	174.8	180.9	174.1	106.7	60.3	47.8	167.7	173.8	165.3	110.7	36.7
1.27	32.2	194.1	188.6	177.6	120.6	66.2	53.3	178.2	184.1	175.8	113.3	42.4
1.42	32.8	208.8	199.2	189.2	137.1	70.9	56.2	187.1	192.8	181.1	121.1	44.8
1.55	33.6	219.8	208.2	202.2	144.5	75.5	59.2	194.3	209.2	191.3	132.2	46.9
1.70	34.7	223.9	214.1	207.0	154.1	77.6	64.8	201.2	220.3	203.6	136.8	48.3
1.85	36.1	238.3	222.9	218.1	165.8	79.8	71.6	211.0	231.8	211.2	142.7	49.7
2.00	37.6	246.9	229.1	226.1	169.7	82.1	79.4	220.2	237.7	218.7	154.7	51.3
2.15	39.4	258.2	242.2	232.3	174.7	84.2	87.3	231.6	238.8	232.8	163.8	52.1

TABLE B-2 (CONT.)

DIGITAL OUTPUT FOR CHANNELS 13 THROUGH 24 --TEST AB5
(REFER TO TABLE A-1 FOR CHANNEL DESCRIPTIONS)

TIME MINUTES	DAS 13 DEG C	DAS 14 DEG C	DAS 15 DEG C	DAS 16 DEG C	DAS 17 DEG C	DAS 18 DEG C	DAS 19 DEG C	DAS 20 DEG C	DAS 21 DEG C	DAS 22 DEG C	DAS 23 DEG C	DAS 24 DEG C
2.30	41.4	263.2	248.9	231.4	186.9	85.4	95.5	235.9	240.9	234.1	170.8	53.3
2.45	44.0	265.7	251.8	239.3	195.2	86.8	103.3	242.0	249.7	238.8	174.1	54.6
2.58	46.8	265.9	254.3	242.9	198.8	88.1	111.8	245.4	255.3	243.3	178.1	55.4
2.73	50.2	271.5	257.1	251.2	198.2	88.8	118.7	245.2	256.3	239.8	180.1	56.4
2.88	54.0	274.2	264.2	259.3	198.5	90.0	125.6	249.3	257.2	243.8	181.4	57.2
3.03	58.2	274.8	266.2	264.3	202.2	90.4	131.7	260.6	271.7	247.6	180.7	58.3
3.18	62.9	276.9	266.8	265.3	208.3	91.5	137.7	266.0	272.2	250.8	183.2	59.4
3.33	68.1	277.2	268.6	268.9	215.9	91.4	142.8	268.5	271.4	251.6	187.8	60.3
3.48	72.9	278.8	269.8	268.3	210.3	91.6	147.9	264.8	267.7	258.1	197.3	61.1
3.63	78.3	278.2	269.9	267.8	217.9	91.1	152.7	278.1	263.4	264.8	195.8	61.8
3.77	83.4	273.2	269.2	266.4	221.7	90.6	155.8	280.7	267.2	265.8	194.1	61.9
3.92	89.1	274.3	269.6	268.3	237.0	89.4	158.9	279.9	277.0	262.5	199.3	62.3
4.07	94.7	276.5	270.7	268.9	226.7	89.1	161.7	280.1	279.4	265.7	206.3	62.4
4.22	99.8	276.9	272.6	270.2	226.3	88.9	164.5	278.7	277.3	264.4	213.1	62.7
4.37	104.8	280.1	275.1	270.2	234.8	88.3	167.0	277.8	273.6	264.8	217.0	62.9
4.52	109.9	287.4	278.4	270.6	244.7	86.9	169.4	282.2	271.8	269.3	216.3	63.3
4.67	115.0	290.1	281.4	273.8	244.1	86.8	171.8	289.6	272.1	273.8	216.9	63.5
4.80	120.1	289.3	283.6	276.1	250.3	86.6	173.9	285.2	275.9	272.3	219.9	63.4
4.95	124.7	291.3	285.0	278.2	252.7	87.1	175.4	285.8	275.9	272.7	222.0	63.7
5.10	123.9	292.9	286.3	278.1	257.4	88.4	177.7	289.7	278.2	274.6	225.9	63.7
5.25	133.7	300.8	289.9	278.8	252.1	87.9	180.1	289.1	283.7	275.3	231.9	64.3
5.40	137.8	300.0	288.8	278.1	250.1	88.7	182.8	290.2	287.7	275.5	235.7	64.4
5.55	142.3	295.5	287.7	279.1	256.4	88.4	185.3	288.7	288.5	276.8	233.2	64.7
5.70	146.5	302.6	289.0	281.6	262.4	88.3	187.7	297.3	293.9	276.4	229.9	65.0
5.83	150.7	302.3	290.5	281.9	260.3	89.3	190.1	294.7	293.9	278.5	234.1	65.3
5.98	155.0	312.4	296.2	282.9	256.0	89.4	193.1	304.4	290.7	285.2	239.6	65.9
6.13	158.9	316.6	311.1	285.1	253.5	99.8	196.6	299.1	291.8	283.3	251.4	67.0
6.28	163.2	316.0	314.0	283.2	256.7	96.7	201.2	300.7	292.2	286.1	250.6	67.7
6.43	167.2	315.8	307.9	283.0	261.6	95.6	206.0	304.3	297.2	289.6	252.3	67.6
6.58	171.0	321.3	310.7	285.1	269.2	95.3	210.4	309.3	304.2	295.1	244.3	68.9
6.73	175.1	321.9	311.3	286.9	270.4	95.9	214.1	309.9	309.2	298.6	243.3	69.9
6.88	179.0	323.6	313.7	289.2	274.6	97.4	217.1	311.7	324.5	296.1	243.9	70.3
7.02	183.3	323.8	317.6	298.9	278.6	100.5	220.1	311.2	320.5	293.3	245.2	70.1
7.17	187.6	324.3	323.2	303.7	281.1	102.5	222.7	317.3	318.0	295.1	246.2	70.6
7.32	192.2	327.5	322.7	307.9	279.4	104.3	226.0	319.9	318.1	293.2	248.7	71.4

TABLE B-2 (CONT.)

DIGITAL OUTPUT FOR CHANNELS 13 THROUGH 24 --TEST AB5
(REFER TO TABLE A-1 FOR CHANNEL DESCRIPTIONS)

TIME MINUTES	DAS 13 DEG C	DAS 14 DEG C	DAS 15 DEG C	DAS 16 DEG C	DAS 17 DEG C	DAS 18 DEG C	DAS 19 DEG C	DAS 20 DEG C	DAS 21 DEG C	DAS 22 DEG C	DAS 23 DEG C	DAS 24 DEG C
7.47	197.6	330.9	324.6	311.1	283.3	110.6	229.9	324.8	315.5	301.3	250.2	72.5
7.62	202.9	336.6	327.2	313.7	282.4	111.4	234.2	334.3	316.8	300.3	253.1	72.7
7.77	208.9	344.4	331.0	311.7	284.1	110.7	239.4	347.6	319.8	303.0	257.9	73.3
7.92	214.7	343.1	327.1	310.7	286.1	112.6	246.9	616.3	325.2	330.1	260.2	74.0
8.05	220.4	342.3	324.6	307.4	286.6	114.8	257.1	454.4	327.3	345.5	261.0	75.8
8.20	225.6	339.1	323.1	309.2	297.8	115.3	266.0	375.3	331.6	350.2	260.0	77.1
8.35	230.7	336.4	323.8	315.8	296.9	117.3	272.5	344.4	328.6	338.2	257.6	77.2
8.50	235.5	342.8	328.3	321.7	297.1	118.6	277.9	336.0	326.3	333.1	258.3	77.8
8.65	244.1	339.4	330.1	324.0	292.1	120.5	281.9	335.2	323.9	328.8	260.6	78.2
8.80	244.7	340.8	330.1	324.3	298.2	121.9	284.5	331.0	327.4	328.2	261.7	78.4
8.95	249.2	341.7	331.2	328.4	297.4	123.9	286.8	327.6	330.3	325.3	262.4	79.2
9.10	253.9	342.2	332.3	331.7	301.7	126.3	289.6	324.2	331.9	323.4	260.8	79.5
9.25	259.1	343.8	333.9	330.7	300.3	127.2	290.4	319.7	331.9	320.0	260.6	79.9
9.38	264.6	345.7	336.2	329.2	303.9	127.9	290.4	320.2	333.3	318.4	262.7	80.3
9.53	269.8	350.1	339.9	331.9	304.9	128.4	289.9	320.0	334.8	317.3	264.3	80.4
9.68	274.7	352.6	340.1	328.1	303.4	128.5	290.4	325.4	337.1	322.1	264.8	80.9
9.83	279.3	353.8	338.2	327.3	307.4	129.7	291.4	324.9	335.8	322.3	263.1	81.2
9.98	283.3	354.3	338.8	330.8	301.8	131.0	291.1	326.7	337.3	323.2	265.6	81.4
10.13	286.4	357.9	339.2	332.7	298.6	130.6	291.3	327.0	340.1	323.4	267.2	81.7
10.28	288.8	357.7	339.6	326.9	298.7	130.5	292.3	326.7	336.4	324.8	264.7	81.8
10.43	290.8	352.2	341.0	320.4	302.2	130.6	292.6	329.4	338.2	326.3	268.8	81.9
10.57	292.3	355.7	339.4	320.0	315.6	130.1	292.1	330.9	334.4	330.5	268.5	82.5
10.72	293.8	353.3	342.4	321.0	308.9	130.3	292.4	332.7	339.7	334.4	271.1	82.6
10.87	295.3	353.7	347.9	329.6	309.0	130.1	292.9	330.6	340.7	336.7	266.9	83.5
11.02	296.5	351.9	346.8	333.2	307.1	131.2	293.3	331.1	339.9	335.5	264.9	84.0
11.17	297.9	354.6	346.9	338.8	310.9	130.7	293.1	330.2	339.8	335.7	263.0	84.6
11.32	299.4	354.7	347.6	342.6	317.4	133.6	292.6	332.3	345.4	334.9	263.1	84.8
11.47	301.1	359.5	351.1	344.0	316.4	133.0	291.4	349.9	346.9	345.1	262.9	85.1
11.62	302.3	361.5	352.0	345.7	309.2	133.2	289.9	358.6	344.7	351.9	263.1	85.2
11.75	303.3	364.4	354.1	345.8	311.0	132.9	288.1	360.1	347.2	350.4	266.9	85.1
11.90	304.3	365.1	353.7	349.3	315.0	133.9	286.1	353.1	348.6	349.0	268.9	85.9
12.05	305.3	365.8	356.1	353.5	313.2	135.6	284.6	350.6	346.7	350.5	269.7	86.2
12.20	306.2	366.9	356.0	356.3	317.9	136.2	283.1	348.6	345.7	350.8	268.2	86.9
12.35	307.1	362.7	355.3	353.2	317.2	138.4	281.6	347.6	348.3	353.6	269.6	87.4
12.50	308.2	364.7	356.1	354.2	323.2	139.1	280.7	344.6	345.4	352.7	269.1	88.4

TABLE B-2 (CONT.)

DIGITAL OUTPUT FOR CHANNELS 13 THROUGH 24 --TEST AB5
(REFER TO TABLE A-1 FOR CHANNEL DESCRIPTIONS)

TIME MINUTES	DAS 13 DEG C	DAS 14 DEG C	DAS 15 DEG C	DAS 16 DEG C	DAS 17 DEG C	DAS 18 DEG C	DAS 19 DEG C	DAS 20 DEG C	DAS 21 DEG C	DAS 22 DEG C	DAS 23 DEG C	DAS 24 DEG C
12.65	309.2	368.3	358.1	353.4	314.8	140.4	280.7	344.4	349.9	352.1	268.1	88.8
12.80	310.1	366.1	355.1	347.1	315.3	140.6	281.1	350.4	355.7	351.2	266.1	89.1
12.95	310.7	364.7	353.7	347.1	315.9	141.4	281.4	353.3	357.6	348.4	268.4	89.1
13.08	311.5	363.9	356.1	348.3	316.3	141.4	281.6	350.4	355.1	349.3	269.6	90.2
13.23	312.2	362.8	356.7	350.6	318.3	141.8	282.7	357.7	351.3	350.6	271.9	90.7
13.38	312.8	366.2	357.3	350.4	316.4	142.6	284.1	358.7	349.9	348.2	272.5	91.3
13.55	313.6	370.2	362.8	349.3	316.2	144.2	285.5	354.8	349.4	348.6	275.7	92.8
15.33	315.2	333.6	323.5	304.2	271.2	139.7	291.4	310.4	312.1	296.9	251.9	94.5
20.33	246.1	164.8	156.9	147.3	121.8	83.0	223.2	150.9	163.4	140.6	125.6	60.6
25.33	200.2	135.8	128.6	121.2	99.2	69.8	196.4	123.6	132.6	117.5	100.6	54.5
30.00	178.0	125.8	118.4	112.4	91.1	66.3	183.4	115.1	123.4	110.1	91.4	51.1
32.50	170.5	122.7	115.3	109.4	88.8	65.1	178.1	112.7	120.8	107.8	88.7	50.9
35.00	164.5	120.4	112.8	107.1	86.8	64.7	173.4	110.9	118.8	106.1	86.7	50.7
37.50	159.6	118.6	110.7	105.3	85.5	64.2	169.2	109.3	117.2	104.5	85.1	50.7
40.00	155.5	116.9	109.0	103.7	83.9	63.7	165.4	108.2	115.8	103.3	83.6	50.6
42.50	152.1	115.7	107.5	102.1	82.6	63.3	162.0	107.2	114.7	102.2	82.1	50.3
45.00	149.2	114.4	106.1	100.7	81.6	62.9	158.9	106.4	113.8	101.2	81.1	50.3
47.50	146.6	113.4	105.1	100.0	80.6	62.7	156.3	105.5	112.9	100.3	80.2	50.2
50.00	144.4	112.6	104.1	98.9	79.9	62.6	153.7	104.6	112.3	99.4	79.2	49.9
52.50	142.2	111.8	103.1	98.1	79.1	62.4	151.2	103.9	111.5	98.5	78.5	49.8
55.00	140.4	111.1	102.2	97.1	78.4	62.2	149.3	103.3	110.8	97.8	77.9	49.6
57.50	138.7	110.4	101.5	96.3	77.8	62.1	147.2	102.9	110.3	97.1	77.4	49.1
60.00	137.2	109.9	101.2	95.4	77.4	62.1	145.5	102.3	109.7	96.6	76.9	49.1
62.50	135.7	109.3	100.6	94.7	76.9	61.9	143.8	101.8	109.3	96.0	76.3	48.8
65.00	134.4	108.7	99.9	94.1	76.4	61.8	142.2	101.4	108.8	95.4	75.9	48.6
67.50	133.3	108.3	99.5	93.4	76.0	61.7	140.6	101.0	108.4	94.9	75.6	48.4
70.00	132.2	107.7	98.8	93.1	75.7	61.4	139.3	100.5	108.0	94.4	75.2	48.4
72.50	131.1	107.4	98.4	92.3	75.3	61.4	137.9	100.2	107.5	93.8	74.9	48.2
75.00	130.0	106.9	98.0	91.8	74.9	61.2	136.7	99.8	107.1	93.4	74.6	48.1
77.50	129.1	106.6	97.4	91.3	74.7	61.1	135.5	99.5	106.8	92.9	74.3	48.1
80.00	128.2	106.2	97.2	90.6	74.3	61.1	134.4	99.1	106.4	92.6	73.9	47.9
82.50	127.4	105.8	96.8	90.2	74.0	60.9	133.4	98.8	106.1	92.0	73.7	47.8
85.00	126.7	105.4	96.4	90.1	73.9	60.9	132.4	98.4	105.7	91.5	73.4	47.8
87.50	126.0	105.1	96.3	89.6	73.5	60.8	131.5	98.1	105.4	91.3	73.1	47.7
90.00	125.2	104.7	95.9	89.1	73.2	60.7	130.6	97.7	105.1	90.9	72.9	47.6

TABLE B-3

DIGITAL OUTPUT FOR CHANNELS 25 THROUGH 41 --TEST AB5
(REFER TO TABLE A-1 FOR CHANNEL DESCRIPTIONS)

TIME MINUTES	DAS 25 DEG C	DAS 26 DEG C	DAS 27 DEG C	DAS 30 DEG C	DAS 31 DEG C	DAS 32 DEG C	DAS 35 DEG C	DAS 37 DEG C	DAS 38 DEG C	DAS 39 DEG C	DAS 40 DEG C	DAS 41 DEG C
-2.87	30.2	30.3	29.3	28.3	27.5	27.7	30.1	26.9	24.7	32.8	33.1	33.6
-2.72	30.3	30.4	29.4	28.4	27.6	27.8	30.1	26.9	24.8	32.8	33.1	33.6
-2.57	30.4	30.4	29.4	28.3	27.6	27.8	30.1	26.9	24.8	32.8	33.1	33.6
-2.42	30.4	30.4	29.3	28.4	27.6	27.8	30.1	26.9	24.8	32.7	33.1	33.6
-2.27	30.3	30.4	29.4	28.4	27.5	27.8	30.2	26.9	24.7	32.9	33.2	33.6
-2.13	30.3	30.4	29.4	28.4	27.6	27.7	30.2	26.9	24.8	32.9	33.2	33.6
-1.98	30.3	30.3	29.4	28.3	27.6	27.8	30.1	26.9	24.6	32.9	33.2	33.7
-1.83	30.3	30.4	29.4	28.4	27.6	27.8	30.1	26.9	24.8	32.8	33.2	33.7
-1.68	30.3	30.5	29.3	28.4	27.6	27.7	30.1	26.9	24.8	32.8	33.1	33.7
-1.53	30.3	30.4	29.4	28.4	27.6	27.7	30.1	26.9	24.7	32.8	33.1	33.6
-1.38	30.3	30.4	29.4	28.4	27.6	27.8	30.2	26.9	24.7	32.8	33.2	33.7
-1.25	30.3	30.4	29.3	28.3	27.6	27.7	30.1	26.9	24.7	32.8	33.1	33.7
-1.10	30.4	30.4	29.3	28.3	27.6	27.7	30.1	27.1	24.6	32.8	33.1	33.6
-0.95	30.4	30.3	29.3	32.4	27.7	27.7	30.1	27.1	24.8	32.8	33.1	33.7
-0.80	30.3	30.4	29.3	28.4	27.6	27.8	30.2	27.0	24.7	32.8	33.1	33.6
-0.65	30.3	30.4	29.3	28.4	27.6	27.8	30.2	27.0	24.7	32.8	33.1	33.6
-0.52	30.3	30.4	29.3	28.4	27.6	27.7	30.2	27.0	24.7	32.8	33.1	33.6
-0.37	30.3	30.4	29.3	28.4	27.7	27.7	30.1	27.1	24.7	32.8	33.1	33.6
-0.22	30.4	30.4	29.4	28.4	27.6	27.7	30.1	27.1	24.7	32.8	33.1	33.7
-0.07	30.3	30.4	29.3	28.4	27.4	27.7	30.1	27.0	24.7	32.8	33.1	33.7
0.08	30.3	30.4	29.3	28.3	27.5	27.7	30.2	27.0	24.7	32.8	33.1	33.6
0.23	30.3	30.3	29.3	28.3	27.6	27.7	30.1	27.7	24.7	32.8	33.2	33.6
0.37	30.5	31.3	29.3	28.4	28.9	28.2	30.3	31.3	25.6	43.0	45.8	48.2
0.52	32.2	35.3	30.2	28.4	30.2	28.8	30.5	34.8	30.4	74.3	79.3	81.2
0.67	35.4	39.5	32.6	28.7	31.3	29.3	30.7	40.9	37.1	99.6	97.8	108.8
0.82	39.1	44.0	34.2	29.2	33.9	30.2	30.7	49.2	42.7	115.5	122.0	130.1
0.97	42.7	49.2	36.6	29.6	36.2	31.7	30.3	54.4	49.6	133.7	136.7	153.4
1.12	46.6	53.8	39.1	30.4	38.6	33.9	30.4	58.5	54.1	140.6	147.4	164.1
1.27	50.3	57.5	41.2	31.2	41.4	36.4	30.4	62.5	57.7	161.1	174.9	186.8
1.42	54.7	60.1	43.8	32.3	43.7	38.8	30.6	65.8	60.9	160.3	173.9	187.3
1.55	58.8	64.7	46.4	33.7	45.5	41.4	30.8	71.4	64.2	182.9	198.2	211.5
1.70	63.3	67.1	48.4	35.1	47.8	43.8	30.8	77.1	70.2	197.4	221.3	231.7
1.85	66.7	69.8	50.7	36.3	49.3	46.3	31.1	81.1	76.4	203.2	223.2	236.7
2.00	70.0	72.1	53.4	37.8	51.1	48.7	31.3	82.3	78.4	206.2	220.6	234.8
2.15	72.4	73.3	55.2	40.1	52.3	50.7	31.3	83.2	80.3	209.3	219.4	238.2

TABLE B-3 (CONT.)

DIGITAL OUTPUT FOR CHANNELS 25 THROUGH 41 --TEST AB5
(REFER TO TABLE A-1 FOR CHANNEL DESCRIPTIONS)

TIME MINUTES	DAS 25 DEG C	DAS 26 DEG C	DAS 27 DEG C	DAS 30 DEG C	DAS 31 DEG C	DAS 32 DEG C	DAS 35 DEG C	DAS 37 DEG C	DAS 38 DEG C	DAS 39 DEG C	DAS 40 DEG C	DAS 41 DEG C
2.30	74.1	75.0	56.4	41.3	53.8	52.7	31.5	83.9	81.6	215.1	224.7	240.7
2.45	75.8	76.9	58.1	43.1	54.7	54.9	31.6	84.0	82.3	230.0	244.4	258.6
2.58	78.7	81.9	59.6	44.7	56.0	56.4	31.8	83.3	92.3	249.5	270.0	280.5
2.73	80.8	85.9	61.7	45.9	57.3	58.0	32.0	82.2	98.2	239.3	259.6	272.9
2.88	82.3	87.7	63.9	47.3	57.7	59.4	32.2	81.9	97.6	225.6	248.3	263.9
3.03	83.4	89.2	65.5	48.7	58.1	60.8	32.6	80.6	95.6	222.1	246.8	262.8
3.18	83.3	91.0	67.2	50.4	58.1	62.2	32.8	79.2	96.7	220.9	247.1	263.9
3.33	83.7	92.3	69.0	51.5	59.1	63.2	32.8	78.2	96.0	216.6	242.4	261.1
3.48	84.4	93.2	70.7	52.6	59.5	64.3	33.2	77.1	96.9	214.7	234.4	256.9
3.63	85.2	93.9	72.2	53.7	60.1	65.2	33.3	75.7	95.9	213.6	239.7	261.5
3.77	85.9	94.7	73.3	54.8	60.7	66.3	33.7	74.3	97.1	216.8	242.6	263.3
3.92	86.4	97.3	74.3	55.8	61.4	67.2	33.8	72.2	99.6	216.8	242.3	264.7
4.07	86.6	100.1	75.6	56.8	61.8	68.2	34.1	71.9	104.2	221.6	238.6	262.1
4.22	87.2	101.2	76.5	57.7	62.8	69.2	34.4	70.8	104.2	218.9	231.3	255.8
4.37	87.8	101.1	77.6	59.7	64.0	70.6	34.5	70.3	102.6	220.8	230.7	254.8
4.52	88.3	100.5	78.4	61.2	65.2	72.0	34.8	69.6	99.8	214.4	225.9	249.5
4.67	88.8	99.9	79.0	61.4	66.2	73.3	35.1	68.2	98.3	210.4	229.7	255.3
4.80	89.8	102.3	79.9	61.9	66.7	74.4	35.3	67.4	104.9	228.7	257.7	279.2
4.95	91.1	103.8	80.7	62.8	67.3	75.2	35.6	67.7	109.1	233.2	261.4	278.0
5.10	92.1	104.8	81.8	63.6	68.3	76.1	35.8	67.7	109.3	234.2	262.7	277.4
5.25	93.3	105.7	83.1	64.5	69.4	77.3	36.2	68.1	108.9	242.1	265.2	279.2
5.40	93.9	106.8	84.1	65.7	70.6	78.6	36.5	67.9	108.1	243.3	266.6	282.6
5.55	94.7	107.2	84.8	66.4	70.8	80.0	36.7	68.2	112.9	248.1	276.9	290.4
5.70	95.7	108.2	85.4	67.1	71.1	81.2	37.1	68.3	118.1	250.2	275.6	288.8
5.83	95.7	108.9	86.4	67.8	71.6	81.8	37.3	68.7	118.8	250.5	273.4	286.7
5.98	95.8	109.9	87.3	68.5	72.1	82.7	37.6	69.7	119.3	250.4	269.9	284.7
6.13	95.6	110.5	88.2	69.2	73.4	83.7	37.9	70.2	119.2	256.4	274.6	289.3
6.28	95.6	110.2	88.7	70.1	74.6	85.1	38.3	71.1	118.6	259.2	272.6	287.4
6.43	95.9	110.6	89.3	70.9	74.5	86.5	38.7	71.4	119.2	259.8	273.0	288.5
6.58	96.0	111.4	90.2	71.7	74.9	87.4	38.9	71.4	117.7	258.2	272.8	290.4
6.73	97.4	114.0	90.8	72.4	74.4	88.3	39.4	71.8	121.7	262.8	291.1	313.6
6.88	98.7	117.8	91.6	73.2	76.8	89.1	39.7	72.7	127.2	267.6	296.9	314.1
7.02	99.3	118.6	92.3	73.7	77.6	89.7	39.9	74.2	129.1	273.6	302.8	316.3
7.17	98.8	119.8	93.4	74.4	77.3	90.3	40.3	75.6	131.4	274.7	293.8	308.8
7.32	98.9	119.0	94.1	74.9	77.3	90.8	40.7	76.7	131.8	276.2	299.8	313.1

TABLE B-3 (CONT.)

DIGITAL OUTPUT FOR CHANNELS 25 THROUGH 41 --TEST AB5
(REFER TO TABLE A-1 FOR CHANNEL DESCRIPTIONS)

TIME MINUTES	DAS 25 DEG C	DAS 26 DEG C	DAS 27 DEG C	DAS 30 DEG C	DAS 31 DEG C	DAS 32 DEG C	DAS 35 DEG C	DAS 37 DEG C	DAS 38 DEG C	DAS 39 DEG C	DAS 40 DEG C	DAS 41 DEG C
7.47	98.9	118.2	94.7	74.9	78.6	91.1	41.1	78.2	132.5	274.4	290.8	305.2
7.62	99.1	118.2	95.6	76.3	84.9	91.4	41.4	79.8	130.6	271.9	289.3	303.4
7.77	99.9	116.6	96.3	76.9	83.6	92.3	41.8	81.9	131.3	273.3	290.2	303.9
7.92	101.3	117.6	97.3	77.7	85.3	93.5	42.3	83.2	130.9	274.7	296.9	310.2
8.05	103.7	117.7	97.7	78.4	85.2	94.6	42.6	85.5	131.4	276.9	302.9	315.0
8.20	104.7	116.7	98.3	79.1	85.9	95.7	43.1	86.6	132.8	279.8	309.8	321.6
8.35	105.3	116.4	98.8	79.8	84.9	96.8	43.5	88.4	135.4	287.7	317.1	328.4
8.50	105.9	116.3	99.6	80.5	83.7	97.6	43.8	89.1	137.3	287.9	311.1	322.4
8.65	105.3	115.9	100.1	81.2	83.2	98.4	44.2	90.1	137.4	289.3	311.3	323.1
8.80	105.2	115.6	100.4	81.9	82.9	99.6	44.6	93.0	138.4	297.3	318.3	329.1
8.95	105.9	116.2	100.9	82.7	83.3	100.3	45.1	94.1	140.8	311.7	325.6	335.6
9.10	107.3	117.5	101.3	83.4	83.8	101.1	45.5	94.9	147.4	316.8	328.9	338.7
9.25	108.3	118.8	101.9	84.1	84.2	101.9	46.1	96.1	153.2	310.7	325.5	335.7
9.38	109.1	119.6	102.2	84.8	84.9	102.6	46.5	96.7	154.0	307.0	322.4	333.5
9.53	109.7	120.1	102.7	85.4	84.3	103.1	46.9	97.2	153.5	304.8	321.1	331.8
9.68	110.7	120.5	103.1	86.1	85.6	103.7	47.4	98.3	154.1	308.9	323.8	335.0
9.83	112.1	122.2	103.4	86.8	86.1	104.3	47.9	99.2	155.3	310.6	325.2	336.2
9.98	112.2	122.1	104.1	87.5	87.0	104.9	48.6	100.2	155.4	306.9	321.7	332.8
10.13	112.6	124.8	104.5	88.2	87.4	105.7	48.9	100.1	157.9	312.8	323.4	332.4
10.28	113.2	126.5	104.9	88.8	87.6	106.6	49.5	99.5	159.6	312.1	320.3	331.8
10.43	113.0	126.5	105.3	89.6	87.8	107.5	50.0	100.4	158.6	308.1	316.0	328.4
10.57	112.5	126.8	105.8	90.3	87.8	108.6	50.5	101.2	158.8	307.9	315.7	328.1
10.72	112.6	126.6	106.3	91.1	87.7	109.6	51.1	101.9	159.2	313.1	321.8	334.8
10.87	113.7	126.4	106.7	91.8	88.0	110.4	51.6	102.4	160.8	314.8	325.9	338.6
11.02	114.9	126.4	107.3	92.4	88.4	111.1	51.9	102.7	162.3	318.6	330.3	342.3
11.17	115.3	127.7	107.8	93.2	88.6	111.8	52.6	104.1	163.5	316.8	329.9	341.5
11.32	115.1	129.1	108.2	93.8	88.9	112.7	52.9	105.0	163.6	308.9	322.0	335.2
11.47	114.8	129.7	108.8	94.7	89.7	113.3	53.6	105.3	162.2	302.4	315.3	329.8
11.62	114.0	129.1	109.2	95.4	90.0	113.8	54.2	105.3	160.0	297.9	314.0	328.8
11.75	114.1	128.5	109.6	96.1	90.8	114.6	54.5	105.7	158.9	298.9	315.8	329.8
11.90	113.8	129.1	110.0	96.8	91.8	115.0	54.9	106.9	158.7	299.7	315.9	331.2
12.05	114.2	129.8	110.7	97.6	92.1	115.1	55.5	107.2	159.6	304.3	321.5	335.6
12.20	114.5	130.4	111.1	98.4	92.7	115.6	55.9	107.7	160.6	308.2	325.6	339.7
12.35	115.9	131.8	111.6	99.3	93.1	116.3	56.5	108.8	162.2	313.6	329.8	343.3
12.50	116.8	132.9	112.2	100.3	93.6	117.2	57.2	109.3	162.8	307.8	325.7	340.7

TABLE B-3 (CONT.)

DIGITAL OUTPUT FOR CHANNELS 25 THROUGH 41 --TEST AB5
(REFER TO TABLE A-1 FOR CHANNEL DESCRIPTIONS)

TIME MINUTES	DAS 25 DEG C	DAS 26 DEG C	DAS 27 DEG C	DAS 30 DEG C	DAS 31 DEG C	DAS 32 DEG C	DAS 35 DEG C	DAS 37 DEG C	DAS 38 DEG C	DAS 39 DEG C	DAS 40 DEG C	DAS 41 DEG C
12.65	117.4	132.7	112.6	101.4	94.1	118.1	57.7	110.6	162.3	301.9	320.4	336.8
12.80	117.8	132.8	113.1	102.4	95.2	118.9	58.2	112.2	161.4	298.4	317.8	334.6
12.95	118.4	133.6	113.6	103.2	95.7	119.9	58.6	112.8	161.3	296.0	314.8	333.4
13.08	118.9	133.8	114.3	103.9	96.2	120.8	59.2	113.4	161.1	296.1	312.1	330.2
13.23	119.6	133.6	114.9	104.7	97.2	121.6	59.9	114.6	161.8	298.3	309.2	327.9
13.38	120.3	133.8	115.4	105.4	98.0	122.5	60.3	115.9	162.2	297.8	311.0	330.1
13.55	121.3	133.5	116.6	107.1	98.9	124.5	61.7	117.7	163.0	296.4	323.1	342.8
15.33	123.3	249.1	122.3	114.8	98.8	130.8	67.9	127.3	158.1	274.4	287.0	301.9
20.33	110.5	126.2	114.4	105.0	84.6	97.9	81.3	81.2	126.8	172.3	184.6	192.7
25.33	110.7	113.3	107.2	100.9	83.8	89.8	90.4	72.6	120.9	151.3	157.2	161.1
30.00	111.7	112.5	105.1	99.8	83.6	87.5	96.7	69.9	118.1	141.6	146.6	149.4
32.50	112.1	112.2	104.6	99.6	83.7	87.1	99.3	68.8	116.7	138.3	142.8	145.5
35.00	112.5	112.4	104.3	99.3	83.6	86.7	101.8	68.3	115.5	135.6	140.0	142.3
37.50	112.9	112.2	104.1	99.1	83.6	86.3	104.1	67.6	114.3	133.9	137.6	139.7
40.00	113.2	112.3	104.1	98.8	83.5	85.9	106.0	66.8	113.2	132.2	135.4	137.4
42.50	113.4	112.5	103.9	98.5	83.3	85.5	107.6	66.4	112.3	130.8	133.9	135.6
45.00	113.9	112.6	103.9	98.4	83.3	85.1	109.2	66.1	111.2	129.4	132.1	133.7
47.50	114.0	112.7	103.7	98.1	83.0	84.8	110.3	65.5	110.4	128.1	130.9	132.4
50.00	114.3	112.6	99.4	97.8	83.0	84.6	111.5	65.3	109.4	127.2	129.6	131.0
52.50	114.4	112.7	103.5	97.4	82.8	84.2	112.4	64.8	108.7	126.0	128.7	129.9
55.00	114.5	112.7	103.3	97.1	82.6	83.8	113.2	64.5	107.9	125.4	127.8	128.9
57.50	114.8	112.8	103.2	96.9	82.6	83.6	114.1	64.4	107.3	124.1	126.7	127.8
60.00	114.7	112.8	102.9	96.6	82.2	83.2	114.6	64.1	106.6	123.4	125.9	126.9
62.50	114.7	112.9	102.8	96.3	82.1	83.1	115.2	63.9	105.9	122.5	125.1	126.1
65.00	115.0	112.9	102.8	95.9	81.8	82.6	115.8	63.7	105.2	122.1	124.3	125.2
67.50	115.1	112.8	102.6	95.6	81.5	82.3	116.0	63.6	104.6	121.3	123.7	124.6
70.00	115.1	112.7	102.4	95.3	81.5	82.1	116.5	63.2	103.9	120.7	122.9	123.8
72.50	115.1	112.8	102.2	95.2	81.2	81.9	116.8	62.9	103.4	120.1	122.2	123.0
75.00	115.0	112.7	102.1	94.7	80.9	81.6	117.1	63.0	102.9	119.6	121.7	122.6
77.50	115.1	112.6	101.9	94.5	80.8	81.3	117.3	62.9	102.3	119.0	121.0	121.8
80.00	114.9	112.6	101.7	94.1	80.4	81.0	117.4	62.7	101.9	118.5	120.5	121.3
82.50	114.9	112.5	101.5	93.7	80.2	80.7	117.6	62.5	101.3	117.7	119.8	120.7
85.00	114.8	112.4	101.3	93.5	80.1	80.5	117.7	62.4	100.8	117.3	119.4	120.2
87.50	114.8	112.2	101.0	93.2	79.8	80.2	117.9	62.3	100.4	116.6	118.8	119.7
90.00	114.7	112.2	100.8	92.9	79.6	79.9	117.9	62.3	100.0	116.2	118.3	119.2

TABLE B-4

DIGITAL OUTPUT FOR CHANNELS 42 THROUGH 55 --TEST AB5
(REFER TO TABLE A-1 FOR CHANNEL DESCRIPTIONS)

TIME MINUTES	DAS 42 DEG C	DAS 43 DEG C	DAS 45 DEG C	DAS 46 DEG C	DAS 47 DEG C	DAS 48 DEG C	DAS 50 DEG C	DAS 51 DEG C	DAS 52 DEG C	DAS 53 DEG C	DAS 54 DEG C	DAS 55 DEG C
-2.87	33.3	27.2	26.8	25.9	28.1	30.8	29.3	28.8	27.4	27.2	27.9	21.9
-2.72	33.3	27.3	26.9	26.1	28.2	30.9	29.4	28.8	27.5	27.2	27.9	21.9
-2.57	33.3	27.3	26.9	26.2	28.2	30.8	29.3	28.8	27.5	27.2	27.9	22.0
-2.42	33.3	27.3	26.9	26.1	28.2	30.9	29.2	28.8	27.4	27.3	27.8	22.0
-2.27	33.3	27.3	26.9	26.1	28.2	30.8	29.2	28.7	27.4	27.3	27.7	21.9
-2.13	33.2	27.3	26.8	26.1	28.2	30.8	29.2	28.7	27.4	27.3	27.7	21.9
-1.98	33.3	27.2	26.8	25.9	-17.8	30.8	29.3	28.8	27.4	27.2	27.8	21.9
-1.83	33.3	27.2	26.8	26.0	28.3	30.8	29.2	28.8	27.4	27.2	27.9	21.9
-1.68	33.4	27.2	26.9	26.0	28.2	30.8	29.2	28.7	27.4	27.2	27.9	21.9
-1.53	33.3	27.3	26.9	26.1	28.2	30.8	29.2	28.7	27.4	27.3	27.8	21.9
-1.38	33.3	27.2	26.8	26.1	28.2	30.8	29.3	28.7	27.4	27.2	27.8	21.8
-1.25	33.3	27.2	26.8	26.1	28.3	30.8	29.2	28.7	27.4	27.2	27.8	21.8
-1.10	33.3	27.4	26.8	26.1	28.3	30.7	29.2	28.7	27.4	27.3	27.7	21.9
-0.95	33.3	27.3	26.9	26.1	28.3	30.8	29.2	28.7	27.4	27.2	27.8	21.8
-0.80	33.3	27.2	26.9	26.1	28.3	30.8	29.2	28.7	27.4	27.3	27.9	21.8
-0.65	33.4	27.3	26.9	26.0	28.2	30.9	29.4	28.8	27.4	27.3	27.9	21.8
-0.52	33.4	27.3	26.8	26.0	28.2	30.9	29.3	28.8	27.8	27.2	27.9	21.8
-0.37	33.3	27.3	26.8	26.0	28.3	30.8	29.2	28.8	27.4	27.3	27.8	21.9
-0.22	33.4	27.2	26.9	26.0	28.2	30.8	29.2	28.8	27.4	27.2	27.8	21.9
-0.07	33.4	27.2	26.9	26.0	28.2	30.8	29.2	28.7	27.4	27.2	27.8	21.8
0.08	33.4	27.3	26.9	25.9	28.2	30.8	29.2	28.7	27.4	27.3	27.8	21.9
0.23	33.6	27.3	26.9	26.1	28.6	30.7	29.2	28.7	27.4	27.2	27.8	21.9
0.37	51.2	27.4	32.7	26.5	32.3	31.5	29.2	28.7	27.4	27.3	27.8	21.8
0.52	82.9	27.4	39.9	27.2	42.8	33.2	29.3	28.8	27.4	27.2	27.9	21.8
0.67	120.3	27.7	42.8	28.1	54.0	34.7	29.5	28.9	27.4	27.2	27.9	21.9
0.82	139.6	28.2	44.8	29.2	83.0	36.8	29.6	29.0	27.4	27.4	27.8	21.8
0.97	166.9	28.7	45.8	30.2	96.2	39.3	29.8	29.3	27.4	27.5	27.8	21.8
1.12	179.0	29.2	46.7	30.8	111.7	40.2	30.2	29.7	27.4	27.6	27.8	21.9
1.27	196.9	29.8	47.4	31.3	122.8	43.0	30.6	30.1	27.6	27.9	27.8	21.9
1.42	201.4	30.8	48.2	31.7	135.7	44.0	30.9	30.3	27.4	28.0	27.8	21.9
1.55	226.2	31.7	49.7	32.0	141.7	45.7	31.3	30.9	27.4	28.0	27.9	21.8
1.70	236.9	32.7	51.3	32.2	149.8	50.3	31.8	31.3	27.4	28.2	27.9	21.9
1.85	244.8	33.9	51.9	32.4	146.3	51.5	32.4	31.8	27.4	28.2	27.9	21.9
2.00	247.3	35.1	52.3	32.4	157.3	53.2	33.0	32.4	27.6	28.3	27.8	22.0
2.15	252.7	36.3	52.2	32.6	169.3	54.2	33.4	32.8	27.4	28.3	27.8	21.9

TABLE B-4 (CONT.)

DIGITAL OUTPUT FOR CHANNELS 42 THROUGH 55 --TEST AB5
(REFER TO TABLE A-1 FOR CHANNEL DESCRIPTIONS)

TIME MINUTES	DAS 42 DEG C	DAS 43 DEG C	DAS 45 DEG C	DAS 46 DEG C	DAS 47 DEG C	DAS 48 DEG C	DAS 50 DEG C	DAS 51 DEG C	DAS 52 DEG C	DAS 53 DEG C	DAS 54 DEG C	DAS 55 DEG C
2.30	252.1	37.5	52.3	32.7	170.6	54.8	34.0	33.4	27.5	28.4	27.8	21.9
2.45	266.4	38.7	52.3	32.7	181.9	59.8	34.6	34.1	27.5	28.5	27.8	21.9
2.58	282.2	39.8	52.3	32.7	178.6	65.2	35.3	34.7	27.6	28.4	27.7	21.9
2.73	281.2	40.8	52.3	32.7	177.3	65.4	35.8	35.2	27.6	28.6	27.8	22.0
2.88	277.3	41.9	52.3	32.7	178.5	65.8	36.5	35.7	27.6	28.8	27.8	21.9
3.03	275.9	43.1	52.4	32.7	187.7	66.6	37.1	36.3	27.5	28.8	27.9	21.9
3.18	274.5	44.2	52.3	32.6	184.8	67.7	37.7	36.9	27.5	28.7	27.9	21.8
3.33	274.1	44.9	52.8	32.6	186.0	68.2	38.5	37.4	27.6	28.9	27.9	21.8
3.48	274.9	45.8	55.7	32.4	193.7	68.3	39.1	38.1	27.6	28.9	28.0	21.9
3.63	274.8	46.4	57.7	32.4	193.3	69.9	39.7	38.8	27.6	28.9	28.0	21.9
3.77	277.9	46.9	58.9	32.4	194.6	70.6	40.4	39.4	27.7	29.1	27.8	21.9
3.92	278.3	47.4	60.5	32.4	196.8	71.9	41.0	40.1	27.6	29.2	27.7	21.8
4.07	279.1	48.0	62.4	32.4	198.5	71.9	41.9	40.8	27.7	29.2	27.9	21.9
4.22	276.1	48.6	63.1	32.5	199.4	71.3	42.6	41.4	27.6	29.3	27.8	21.8
4.37	274.3	49.0	62.9	32.4	201.1	71.9	43.2	42.2	27.6	29.3	27.9	21.9
4.52	271.5	49.7	62.5	32.4	202.8	72.1	43.9	42.8	27.7	29.4	27.9	22.0
4.67	275.3	50.4	64.1	32.5	216.3	73.8	44.6	43.5	27.8	29.4	27.8	22.0
4.80	291.0	51.2	66.8	32.4	218.6	77.6	45.2	44.2	27.7	29.5	27.9	22.0
4.95	292.2	52.1	68.4	32.4	220.4	77.4	45.8	44.8	27.7	29.7	27.9	21.9
5.10	289.9	52.8	68.6	32.4	220.2	77.6	46.5	45.5	27.7	29.7	27.9	21.9
5.25	289.4	53.7	68.1	32.5	226.1	78.2	47.1	46.2	27.8	29.9	27.9	21.9
5.40	291.6	54.7	67.2	32.5	229.9	82.0	47.8	46.9	27.8	30.0	27.9	21.9
5.55	300.8	55.7	66.1	32.5	238.7	85.3	48.5	47.4	27.8	30.2	27.9	21.9
5.70	302.7	56.6	65.0	32.8	249.6	85.2	49.2	48.1	27.9	30.3	27.8	21.9
5.83	302.0	57.6	64.2	32.8	241.9	85.6	49.9	48.7	27.8	30.4	27.9	21.9
5.98	300.0	58.3	63.3	32.8	237.9	84.6	50.8	49.5	28.0	30.4	27.9	22.1
6.13	301.7	59.1	62.6	33.1	238.3	85.1	51.5	50.2	28.0	30.5	27.9	22.1
6.28	301.9	59.7	63.0	33.2	231.7	85.9	52.2	50.7	28.1	30.7	28.1	22.1
6.43	302.9	60.6	63.2	33.6	235.1	86.6	52.8	51.5	28.1	30.7	28.1	22.1
6.58	303.9	61.5	62.9	33.8	240.7	88.3	53.5	52.1	28.1	30.9	28.1	22.0
6.73	319.7	62.4	62.3	34.0	243.8	92.8	54.1	52.7	28.0	30.9	28.1	21.9
6.88	323.8	63.3	62.2	34.2	240.5	94.3	54.9	53.4	28.1	30.9	28.1	21.9
7.02	324.9	64.2	62.2	34.3	244.1	96.2	55.8	54.2	28.1	30.9	28.1	22.1
7.17	321.7	64.8	62.7	34.3	242.7	95.6	56.6	54.7	28.2	31.3	27.9	22.0
7.32	322.6	65.5	63.2	34.5	247.9	96.4	57.3	55.3	28.2	31.6	27.9	21.9

TABLE B-4 (CONT.)

DIGITAL OUTPUT FOR CHANNELS 42 THROUGH 55 --TEST AB5
(REFER TO TABLE A-1 FOR CHANNEL DESCRIPTIONS)

TIME MINUTES	DAS 42 DEG C	DAS 43 DEG C	DAS 45 DEG C	DAS 46 DEG C	DAS 47 DEG C	DAS 48 DEG C	DAS 50 DEG C	DAS 51 DEG C	DAS 52 DEG C	DAS 53 DEG C	DAS 54 DEG C	DAS 55 DEG C
7.47	319.8	66.2	64.1	34.8	246.3	95.1	58.2	56.1	28.3	31.7	27.9	22.1
7.62	318.3	66.8	64.8	35.1	244.9	95.8	58.9	56.7	28.2	31.9	27.9	22.1
7.77	318.2	67.5	65.3	35.1	246.1	95.2	59.7	57.5	28.4	32.0	27.7	22.0
7.92	322.0	68.4	65.3	35.2	251.2	96.3	60.4	58.2	28.3	32.2	27.9	22.0
8.05	324.2	69.1	65.4	35.5	256.4	98.7	61.1	58.8	28.3	32.3	27.9	22.1
8.20	326.6	69.7	65.5	35.6	256.1	100.3	61.9	59.5	28.4	32.4	27.8	22.0
8.35	333.0	70.5	-17.8	35.8	256.0	101.7	62.7	60.3	28.4	32.4	27.7	22.1
8.50	333.5	71.3	65.8	35.8	250.9	102.1	63.4	60.8	28.4	32.5	27.7	22.0
8.65	334.2	72.1	65.9	36.1	252.3	102.9	64.2	61.6	28.4	32.5	27.7	22.1
8.80	337.1	72.6	66.1	36.1	253.3	104.3	65.2	62.3	28.7	32.7	27.6	22.2
8.95	340.3	73.3	65.9	36.2	253.7	106.1	66.0	63.1	28.7	32.7	27.4	22.2
9.10	343.8	74.0	66.0	36.2	253.9	107.3	66.8	63.7	28.7	32.8	27.4	22.2
9.25	344.3	74.6	66.2	36.6	251.8	108.0	67.5	64.3	28.7	32.9	27.4	22.2
9.38	342.9	75.1	66.3	36.6	255.2	108.2	68.2	64.9	28.8	32.9	27.3	22.2
9.53	342.6	75.5	66.8	36.8	255.2	108.4	69.0	65.6	28.8	33.1	27.4	22.2
9.68	345.7	75.9	67.5	37.0	257.5	109.6	69.7	66.4	28.9	33.1	27.4	22.2
9.83	346.1	76.3	68.3	37.0	259.2	110.7	70.6	67.1	28.9	33.2	27.3	22.2
9.98	344.7	76.7	68.7	37.2	262.1	111.1	71.3	67.7	28.9	33.2	27.2	22.3
10.13	345.9	77.1	69.4	37.2	262.9	111.9	72.1	68.4	29.1	33.2	27.1	22.3
10.28	346.4	77.6	69.8	37.3	266.4	114.0	72.9	69.0	29.2	33.3	27.1	22.3
10.43	344.0	78.2	70.2	37.4	267.2	115.4	73.7	69.7	29.3	33.4	27.2	22.3
10.57	344.3	78.8	70.3	37.7	266.4	116.7	74.4	70.5	29.3	33.4	27.3	22.4
10.72	348.1	79.4	70.4	37.7	265.6	118.5	75.2	71.1	29.3	33.4	27.4	22.4
10.87	349.1	80.1	70.6	37.9	266.6	119.8	75.9	71.8	29.3	33.6	27.3	22.4
11.02	350.9	80.6	70.6	37.9	267.3	121.1	76.7	72.4	29.4	33.7	27.4	22.3
11.17	352.6	81.2	70.6	38.1	267.2	121.6	77.3	73.0	29.5	33.6	27.4	22.4
11.32	351.1	81.7	70.8	38.1	264.8	121.6	78.2	73.7	29.6	33.6	27.6	22.3
11.47	348.3	82.3	71.1	38.2	262.7	121.5	79.1	74.6	29.6	33.7	27.4	22.4
11.62	346.8	82.6	71.2	38.4	262.9	121.2	79.8	75.2	29.7	33.8	27.3	22.5
11.75	347.3	82.8	71.5	38.4	262.9	121.1	80.6	76.0	29.7	33.9	27.1	22.4
11.90	349.0	83.0	71.7	38.5	263.5	121.3	81.4	76.7	29.9	34.1	27.0	22.4
12.05	351.3	83.2	71.9	38.7	262.9	121.6	82.1	77.3	29.9	34.2	27.0	22.5
12.20	353.9	83.3	72.0	39.1	265.1	122.3	82.8	78.0	29.9	34.2	27.2	22.6
12.35	357.6	83.6	72.1	39.2	266.1	123.6	83.6	78.8	30.0	34.2	27.4	22.6
12.50	357.1	84.1	72.2	39.1	266.8	124.8	84.4	79.5	30.2	34.6	27.4	22.4

TABLE B-4 (CONT.)

DIGITAL OUTPUT FOR CHANNELS 42 THROUGH 55 --TEST AB5
(REFER TO TABLE A-1 FOR CHANNEL DESCRIPTIONS)

TIME MINUTES	DAS 42 DEG C	DAS 43 DEG C	DAS 45 DEG C	DAS 46 DEG C	DAS 47 DEG C	DAS 48 DEG C	DAS 50 DEG C	DAS 51 DEG C	DAS 52 DEG C	DAS 53 DEG C	DAS 54 DEG C	DAS 55 DEG C
12.65	355.8	84.4	72.2	39.3	266.5	125.3	85.1	80.2	30.1	36.8	27.5	22.6
12.80	356.2	84.6	72.2	39.4	267.9	126.1	[illegible].9	80.9	30.2	38.6	27.6	22.5
12.95	357.8	84.9	72.9	39.6	268.1	126.9	86.7	81.7	30.3	39.3	27.8	22.6
13.08	356.1	85.3	73.9	39.6	269.0	127.3	87.6	82.3	30.4	39.7	27.9	22.4
13.23	356.4	85.6	74.5	39.8	268.4	128.1	88.3	83.0	30.5	39.7	27.8	22.4
13.38	355.9	85.8	74.9	40.1	266.7	128.8	89.1	83.8	30.6	39.9	27.7	22.5
13.55	358.6	86.9	74.7	40.4	269.9	130.3	91.4	86.2	30.9	39.5	27.9	22.5
15.33	322.2	92.3	73.9	39.3	239.8	135.4	99.6	93.7	31.9	38.9	28.4	22.8
20.33	195.8	76.1	58.2	39.4	108.9	126.6	105.6	98.4	34.6	38.5	29.3	22.6
25.33	160.4	71.8	49.9	41.2	89.8	123.7	107.3	99.5	36.8	38.4	30.1	23.1
30.00	148.6	70.9	46.8	42.6	84.1	122.4	107.9	99.8	38.6	38.3	30.9	23.4
32.50	144.9	70.7	45.9	42.1	82.4	121.7	108.2	100.0	39.4	38.2	31.3	23.6
35.00	141.8	70.6	45.2	40.6	81.0	121.2	108.4	100.0	40.3	38.4	30.9	23.1
37.50	139.1	70.4	45.0	39.6	80.1	120.5	108.6	100.1	41.2	38.3	31.3	23.4
40.00	136.8	70.3	44.8	39.4	78.9	119.8	108.6	99.9	41.9	38.4	31.2	23.2
42.50	135.1	70.3	44.6	38.2	78.0	119.3	108.6	99.9	42.8	38.4	31.5	23.4
45.00	133.3	70.2	44.6	38.9	77.1	118.6	108.6	99.9	43.7	38.4	31.7	23.7
47.50	131.9	70.0	44.4	38.3	76.6	118.0	108.7	99.6	44.3	38.5	32.0	23.4
50.00	130.6	69.8	44.5	38.4	75.8	117.3	108.6	99.6	45.0	38.4	31.8	23.5
52.50	129.5	69.8	44.4	38.8	75.3	116.8	108.2	99.2	45.8	38.4	31.8	23.3
55.00	128.4	69.6	44.4	38.7	74.8	116.3	108.2	99.0	46.3	38.6	31.3	23.3
57.50	127.3	69.4	44.6	38.6	74.4	115.5	108.1	98.8	47.0	38.6	31.8	23.6
60.00	126.5	69.3	44.6	38.8	74.0	115.1	107.9	98.6	47.6	38.7	31.6	23.8
62.50	125.7	69.1	44.5	38.8	73.7	114.4	107.8	98.4	48.2	38.7	32.2	23.8
65.00	124.7	68.9	44.6	39.2	73.2	113.8	107.6	98.1	48.8	38.8	32.2	23.8
67.50	124.2	68.9	44.6	39.0	72.9	113.4	107.4	98.0	49.4	38.7	32.8	23.9
70.00	123.4	68.7	44.6	39.3	72.7	112.6	107.1	97.7	49.8	38.8	32.2	23.9
72.50	122.6	68.6	44.7	39.4	72.2	112.1	107.1	97.4	50.4	38.9	32.2	24.4
75.00	122.1	68.4	44.6	39.5	72.1	111.6	106.8	97.3	50.8	38.9	32.4	24.1
77.50	121.4	68.3	44.8	39.8	71.8	111.1	106.6	96.9	51.5	39.2	32.2	24.0
80.00	120.8	68.2	44.7	39.8	71.5	110.5	106.4	96.7	51.9	39.1	32.4	24.2
82.50	120.3	68.1	44.8	39.9	71.3	110.0	106.2	96.4	52.3	39.1	32.0	24.0
85.00	119.8	67.9	44.9	40.1	71.0	109.4	106.1	96.2	52.8	39.3	32.3	24.4
87.50	119.2	67.7	44.9	40.3	70.9	108.9	105.7	95.9	53.1	39.3	32.4	24.6
90.00	118.7	67.6	44.9	40.4	70.7	108.3	105.4	95.6	53.4	39.3	32.6	24.5

TABLE B-5

DIGITAL OUTPUT FOR CHANNELS 57 THROUGH 74 --TEST AB5
(REFER TO TABLE A-1 FOR CHANNEL DESCRIPTIONS)

TIME MINUTES	DAS 57 DEG C	DAS 61 DEG C	DAS 62 DEG C	DAS 63 DEG C	DAS 64 DEG C	DAS 65 DEG C	DAS 66 DEG C	DAS 67 DEG C	DAS 68 DEG C	DAS 69 DEG C	DAS 73 DEG C	DAS 74 DEG C
-2.87	22.8	31.2	31.3	31.6	31.6	30.2	29.7	29.8	28.9	26.4	563.1	565.9
-2.72	22.9	31.2	31.3	31.6	31.6	30.1	29.8	29.8	28.9	26.4	563.0	565.8
-2.57	22.8	31.1	31.3	31.5	31.6	30.1	29.8	29.8	28.9	26.4	563.1	566.1
-2.42	22.8	31.1	31.3	31.6	31.6	30.1	29.8	29.8	28.9	26.3	562.9	566.0
-2.27	22.8	31.1	31.3	31.6	31.6	30.1	29.7	29.9	28.9	26.4	563.3	566.3
-2.13	22.8	31.1	31.3	31.6	31.6	30.1	29.7	29.8	28.9	26.4	563.3	566.1
-1.98	22.8	31.2	31.3	31.6	31.6	30.1	29.7	29.8	28.9	26.4	563.4	566.1
-1.83	22.9	31.1	31.3	31.6	31.6	30.1	29.7	29.8	28.9	26.4	563.3	566.0
-1.68	22.8	31.1	31.3	31.6	31.7	30.1	29.7	29.8	28.9	26.4	563.4	566.2
-1.53	22.8	31.1	31.3	31.6	31.6	30.1	29.7	29.8	28.9	26.3	563.3	566.0
-1.38	22.8	31.1	31.3	31.6	31.6	30.1	29.7	29.8	28.9	26.3	563.3	565.9
-1.25	22.9	31.1	31.3	31.6	31.6	30.1	29.7	29.8	28.9	26.4	563.2	566.1
-1.10	22.8	31.2	31.4	31.6	31.6	30.1	29.7	29.9	28.9	26.4	563.3	565.9
-0.95	23.0	31.1	31.4	31.6	31.6	30.1	29.7	29.8	28.9	26.3	563.3	566.1
-0.80	23.1	31.1	31.4	31.7	31.6	30.1	29.7	29.8	28.9	26.3	563.3	566.1
-0.65	23.0	31.2	31.3	31.6	31.6	30.1	29.7	29.8	28.8	26.3	563.3	565.9
-0.52	23.1	31.2	31.3	31.6	31.6	30.1	29.7	29.8	28.9	26.3	563.2	566.0
-0.37	23.1	31.2	31.3	31.6	31.6	30.1	29.7	29.8	28.9	26.4	563.4	566.1
-0.22	23.1	31.2	31.3	31.6	31.6	30.1	29.7	29.8	28.9	26.3	563.3	566.0
-0.07	23.2	31.2	31.4	32.9	31.6	30.2	29.7	29.8	28.9	26.3	563.4	566.1
0.08	23.2	31.2	31.3	31.6	31.6	30.1	29.7	29.8	28.9	26.2	563.3	566.1
0.23	23.0	31.9	32.1	32.3	32.4	30.2	29.8	29.8	29.1	26.3	563.3	566.2
0.37	23.2	43.8	45.6	45.9	48.3	30.6	30.2	29.9	29.8	26.3	562.9	566.1
0.52	23.0	67.4	68.8	68.9	68.9	32.1	31.6	29.9	31.6	26.2	563.3	566.1
0.67	23.0	86.0	88.2	88.7	90.6	34.2	32.3	30.4	34.2	26.2	563.2	566.0
0.82	23.1	113.6	117.5	118.8	128.2	37.0	33.4	31.5	36.7	26.3	563.4	566.2
0.97	23.2	137.8	141.7	144.3	153.8	40.7	34.2	33.0	39.9	26.3	563.6	566.1
1.12	23.1	139.8	145.2	150.1	161.6	43.2	36.8	34.9	42.9	26.3	563.4	566.1
1.27	23.1	149.8	155.6	162.7	177.1	44.9	38.4	37.1	47.7	26.2	563.3	566.2
1.42	23.2	166.3	172.4	181.0	193.9	46.9	40.4	39.3	51.5	26.2	563.3	565.9
1.55	23.2	172.3	180.3	192.0	205.5	48.8	41.4	41.5	54.1	26.2	563.4	566.2
1.70	23.1	179.6	188.1	199.8	213.3	50.4	43.8	43.6	57.6	26.3	563.2	565.9
1.85	23.1	183.2	190.9	201.7	216.6	52.2	44.4	45.4	59.4	26.2	563.3	566.0
2.00	22.9	192.2	199.2	208.4	222.7	53.4	47.3	47.4	60.5	26.2	563.5	566.3
2.15	23.0	199.2	206.8	217.2	233.9	54.9	48.3	49.2	63.2	26.2	563.6	566.1

TABLE B-5 (CONT.)

DIGITAL OUTPUT FOR CHANNELS 57 THROUGH 74 --TEST AB5
(REFER TO TABLE A-1 FOR CHANNEL DESCRIPTIONS)

TIME MINUTES	DAS 57 DEG C	DAS 61 DEG C	DAS 62 DEG C	DAS 63 DEG C	DAS 64 DEG C	DAS 65 DEG C	DAS 66 DEG C	DAS 67 DEG C	DAS 68 DEG C	DAS 69 DEG C	DAS 73 DEG C	DAS 74 DEG C
2.30	22.9	204.9	213.0	223.3	238.6	56.1	49.7	51.1	65.1	26.3	563.6	566.1
2.45	23.0	205.8	214.3	226.0	243.8	57.1	50.7	52.6	66.4	26.2	563.5	566.0
2.58	23.0	206.7	215.7	228.1	248.8	58.2	51.3	53.9	68.2	26.2	563.6	566.0
2.73	22.9	214.1	222.5	233.8	254.4	58.9	51.9	55.1	68.4	26.2	563.7	566.2
2.88	22.9	215.4	223.6	234.6	255.2	59.8	53.7	56.2	68.2	26.3	563.6	566.1
3.03	22.9	213.4	220.9	231.7	254.2	61.7	53.8	57.1	67.8	26.3	563.7	566.2
3.18	22.9	214.4	222.3	234.0	255.8	63.1	53.8	57.9	68.4	26.3	563.7	566.1
3.33	23.0	214.2	221.4	233.2	254.5	64.0	54.9	58.7	69.1	26.3	563.7	566.1
3.48	23.1	219.6	226.4	237.3	256.7	64.9	55.7	59.6	69.4	26.2	563.7	566.0
3.63	23.2	219.9	226.9	237.4	259.2	66.8	56.3	60.4	69.6	26.2	563.6	566.0
3.77	23.1	220.2	227.2	238.4	259.1	67.3	56.8	61.3	70.1	26.2	563.7	566.1
3.92	23.2	220.8	227.4	238.6	259.3	67.6	58.5	62.1	70.4	26.3	563.7	566.0
4.07	23.2	219.2	226.3	237.3	260.5	68.9	59.2	62.7	70.2	26.3	563.7	566.0
4.22	23.2	219.7	226.2	236.6	259.7	70.1	61.0	63.5	71.6	26.3	563.8	566.1
4.37	23.2	223.7	230.2	240.3	263.7	70.8	62.3	64.2	72.7	26.2	563.6	566.0
4.52	23.3	226.8	232.7	242.5	265.6	71.7	63.7	64.9	73.8	26.2	563.7	566.0
4.67	23.3	225.9	231.7	242.4	267.0	71.7	63.5	65.6	74.1	26.3	563.7	566.1
4.80	23.3	226.8	232.7	243.6	268.5	72.3	64.1	66.3	75.8	26.3	563.8	566.1
4.95	23.4	229.3	235.3	245.4	269.1	73.2	65.0	67.0	76.7	26.4	563.9	566.0
5.10	23.3	233.1	238.8	248.3	271.2	74.8	65.6	67.6	77.3	26.4	563.7	566.0
5.25	-17.8	233.9	239.8	249.1	271.7	76.1	66.8	68.4	79.1	26.4	563.8	566.0
5.40	23.3	233.4	239.1	248.6	271.9	76.7	67.7	69.0	79.6	26.3	563.7	566.0
5.55	23.4	234.3	239.8	249.3	273.0	76.6	68.1	69.5	81.3	26.3	563.8	565.8
5.70	23.4	234.8	240.3	250.2	274.0	76.9	68.4	70.2	82.3	26.4	563.9	566.0
5.83	23.4	236.5	241.5	251.5	278.5	78.6	68.9	70.7	82.7	26.3	563.8	565.9
5.98	23.3	239.6	245.2	254.1	282.1	81.7	70.1	71.3	82.3	26.3	563.9	565.9
6.13	23.2	237.7	244.1	253.4	280.9	82.9	71.8	72.1	82.3	26.3	563.9	566.0
6.28	23.2	237.8	244.6	253.9	281.5	83.3	72.7	72.9	83.1	26.4	563.6	565.8
6.43	23.3	238.2	244.8	254.1	282.1	83.5	73.3	73.6	83.4	26.4	563.9	565.9
6.58	23.3	239.6	245.9	255.2	283.2	83.7	74.0	74.4	84.1	26.5	564.2	566.1
6.73	23.4	242.6	247.8	257.3	286.1	83.9	74.0	75.1	85.1	26.4	564.1	566.0
6.88	23.3	245.2	249.9	259.3	288.3	84.4	74.8	75.7	86.8	26.4	563.9	565.9
7.02	23.3	247.5	252.2	261.2	289.3	85.1	76.7	76.2	87.9	26.4	563.9	566.0
7.17	23.3	246.8	252.4	261.7	288.1	85.9	77.6	76.8	88.7	26.4	563.9	566.2
7.32	23.4	248.7	254.0	263.2	291.3	87.7	78.8	77.5	90.1	26.6	564.0	566.0

TABLE B-5 (CONT.)

DIGITAL OUTPUT FOR CHANNELS 57 THROUGH 74 --TEST AB5
(REFER TO TABLE A-1 FOR CHANNEL DESCRIPTIONS)

TIME MINUTES	DAS 57 DEG C	DAS 61 DEG C	DAS 62 DEG C	DAS 63 DEG C	DAS 64 DEG C	DAS 65 DEG C	DAS 66 DEG C	DAS 67 DEG C	DAS 68 DEG C	DAS 69 DEG C	DAS 73 DEG C	DAS 74 DEG C
7.47	23.3	251.7	256.9	265.3	295.2	90.3	79.8	78.2	90.6	26.5	563.9	566.0
7.62	23.4	254.4	259.8	267.4	299.7	93.1	80.4	78.8	91.1	26.6	564.1	565.9
7.77	23.4	255.9	261.6	268.9	300.5	95.9	80.9	79.6	91.7	26.7	564.1	566.1
7.92	23.4	255.2	261.3	269.2	300.6	96.7	81.3	80.2	91.8	26.6	564.0	565.9
8.05	23.5	254.9	260.9	269.3	302.8	96.2	81.9	80.8	92.2	26.6	564.0	566.0
8.20	23.4	255.1	261.2	269.7	304.7	95.7	82.4	81.4	93.9	26.7	564.1	565.9
8.35	23.5	255.7	261.7	270.1	304.8	95.8	83.2	81.8	95.6	26.7	563.9	566.1
8.50	23.5	256.6	262.5	270.8	307.1	96.8	83.8	82.2	95.4	26.8	564.2	566.0
8.65	23.5	257.6	263.4	271.4	308.1	98.4	84.6	82.6	95.3	26.7	564.1	565.9
8.80	23.5	257.3	263.2	271.7	309.6	98.6	85.1	83.2	95.9	26.8	564.1	566.1
8.95	23.4	257.7	263.5	272.2	310.3	98.4	85.6	83.7	97.4	26.9	564.2	566.0
9.10	23.4	258.3	263.9	272.6	310.1	98.8	86.1	84.2	98.1	26.9	564.1	565.9
9.25	23.4	258.1	264.1	273.1	309.2	98.9	86.7	84.5	99.2	26.9	564.2	565.9
9.38	23.4	258.5	264.6	273.8	309.9	99.9	87.7	84.8	98.8	27.1	564.1	565.9
9.53	23.5	258.6	264.8	274.4	310.7	101.3	88.7	85.3	99.2	27.2	564.2	565.8
9.68	23.6	258.1	264.8	274.9	311.1	102.6	89.8	85.7	99.3	27.2	564.2	566.0
9.83	23.6	257.8	264.6	275.7	313.8	102.9	89.8	86.1	99.1	27.3	564.3	565.9
9.98	23.6	258.1	264.7	276.6	315.3	103.7	90.3	86.2	98.5	27.2	563.8	565.9
10.13	23.4	257.4	264.3	277.2	315.8	104.2	90.8	86.6	98.5	27.4	564.2	565.9
10.28	23.6	256.7	264.1	277.9	314.6	104.8	91.9	86.6	98.0	27.4	564.3	565.9
10.43	23.6	256.3	263.7	278.3	312.8	105.7	92.3	86.8	97.6	27.5	564.3	566.0
10.57	23.4	255.5	263.1	278.3	311.9	106.5	93.4	87.0	97.4	27.4	564.3	566.0
10.72	23.4	254.3	262.0	278.3	311.4	107.3	93.9	87.3	98.0	27.7	564.3	565.8
10.87	23.6	255.1	262.4	278.7	314.9	108.1	94.4	87.6	98.4	27.6	564.2	566.0
11.02	23.6	255.6	262.7	279.3	315.4	108.8	94.6	88.0	98.6	27.8	564.3	565.9
11.17	23.4	256.4	263.3	279.7	317.8	109.4	95.2	88.3	98.6	27.7	564.2	565.8
11.32	23.6	257.1	264.6	280.6	318.1	109.8	96.5	88.9	99.1	27.9	564.4	565.9
11.47	23.6	259.9	266.7	282.9	326.6	112.3	97.4	89.5	98.8	27.9	564.4	565.9
11.62	23.4	261.1	268.2	284.0	326.6	114.7	98.4	90.1	99.3	28.0	564.3	565.9
11.75	23.6	263.8	270.7	285.9	328.8	117.1	99.3	90.8	101.6	28.0	564.2	565.9
11.90	23.4	263.2	270.9	285.6	328.3	117.6	101.0	91.6	101.7	28.2	564.3	566.0
12.05	23.7	262.3	270.6	285.7	327.8	117.2	102.9	92.3	103.2	28.2	564.5	566.1
12.20	23.7	261.9	270.5	286.0	329.6	117.1	103.8	93.0	104.1	28.2	564.3	566.1
12.35	23.7	262.1	270.6	286.4	329.4	117.4	104.0	93.6	103.8	28.3	564.3	566.3
12.50	23.7	262.7	271.2	287.3	330.2	118.5	105.1	94.2	103.8	28.4	564.4	566.3

TABLE B-5 (CONT.)

DIGITAL OUTPUT FOR CHANNELS 57 THROUGH 74 --TEST AB5
(REFER TO TABLE A-1 FOR CHANNEL DESCRIPTIONS)

TIME MINUTES	DAS 57 DEG C	DAS 61 DEG C	DAS 62 DEG C	DAS 63 DEG C	DAS 64 DEG C	DAS 65 DEG C	DAS 66 DEG C	DAS 67 DEG C	DAS 68 DEG C	DAS 69 DEG C	DAS 73 DEG C	DAS 74 DEG C
12.65	23.4	263.5	272.2	288.3	329.5	120.2	106.1	94.7	103.5	28.5	564.3	566.3
12.80	23.4	263.7	272.7	288.3	327.7	121.7	106.4	95.1	103.7	28.5	564.2	566.2
12.95	23.4	263.9	273.2	289.5	330.6	122.6	106.7	95.6	103.8	28.7	564.4	566.3
13.08	23.5	266.1	275.1	292.9	336.6	125.1	107.8	95.9	104.7	28.8	564.3	566.2
13.23	23.4	267.2	277.4	294.3	336.0	127.0	108.8	96.4	105.5	28.9	564.3	566.1
13.38	23.5	267.5	278.3	294.2	336.4	127.6	109.8	96.8	105.6	28.9	564.3	566.1
13.55	23.8	267.9	278.8	296.1	334.7	126.5	112.1	98.2	107.7	29.3	564.5	566.2
15.33	23.9	247.3	265.7	283.4	286.0	121.8	111.6	99.4	96.7	30.4	564.7	566.9
20.33	23.4	159.1	164.1	184.1	153.2	105.3	99.6	78.2	73.3	33.6	564.6	566.7
25.33	24.2	126.9	129.1	136.7	124.3	102.4	97.3	75.9	69.2	35.8	564.3	566.6
30.00	24.8	115.1	116.5	120.3	115.6	100.3	95.9	75.8	67.7	36.8	564.1	565.8
32.50	24.5	111.9	113.3	116.2	112.9	99.5	95.2	75.9	67.3	37.0	563.9	565.2
35.00	24.4	109.2	110.4	112.8	110.9	98.8	94.6	76.1	67.1	37.2	563.6	564.6
37.50	24.8	107.2	108.3	110.4	109.2	97.8	94.0	76.4	66.9	37.2	563.5	563.9
40.00	24.4	105.6	106.6	108.3	107.6	97.2	93.5	76.6	66.8	37.4	563.3	563.3
42.50	24.6	104.1	105.1	106.8	106.4	96.4	92.8	76.7	66.6	37.3	563.1	562.4
45.00	24.7	102.8	103.8	105.3	105.1	95.8	92.3	77.0	66.6	37.4	562.9	561.6
47.50	24.4	101.7	102.8	104.3	104.2	95.2	91.7	77.1	66.4	37.3	562.7	561.0
50.00	24.9	100.9	102.0	103.3	103.2	94.7	91.1	77.3	66.4	37.3	562.5	560.2
52.50	24.4	99.9	100.9	102.4	102.3	94.1	90.8	77.4	66.4	37.3	562.3	559.5
55.00	24.4	99.2	100.3	101.6	101.7	93.7	90.2	77.6	66.2	37.1	562.0	558.9
57.50	25.1	98.4	99.5	100.8	100.8	93.1	89.8	77.8	66.2	37.1	561.8	558.0
60.00	25.1	97.8	98.8	100.1	100.3	92.7	89.3	77.8	66.1	37.1	561.6	557.5
62.50	25.0	97.2	98.2	99.4	99.6	92.2	88.8	78.0	66.0	36.9	561.4	556.7
65.00	25.2	96.4	97.6	98.8	99.1	91.8	88.4	78.2	66.0	36.8	561.2	556.0
67.50	25.5	96.0	97.2	98.4	98.5	91.3	87.9	78.2	65.9	36.9	560.9	555.3
70.00	24.9	95.5	96.7	97.8	97.9	90.9	87.6	78.3	65.9	36.8	560.7	554.6
72.50	25.3	94.8	96.0	97.3	97.4	90.5	87.2	78.3	65.8	36.6	560.3	553.8
75.00	24.8	94.4	95.6	96.8	96.9	90.2	86.8	78.5	65.7	36.6	560.2	553.2
77.50	24.9	93.8	95.1	96.3	96.4	89.8	86.4	78.2	65.6	36.7	559.9	552.4
80.00	25.6	93.5	94.7	95.9	96.1	89.4	85.8	78.6	65.6	36.6	559.6	551.8
82.50	25.6	93.1	94.3	95.4	95.6	89.1	85.5	78.6	65.5	36.6	559.3	551.2
85.00	25.6	92.6	93.7	94.9	95.2	88.8	85.2	78.6	65.6	36.5	559.1	550.4
87.50	25.9	92.3	93.4	94.5	94.8	88.4	84.9	78.7	65.4	36.6	558.9	549.9
90.00	25.7	91.8	93.1	94.1	94.3	88.1	84.6	78.8	65.3	36.6	558.7	549.3

TABLE B-6

DIGITAL OUTPUT FOR CHANNELS 76 THROUGH 91 --TEST AB5
(REFER TO TABLE A-1 FOR CHANNEL DESCRIPTIONS)

TIME MINUTES	DAS 76 DEG C	DAS 77 DEG C	DAS 79 DEG C	DAS 80 DEG C	DAS 81 DEG C	DAS 85 DEG C	DAS 86 DEG C	DAS 87 PERCENT	DAS 88 PERCENT	DAS 89 PERCENT	DAS 90 PERCENT	DAS 91 PERCENT
-2.87	259.1	297.2	27.1	30.1	30.5	17.3	17.3	23.4	23.3	-0.1	0.0	22.2
-2.72	259.1	297.2	27.1	30.1	30.5	17.3	17.3	23.3	23.3	-0.4	-0.2	22.2
-2.57	259.2	297.2	27.1	30.1	30.5	17.3	17.3	23.3	23.3	-0.2	-0.1	22.2
-2.42	259.2	297.2	27.1	30.1	30.5	17.3	17.3	23.3	23.3	-0.2	0.0	22.2
-2.27	259.2	297.2	27.2	30.2	30.5	17.3	17.3	23.4	23.3	0.7	9.1	22.2
-2.13	259.2	297.2	27.1	30.2	30.4	17.3	17.3	23.4	23.3	0.1	0.5	22.2
-1.98	259.2	297.2	27.1	30.1	30.4	17.3	17.3	23.3	23.3	0.1	0.2	22.2
-1.83	259.3	297.3	27.1	30.1	30.5	17.3	17.3	23.3	23.3	-0.3	-0.1	22.2
-1.68	259.3	297.2	27.1	30.2	30.4	17.3	17.3	23.3	23.3	-0.2	-0.1	22.2
-1.53	259.3	297.2	27.2	30.1	30.5	17.2	17.3	23.3	23.3	-0.2	-0.1	22.2
-1.38	259.3	297.2	27.1	30.2	30.4	17.2	17.3	23.3	23.3	-0.1	0.0	22.2
-1.25	259.3	297.2	27.1	30.2	30.2	17.2	17.3	23.3	23.3	-0.1	0.0	22.2
-1.10	259.3	297.2	27.2	30.2	30.4	17.2	17.4	23.3	23.3	9.1	0.2	22.2
-0.95	259.3	297.3	27.1	30.1	30.4	17.2	17.4	23.3	23.3	-1.0	0.0	22.2
-0.80	259.3	297.2	27.2	30.1	30.4	17.2	17.4	23.3	23.3	-0.4	-0.1	22.2
-0.65	259.3	297.3	27.1	30.1	30.6	17.2	17.4	23.3	23.3	-0.3	-0.1	22.2
-0.52	259.2	297.3	27.1	30.1	30.5	17.2	17.4	23.3	23.3	-0.2	-0.1	22.2
-0.37	259.3	297.2	27.2	30.2	30.4	17.2	17.4	23.4	23.3	-0.2	-0.1	22.2
-0.22	259.3	297.2	27.1	30.2	30.4	17.2	17.4	23.4	23.3	-0.2	0.0	22.2
-0.07	260.1	297.3	27.1	29.8	30.4	17.2	17.4	23.3	23.3	-0.1	0.0	22.2
0.08	265.2	302.7	27.1	30.1	30.5	17.2	17.4	23.4	23.3	9.1	0.2	22.2
0.23	367.7	360.3	36.8	30.6	30.5	17.5	17.5	23.4	23.4	-0.2	0.2	22.2
0.37	425.9	428.5	37.1	32.5	30.7	17.7	17.9	23.7	23.6	-0.4	-0.2	22.2
0.52	453.1	460.4	36.2	39.3	31.5	17.7	17.9	24.1	23.7	-0.1	-0.1	22.2
0.67	473.0	483.2	35.7	47.7	32.2	17.7	17.9	24.4	23.9	-0.2	-0.1	22.2
0.82	485.9	496.6	36.2	58.3	32.9	17.8	17.9	24.0	24.0	-0.3	-0.1	22.2
0.97	487.2	502.0	36.6	70.9	33.7	17.7	17.8	24.0	24.0	-0.2	-0.1	22.2
1.12	487.9	509.0	37.3	81.0	34.5	17.8	17.7	24.0	24.1	-0.2	0.0	22.2
1.27	492.6	514.5	37.2	89.3	35.7	17.8	17.7	24.2	24.1	9.3	0.0	22.2
1.42	499.7	523.9	39.2	96.6	36.7	17.8	17.6	24.4	24.1	0.3	8.9	22.2
1.55	507.2	543.8	39.4	103.9	38.0	17.7	17.6	24.4	24.1	0.0	0.4	22.2
1.70	513.7	556.0	39.9	110.6	39.4	17.7	17.5	24.5	24.1	-0.2	0.0	22.2
1.85	518.9	560.7	40.6	117.7	40.6	17.6	17.5	24.5	24.2	-0.1	0.0	22.2
2.00	523.2	558.4	40.9	125.5	41.7	17.6	17.4	24.6	24.3	-0.3	-0.2	22.2
2.15	526.8	559.3	41.2	132.8	42.4	17.6	17.4	24.7	24.3	0.0	0.0	22.2

TABLE B-6 (CONT.)

DIGITAL OUTPUT FOR CHANNELS 76 THROUGH 91 --TEST AB5
(REFER TO TABLE A-1 FOR CHANNEL DESCRIPTIONS)

TIME MINUTES	DAS 76 DEG C	DAS 77 DEG C	DAS 79 DEG C	DAS 80 DEG C	DAS 81 DEG C	DAS 85 DEG C	DAS 86 DEG C	DAS 87 PERCENT	DAS 88 PERCENT	DAS 89 PERCENT	DAS 90 PERCENT	DAS 91 PERCENT
2.30	530.0	563.1	41.7	138.1	43.4	17.6	17.4	24.7	24.3	-0.3	-0.1	22.2
2.45	533.3	567.3	41.4	142.6	44.4	17.5	17.3	24.6	24.3	9.5	0.1	22.2
2.58	536.0	571.2	41.7	149.3	45.9	17.5	17.3	24.6	24.3	0.2	8.9	22.2
2.73	538.9	576.2	41.7	152.6	47.1	17.5	17.2	24.6	24.3	0.0	0.3	22.2
2.88	542.1	580.5	42.2	155.6	48.5	17.4	17.2	24.6	24.1	-0.1	0.0	22.2
3.03	544.6	580.6	42.8	158.3	49.1	17.4	17.2	24.7	24.2	0.0	0.0	22.2
3.18	546.5	582.4	43.1	160.7	49.7	17.4	17.2	24.7	24.2	-0.3	-0.2	22.2
3.33	548.0	589.4	43.1	163.2	50.7	17.3	17.2	24.8	24.1	-0.1	0.0	22.2
3.48	548.9	598.1	43.1	165.6	51.9	17.3	17.1	24.8	24.5	-0.3	-0.2	22.2
3.63	549.9	598.4	43.2	168.1	52.6	17.3	17.1	24.8	24.0	9.4	-0.4	22.2
3.77	550.6	602.9	46.0	169.8	53.1	17.3	17.1	24.8	23.9	0.4	9.4	22.2
3.92	550.8	605.9	44.6	171.6	54.0	17.2	17.1	24.9	23.9	0.0	0.1	22.2
4.07	551.1	609.2	44.4	173.8	54.7	17.2	17.1	24.9	23.9	-0.1	0.0	22.2
4.22	552.8	611.4	44.4	176.9	55.2	17.2	17.1	24.9	23.9	-0.2	-0.1	22.2
4.37	552.8	614.2	44.8	180.0	55.6	17.2	17.1	24.9	23.9	0.0	0.0	22.2
4.52	553.4	611.0	44.9	183.9	56.3	17.1	17.0	24.9	23.9	-0.3	-0.1	22.2
4.67	554.4	606.0	45.4	186.5	57.2	17.1	17.0	25.0	23.9	-0.2	-0.1	22.2
4.80	555.9	602.6	46.3	190.1	58.0	17.1	17.0	25.5	23.9	-0.2	0.0	22.2
4.95	557.9	607.7	46.4	192.6	59.3	17.1	17.0	24.5	23.9	0.2	9.3	22.2
5.10	559.2	603.3	46.6	195.6	60.4	17.0	17.0	24.5	23.9	0.0	0.2	22.2
5.25	560.4	602.1	47.2	198.8	61.1	17.0	16.9	24.5	23.9	-0.3	-0.1	22.2
5.40	561.0	603.3	48.1	200.8	61.8	17.0	16.9	24.7	23.9	-0.2	0.0	22.3
5.55	561.4	604.9	48.5	202.3	63.0	17.0	16.9	24.3	24.0	-0.2	-0.1	22.3
5.70	561.7	600.9	49.2	204.5	63.9	16.9	16.9	24.2	24.0	-0.1	-0.1	22.3
5.83	563.1	599.9	49.3	206.7	64.8	16.9	16.9	24.2	24.0	-0.2	-0.1	22.3
5.98	566.9	620.9	50.3	210.4	65.8	16.9	16.9	24.4	24.0	-0.1	-0.1	22.3
6.13	572.6	613.7	51.1	220.1	66.8	16.8	16.9	24.4	24.0	-0.1	9.3	22.3
6.28	574.9	616.5	51.5	234.1	67.9	16.8	16.9	23.7	23.9	-0.5	0.6	22.3
6.43	577.4	622.4	52.2	244.5	68.7	16.8	16.8	23.6	23.9	-0.1	0.3	22.3
6.58	583.4	626.4	52.3	254.5	69.5	16.7	16.8	23.5	23.9	0.0	0.2	22.3
6.73	584.5	623.7	52.7	346.1	70.4	16.6	16.7	23.5	23.9	-0.1	0.1	22.3
6.88	584.4	621.7	53.0	412.4	71.2	16.5	16.9	23.5	23.9	0.0	0.1	22.3
7.02	585.1	626.3	53.5	466.3	71.7	16.4	16.7	23.5	23.9	-0.1	0.0	22.3
7.17	583.4	632.4	53.8	511.7	74.9	16.3	16.8	23.5	23.9	-0.1	0.0	22.3
7.32	585.1	619.8	54.3	536.6	73.3	16.1	16.8	23.4	23.9	7.7	0.2	22.3

TABLE B-6 (CONT.)

DIGITAL OUTPUT FOR CHANNELS 76 THROUGH 91 --TEST AB5
(REFER TO TABLE A-1 FOR CHANNEL DESCRIPTIONS)

TIME MINUTES	DAS 76 DEG C	DAS 77 DEG C	DAS 79 DEG C	DAS 80 DEG C	DAS 81 DEG C	DAS 85 DEG C	DAS 86 DEG C	DAS 87 PERCENT	DAS 88 PERCENT	DAS 89 PERCENT	DAS 90 PERCENT	DAS 91 PERCENT
7.47	585.7	632.3	55.3	547.5	74.2	16.0	16.8	23.4	23.9	-0.2	0.2	22.3
7.62	583.3	645.8	55.3	544.9	75.3	15.8	16.8	23.5	23.9	-0.2	0.0	22.3
7.77	580.7	661.6	56.0	523.1	76.0	15.7	16.8	23.4	23.9	-0.2	-0.1	22.3
7.92	579.4	653.3	57.3	512.4	77.5	15.6	16.8	23.2	23.9	-0.2	-0.1	22.3
8.05	578.3	654.3	60.0	474.4	79.4	15.5	16.7	23.2	23.9	-0.1	-0.1	22.4
8.20	579.7	629.2	62.3	453.8	80.8	15.3	16.7	23.1	23.9	0.0	0.1	22.4
8.35	581.3	622.1	63.9	438.0	81.1	15.2	16.7	23.1	23.9	-0.4	-0.2	22.4
8.50	581.4	624.2	65.2	413.3	82.8	15.1	16.7	23.0	23.9	9.3	-0.1	22.4
8.65	580.5	625.3	65.9	391.1	83.7	15.0	16.7	22.9	23.9	-0.5	0.2	22.4
8.80	581.6	626.2	66.8	373.9	84.7	15.0	16.7	22.9	23.9	-0.4	-0.1	22.4
8.95	581.6	626.8	67.0	355.5	85.8	14.9	16.7	22.8	23.9	-0.5	-0.2	22.4
9.10	584.8	621.1	67.9	340.1	86.7	14.8	16.8	22.8	23.9	-0.2	-0.1	22.5
9.25	587.7	612.9	72.3	321.8	87.6	14.7	16.9	22.8	23.8	0.1	0.0	22.5
9.38	589.8	620.4	68.3	308.2	88.5	14.6	16.8	22.7	23.8	-0.3	-0.1	22.5
9.53	608.1	621.4	68.2	307.2	89.4	14.5	16.8	22.7	23.8	-0.2	0.0	-0.2
9.68	592.7	622.7	68.9	300.1	90.6	14.5	16.7	22.6	23.7	9.2	0.0	22.5
9.83	591.1	619.8	69.1	297.9	91.6	14.4	16.7	22.5	23.7	-0.3	-0.2	22.5
9.98	589.3	618.1	70.6	294.7	92.5	14.3	16.7	22.4	23.7	-0.2	-0.1	22.5
10.13	587.7	621.4	71.2	294.1	93.4	14.2	16.7	22.3	23.7	-0.2	-0.1	22.5
10.28	561.9	628.5	70.9	289.0	94.7	14.2	16.7	22.3	23.8	-0.3	-0.1	22.5
10.43	565.2	643.7	70.9	285.4	95.9	14.1	16.7	22.2	23.8	-0.3	-0.1	22.5
10.57	564.1	652.1	71.2	283.4	96.7	14.0	16.7	22.1	23.7	-0.1	0.0	22.5
10.72	563.1	653.3	72.1	283.4	98.1	13.9	16.7	22.0	23.6	-0.2	0.0	22.5
10.87	562.1	643.4	72.6	283.8	99.9	13.9	16.7	21.9	23.6	9.2	-0.1	22.5
11.02	561.0	635.4	72.9	283.3	101.3	13.8	16.7	21.9	23.6	0.1	-0.7	22.4
11.17	560.8	629.8	73.3	284.4	102.0	13.7	16.7	21.9	23.5	-0.2	-0.1	22.5
11.32	560.0	625.1	73.6	285.8	102.3	13.6	16.7	21.8	23.5	-0.1	0.0	22.5
11.47	560.1	620.8	73.7	287.6	102.7	13.6	16.7	21.7	23.4	-1.0	-0.6	22.4
11.62	558.4	621.3	73.9	289.2	103.3	13.5	16.7	21.6	23.3	-0.1	0.0	22.4
11.75	558.2	620.2	74.1	291.0	103.9	13.3	16.7	21.6	23.3	0.1	0.1	22.4
11.90	560.5	619.0	-17.8	292.5	104.3	13.4	16.7	21.5	23.4	0.1	0.2	22.4
12.05	560.8	616.3	75.4	295.4	105.2	13.3	16.6	21.4	23.4	9.1	0.0	22.4
12.20	561.2	616.0	75.8	296.6	106.1	13.2	16.6	21.3	23.3	0.1	8.5	22.4
12.35	561.8	623.0	76.3	297.6	106.7	13.1	16.6	21.3	23.2	-0.3	-0.8	22.3
12.50	561.9	640.8	76.6	297.9	107.7	13.0	16.6	21.2	23.1	-0.2	-0.3	22.3

TABLE B-6 (CONT.)

DIGITAL OUTPUT FOR CHANNELS 76 THROUGH 91 --TEST AB5
(REFER TO TABLE A-1 FOR CHANNEL DESCRIPTIONS)

TIME MINUTES	DAS 76 DEG C	DAS 77 DEG C	DAS 79 DEG C	DAS 80 DEG C	DAS 81 DEG C	DAS 85 DEG C	DAS 86 DEG C	DAS 87 PERCENT	DAS 88 PERCENT	DAS 89 PERCENT	DAS 90 PERCENT	DAS 91 PERCENT
12.65	561.5	644.1	76.9	299.3	108.6	12.8	16.6	21.1	23.1	-0.3	-0.3	22.3
12.80	561.9	645.0	76.8	300.0	109.3	12.7	16.6	21.0	23.1	-0.2	-0.2	22.3
12.95	562.2	631.5	77.2	301.0	110.0	12.6	16.6	20.9	23.1	0.0	0.0	22.2
13.08	563.4	622.2	77.9	302.1	110.5	12.5	16.6	20.8	22.9	-0.3	-0.2	22.2
13.23	563.7	619.1	78.2	303.2	111.1	12.3	16.6	20.7	22.9	8.9	0.4	22.2
13.38	564.1	622.1	78.8	304.7	111.8	12.2	16.6	20.7	22.9	-0.1	8.4	22.2
13.55	565.9	609.9	80.0	307.1	115.9	11.7	16.6	20.3	22.7	-0.4	-0.2	22.0
15.33	654.1	727.8	84.4	293.3	122.4	10.7	16.3	19.3	21.7	-0.1	8.5	21.6
20.33	749.0	840.4	84.8	224.6	127.7	8.8	16.8	19.6	24.1	0.3	0.1	20.7
25.33	682.4	817.5	82.3	194.9	132.4	7.4	17.0	19.5	20.2	-0.1	0.0	20.1
30.00	650.3	837.3	80.1	174.3	135.2	6.0	16.9	19.6	20.0	-0.1	0.0	19.7
32.50	627.5	827.4	79.2	167.3	135.9	5.4	16.6	19.6	19.9	7.7	0.5	19.6
35.00	589.6	919.6	78.1	159.4	136.7	4.7	15.8	19.6	19.9	0.1	7.7	19.5
37.50	553.1	885.7	77.2	152.7	137.4	4.0	14.1	19.7	19.9	0.5	0.6	19.5
40.00	519.9	783.1	76.6	146.7	137.7	3.4	13.0	19.7	19.9	0.2	0.2	19.4
42.50	486.3	606.3	75.8	140.9	137.9	2.7	12.1	19.7	19.9	-0.2	0.1	19.4
45.00	446.6	530.8	75.1	135.2	138.1	2.0	11.3	19.7	19.9	-0.1	0.2	19.4
47.50	421.3	490.9	74.7	132.1	137.9	1.5	10.8	19.7	19.9	-0.6	-0.2	19.4
50.00	394.2	449.3	74.0	128.0	137.8	1.0	10.2	19.7	19.9	0.0	0.1	19.4
52.50	366.9	412.3	73.6	123.8	137.7	0.3	9.5	19.7	19.9	0.1	7.7	19.3
55.00	349.5	391.8	73.2	121.9	137.4	-0.1	9.0	19.7	19.9	-0.4	0.0	19.3
57.50	327.3	363.2	72.7	118.7	137.1	-0.7	8.3	19.7	19.9	0.5	0.5	19.3
60.00	313.1	347.8	72.3	116.7	136.8	-1.2	7.8	19.8	19.9	-0.2	0.0	19.3
62.50	297.9	331.0	71.9	114.3	136.6	-1.7	7.2	19.8	19.9	7.7	0.3	19.3
65.00	282.1	314.7	71.4	112.3	136.2	-2.3	6.3	19.8	19.9	0.4	0.4	19.3
67.50	271.8	304.7	71.2	110.9	135.9	-2.7	5.7	19.8	19.9	-0.2	0.0	19.3
70.00	260.4	292.9	70.9	109.4	135.5	-3.2	4.7	19.8	19.9	0.1	0.1	19.3
72.50	248.4	280.8	70.4	107.5	134.9	-3.8	4.4	19.8	19.8	0.2	0.4	19.3
75.00	240.6	273.3	70.1	106.6	134.6	-4.2	4.2	19.8	19.8	-0.5	-0.1	19.3
77.50	230.4	263.5	69.7	105.1	134.2	-4.8	3.8	19.8	19.8	0.3	0.4	19.3
80.00	223.6	257.2	69.4	104.1	133.9	-5.3	3.4	19.8	19.8	-0.4	-0.1	-0.2
82.50	215.9	251.3	69.1	103.2	133.4	-5.8	3.4	19.8	19.8	-0.1	0.1	19.2
85.00	207.7	242.6	68.7	102.1	133.0	-6.5	3.0	19.8	19.8	-2.3	-1.1	19.2
87.50	202.3	238.3	68.6	101.3	132.7	-7.0	2.7	19.8	19.8	-0.6	-0.2	19.2
90.00	196.3	235.6	68.2	100.3	132.2	-7.5	2.5	19.8	19.8	0.5	0.4	19.2

TABLE B-7

DIGITAL OUTPUT FOR CHANNELS 92 THROUGH 117 --TEST AB5
(REFER TO TABLE A-1 FOR CHANNEL DESCRIPTIONS)

TIME MINUTES	DAS 92 PERCENT	DAS 93 PERCENT	DAS 105 KPa ABS	DAS 106 Kg (a)	DAS 107 g / SEC	DAS 109 KPa	DAS 113 PERCENT	DAS 115 PERCENT	DAS 117 PERCENT
-2.87	22.1	22.4	122.1	859.5	-6.9	415.2	0.5	0.6	0.3
-2.72	22.1	22.4	122.1	859.6	-16.6	415.4	0.5	0.6	0.3
-2.57	22.1	22.4	122.1	859.6	-6.9	415.4	0.5	0.6	0.3
-2.42	22.1	22.5	122.1	859.5	-5.4	415.4	0.5	0.5	0.3
-2.27	22.1	22.5	122.1	859.5	3.6	415.4	0.5	0.6	0.3
-2.13	22.1	22.5	122.1	859.6	9.4	415.5	0.5	0.6	0.3
-1.98	22.1	22.4	122.1	859.6	-1.6	415.5	0.5	0.6	0.3
-1.83	22.1	22.4	122.1	859.5	-3.5	415.6	0.5	0.5	0.3
-1.68	22.1	22.5	122.1	859.5	-5.0	415.5	0.5	0.6	0.3
-1.53	22.1	22.4	122.1	859.6	-8.2	415.6	0.5	0.5	0.3
-1.38	22.1	22.4	122.1	859.6	0.2	415.6	0.5	0.5	0.3
-1.25	22.1	22.4	122.1	859.5	-9.4	415.5	0.5	0.5	0.3
-1.10	22.1	22.4	122.1	859.6	-7.1	415.6	0.5	0.6	0.3
-0.95	22.1	22.4	122.1	859.6	0.0	415.5	0.5	0.5	0.3
-0.80	22.1	22.4	122.1	859.5	0.6	415.5	0.5	0.6	0.3
-0.65	22.1	22.5	122.1	859.5	-9.2	415.5	0.5	0.5	0.3
-0.52	22.1	22.5	122.1	859.6	-15.3	415.5	0.5	0.6	0.3
-0.37	22.1	22.5	122.1	859.8	-6.6	415.5	0.5	0.6	0.3
-0.22	22.1	22.4	122.1	859.9	2.2	415.8	0.5	0.6	0.3
-0.07	22.1	22.5	122.2	867.3	11.7	412.5	0.5	0.6	0.3
0.08	22.1	22.4	122.2	851.1	374.1	410.4	0.5	0.6	0.3
0.23	22.1	22.4	130.8	838.5	273.1	398.9	0.5	0.6	0.3
0.37	22.1	22.5	142.1	833.2	248.6	387.1	0.5	0.6	0.3
0.52	22.1	22.5	151.2	850.6	260.1	375.5	0.5	0.6	0.3
0.67	22.1	22.5	159.9	856.8	14.7	366.8	0.5	0.6	0.3
0.82	22.1	22.5	166.2	847.2	252.4	359.8	0.5	0.6	0.3
0.97	22.1	22.5	168.6	848.5	257.8	356.3	0.5	0.6	0.3
1.12	22.1	22.5	173.2	841.8	247.1	351.0	0.5	0.6	0.3
1.27	22.1	22.5	176.3	838.2	264.2	347.0	0.5	0.6	0.3
1.42	22.1	22.5	178.9	836.8	252.7	343.5	0.5	0.6	0.3
1.55	22.1	22.5	181.4	832.3	245.2	340.1	0.6	0.6	0.3
1.70	22.1	22.5	183.3	830.0	250.7	337.0	0.6	0.6	0.3
1.85	22.1	22.5	185.2	827.5	235.0	334.1	0.6	0.6	0.3
2.00	22.1	22.4	187.1	825.8	241.1	331.2	0.6	0.6	0.3
2.15	22.1	22.4	188.4	824.4	241.5	329.0	0.5	0.6	0.3

(a) MULTIPLY BY CALIBRATION FACTOR 1.039

TABLE B-7 (CONT.)

DIGITAL OUTPUT FOR CHANNELS 92 THROUGH 117 --TEST AB5
(REFER TO TABLE A-1 FOR CHANNEL DESCRIPTIONS)

TIME MINUTES	DAS 92 PERCENT	DAS 93 PERCENT	DAS 105 KPa ABS	DAS 106 Kg (a)	DAS 107 g / SEC	DAS 109 KPa	DAS 113 PERCENT	DAS 115 PERCENT	DAS 117 PERCENT
2.30	22.1	22.4	189.4	823.3	234.6	327.0	0.5	0.6	0.3
2.45	22.1	22.4	190.0	821.4	231.6	325.4	0.5	0.6	0.3
2.58	22.1	22.4	190.5	819.4	235.9	325.2	0.5	0.6	0.3
2.73	22.1	22.4	191.0	817.3	233.2	337.9	0.5	0.6	0.3
2.88	22.1	22.4	191.3	815.5	234.4	338.4	0.5	0.6	0.3
3.03	22.1	22.4	191.5	813.0	238.1	339.5	0.5	0.6	0.3
3.18	22.1	22.4	191.8	811.0	258.1	340.2	0.5	0.6	0.3
3.33	22.1	22.4	192.1	809.2	224.9	337.9	0.5	0.5	0.3
3.48	22.1	22.4	192.4	807.5	242.9	338.1	0.5	0.6	0.3
3.63	22.1	22.4	192.7	805.5	250.2	338.3	0.5	0.6	0.3
3.77	22.1	22.4	193.1	803.7	246.4	338.4	0.5	0.6	0.3
3.92	22.1	22.4	193.5	801.7	233.1	338.4	0.5	0.6	0.3
4.07	22.1	22.4	194.1	799.8	221.4	338.4	0.5	0.6	0.3
4.22	22.1	22.4	195.3	797.9	244.5	337.6	0.5	0.6	0.3
4.37	22.0	22.4	196.5	795.3	242.0	336.9	0.5	0.6	0.3
4.52	22.0	22.4	197.3	793.3	240.8	336.3	0.6	0.6	0.3
4.67	22.0	22.4	197.5	791.4	246.5	336.5	0.6	0.6	0.3
4.80	22.0	22.4	198.0	789.5	238.0	336.5	0.6	0.6	0.3
4.95	22.0	22.4	198.5	787.8	246.6	336.2	0.6	0.6	0.3
5.10	22.0	22.4	199.0	785.3	234.9	336.1	0.6	0.6	0.3
5.25	22.0	22.4	199.3	783.5	245.1	339.1	0.6	0.6	0.3
5.40	22.0	22.4	199.5	781.4	238.9	340.2	0.6	0.6	0.3
5.55	22.0	22.4	200.1	779.2	240.1	340.3	0.6	0.6	0.3
5.70	22.0	22.4	200.5	777.4	228.1	340.6	0.6	0.6	0.3
5.83	22.0	22.4	201.0	775.5	256.2	340.9	0.6	0.6	0.3
5.98	22.0	22.4	201.5	773.5	253.5	341.2	0.6	0.6	0.3
6.13	22.0	22.4	202.0	771.6	232.5	341.3	0.6	0.6	0.3
6.28	22.0	22.5	202.9	769.7	236.5	341.0	0.6	0.6	0.3
6.43	22.0	22.4	203.8	767.4	234.4	340.8	0.6	0.6	0.3
6.58	22.0	22.4	204.4	765.4	252.5	340.8	0.6	0.6	0.3
6.73	21.9	22.5	204.9	763.5	233.1	340.9	0.6	0.6	0.3
6.88	21.9	22.5	205.7	761.4	252.0	340.9	0.6	0.6	0.3
7.02	21.9	22.4	206.2	759.4	231.2	340.9	0.6	0.6	0.3
7.17	21.9	22.4	206.6	757.1	253.1	341.0	0.6	0.6	0.3
7.32	21.8	22.4	207.3	755.1	241.5	340.8	0.6	0.6	0.3

(a) MULTIPLY BY CALIBRATION FACTOR 1.039

TABLE B-7 (CONT.)

DIGITAL OUTPUT FOR CHANNELS 92 THROUGH 117 --TEST AB5
(REFER TO TABLE A-1 FOR CHANNEL DESCRIPTIONS)

TIME MINUTES	DAS 92 PERCENT	DAS 93 PERCENT	DAS 105 KPa ABS	DAS 106 Kg (a)	DAS 107 g / SEC	DAS 109 KPa	DAS 113 PERCENT	DAS 115 PERCENT	DAS 117 PERCENT
7.47	21.8	22.4	208.0	752.8	229.9	340.6	0.6	0.6	0.3
7.62	21.8	22.4	208.5	751.0	239.5	340.5	0.6	0.6	0.3
7.77	21.8	22.4	208.5	749.1	252.0	340.9	0.6	0.6	0.3
7.92	21.7	22.4	208.7	747.0	225.1	341.2	0.6	0.6	0.3
8.05	21.7	22.4	209.1	744.6	235.0	341.2	0.6	0.6	0.3
8.20	21.7	22.4	209.4	742.7	240.5	341.3	0.6	0.6	0.3
8.35	21.6	22.4	209.5	740.7	234.4	348.1	0.6	0.6	0.3
8.50	21.6	22.4	209.8	738.4	255.8	348.7	0.6	0.6	0.3
8.65	21.6	22.4	209.9	736.0	243.7	349.7	0.6	0.6	0.3
8.80	21.6	22.4	209.9	734.2	233.9	350.8	0.6	0.6	0.3
8.95	21.6	22.5	209.8	732.0	234.2	351.8	0.6	0.6	0.3
9.10	21.6	22.5	209.7	730.1	241.0	352.7	0.6	0.6	0.3
9.25	21.6	22.5	209.9	727.8	242.2	353.6	0.6	0.6	0.3
9.38	21.6	22.4	210.2	725.6	239.6	346.5	0.6	0.6	0.3
9.53	21.6	22.4	210.3	723.6	246.6	347.6	0.6	0.6	0.3
9.68	21.6	22.4	210.3	721.7	246.2	347.6	0.6	0.6	0.3
9.83	21.6	22.4	210.6	719.5	247.9	347.6	0.6	0.6	0.3
9.98	21.6	22.4	210.5	717.2	244.2	348.1	0.6	0.6	0.3
10.13	21.6	22.5	210.4	715.1	242.2	348.3	0.6	0.6	0.3
10.28	21.6	22.4	210.5	712.9	242.4	348.3	0.6	0.6	0.3
10.43	21.5	22.5	210.6	710.8	242.9	348.5	0.6	0.6	0.3
10.57	21.5	22.5	210.6	708.8	241.2	348.6	0.6	0.6	0.3
10.72	21.5	22.5	210.6	707.0	244.2	348.9	0.6	0.6	0.3
10.87	21.5	22.5	210.7	705.2	246.7	348.9	0.6	0.6	0.3
11.02	21.4	22.4	211.0	702.6	241.5	348.7	0.6	0.5	0.3
11.17	21.4	22.5	211.2	701.0	242.1	348.7	0.6	0.5	0.3
11.32	21.4	22.4	211.7	698.8	244.7	348.5	0.6	0.6	0.3
11.47	21.3	22.4	212.2	696.6	245.4	348.2	0.6	0.6	0.3
11.62	21.3	22.4	212.7	694.5	239.9	347.8	0.6	0.5	0.3
11.75	21.2	22.5	213.0	692.1	244.7	347.6	0.6	0.5	0.3
11.90	21.2	22.5	213.2	689.8	253.9	347.6	0.6	0.5	0.3
12.05	21.2	22.5	213.3	687.7	249.4	347.5	0.6	0.5	0.3
12.20	21.1	22.5	213.2	685.8	247.1	347.8	0.6	0.5	0.3
12.35	21.1	22.5	213.2	683.7	242.6	348.2	0.5	0.5	0.3
12.50	21.0	22.5	213.2	681.7	253.8	348.2	0.6	0.5	0.3

(a) MULTIPLY BY CALIBRATION FACTOR 1.039

TABLE B-7 (CONT.)

DIGITAL OUTPUT FOR CHANNELS 92 THROUGH 117 --TEST AB5
(REFER TO TABLE A-1 FOR CHANNEL DESCRIPTIONS)

TIME MINUTES	DAS 92 PERCENT	DAS 93 PERCENT	DAS 105 KPa ABS	DAS 106 Kg (a)	DAS 107 g / SEC	DAS 109 KPa	DAS 113 PERCENT	DAS 115 PERCENT	DAS 117 PERCENT
12.65	21.0	22.4	213.3	679.2	234.7	348.3	0.5	0.5	0.3
12.80	21.0	22.4	213.3	677.0	237.8	348.5	0.6	0.5	0.3
12.95	20.9	22.4	213.4	675.0	244.8	348.5	0.6	0.5	0.3
13.08	20.9	22.4	213.6	673.0	245.2	348.5	0.6	0.5	0.3
13.23	20.8	22.4	213.7	671.1	240.2	348.5	0.6	0.5	0.3
13.38	20.7	22.5	213.9	668.9	245.1	348.5	0.5	0.5	0.3
13.55	20.4	22.5	213.8	658.5	245.3	349.2	0.5	0.5	0.3
15.33	19.7	22.5	179.2	645.2	-9.0	391.9	0.5	0.4	0.3
20.33	18.2	22.4	150.4	653.0	-28.5	429.7	0.4	0.3	0.3
25.33	18.5	22.3	144.9	654.0	-39.8	131.4	0.4	0.4	0.3
30.00	18.6	22.3	142.7	656.7	-45.0	63.6	0.4	0.4	0.3
32.50	18.6	22.2	142.0	657.6	-47.8	36.1	0.4	0.4	0.3
35.00	18.6	22.3	141.4	658.8	-48.0	17.7	0.4	0.3	0.3
37.50	18.6	22.4	140.8	659.4	-47.2	9.5	0.3	0.4	0.4
40.00	18.7	21.7	140.3	660.4	-47.0	265.2	0.3	0.4	0.3
42.50	18.7	20.1	139.8	661.8	-46.6	265.3	0.3	0.4	0.1
45.00	18.7	19.1	139.4	662.8	-44.6	265.3	0.3	0.4	0.1
47.50	18.7	19.0	139.1	663.1	-46.2	265.0	0.3	0.4	0.1
50.00	18.7	19.0	138.8	663.6	-45.5	265.2	0.3	0.4	0.1
52.50	18.7	19.0	138.5	664.2	-43.6	265.0	0.4	0.3	0.1
55.00	18.7	19.0	138.2	664.4	-43.5	264.9	0.4	0.4	0.1
57.50	18.7	19.0	137.9	665.1	-40.7	264.9	0.3	0.4	0.1
60.00	18.7	19.0	137.8	665.2	-42.2	264.8	0.3	0.4	0.1
62.50	18.7	19.0	137.5	665.5	-42.2	264.6	0.4	0.4	0.1
65.00	18.7	19.0	137.3	666.1	-39.4	264.5	0.3	0.4	0.1
67.50	18.7	19.0	137.1	666.1	-40.9	-1.0	0.3	0.4	0.1
70.00	18.7	19.0	137.0	666.5	-39.9	264.4	0.4	0.4	0.1
72.50	18.7	19.1	136.8	666.9	-38.1	264.2	0.3	0.4	0.1
75.00	18.7	19.1	136.7	667.0	-39.1	264.1	0.4	0.4	0.1
77.50	18.7	19.1	136.5	667.5	-37.3	263.8	0.3	0.4	0.1
80.00	-0.2	19.1	136.4	667.6	-39.0	263.8	0.3	0.4	0.1
82.50	18.7	19.1	136.2	667.8	-38.5	263.7	0.3	0.4	0.1
85.00	18.7	19.1	136.1	668.2	-36.7	263.4	0.3	0.4	0.1
87.50	18.7	19.1	135.9	668.4	-38.2	263.3	0.3	0.4	0.1
90.00	18.7	19.1	135.8	667.2	-38.0	263.0	0.3	0.4	0.1

(a) MULTIPLY BY CALIBRATION FACTOR 1.039

APPENDIX C

TEMPERATURE AND PRESSURE DATA

APPENDIX C

TEMPERATURE AND PRESSURE DATA

Table C-1 presents the mean containment temperature, mean containment vessel steel temperature, containment pressure, factor for converting standard volume to volume at containment conditions, and the temperature gradients at the vertical wall and ceiling, all as a function of time from -2.27 minutes to 8505 minutes.

The method for calculating the mean temperatures is discussed in Section 4.3.1 of the main report, the method of measuring the temperature gradients near the wall and ceiling is discussed in Section 4.3.3, and the method for calculating the volume conversion factor is described in Section 4.3.6.

TABLE C-1

TEMPERATURE AND PRESSURE DATA FOR TEST AB5

TIME MIN.	CV ATMOS AVG TEMP DEG C	CV PRESS KPa	FACTOR STD. TO ACTUAL CU. M	AVG CV STEEL TEMP DEG C	GRADIENT DEG C / CM WALL	GRADIENT DEG C / CM CEILING
-2.27	29.2	122.1	1.088	28.4	1.0	5.4
-2.13	29.2	122.1	1.088	28.4	1.1	5.4
-1.98	29.2	122.1	1.088	28.4	1.1	5.5
-1.83	29.2	122.1	1.089	28.4	1.0	5.4
-1.68	29.2	122.1	1.088	28.4	1.0	5.3
-1.53	29.2	122.1	1.089	28.4	1.1	5.4
-1.38	29.2	122.1	1.088	28.4	1.0	5.4
-1.25	29.1	122.1	1.088	28.4	1.0	5.4
-1.10	29.2	122.1	1.088	28.4	1.1	5.4
-0.95	29.1	122.1	1.088	28.5	1.0	5.3
-0.80	29.2	122.1	1.088	28.4	1.1	5.4
-0.65	29.2	122.1	1.088	28.4	1.1	5.4
-0.52	29.2	122.1	1.088	28.5	1.1	5.4
-0.37	29.2	122.1	1.089	28.4	1.1	5.4
-0.22	29.2	122.1	1.088	28.4	1.1	5.4
-0.07	29.2	122.2	1.089	28.4	1.0	5.4
0.08	29.2	122.2	1.090	28.4	1.1	5.4
0.23	29.2	130.8	1.166	28.4	1.7	5.4
0.37	34.8	142.1	1.243	28.6	13.2	11.6
0.52	49.6	151.2	1.263	29.4	35.3	29.2
0.67	68.2	159.9	1.262	30.4	51.8	41.7
0.82	88.1	166.2	1.240	31.5	76.6	48.6
0.97	103.7	168.6	1.206	32.9	97.1	56.0
1.12	114.0	173.2	1.206	34.2	96.6	57.7
1.27	122.6	176.3	1.201	35.5	104.9	68.9
1.42	130.8	178.9	1.194	36.7	119.4	66.3
1.55	138.0	181.4	1.189	37.9	123.5	79.1
1.70	146.4	183.3	1.178	39.4	129.1	84.8
1.85	155.4	185.2	1.165	40.5	131.0	84.6
2.00	161.4	187.1	1.161	41.6	138.8	85.2
2.15	168.2	188.4	1.151	42.5	144.3	86.0
2.30	172.8	189.4	1.145	43.4	148.8	89.0
2.45	177.0	190.0	1.138	44.3	148.7	98.5
2.58	180.3	190.5	1.132	45.7	148.5	104.8
2.73	185.8	191.0	1.122	46.7	155.1	94.0

TABLE C-1

TEMPERATURE AND PRESSURE DATA FOR TEST AB5

TIME MIN.	CV ATMOS AVG TEMP DEG C	CV PRESS KPa	FACTOR STD. TO ACTUAL CU. M	AVG CV STEEL TEMP DEG C	GRADIENT DEG C / CM	
					WALL	CEILING
2.88	191.8	191.3	1.109	47.3	155.6	85.4
3.03	196.4	191.5	1.099	47.8	151.7	84.4
3.18	199.1	191.8	1.095	48.4	151.3	82.9
3.33	203.5	192.1	1.086	49.0	150.2	80.4
3.48	206.2	192.4	1.082	49.5	154.7	78.6
3.63	208.6	192.7	1.078	50.0	153.1	78.4
3.77	210.0	193.1	1.078	50.6	152.9	79.8
3.92	214.1	193.5	1.070	51.2	153.2	78.1
4.07	212.8	194.1	1.077	52.0	150.3	78.3
4.22	212.8	195.3	1.084	52.5	149.6	76.5
4.37	213.6	196.5	1.088	53.0	152.9	78.8
4.52	216.3	197.3	1.087	53.5	155.1	76.4
4.67	220.0	197.5	1.080	53.8	154.2	74.7
4.80	221.5	198.0	1.079	54.7	154.6	82.5
4.95	223.4	198.5	1.078	55.4	156.1	82.7
5.10	225.2	199.0	1.077	56.0	158.2	83.3
5.25	227.0	199.3	1.074	56.6	157.8	88.7
5.40	228.1	199.5	1.073	57.3	156.8	90.1
5.55	229.0	200.1	1.074	58.0	157.7	90.1
5.70	234.2	200.5	1.065	58.7	157.9	88.1
5.83	235.7	201.0	1.065	59.2	157.9	87.8
5.98	238.4	201.5	1.062	59.7	157.9	87.4
6.13	239.4	202.0	1.062	60.2	154.8	91.5
6.28	240.9	202.9	1.064	60.7	154.5	93.7
6.43	242.1	203.8	1.066	61.2	154.7	93.8
6.58	245.6	204.4	1.062	61.6	155.9	93.7
6.73	247.2	204.9	1.062	62.4	158.6	94.1
6.88	250.9	205.7	1.058	63.3	160.8	93.6
7.02	253.9	206.2	1.054	64.0	162.4	96.3
7.17	257.5	206.6	1.050	64.5	160.9	95.6
7.32	259.2	207.3	1.050	65.0	161.0	96.3
7.47	261.8	208.0	1.048	65.5	161.4	94.6
7.62	262.7	208.5	1.049	66.1	161.3	94.2
7.77	264.9	208.5	1.045	66.6	160.0	94.6
7.92	267.3	208.7	1.041	67.1	158.6	95.9

TABLE C-1

TEMPERATURE AND PRESSURE DATA FOR TEST AB5

TIME MIN.	CV ATMOS AVG TEMP DEG C	CV PRESS KPa	FACTOR STD. TO ACTUAL CU. M	AVG CV STEEL TEMP DEG C	GRADIENT DEG C / CM WALL	GRADIENT DEG C / CM CEILING
8.05	270.5	209.1	1.037	67.7	158.7	97.0
8.20	273.9	209.4	1.032	68.2	159.4	98.0
8.35	275.0	209.5	1.031	68.8	159.9	101.5
8.50	276.4	209.8	1.029	69.2	159.7	100.4
8.65	276.6	209.9	1.029	69.5	159.1	101.2
8.80	277.2	209.9	1.028	70.0	158.7	106.0
8.95	277.8	209.8	1.026	70.6	159.3	113.9
9.10	279.4	209.7	1.023	71.4	159.6	112.9
9.25	279.4	209.9	1.024	72.1	159.2	105.0
9.38	280.1	210.2	1.024	72.5	158.6	102.0
9.53	280.8	210.3	1.023	72.9	157.2	100.9
9.68	281.6	210.3	1.022	73.5	155.6	103.2
9.83	284.0	210.6	1.019	74.0	154.9	103.5
9.98	284.2	210.5	1.018	74.3	154.4	101.0
10.13	284.1	210.4	1.018	74.9	153.2	103.3
10.28	283.2	210.5	1.020	75.5	151.9	101.7
10.43	283.6	210.6	1.020	75.8	150.6	99.7
10.57	284.9	210.6	1.017	76.2	149.0	99.4
10.72	286.2	210.6	1.015	76.7	147.0	102.6
10.87	287.7	210.7	1.013	77.2	147.0	102.7
11.02	288.8	211.0	1.012	77.7	146.8	104.2
11.17	290.7	211.2	1.010	78.1	146.9	102.2
11.32	292.6	211.7	1.009	78.6	147.3	96.9
11.47	294.9	212.2	1.007	79.0	147.6	93.5
11.62	296.7	212.7	1.006	79.3	146.4	92.0
11.75	296.8	213.0	1.008	79.8	146.8	93.3
11.90	296.9	213.2	1.008	80.3	145.6	94.0
12.05	297.2	213.3	1.008	80.7	145.1	96.5
12.20	298.0	213.2	1.006	81.2	144.8	98.4
12.35	298.4	213.2	1.005	81.7	144.6	100.9
12.50	299.0	213.2	1.005	82.3	144.2	96.7
12.65	300.2	213.3	1.003	83.0	143.3	93.0
12.80	300.8	213.3	1.002	83.7	141.9	91.3
12.95	301.5	213.4	1.001	84.3	141.3	89.8
13.08	301.8	213.6	1.001	84.8	141.0	90.0

TABLE C-1

TEMPERATURE AND PRESSURE DATA FOR TEST AB5

TIME MIN.	CV ATMOS AVG TEMP DEG C	CV PRESS KPa	FACTOR STD. TO ACTUAL CU. M	AVG CV STEEL TEMP DEG C	GRADIENT DEG C / CM WALL	GRADIENT DEG C / CM CEILING
13.23	303.5	213.7	0.999	85.4	140.2	91.0
13.38	303.8	213.9	1.000	85.9	139.9	90.4
13.55	304.2	213.8	0.998	87.0	141.4	89.0
15.33	275.9	179.2	0.880	93.5	125.6	77.5
20.33	151.3	150.4	0.956	83.3	53.7	30.4
25.33	123.0	144.9	0.986	82.0	24.5	20.3
30.00	112.9	142.7	0.996	81.8	14.7	15.7
32.50	109.7	142.0	1.000	81.7	12.4	14.4
35.00	107.3	141.4	1.002	81.7	10.4	13.4
37.50	105.3	140.8	1.003	81.7	9.4	13.0
40.00	103.6	140.3	1.004	81.6	8.4	12.6
42.50	102.0	139.8	1.004	81.6	7.7	12.3
45.00	100.7	139.4	1.005	81.6	7.0	12.1
47.50	99.6	139.1	1.006	81.5	6.5	11.8
50.00	98.6	138.8	1.007	81.3	6.2	11.8
52.50	97.6	138.5	1.007	81.4	5.8	11.5
55.00	96.8	138.2	1.007	81.3	5.4	11.7
57.50	96.0	137.9	1.007	81.3	5.3	11.2
60.00	95.4	137.8	1.008	81.2	5.1	11.3
62.50	94.7	137.5	1.008	81.1	5.0	11.0
65.00	94.1	137.3	1.008	81.1	4.7	11.3
67.50	93.5	137.1	1.008	81.0	4.7	11.1
70.00	93.0	137.0	1.008	80.8	4.6	11.2
72.50	92.5	136.8	1.008	80.8	4.3	11.1
75.00	92.0	136.7	1.009	80.7	4.3	11.1
77.50	91.5	136.5	1.009	80.6	4.1	11.1
80.00	91.1	136.4	1.009	80.5	4.1	11.1
82.50	90.7	136.2	1.009	80.4	3.9	10.9
85.00	90.3	136.1	1.009	80.3	3.8	11.0
87.50	90.0	135.9	1.009	80.2	3.8	10.8
90.00	89.6	135.8	1.009	80.1	3.7	10.8
92.50	89.2	135.6	1.009	80.0	3.6	10.8
95.00	89.0	135.5	1.008	79.9	3.5	10.7
97.50	88.6	135.3	1.008	79.7	3.4	10.6
100.00	88.3	135.3	1.009	79.6	3.3	10.7

TABLE C-1

TEMPERATURE AND PRESSURE DATA FOR TEST AB5

TIME MIN.	CV ATMOS AVG TEMP DEG C	CV PRESS KPa	FACTOR STD. TO ACTUAL CU. M	AVG CV STEEL TEMP DEG C	GRADIENT DEG C / CM	
					WALL	CEILING
105.00	87.7	135.0	1.009	79.4	3.4	10.6
110.00	87.2	134.9	1.009	79.2	3.2	10.4
115.00	86.7	134.6	1.008	78.9	3.1	10.4
120.00	86.2	134.5	1.009	78.7	3.1	10.3
125.00	85.7	134.3	1.008	78.4	2.9	10.1
130.00	85.3	134.0	1.008	78.2	3.1	10.1
135.00	84.8	133.9	1.008	78.0	2.9	10.1
140.00	84.4	133.8	1.008	77.7	2.9	10.1
145.00	83.9	133.5	1.008	77.5	2.9	10.1
150.00	83.6	133.3	1.007	77.2	2.8	10.0
155.00	83.2	133.1	1.007	76.9	2.8	9.9
160.00	82.8	132.9	1.006	76.6	2.8	9.7
165.00	82.4	132.7	1.006	76.5	2.7	9.5
170.00	82.0	132.4	1.005	76.2	2.7	9.4
175.00	81.6	132.2	1.004	76.0	2.7	9.2
180.00	81.3	132.0	1.004	75.6	2.6	9.3
185.00	80.9	131.7	1.003	75.4	2.7	9.1
190.00	80.6	131.5	1.002	75.2	2.7	8.9
195.00	80.3	131.3	1.001	75.0	2.6	9.0
200.00	79.9	131.0	1.000	74.7	2.7	9.0
210.00	79.3	130.6	0.999	74.2	2.7	9.3
220.00	78.7	130.4	0.999	73.7	2.7	9.0
230.00	78.0	130.2	0.999	73.0	2.6	9.9
240.00	77.5	130.0	1.000	72.7	2.4	10.1
250.00	76.9	129.8	1.000	72.3	2.6	9.9
260.00	76.3	129.6	1.000	71.8	2.6	10.0
270.00	75.8	129.4	1.000	71.4	2.4	9.7
280.00	75.2	129.2	0.999	71.0	2.3	10.2
290.00	74.7	129.0	1.000	70.6	2.4	9.6
300.00	74.1	128.7	0.999	70.1	2.3	9.7
310.00	73.6	128.5	0.999	69.7	2.4	9.7
320.00	73.1	128.2	0.998	69.2	2.3	9.8
330.00	72.5	127.9	0.997	68.8	2.3	9.7
340.00	72.1	127.5	0.996	68.4	2.3	9.7
350.00	71.5	127.0	0.993	68.0	2.3	9.4

TABLE C-1

TEMPERATURE AND PRESSURE DATA FOR TEST AB5

TIME MIN.	CV ATMOS AVG TEMP DEG C	CV PRESS KPa	FACTOR STD. TO ACTUAL CU. M	AVG CV STEEL TEMP DEG C	GRADIENT DEG C / CM WALL	CEILING
360.00	71.1	126.7	0.992	67.6	2.2	9.2
370.00	70.6	126.3	0.990	67.2	2.2	8.9
380.00	70.1	125.9	0.989	66.8	2.2	9.0
390.00	69.6	125.6	0.988	66.4	2.1	8.4
400.00	69.1	125.3	0.986	66.0	2.1	8.3
410.00	68.7	124.9	0.985	65.6	2.1	8.1
420.00	68.3	124.6	0.984	65.3	2.1	8.1
430.00	67.8	124.3	0.983	64.9	2.1	7.7
440.00	67.4	124.0	0.982	64.5	2.1	7.6
450.00	66.9	123.8	0.981	64.2	2.0	7.4
460.00	66.5	123.6	0.981	63.8	1.9	7.4
470.00	66.1	123.4	0.980	63.4	1.9	7.1
480.00	65.8	123.3	0.981	63.2	2.1	7.3
490.00	65.3	123.3	0.982	62.8	1.9	7.6
505.00	64.7	123.2	0.983	62.3	1.9	7.3
520.00	64.2	123.2	0.984	61.8	1.9	7.6
540.00	63.4	122.9	0.985	61.1	1.8	7.6
560.00	62.6	122.9	0.986	60.5	1.8	7.4
580.00	61.9	122.8	0.988	59.9	1.7	7.6
600.00	61.2	122.6	0.988	59.3	1.8	7.6
620.00	60.5	122.3	0.988	58.6	1.9	7.7
640.00	59.9	122.0	0.988	58.1	1.8	7.7
660.00	59.2	121.7	0.987	57.5	1.7	7.7
680.00	58.5	121.4	0.986	56.9	1.8	7.7
700.00	57.9	121.2	0.987	56.3	1.7	7.6
720.00	57.2	121.0	0.987	55.8	1.8	7.7
740.00	56.6	120.7	0.987	55.2	1.7	7.7
760.00	56.1	120.3	0.985	54.7	1.9	8.0
780.00	55.4	119.8	0.983	54.1	1.7	8.1
800.00	54.8	119.5	0.982	53.5	1.7	8.0
820.00	54.2	119.2	0.981	53.0	1.8	8.1
840.00	53.7	119.1	0.982	52.5	1.8	8.2
860.00	53.1	118.7	0.981	52.0	1.8	8.1
880.00	52.5	118.3	0.979	51.5	1.7	8.0
900.00	52.1	117.9	0.977	51.1	1.6	7.7

TABLE C-1

TEMPERATURE AND PRESSURE DATA FOR TEST AB5

TIME MIN.	CV ATMOS AVG TEMP DEG C	CV PRESS KPa	FACTOR STD. TO ACTUAL CU. M	AVG CV STEEL TEMP DEG C	GRADIENT DEG C / CM	
					WALL	CEILING
920.00	51.5	117.5	0.976	50.6	1.6	7.7
940.00	51.1	117.2	0.974	50.1	1.8	7.4
960.00	50.5	117.0	0.974	49.6	1.6	7.4
980.00	50.0	116.5	0.972	49.2	1.6	7.6
1000.00	49.5	116.2	0.970	48.8	1.6	7.6
1040.00	48.4	115.4	0.967	47.8	1.4	7.6
1080.00	47.4	114.5	0.963	46.9	1.3	7.3
1120.00	46.4	114.0	0.961	46.1	1.2	7.1
1160.00	45.5	113.3	0.958	45.2	1.1	6.9
1200.00	44.6	112.8	0.957	44.4	1.2	6.9
1240.00	43.8	112.3	0.955	43.7	1.2	6.8
1255.00	43.5	111.8	0.951	43.4	1.2	7.0
1300.00	42.6	110.9	0.947	42.5	0.9	7.1
1345.00	41.8	110.5	0.946	41.7	1.0	6.7
1390.00	41.1	109.8	0.942	41.1	1.1	5.4
1435.00	40.4	108.5	0.933	40.4	0.9	4.0
1480.00	39.7	107.7	0.927	39.9	0.6	3.1
1525.00	39.1	106.9	0.922	39.2	0.5	2.7
1570.00	38.5	106.0	0.917	38.7	0.6	2.3
1615.00	38.0	105.4	0.913	38.1	0.7	1.9
1660.00	37.5	104.8	0.909	37.7	0.7	1.6
1705.00	37.0	104.3	0.906	37.2	0.4	1.5
1750.00	36.6	104.7	0.911	36.7	0.5	1.1
1795.00	36.1	105.3	0.918	36.3	0.6	0.7
1840.00	35.7	105.0	0.916	35.9	0.4	0.2
1885.00	35.3	104.8	0.916	35.6	0.6	0.1
1930.00	34.9	104.4	0.914	35.2	0.6	0.1
1975.00	34.5	104.3	0.914	34.8	0.4	0.0
1990.00	34.5	104.4	0.915	34.8	0.3	0.1
2050.00	34.0	104.3	0.915	34.4	0.3	0.1
2110.00	33.5	104.1	0.915	33.9	0.3	0.0
2170.00	33.1	104.0	0.915	33.5	0.4	-0.1
2230.00	32.7	103.8	0.915	33.1	0.4	-0.3
2290.00	32.3	103.8	0.915	32.7	0.3	-0.2
2350.00	31.9	103.6	0.915	32.3	0.3	-0.4

TABLE C-1

TEMPERATURE AND PRESSURE DATA FOR TEST AB5

TIME MIN.	CV ATMOS AVG TEMP DEG C	CV PRESS KPa	FACTOR STD. TO ACTUAL CU. M	AVG CV STEEL TEMP DEG C	GRADIENT DEG C / CM WALL	CEILING
2410.00	31.5	103.4	0.914	31.9	0.3	-0.4
2470.00	31.1	103.2	0.914	31.5	0.3	-0.3
2530.00	30.8	103.0	0.913	31.2	0.2	-0.3
2590.00	30.5	102.8	0.913	30.8	0.3	-0.3
2650.00	30.1	102.7	0.913	30.5	0.3	-0.2
2710.00	29.7	102.1	0.909	30.2	0.3	-0.3
2770.00	29.3	101.9	0.908	29.9	0.3	-0.4
2830.00	29.2	101.6	0.905	29.7	0.1	-0.4
2890.00	29.0	101.6	0.906	29.4	0.4	-0.6
2950.00	28.7	101.1	0.903	29.2	0.2	-0.7
3010.00	28.6	100.6	0.898	29.0	0.2	-0.4
3105.00	28.4	99.7	0.891	28.8	0.2	-0.6
3165.00	28.4	99.3	0.888	28.6	0.2	-0.6
3225.00	28.6	104.8	0.936	28.6	0.3	-0.6
3285.00	28.2	104.1	0.931	28.5	-0.1	-0.8
3345.00	28.1	103.9	0.929	28.4	0.0	-0.9
3405.00	28.0	103.7	0.928	28.3	0.1	-1.0
3465.00	27.9	103.9	0.930	28.2	0.0	-0.9
3525.00	27.8	103.8	0.929	28.2	0.2	-0.9
3585.00	27.7	103.7	0.929	28.0	0.1	-0.8
3645.00	27.5	103.7	0.929	27.9	0.1	-0.8
3705.00	27.5	103.6	0.929	27.8	0.0	-0.8
3765.00	27.3	103.7	0.930	27.7	0.1	-0.7
3825.00	27.2	103.7	0.930	27.6	0.1	-0.6
3885.00	27.1	103.6	0.930	27.4	0.2	-0.4
3945.00	26.9	103.4	0.929	27.3	0.1	-0.4
4005.00	26.8	103.4	0.929	27.2	0.1	-0.4
4065.00	26.7	103.3	0.928	27.1	0.0	-0.4
4125.00	26.6	102.8	0.925	26.9	0.1	-0.5
4185.00	26.4	102.5	0.922	26.8	0.0	-0.5
4245.00	26.4	101.8	0.916	26.8	0.2	-1.0
4305.00	26.4	102.0	0.917	26.7	0.1	-0.9
4365.00	26.4	101.7	0.915	26.7	-0.1	-0.9
4425.00	26.5	101.3	0.911	26.7	0.1	0.1
4485.00	26.6	100.9	0.907	26.7	0.1	0.0

TABLE C-1

TEMPERATURE AND PRESSURE DATA FOR TEST AB5

TIME MIN.	CV ATMOS AVG TEMP DEG C	CV PRESS KPa	FACTOR STD. TO ACTUAL CU. M	AVG CV STEEL TEMP DEG C	GRADIENT DEG C / CM WALL	GRADIENT DEG C / CM CEILING
4545.00	26.5	100.2	0.901	26.8	0.1	-0.3
4605.00	27.3	100.1	0.898	26.8	0.4	-0.1
4665.00	26.9	101.9	0.916	27.0	0.2	-1.2
4725.00	26.7	101.3	0.910	26.9	0.0	-1.7
4785.00	26.7	101.0	0.908	26.9	0.0	-1.7
4845.00	26.7	100.9	0.907	26.9	-0.1	-1.7
4905.00	26.6	101.0	0.908	26.9	-0.1	-1.6
4965.00	26.6	100.9	0.907	26.9	-0.1	-1.6
5025.00	26.5	100.9	0.907	26.8	0.0	-1.6
5085.00	26.5	100.9	0.907	26.8	-0.2	-1.6
5145.00	26.4	100.9	0.907	26.8	-0.2	-1.6
5205.00	26.3	101.0	0.909	26.7	-0.1	-1.6
5265.00	26.3	101.0	0.909	26.7	-0.1	-1.7
5325.00	26.3	100.9	0.908	26.6	0.1	-1.6
5385.00	26.2	100.8	0.907	26.5	0.0	-1.6
5445.00	26.1	100.9	0.909	26.5	-0.1	-1.5
5505.00	26.1	100.9	0.909	26.4	-0.1	-1.5
5565.00	26.0	100.4	0.905	26.4	-0.1	-1.5
5625.00	26.0	100.3	0.904	26.3	-0.1	-1.4
5685.00	25.9	100.2	0.903	26.2	-0.1	-1.3
5745.00	25.9	100.2	0.903	26.2	-0.1	-1.3
5805.00	25.8	100.2	0.903	26.2	-0.1	-1.3
5865.00	25.9	100.1	0.902	26.2	-0.1	-1.6
5925.00	25.8	100.1	0.902	26.2	0.1	-1.7
5985.00	25.9	99.8	0.900	26.2	-0.1	-1.7
6045.00	25.8	99.1	0.894	26.2	-0.1	-1.9
6105.00	25.8	98.5	0.888	26.3	-0.2	-2.1
6165.00	25.9	98.2	0.885	26.2	-0.2	-2.2
6225.00	25.9	98.1	0.884	26.3	-0.1	-2.2
6285.00	25.9	98.1	0.884	26.3	-0.1	-1.9
6345.00	25.9	98.4	0.887	26.3	-0.1	-1.9
6405.00	26.0	98.3	0.886	26.3	0.0	-1.8
6465.00	26.0	98.3	0.886	26.3	0.0	-1.8
6525.00	26.0	98.3	0.886	26.3	0.0	-1.7
6585.00	26.0	98.4	0.886	26.3	0.0	-1.8

TABLE C-1

TEMPERATURE AND PRESSURE DATA FOR TEST AB5

TIME MIN.	CV ATMOS AVG TEMP DEG C	CV PRESS KPa	FACTOR STD. TO ACTUAL CU. M	AVG CV STEEL TEMP DEG C	GRADIENT DEG C / CM WALL	CEILING
6645.00	26.0	98.5	0.887	26.3	-0.1	-1.7
6705.00	26.0	98.4	0.886	26.3	-0.1	-1.7
6765.00	26.0	98.4	0.887	26.3	-0.1	-1.7
6825.00	26.0	98.3	0.886	26.3	-0.1	-1.7
6885.00	25.9	98.3	0.886	26.3	-0.1	-1.7
6945.00	25.9	98.3	0.886	26.3	-0.1	-1.7
7005.00	25.9	98.1	0.884	26.3	-0.2	-1.7
7065.00	25.9	98.1	0.884	26.3	-0.1	-1.7
7125.00	25.9	98.0	0.884	26.2	-0.2	-1.7
7185.00	25.9	98.1	0.884	26.2	0.0	-1.7
7245.00	25.8	97.9	0.883	26.2	-0.2	-1.6
7305.00	25.8	97.9	0.883	26.1	-0.2	-1.6
7365.00	25.7	97.9	0.883	26.1	0.0	-1.6
7425.00	25.7	97.9	0.882	26.1	-0.1	-1.6
7485.00	25.7	97.9	0.882	26.1	-0.1	-1.6
7545.00	25.7	97.9	0.883	26.1	-0.1	-1.6
7605.00	25.7	97.8	0.882	26.1	-0.2	-1.7
7665.00	25.7	97.8	0.882	26.1	-0.1	-1.7
7725.00	25.7	97.8	0.882	26.1	-0.2	-1.6
7785.00	25.7	98.0	0.884	26.1	-0.2	-1.7
7845.00	25.7	98.2	0.885	26.1	0.1	-1.7
7905.00	30.2	98.2	0.872	26.1	-0.1	-1.7
7965.00	26.8	98.1	0.882	26.1	-0.1	-1.7
8025.00	25.9	98.1	0.884	26.0	-0.1	-1.6
8085.00	25.7	98.1	0.885	26.0	-0.2	-1.7
8145.00	25.6	98.1	0.885	26.0	-0.1	-1.6
8205.00	25.6	98.1	0.885	26.0	0.0	-1.4
8265.00	25.6	98.0	0.885	25.9	-0.1	-1.3
8325.00	25.5	98.2	0.886	25.9	-0.1	-1.3
8385.00	25.4	98.2	0.887	25.8	-0.1	-1.4
8445.00	25.5	97.8	0.883	25.8	0.0	-1.4
8505.00	25.4	97.7	0.882	25.7	0.0	-1.3

APPENDIX D

CASCADE IMPACTOR DATA

APPENDIX D

CASCADE IMPACTOR DATA

Data for individual cascade impactor measurements and the calculational procedures used to extract size data from the stage deposits are presented in this appendix. The collection characteristics of each impactor stage were assumed to be controlled by the dimensionless impaction parameter:

$$\Psi = \frac{\rho u d^2 C}{18 \mu D} \qquad \text{(D-1)}$$

where:

Ψ = Impaction parameter (dimensionless)
u = Gas velocity (cm/s)
ρ = Particle density (g/cm^3)
d = Particle diameter (cm)
μ = Gas viscosity (g/cm•s)
D = Impactor jet diameter (cm)
C = Cunningham slip factor (dimensionless)

At the point of the impaction curve where 50% of the particles are collected, the impaction parameter Ψ takes the value Ψ_{50}. The 50% size is:

$$d_{50} = \left(\frac{18 \mu \quad D \Psi_{50}}{uC} \right)^{0.5} \qquad \text{(D-2)}$$

where:

d_{50} = Particle diameter at the 50% point on efficiency vs size curve

Ψ_{50} = Impaction parameter for the jet at the 50% efficiency point

Equation D-2 was used to determine d_{50} values at flow conditions different from those to calibrate the impactor; it can also be used to relate the d_{50} to the value under calibration conditions. If C is assumed to be constant, then d_{50} can be expressed as:

$$d_{50} = (d_{50})_{ref} \left(\frac{\mu}{\mu_{ref}} \times \frac{Q_{ref}}{Q} \right)^{0.5} \quad \text{(D-3)}$$

where:

d_{50} = Aerodynamic diameter at sampling conditions
μ = Viscosity of gas at sampling conditions
Q = Gas flow rate at sampling conditions
ref = Subscript indicating value of parameter under calibration or reference conditions

Cascade impactors of two designs (Andersen Mark III circular jet impactor* and Sierra rectangular jet impcactor**) were used for particle size analysis. Stage cut-size diameters used to interpret data obtained from the circular jet impactor are recommended by the manufacturer[D-1] and listed in Table D-1. These values are in good agreement with calibrations reported by Cushing et al.[D-2]

Stage cut-off diameters for the rectangular jet impactor are listed in Table D-2, and the data were obtained from the work of Cushing et al.[D-2] Cut diameters listed in Tables D-1 and D-2 were asjusted for sampling conditions using Equation D-3.

Particle size distributions were constructed from cascade impactor data using the cut-off diameter approach described by Mercer.[D-3] Table D-3 presents an example of the calculation method.

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*Manufactured by Andersen 2000, Inc., Atlanta, Ga.
**Model 226, Stack Sampler, Manufactured by Sierra Instrument Co., Inc., Carmel Valley, CA.

TABLE D-1

STAGE CUT DIAMETERS FOR CIRCULAR JET IMPACTOR USED IN AIR CLEANING TESTS

Stage No.	d_{50}* (μm)
0	13.2
1	8.3
2	5.64
3	3.8
4	2.45
5	1.25
6	0.77
7	0.52

*Size of unit density spheres removed with 50% efficiency at 21°C, 1 atm pressure, and 0.50-ACFM flow rate.

TABLE D-2

STAGE CUT DIAMETERS FOR RECTANGULAR JET IMPACTOR USED IN AIR CLEANING TESTS

Stage No.	d_{50}* (μm)
1	18.0
2	11.0
3	4.4
4	2.65
5	1.70
6	0.95

*Size of unit density spheres removed with 50% efficiency at 28°C, 29.5 Hg pressure, and 0.25-ACFM flow rate.

The stage accumulations of sodium were obtained by washing each stage collection paper with water and analyzing the water by flame emission spectrometry. Losses to the interstage impactor walls were ignored. The inlet walls were washed and analyzed for sodium, and the recovered sodium was assumed to be associated with aerosol particles larger than the first-stage cut-off diameter.

The particle size distribution was obtained by plotting the two right-hand columns in Table D-3 on log-probability paper as shown in Figure 20. The aerodynamic mass median diameter and geomtric standard deviation can be obtained from the line drawn through the data points. The geometric standard deviation was obtained from:

$$\sigma_g = \frac{\text{Particle Diameter at 84.13\%}}{\text{Particle Diameter at 50\%}} \qquad \text{(D-4)}$$

Mass distributions of sodium found on the cascade impactor stages are presented in Tables D-4 through D-20 for Test AB5. The data of Tables D-4 through D-20 are plotted on log probability paper in Figures D-1 through D-17.

REFERENCES FOR APPENDIX D

D-1 Operating Manual for Andersen 2000, Inc., Mark II and Mark III Particle Size Stack Samplers, TR 76-900023, Andersen 2000 Inc., Atlanta, GA, January 1976.

D-2 K. M. Cushing et al., Particle Sizing Techniques for Control Device Evaluation: Cascade Impactor Calibrations, EPA-600/2-76-280, Southern Research Institute, Birminhgham, AL, October 1976.

D-3 T. T. Mercer, "The Interpretation of Cascade Impactor Data," Industrial Hygiene Journal 26, pp. 236-241, 1965.

TABLE D-3

EXAMPLE TREATMENT OF CASCADE IMPACTOR DATA[a]

Stage No.	Na Mass (mg)[b]	Mass Fraction	Cumulative Fraction	One Minus Cumulative Fraction	d_{50} (μm)
Inlet	3.31	0.050	--	--	--
1	4.50	0.067	0.117	0.883	21.3
2	8.10	0.122	0.240	0.761	13.0
3	14.80	0.222	0.462	0.539	5.21
4	14.80	0.222	0.684	0.317	3.14
5	9.50	0.143	0.827	0.174	2.01
6	6.90	0.104	0.931	0.071	1.12
7 (filter)	4.70	0.071	1.000		--
TOTAL	66.61	1.000			

(a)Sample No. T3-I3, taken at time 542 s, Sierra Model 226, flow rate 0.136 std l/s.

(b)Net mass after correction for background on stage collection papers.

TABLE D-4

TEST: AB-5 T1-I1 313 MINUTES   SIERRA IMPACTOR

TEMP. AT DAS # 20 DEG F	173.60	ROTOMETER RDG., SCFM	0.20
FIRST BACKGROUND	0.40	CV PRESSURE, PSIA	18.62
SECOND BACKGROUND	0.60	SAMPLE DURATION, MIN.	20.00

STAGE NUMBER	LAB MG SODIUM	NET MG SODIUM	MASS FRACTION	FRACTION LESS THAN CUT SIZE	CUT DIAM MICRO-METERS
N	0.37	0.37	0.045		
F	0.42	0.02	0.002		
1	0.47	0.07	0.009	0.944	19.145
2	0.47	0.07	0.009	0.935	11.700
3	2.30	1.90	0.233	0.703	4.680
4	3.30	2.90	0.355	0.348	2.819
5	2.10	1.70	0.208	0.140	1.808
6	1.03	0.63	0.077	0.062	1.010
BU	1.11	0.51	0.062		
TOTAL		8.17	1.00		

TABLE D-5

TEST: AB-5 T1-I2 TIME = 870 MINUTES   SIERRA IMPACTOR

TEMP. AT DAS # 20 DEG F	129.50	ROTOMETER RDG., SCFM	0.20
FIRST BACKGROUND	0.40	CV PRESSURE, PSIA	17.19
SECOND BACKGROUND	0.60	SAMPLE DURATION, MIN.	40.00

STAGE NUMBER	LAB MG SODIUM	NET MG SODIUM	MASS FRACTION	FRACTION LESS THAN CUT SIZE	CUT DIAM MICRO-METERS
N	0.21	0.21	0.047		
F	0.40	0.00	0.000		
1	0.41	0.01	0.002	0.950	18.488
2	0.43	0.03	0.007	0.943	11.298
3	0.46	0.06	0.014	0.930	4.519
4	1.06	0.66	0.149	0.781	2.722
5	1.06	0.66	0.149	0.633	1.746
6	0.61	0.21	0.047	0.585	0.976
BU	3.20	2.60	0.585		
TOTAL		4.44	1.00		

TABLE D-6

TEST: AB-5 T1-I4 TIME = 4377 MINUTES ANDERSON IMPACTOR

TEMP. AT DAS # 20 DEG F	79.60	ROTOMETER RDG., SCFM	0.50
FIRST BACKGROUND	0.52	CV PRESSURE, PSIA	14.74
SECOND BACKGROUND	0.03	SAMPLE DURATION, MIN.	180.00

STAGE NUMBER	LAB MG SODIUM	NET MG SODIUM	MASS FRACTION	FRACTION LESS THAN CUT SIZE	CUT DIAM MICRO-METERS
N	0.00	0.00	0.007		
P	0.53	0.01	0.017		
1	0.53	0.01	0.017	0.959	12.509
2	0.53	0.01	0.017	0.942	7.866
3	0.55	0.03	0.051	0.891	5.345
4	0.53	0.01	0.017	0.874	3.601
5	0.63	0.11	0.188	0.685	2.322
6	0.72	0.20	0.342	0.344	1.185
7	0.67	0.15	0.256	0.087	0.730
8	0.57	0.05	0.085	0.002	0.493
BU	0.03	0.00	0.002		
TOTAL		0.58	1.00		

TABLE D-7

TEST: AB-5 T3-I1 TIME = 1.05 MINUTES SIERRA IMPACTOR

TEMP. AT DAS # 64 DEG F	315.00	ROTOMETER RDG., SCFM	0.22
FIRST BACKGROUND	0.40	CV PRESSURE, PSIA	24.79
SECOND BACKGROUND	0.60	SAMPLE DURATION, MIN.	0.10

STAGE NUMBER	LAB MG SODIUM	NET MG SODIUM	MASS FRACTION	FRACTION LESS THAN CUT SIZE	CUT DIAM MICRO-METERS
N	0.90	0.90	0.058		
P	0.53	0.13	0.008		
1	0.55	0.15	0.010	0.925	19.021
2	0.56	0.16	0.010	0.914	11.624
3	1.20	0.80	0.051	0.863	4.650
4	4.40	4.00	0.256	0.607	2.800
5	5.80	5.40	0.345	0.262	1.796
6	3.20	2.80	0.179	0.083	1.004
BU	1.90	1.30	0.083		
TOTAL		15.64	1.00		

TABLE D-8

TEST: AB-5 T3-I2 TIME = 5.04 MINUTES SIERRA IMPACTOR

TEMP. AT DAS # 64 DEG F	518.00	ROTOMETER RDG., SCFM	0.20
FIRST BACKGROUND	0.40	CV PRESSURE, PSIA	28.80
SECOND BACKGROUND	0.60	SAMPLE DURATION, MIN.	0.08

STAGE NUMBER	LAB MG SODIUM	NET MG SODIUM	MASS FRACTION	FRACTION LESS THAN CUT SIZE	CUT DIAM MICRO-METERS
N	11.20	11.20	0.174		
P	1.50	1.10	0.017		
1	3.60	3.20	0.050	0.759	20.851
2	6.80	6.40	0.099	0.660	12.742
3	13.60	13.20	0.205	0.455	5.097
4	11.30	10.90	0.169	0.286	3.070
5	8.70	8.30	0.129	0.157	1.969
6	6.60	6.20	0.096	0.061	1.100
BU	4.50	3.90	0.061		
TOTAL		64.40	1.00		

TABLE D-9

TEST: AB-5 T3-I3 TIME = 9.04 MINUTES SIERRA IMPACTOR

TEMP. AT DAS # 64 DEG F	590.00	ROTOMETER RDG., SCFM	0.20
FIRST BACKGROUND	0.40	CV PRESSURE, PSIA	30.42
SECOND BACKGROUND	0.60	SAMPLE DURATION, MIN.	0.08

STAGE NUMBER	LAB MG SODIUM	NET MG SODIUM	MASS FRACTION	FRACTION LESS THAN CUT SIZE	CUT DIAM MICRO-METERS
N	0.01	0.01	0.000		
P	3.70	3.30	0.050		
1	4.90	4.50	0.068	0.883	21.298
2	8.50	8.10	0.122	0.761	13.016
3	15.20	14.80	0.222	0.539	5.206
4	15.20	14.80	0.222	0.317	3.136
5	9.90	9.50	0.143	0.174	2.011
6	7.30	6.90	0.104	0.071	1.124
BU	5.30	4.70	0.071		
TOTAL		66.61	1.00		

TABLE D-10

TEST: AB-5 T3-I6 TIME = 21.04 MINUTES SIERRA IMPACTOR

TEMP. AT DAS # 64 DEG F	300.00	ROTOMETER RDG., SCFM	0.20
FIRST BACKGROUND	0.40	CV PRESSURE, PSIA	21.70
SECOND BACKGROUND	0.60	SAMPLE DURATION, MIN.	0.08

STAGE NUMBER	LAB MG SODIUM	NET MG SODIUM	MASS FRACTION	FRACTION LESS THAN CUT SIZE	CUT DIAM MICRO-METERS
N	0.00	0.00	0.000		
P	0.40	0.00	0.000		
1	13.00	12.60	0.530	0.470	18.694
2	4.50	4.10	0.172	0.298	11.424
3	3.70	3.30	0.139	0.159	4.570
4	2.50	2.10	0.088	0.071	2.752
5	1.33	0.93	0.039	0.032	1.766
6	0.83	0.43	0.018	0.014	0.987
BU	0.93	0.33	0.014		
TOTAL		23.79	1.00		

TABLE D-11

TEST: AB-5 T3-I7 TIME = 36.08 MINUTES ANDERSON IMPACTOR

TEMP. AT DAS # 64 DEG F	230.00	ROTOMETER RDG., SCFM	0.50
FIRST BACKGROUND	0.52	CV PRESSURE, PSIA	20.48
SECOND BACKGROUND	0.03	SAMPLE DURATION, MIN.	0.17

STAGE NUMBER	LAB MG SODIUM	NET MG SODIUM	MASS FRACTION	FRACTION LESS THAN CUT SIZE	CUT DIAM MICRO-METERS
N	1.10	1.10	0.082		
P	2.70	2.18	0.163		
1	1.82	1.30	0.097	0.657	13.232
2	2.10	1.58	0.118	0.538	8.320
3	2.20	1.68	0.126	0.412	5.654
4	3.30	2.78	0.208	0.204	3.809
5	1.45	0.93	0.070	0.134	2.456
6	1.03	0.51	0.038	0.096	1.253
7	1.24	0.72	0.054	0.042	0.772
8	1.00	0.48	0.036	0.006	0.521
BU	0.11	0.08	0.006		
TOTAL		13.34	1.00		

TABLE D-12

TEST: AB-5 T3-I8 TIME = 85.25 MINUTES ANDERSON IMPACTOR

TEMP. AT DAS # 64 DEG F	203.00	ROTOMETER RDG., SCFM	0.50
FIRST BACKGROUND	0.52	CV PRESSURE, PSIA	19.73
SECOND BACKGROUND	0.03	SAMPLE DURATION, MIN.	0.50

STAGE NUMBER	LAB MG SODIUM	NET MG SODIUM	MASS FRACTION	FRACTION LESS THAN CUT SIZE	CUT DIAM MICRO-METERS
N	0.58	0.58	0.064		
P	1.04	0.52	0.057		
1	1.38	0.86	0.094	0.785	13.190
2	1.59	1.07	0.117	0.667	8.294
3	1.99	1.47	0.161	0.506	5.636
4	1.88	1.36	0.149	0.357	3.797
5	1.77	1.25	0.137	0.220	2.448
6	1.25	0.73	0.080	0.139	1.249
7	1.10	0.58	0.064	0.076	0.769
8	1.09	0.57	0.063	0.013	0.520
BU	0.15	0.12	0.013		
TOTAL		9.11	1.00		

TABLE D-13

TEST: AB-5 T3-I9 TIME = 175 MINUTES SIERRA IMPACTOR

TEMP. AT DAS # 64 DEG F	185.90	ROTOMETER RDG., SCFM	0.20
FIRST BACKGROUND	0.40	CV PRESSURE, PSIA	19.17
SECOND BACKGROUND	0.60	SAMPLE DURATION, MIN.	6.00

STAGE NUMBER	LAB MG SODIUM	NET MG SODIUM	MASS FRACTION	FRACTION LESS THAN CUT SIZE	CUT DIAM MICRO-METERS
N	0.22	0.22	0.025		
P	0.53	0.13	0.015		
1	0.57	0.17	0.019	0.940	18.175
2	0.91	0.51	0.058	0.882	11.107
3	3.10	2.70	0.310	0.572	4.443
4	3.50	3.10	0.356	0.217	2.676
5	1.89	1.49	0.171	0.046	1.716
6	0.72	0.32	0.037	0.009	0.959
BU	0.68	0.08	0.009		
TOTAL		8.72	1.00		

TABLE D-14

TEST: AB-5 T3-I10 TIME = 524 MINUTES SIERRA IMPACTOR

TEMP. AT DAS # 64 DEG F	149.30	ROTOMETER RDG., SCFM	0.50
FIRST BACKGROUND	0.40	CV PRESSURE, PSIA	17.86
SECOND BACKGROUND	0.60	SAMPLE DURATION, MIN.	14.00

STAGE NUMBER	LAB MG SODIUM	NET MG SODIUM	MASS FRACTION	FRACTION LESS THAN CUT SIZE	CUT DIAM MICRO-METERS
N	0.21	0.21	0.103		
F	0.40	0.00	0.000		
1	0.40	0.00	0.000	0.896	13.024
2	0.40	0.00	0.000	0.895	7.959
3	0.58	0.18	0.089	0.807	3.184
4	1.13	0.73	0.359	0.448	1.917
5	1.10	0.70	0.344	0.103	1.230
6	0.54	0.14	0.069	0.034	0.687
BU	0.67	0.07	0.034		
TOTAL		2.03	1.00		

TABLE D-15

TEST: AB-5 T3-I11 TIME =1672 MINUTES ANDERSON IMPACTOR

TEMP. AT DAS # 64 DEG F	101.10	ROTOMETER RDG., SCFM	0.50
FIRST BACKGROUND	0.52	CV PRESSURE, PSIA	15.18
SECOND BACKGROUND	0.03	SAMPLE DURATION, MIN.	90.00

STAGE NUMBER	LAB MG SODIUM	NET MG SODIUM	MASS FRACTION	FRACTION LESS THAN CUT SIZE	CUT DIAM MICRO-METERS
N	0.03	0.03	0.004		
F	1.10	0.58	0.082		
1	1.04	0.52	0.073	0.841	12.605
2	1.10	0.58	0.082	0.759	7.926
3	1.02	0.50	0.070	0.689	5.386
4	1.22	0.70	0.098	0.591	3.629
5	1.42	0.90	0.127	0.464	2.340
6	2.10	1.58	0.222	0.242	1.194
7	1.42	0.90	0.127	0.115	0.735
8	1.08	0.56	0.079	0.037	0.497
BU	0.29	0.26	0.037		
TOTAL		7.11	1.00		

TABLE D-16

TEST: AB-5 T3-I12 TIME = 4594 MINUTES ANDERSON IMPACTOR

TEMP. AT DAS # 64 DEG F 84.00 ROTOMETER RDG., SCFM 0.50
FIRST BACKGROUND 0.52 CV PRESSURE, PSIA 14.52
SECOND BACKGROUND 0.03 SAMPLE DURATION, MIN. 20.00

STAGE NUMBER	LAB MG SODIUM	NET MG SODIUM	MASS FRACTION	FRACTION LESS THAN CUT SIZE	CUT DIAM MICRO-METERS
N	0.23	0.23	0.113		
F	1.20	0.68	0.333		
1	0.85	0.33	0.162	0.392	12.464
2	0.77	0.25	0.122	0.270	7.837
3	0.75	0.23	0.113	0.157	5.325
4	0.57	0.05	0.024	0.133	3.588
5	0.61	0.09	0.044	0.089	2.313
6	0.56	0.04	0.020	0.069	1.180
7	0.60	0.08	0.039	0.030	0.727
8	0.58	0.06	0.029	0.000	0.491
BU	0.03	0.00	0.000		
TOTAL		2.04	1.00		

TABLE D-17

TEST: AB-5 T4-I1 TIME= 331 MINUTES SIERRA IMPACTOR

TEMP. AT DAS # 24 DEG F 112.10 ROTOMETER RDG., SCFM 0.20
FIRST BACKGROUND 0.40 CV PRESSURE, PSIA 18.58
SECOND BACKGROUND 0.60 SAMPLE DURATION, MIN. 20.00

STAGE NUMBER	LAB MG SODIUM	NET MG SODIUM	MASS FRACTION	FRACTION LESS THAN CUT SIZE	CUT DIAM MICRO-METERS
N	0.72	0.72	0.121		
F	0.45	0.05	0.008		
1	0.51	0.11	0.018	0.852	19.841
2	0.75	0.35	0.059	0.793	12.125
3	1.76	1.36	0.229	0.565	4.850
4	2.20	1.80	0.302	0.262	2.921
5	1.51	1.11	0.187	0.076	1.874
6	0.85	0.45	0.076	0.000	1.047
BU	0.60	0.00	0.000		
TOTAL		5.95	1.00		

TABLE D-18

TEST: AB-5 T4-I2 TIME = 423 MINUTES SIERRA IMPACTOR

TEMP. AT DAS # 24 DEG F	110.80	ROTOMETER RDG., SCFM	0.20
FIRST BACKGROUND	0.40	CV PRESSURE, PSIA	18.06
SECOND BACKGROUND	0.60	SAMPLE DURATION, MIN.	30.00

STAGE NUMBER	LAB MG SODIUM	NET MG SODIUM	MASS FRACTION	FRACTION LESS THAN CUT SIZE	CUT DIAM MICRO-METERS
N	0.00	0.00	0.000		
P	0.83	0.43	0.060		
1	1.00	0.60	0.084	0.856	19.564
2	1.00	0.60	0.084	0.773	11.956
3	1.68	1.28	0.178	0.595	4.782
4	2.50	2.10	0.292	0.302	2.880
5	1.85	1.45	0.202	0.100	1.848
6	1.00	0.60	0.084	0.017	1.033
BU	0.72	0.12	0.017		
TOTAL		7.18	1.00		

TABLE D-19

TEST: AB-5 T4-I3 TIME = 698 MINUTES SIERRA IMPACTOR

TEMP. AT DAS # 24 DEG F	104.20	ROTOMETER RDG., SCFM	0.20
FIRST BACKGROUND	0.40	CV PRESSURE, PSIA	17.57
SECOND BACKGROUND	0.60	SAMPLE DURATION, MIN.	60.00

STAGE NUMBER	LAB MG SODIUM	NET MG SODIUM	MASS FRACTION	FRACTION LESS THAN CUT SIZE	CUT DIAM MICRO-METERS
N	0.12	0.12	0.036		
P	0.47	0.07	0.021		
1	0.48	0.08	0.024	0.919	19.494
2	0.49	0.09	0.027	0.892	11.913
3	1.14	0.74	0.221	0.671	4.765
4	0.40	0.00	0.000	0.670	2.870
5	1.99	1.59	0.476	0.195	1.841
6	0.98	0.58	0.174	0.021	1.029
BU	0.67	0.07	0.021		
TOTAL		3.34	1.00		

TABLE D-20

TEST: AB-5 T4-I4 TIME = 2885 MINUTES ANDERSON IMPACTOR

TEMP. AT DAS # 24 DEG F	81.70	ROTOMETER RDG., SCFM	0.50
FIRST BACKGROUND	0.52	CV PRESSURE, PSIA	14.73
SECOND BACKGROUND	0.03	SAMPLE DURATION, MIN.	150.00

STAGE NUMBER	LAB MG SODIUM	NET MG SODIUM	MASS FRACTION	FRACTION LESS THAN CUT SIZE	CUT DIAM MICRO-METERS
N	0.00	0.00	0.000		
P	1.08	0.56	0.097		
1	1.19	0.67	0.116	0.786	12.713
2	1.11	0.59	0.102	0.684	7.994
3	1.15	0.63	0.109	0.575	5.432
4	1.06	0.54	0.094	0.481	3.660
5	1.03	0.51	0.089	0.392	2.360
6	1.21	0.69	0.120	0.273	1.204
7	1.29	0.77	0.134	0.139	0.742
8	1.12	0.60	0.104	0.035	0.501
BU	0.23	0.20	0.035		
TOTAL		5.76	1.00		

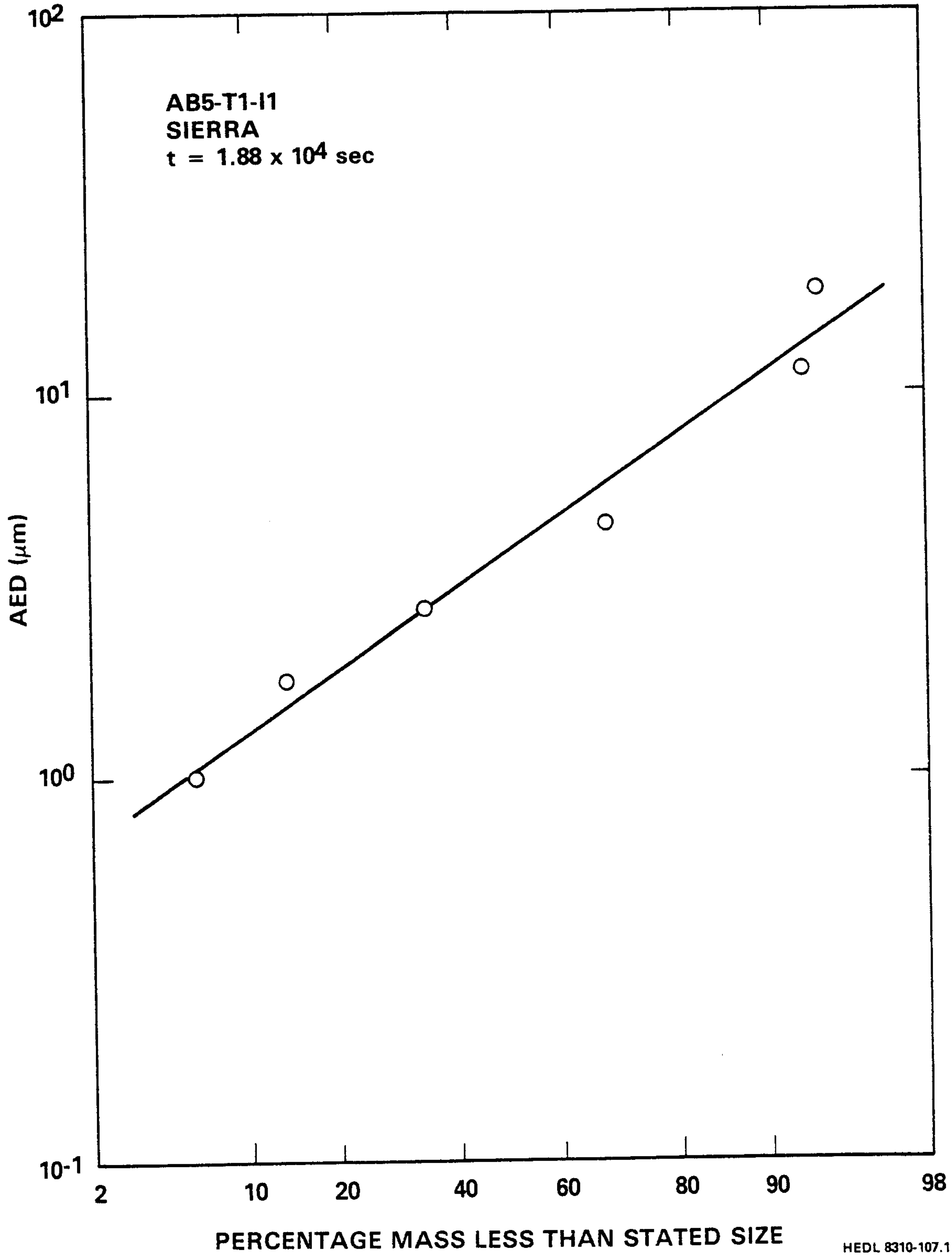

FIGURE D-1. Percent Mass Less Than Stated Size.

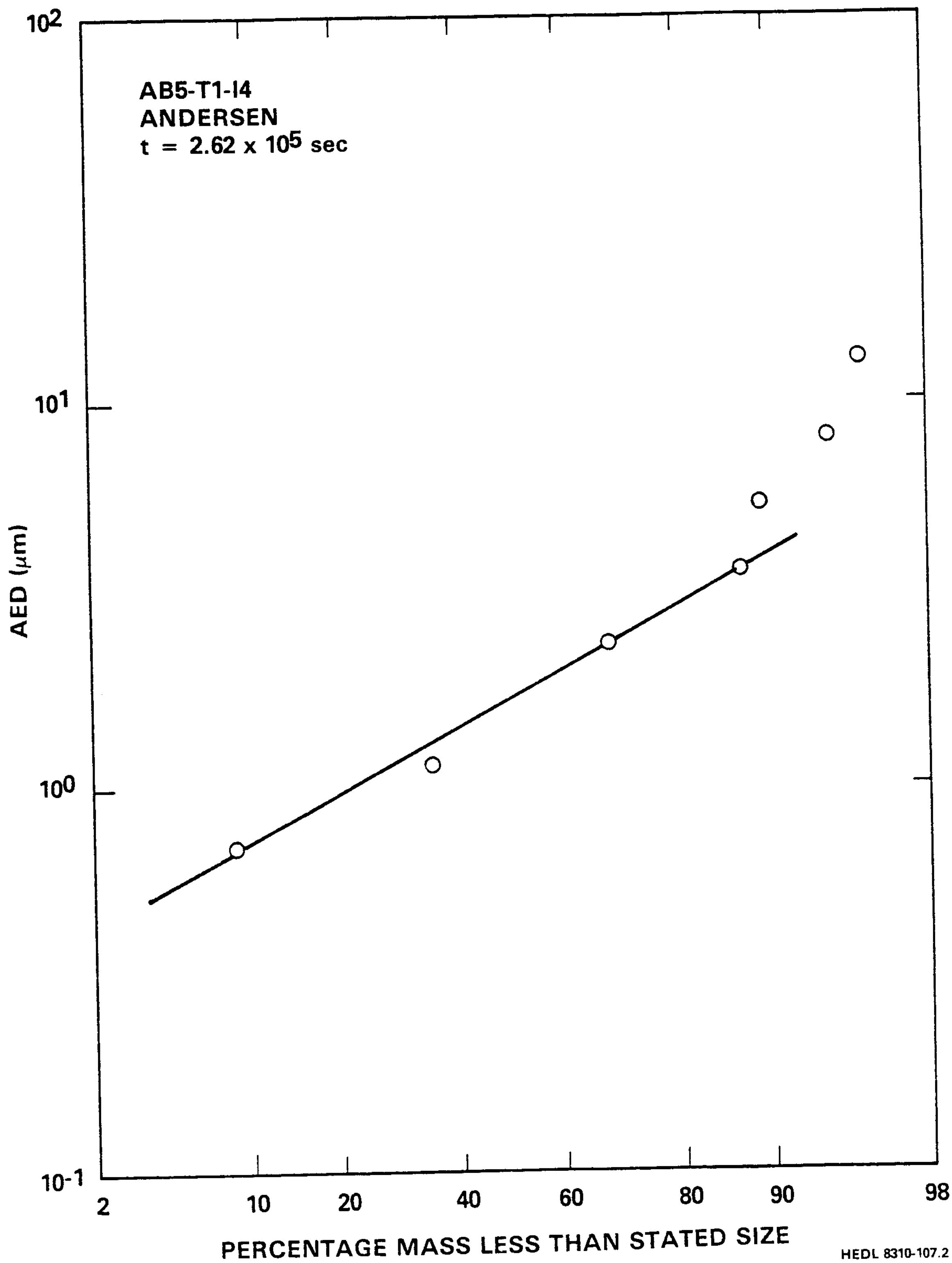

FIGURE D-2. Percent Mass Less Than Stated Size.

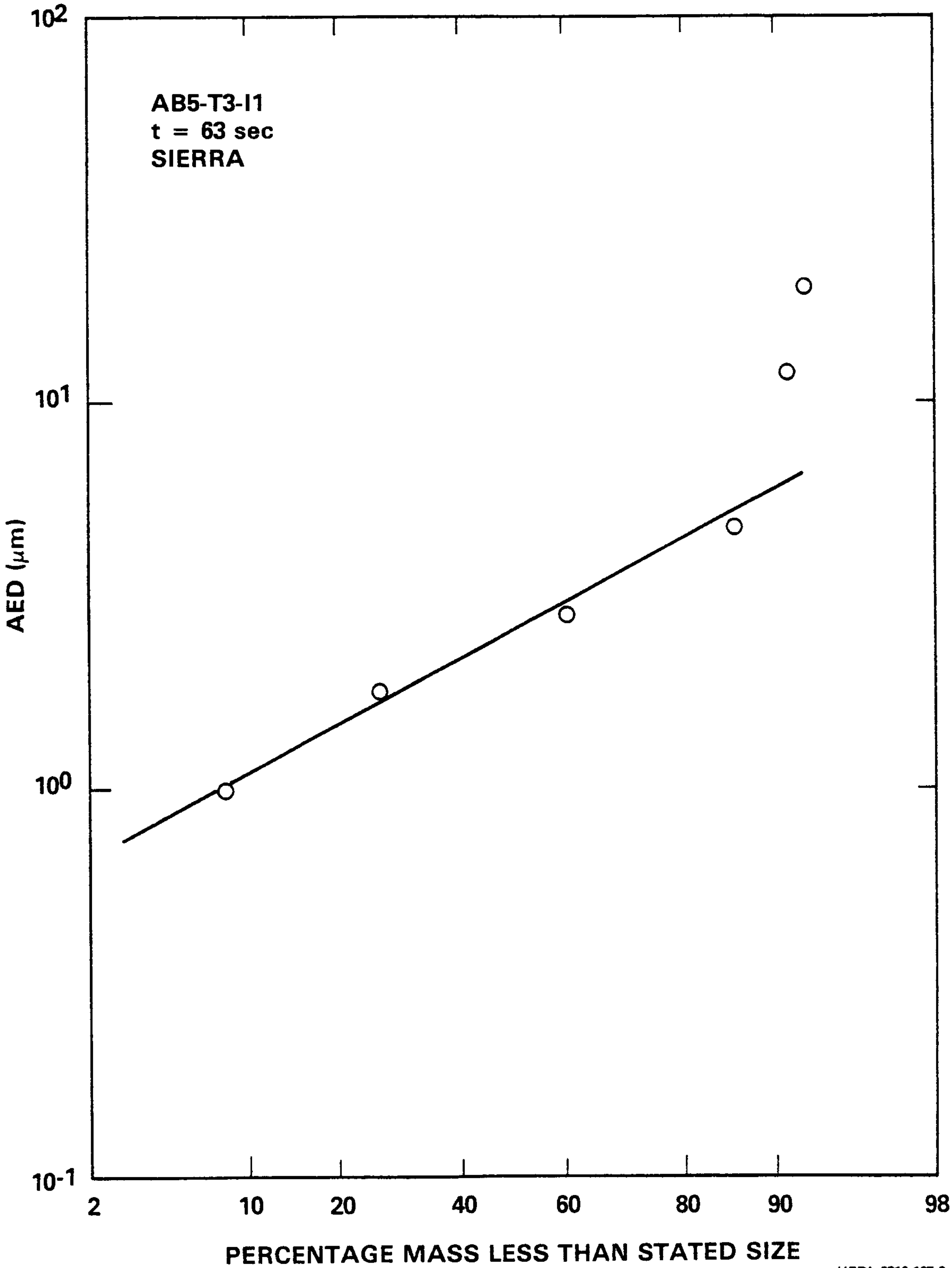

FIGURE D-3. Percent Mass Less Than Stated Size.

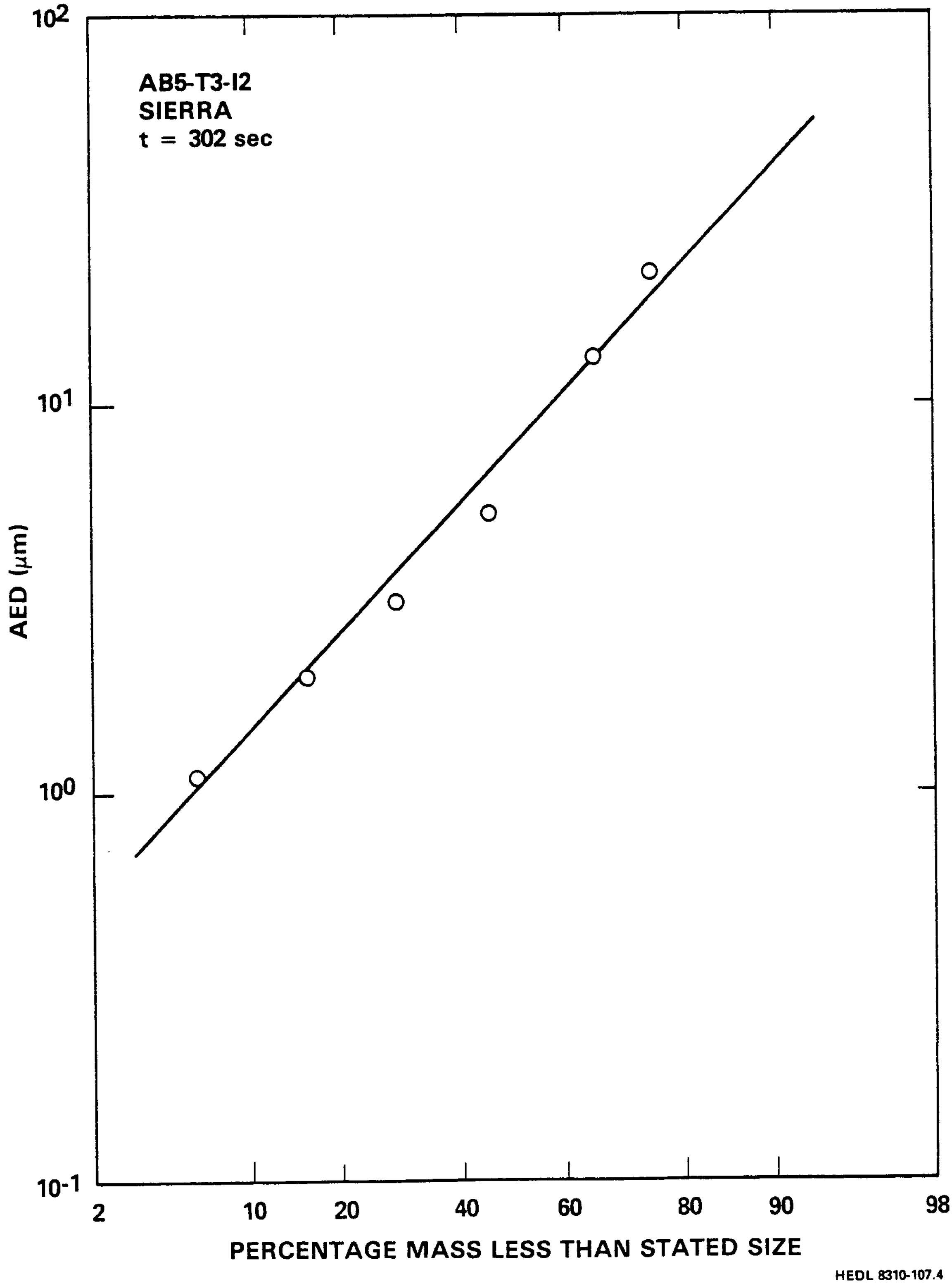

FIGURE D-4. Percent Mass Less Than Stated Size.

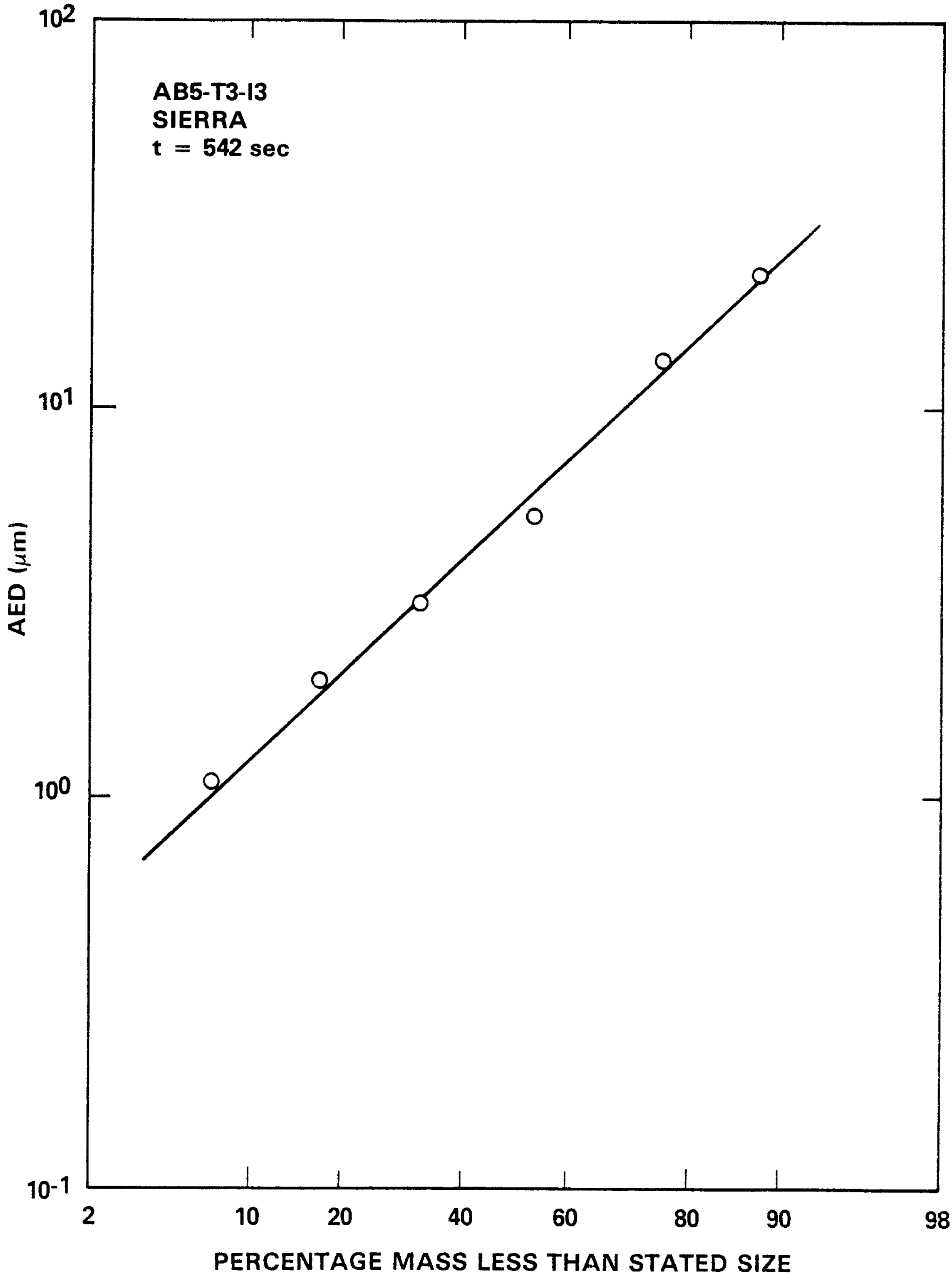

FIGURE D-5. Percent Mass Less Than Stated Size.

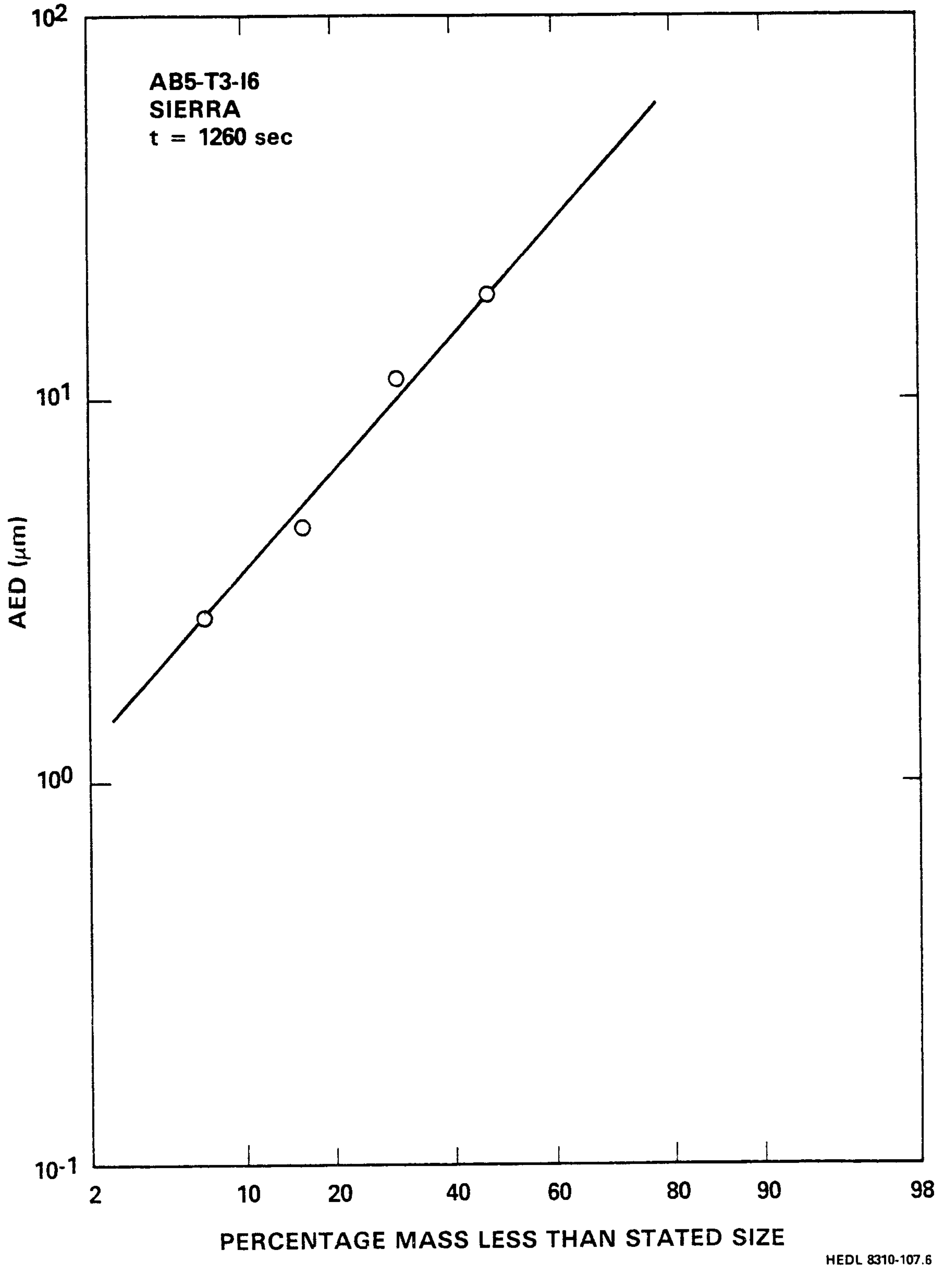

FIGURE D-6. Percent Mass Less Than Stated Size.

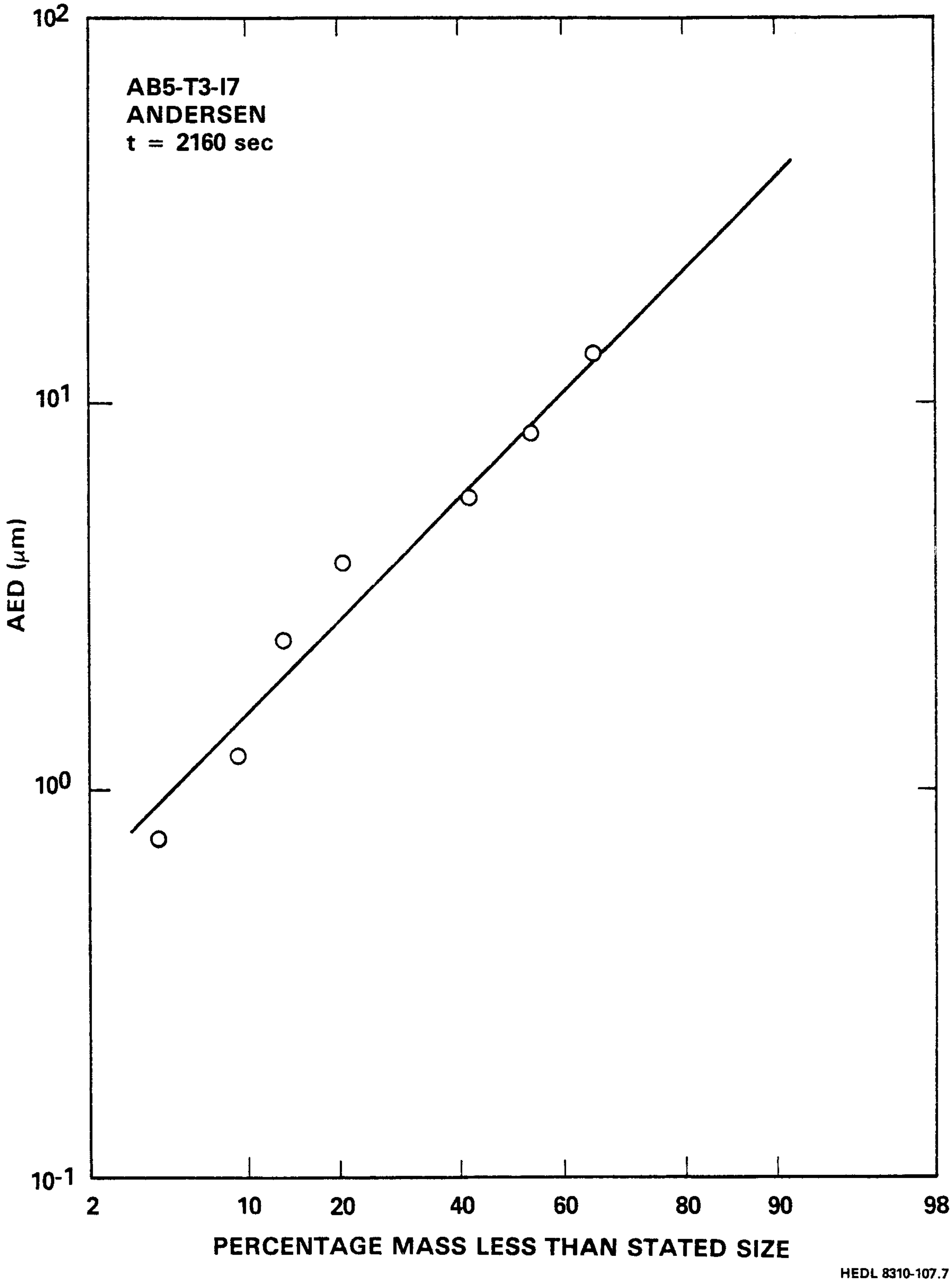

FIGURE D-7. Percent Mass Less Than Stated Size.

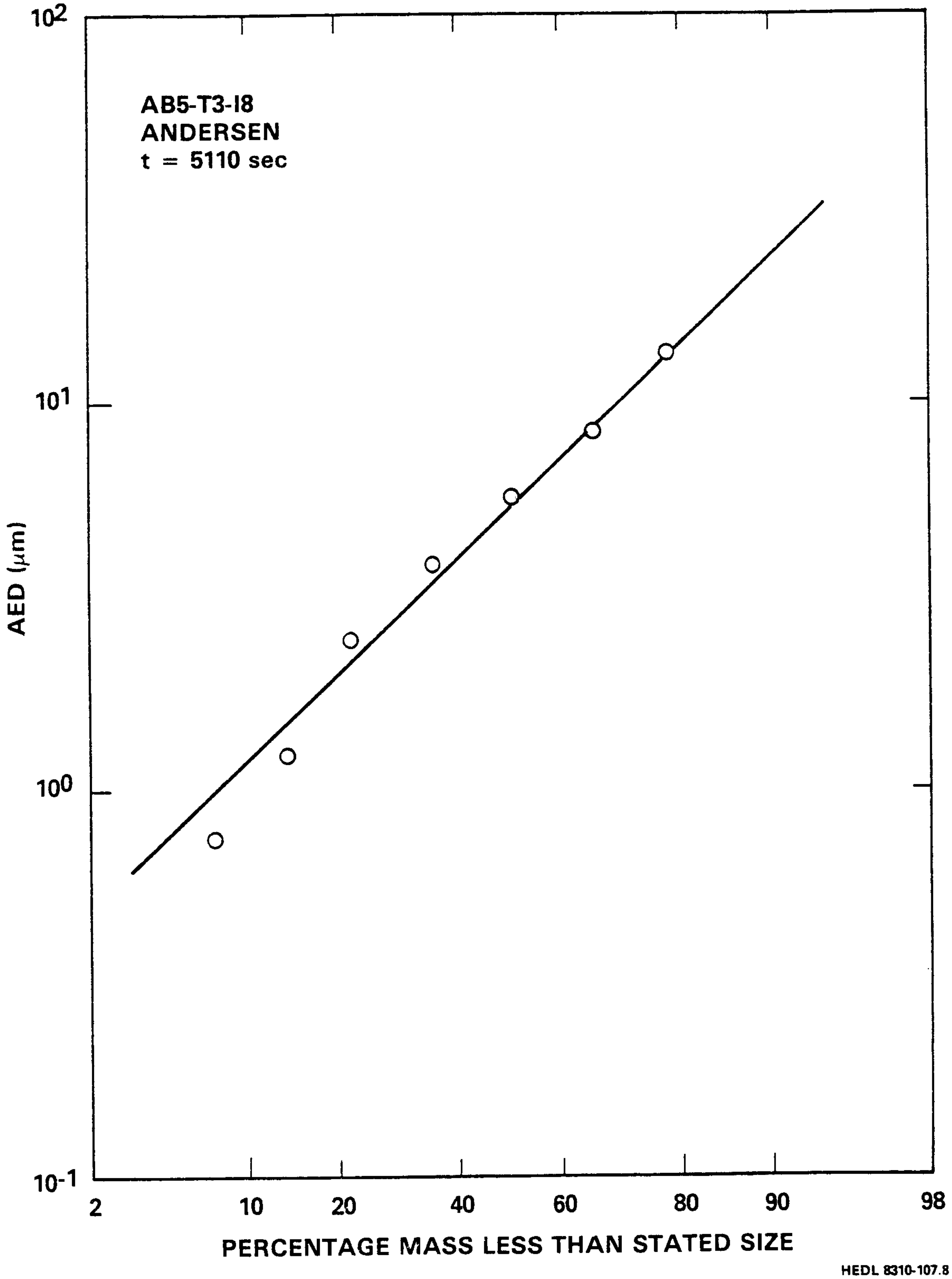

FIGURE D-8. Percent Mass Less Than Stated Size.

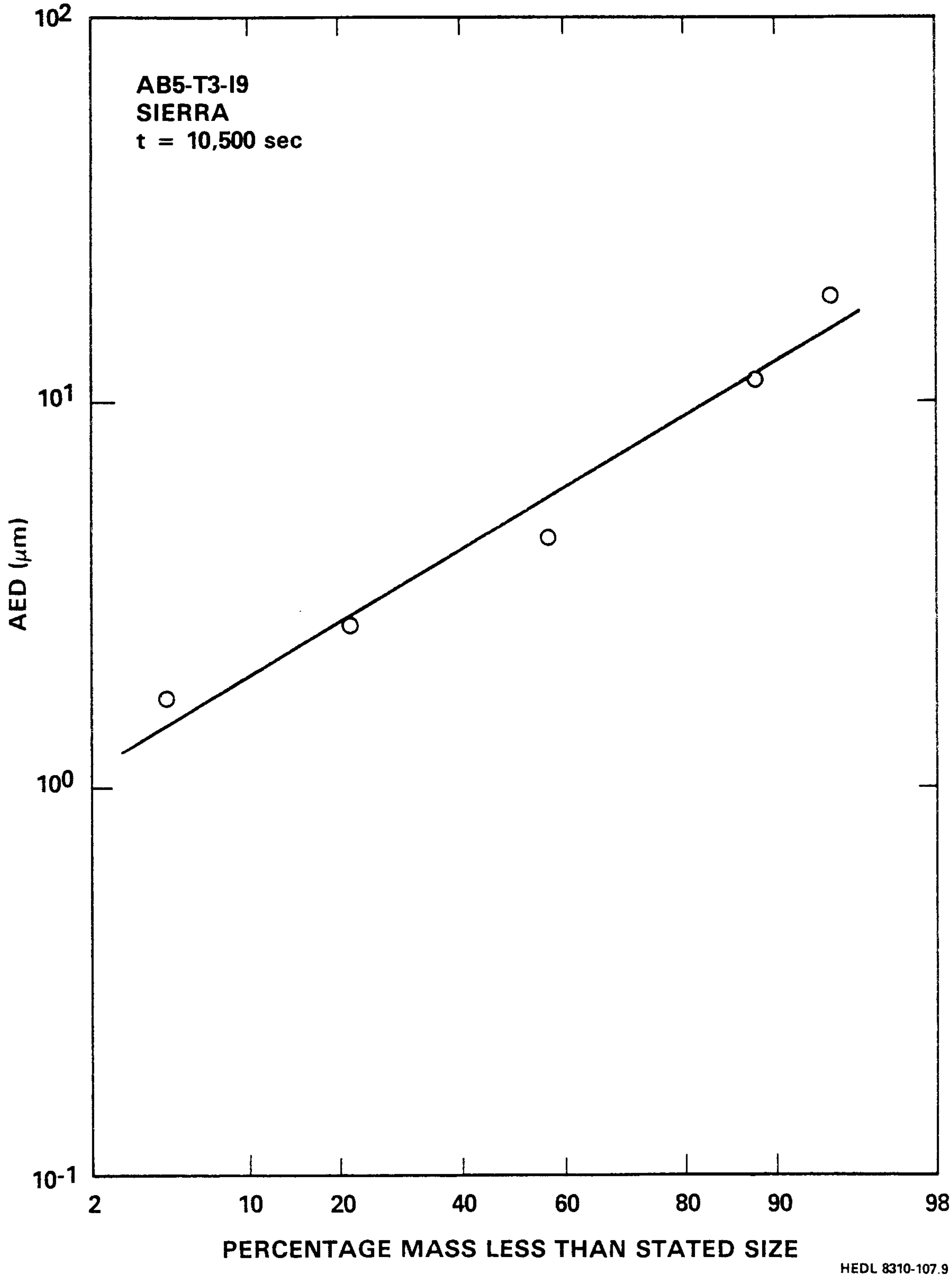

FIGURE D-9. Percent Mass Less Than Stated Size.

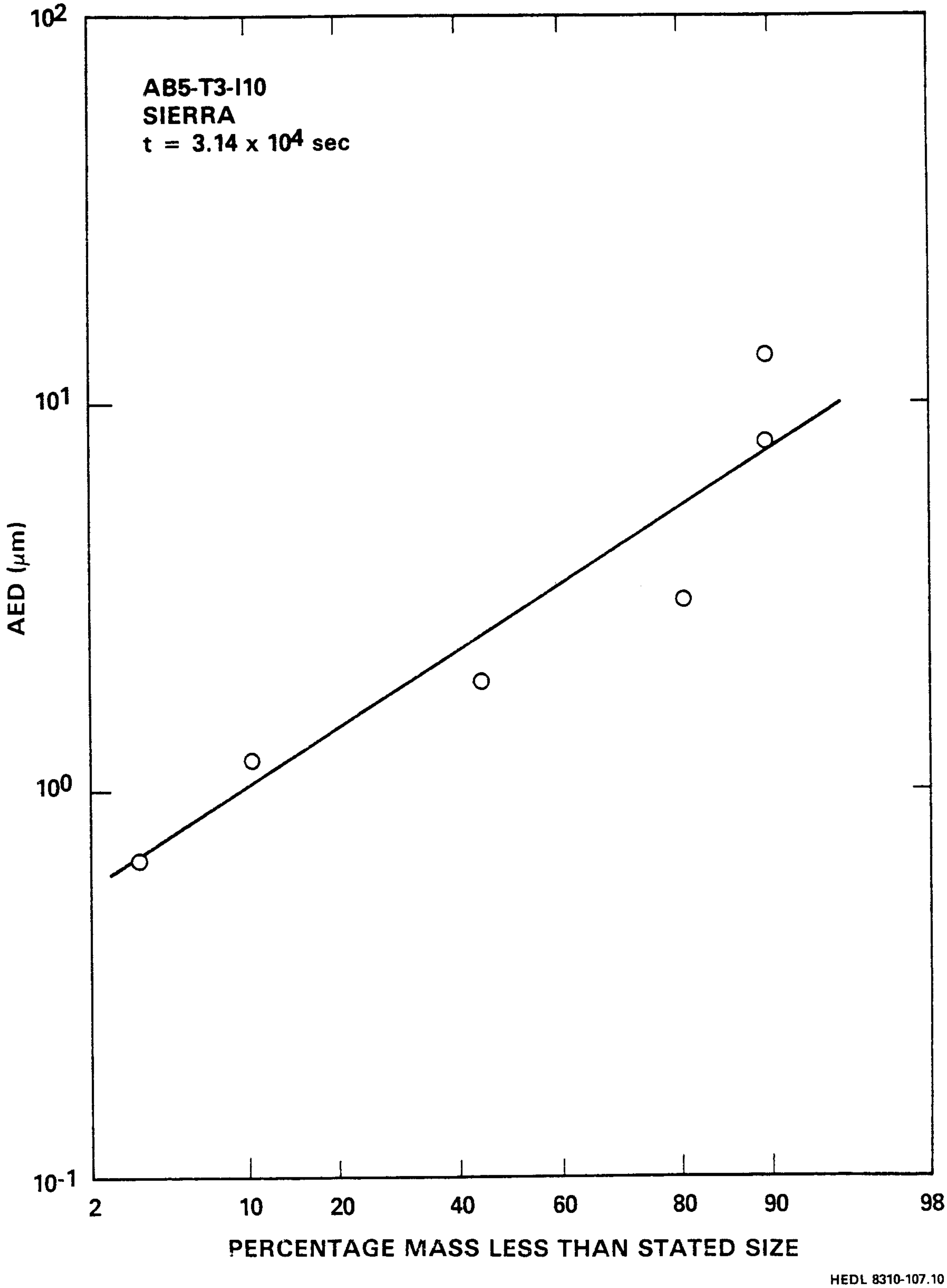

FIGURE D-10. Percent Mass Less Than Stated Size.

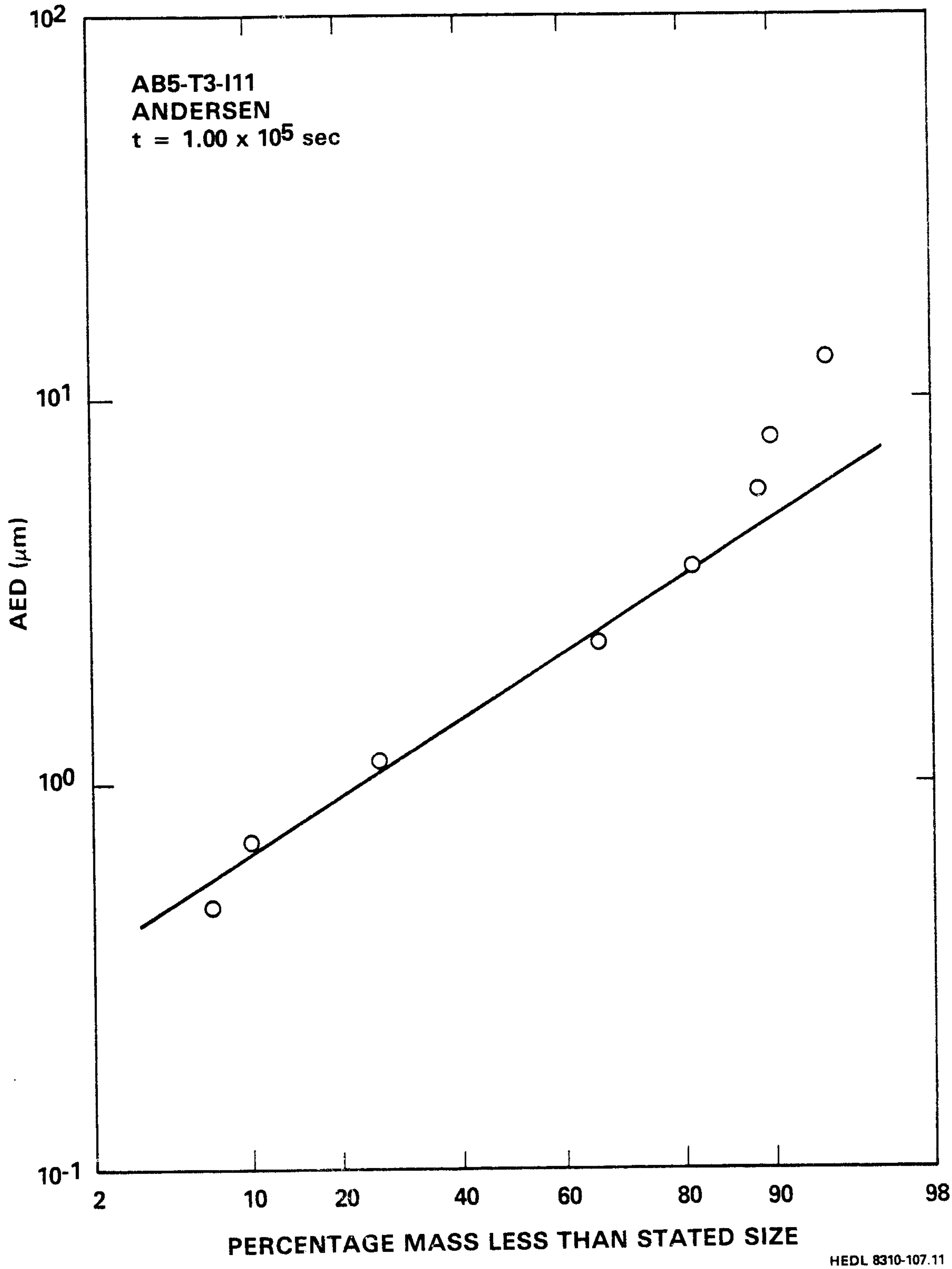

FIGURE D-11. Percent Mass Less Than Stated Size.

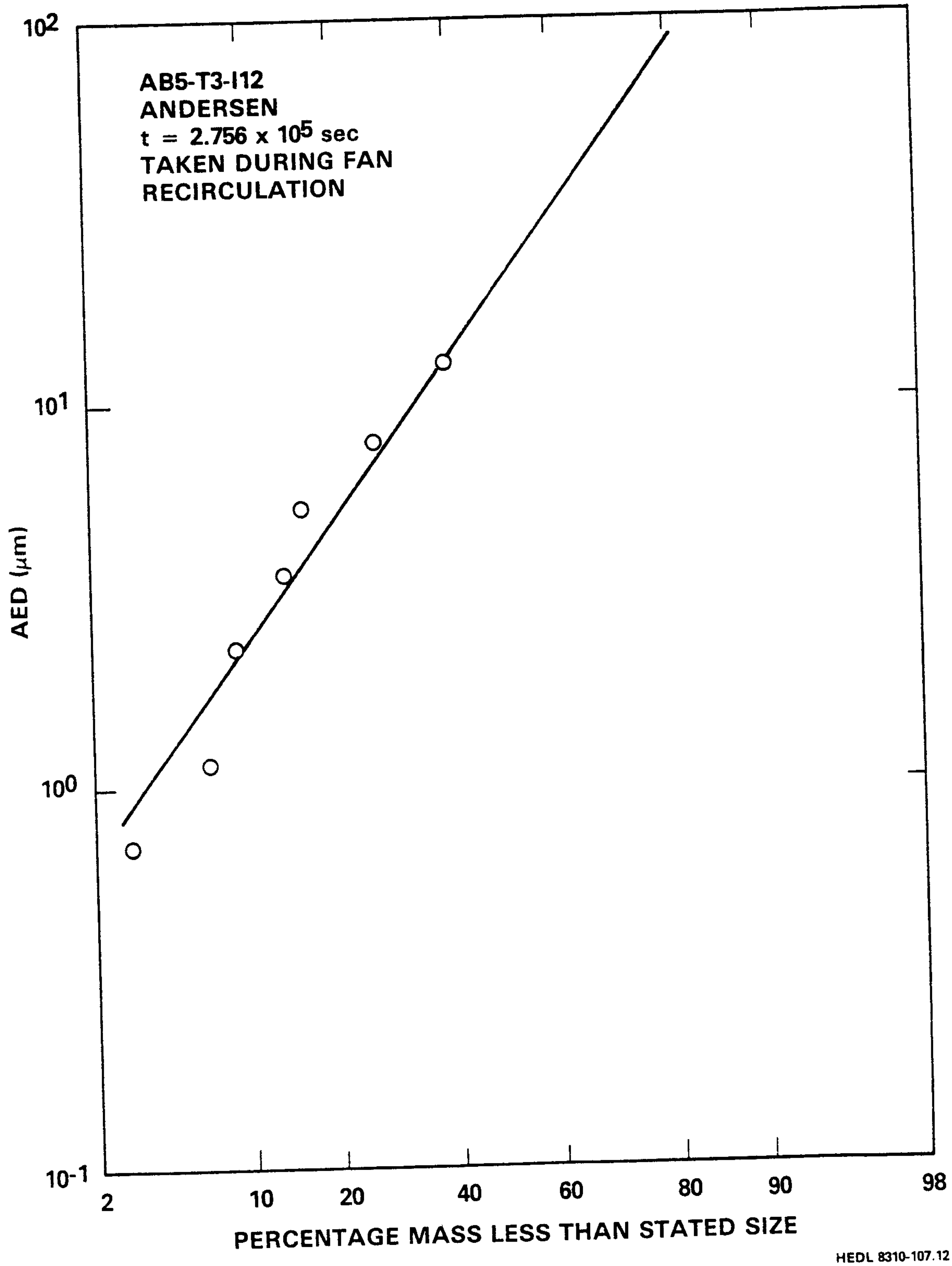

FIGURE D-12. Percent Mass Less Than Stated Size.

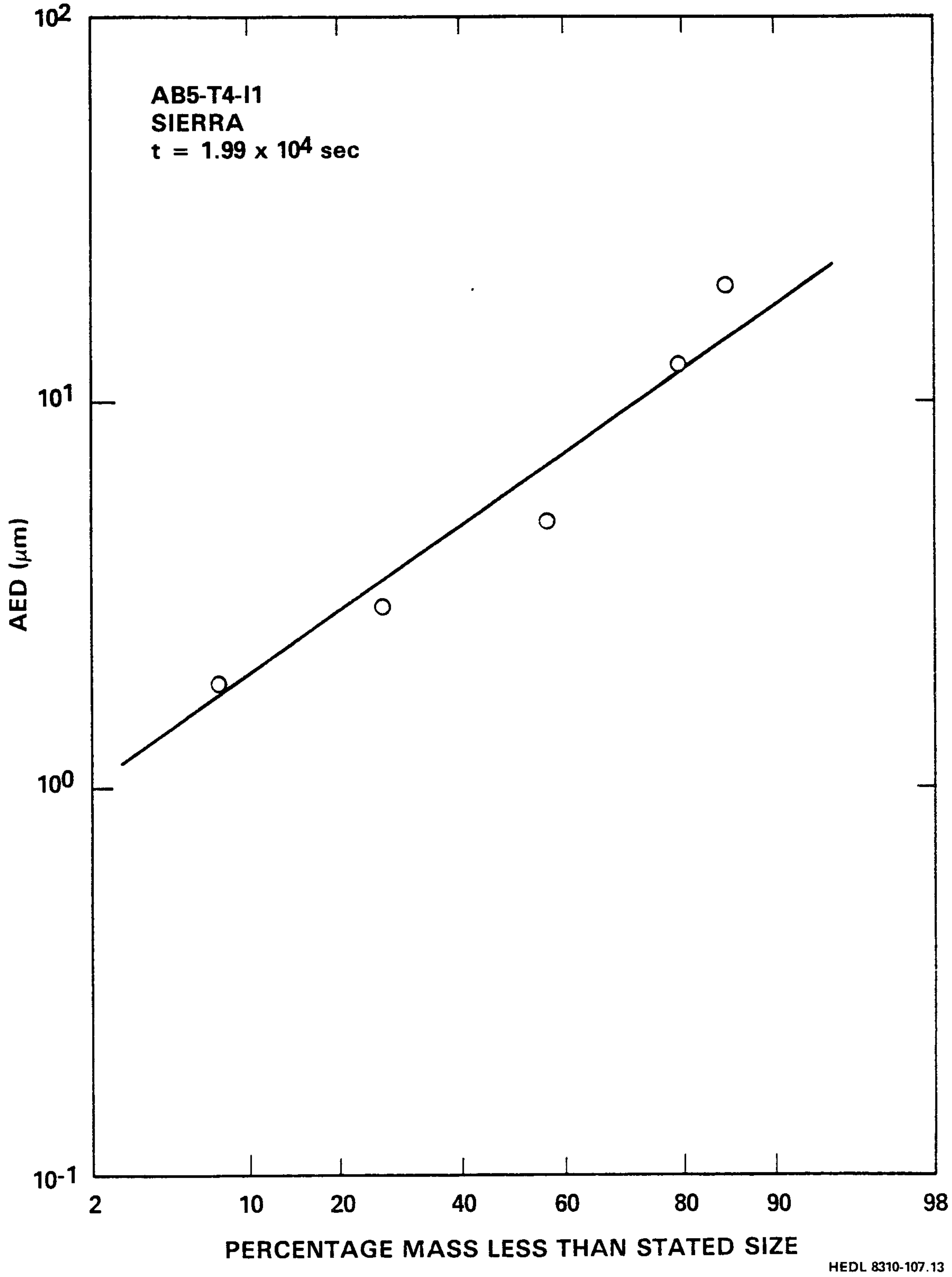

FIGURE D-13. Percent Mass Less Than Stated Size.

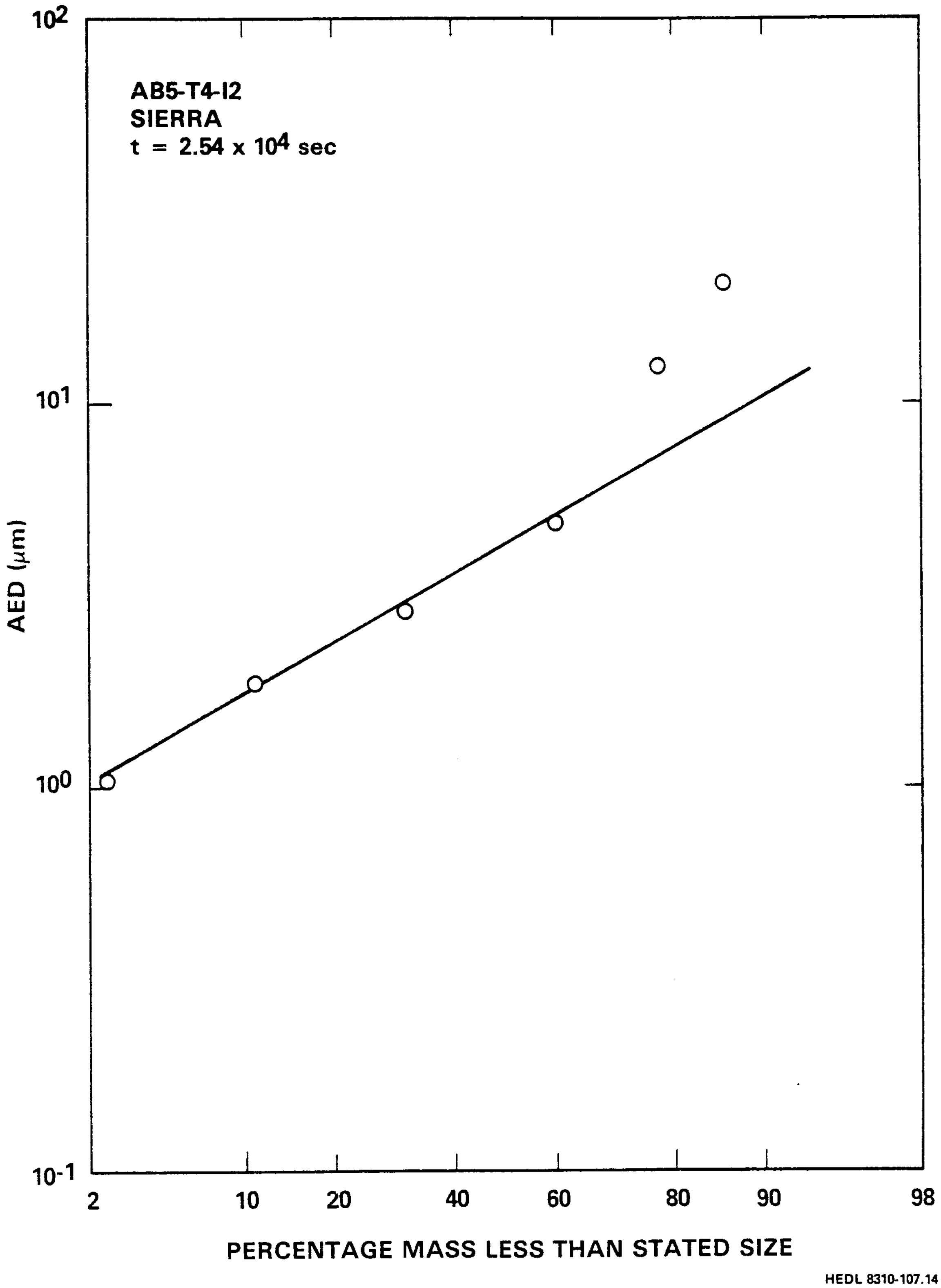

FIGURE D-14. Percent Mass Less Than Stated Size.

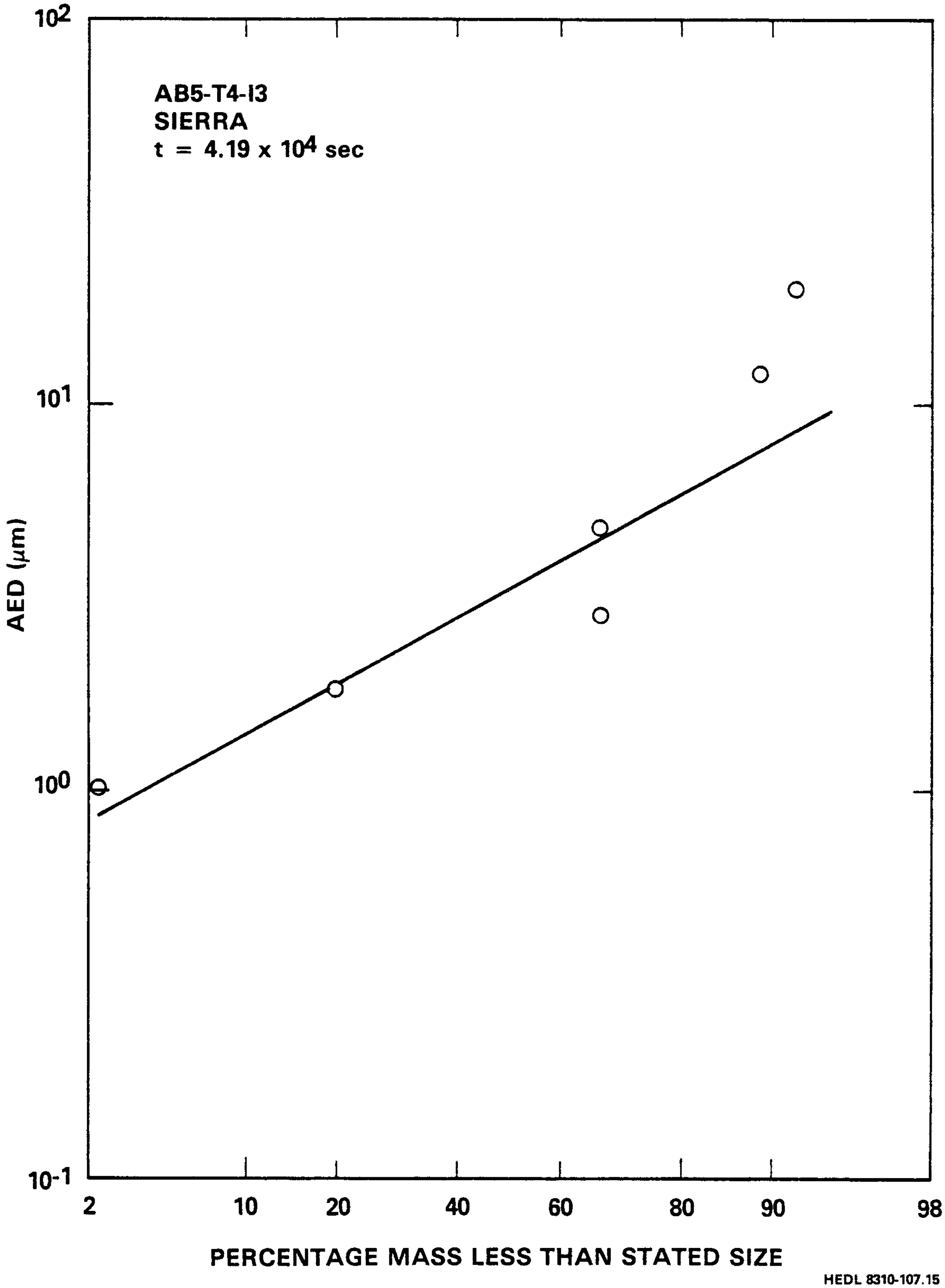

FIGURE D-15. Percent Mass Less Than Stated Size.

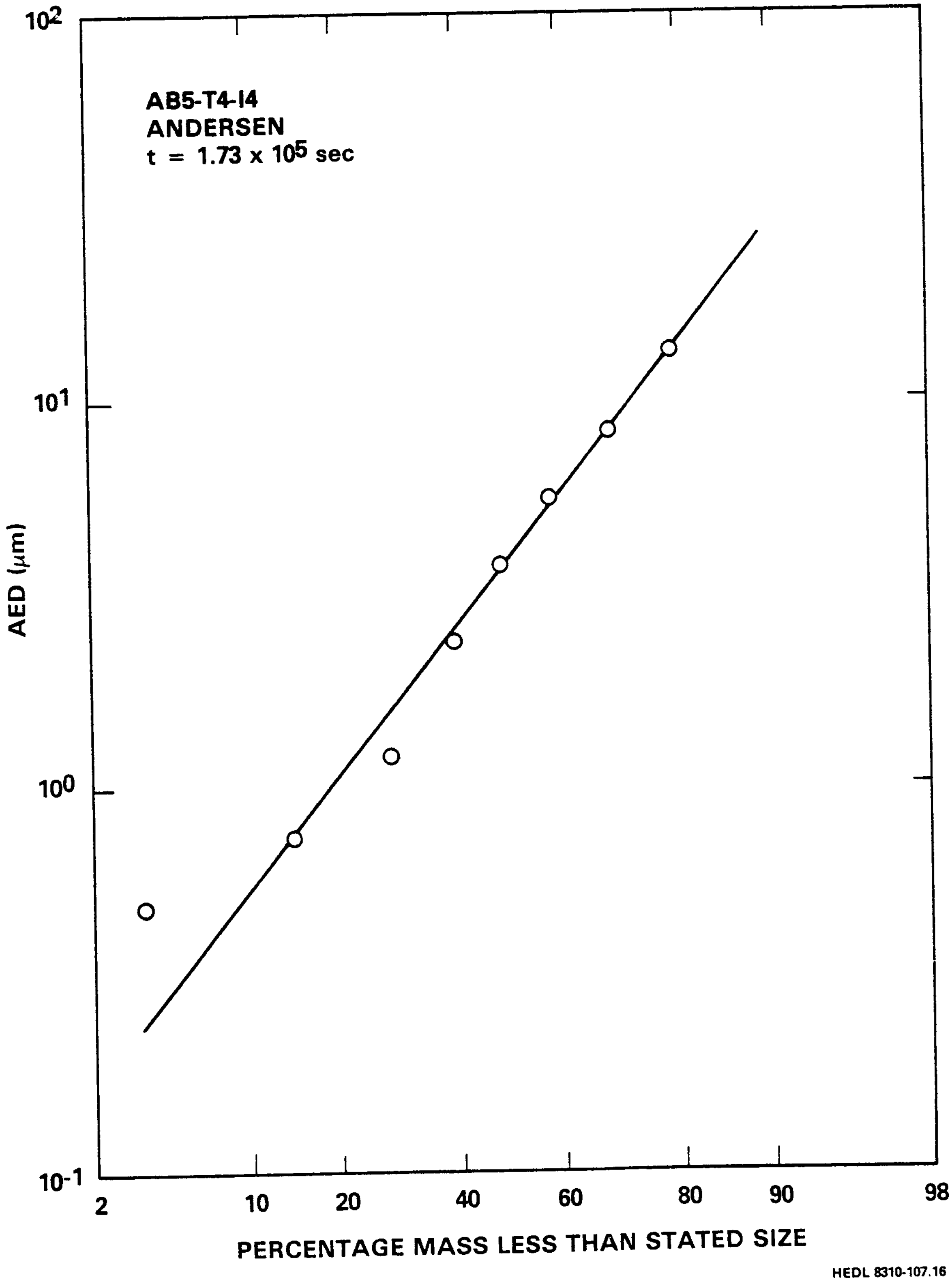

FIGURE D-16. Percent Mass Less Than Stated Size.

A P P E N D I X   E

PRETEST CODE PREDICTIONS SUBMITTED BY CODE USERS

APPENDIX E

PRETEST CODE PREDICTIONS SUBMITTED BY CODE USERS

Pretest code predictions were sent to the test performer and other ABCOVE program participants prior to performance of the test. Copies of the tabular data submitted by each participant are presetned in Tables E-1 through E-11 as follows:

Table	Code Case	Code	User
E-1	1	HAA-3B	GE
E-2	2	HAA-3C	HEDL/SSD
E-3	3	HAA-4	RI/ESG
E-4	4	HAARM-3	HEDL/SSD
E-5	5	HAARM-3	BCL
E-6	6	HAARM-3	ORNL
E-7	7	QUICK	BCL
E-8	8	QUICK	ORNL
E-9	9	MSPEC	BCL
E-10	10	MAEROS	HEDL/CSA
E-11	11	CONTAIN	SNL

TABLE E-1

PRETEST PREDICTIONS OF ABCOVE TEST AB5, CODE CASE 1
BY GE USING HAA-3A CODE[a]

Time sec	Suspended Mass Concentration (g/m^3)	Particle Size Distribution AMMD (μm)	Particle Size Distribution σ_g	Leaked Mass (μg)	Settled Mass (μg)	Plated Mass (μg)
1.0 (2)[b]	6.5 (1)	6.8 (-1)	1.55 (0)	3.2 (5)	4.3 (6)	7.0 (2)
3.0 (2)	2.0 (2)	1.7 (0)	1.95 (0)	3.0 (6)	1.7 (8)	3.8 (9)
5.0 (2)	2.0 (2)	1.1 (1)	3.4 (0)	7.3 (6)	1.0 (11)	4.9 (9)
9.0 (2)	1.95 (2)	1.05 (1)	3.35 (0)	1.55 (7)	3.4 (11)	6.3 (9)
1.0 (3)	1.0 (2)	2.6 (1)	2.65 (0)	1.75 (7)	4.4 (11)	6.4 (9)
2.0 (3)	1.05 (0)	2.05 (1)	1.45 (0)	1.8 (7)	5.1 (11)	6.4 (9)
5.0 (3)	8.3 (-2)	1.3 (1)	1.33 (0)	1.8 (7)	5.15 (11)	6.4 (9)
1.0 (4)	~1.0 (-2)	1.0 (1)	1.25 (0)	1.8 (7)	5.15 (11)	6.4 (9)

(a)Discrete values were read from curves supplied by GE.
(b)Numbers in parenthesis are exponents of ten.

TABLE E-2

PRETEST PREDICTIONS OF ABCOVE TEST AB5, CODE CASE 2
BY HEDL/SSD USING HAA-3C CODE
(August 13, 1982)

Time (Sec)	Suspended Conc. (μg/cm³)	Particle Size Distribution: r_{50} (μm)	Particle Size Distribution: AMMD (μm)	Particle Size Distribution: σ_g	d_{sa}(b) (μm)	Leaked Mass (μg)	Settled Mass (μg)	Plated Mass (μg)	Removal Rate (sec^{-1})
10^2	7.15 (1)(a)	4.7 (-1)	6.9 (-1)	1.52 (0)	8.2 (-1)	3.3 (5)	5.0 (6)	8.0 (8)	1.75 (-4)
3×10^2	2.00 (2)	1.15 (0)	1.70 (0)	2.00 (0)	2.75 (0)	2.95 (6)	1.85 (8)	3.8 (9)	1.15 (-4)
5×10^2	2.12 (2)	7.82 (0)	1.15 (1)	3.37 (0)	5.03 (1)	7.26 (6)	1.03 (11)	4.9 (9)	3.60 (-3)
9×10^2	2.01 (2)	7.56 (0)	1.11 (1)	3.36 (0)	4.82 (1)	1.53 (7)	3.43 (11)	6.4 (9)	3.42 (-3)
1×10^3	9.26 (1)	2.39 (1)	3.52 (1)	2.61 (0)	8.83 (1)	1.68 (7)	4.35 (11)	6.64 (9)	1.13 (-2)
2×10^3	1.00 (0)	1.38 (1)	2.04 (1)	1.50 (0)	2.40 (1)	1.78 (7)	5.13 (11)	6.70 (9)	1.62 (-3)
5×10^3	7.40 (-2)	8.70 (0)	1.28 (1)	1.32 (0)	1.38 (0)	1.78 (7)	5.14 (11)	6.70 (9)	5.50 (-4)
1×10^4	8.78 (-3)	6.90 (0)	1.02 (1)	1.24 (1)	1.07 (1)	1.79 (7)	5.14 (11)	6.70 (9)	3.37 (-4)
3×10^4	6.36 (-5)	5.12 (0)	7.55 (0)	1.17 (0)	7.74 (0)	1.79 (7)	5.14 (11)	6.70 (9)	8.12 (-5)
1×10^5	1.17 (-9)	3.85 (0)	5.68 (0)	1.12 (0)	5.75 (0)	1.79 (7)	5.14 (11)	6.70 (9)	---
2×10^5	1.70 (-14)	3.35 (0)	4.94 (0)	1.10 (0)	4.98 (0)	1.79 (7)	5.14 (11)	6.70 (9)	---

(a) Numbers in parenthesis are exponents of 10.
(b) d_{sa} = aerodynamic settling mean diameter = AMMD $\exp(\ln^2 \sigma_g)$.

TABLE E-3

PRETEST PREDICTIONS OF ABCOVE TEST AB5, CODE CASE 3,
BY ROCKWELL INTERNATIONAL USING HAA-4 CODE

Time (sec)	C (g/m^3)	AED (μm)	σ_g	AEDset (μm)	M_L (g)	M_S (g)	M_P (g)	R (g/s)	F_{Na}
100	6.7 + 1	1.1 + 0	1.9	1.7 + 1	3.3 - 1	7.4 + 0	1.2 + 3	2.5 + 1	0.590
300	1.35 + 2	1.3 + 1	3.6	4.4 + 1	2.5 + 0	5.1 + 4	7.8 + 3	4.7 + 2	0.590
500	1.47 + 2	1.4 + 1	3.6	4.6 + 1	5.3 + 0	1.5 + 5	1.6 + 4	5.6 + 2	0.590
900	1.50 + 2	1.4 + 1	3.6	4.7 + 1	1.12 + 1	3.6 + 5	3.3 + 4	5.76 + 2	0.590
1000	3.9 + 1	7.2 + 1	2.4	1.0 + 2	1.21 + 1	4.5 + 5	3.5 + 4	7.1 + 2	0.590
2000	1.3 - 1	2.6 + 1	1.4	2.7 + 1	1.24 + 1	4.8 + 5	3.5 + 4	2.2 - 1	0.590
5000	4.0 - 2	1.7 + 1	1.24	1.7 + 1	1.24 + 1	4.8 + 5	3.5 + 4	2.8 - 3	0.590

TABLE E-4

PRETEST PREDICTIONS OF ABCOVE TEST AB5, CODE CASE 4
BY HEDL/SSD USING HAARM-3C CODE
(August 31, 1982)

Time (Sec)	Suspended Conc. ($\mu g/cm^3$)	Particle Size Distribution r_{50} (μm)	AMMD (μm)	σ_g	d_{sa}(b) (μm)	Leaked Mass (μg)	Settled Mass (μg)	Plated Mass (μg)	Removal Rate (sec^{-1})
1×10^2	6.84 (1)(a)	4.70 (-1)	1.62 (0)	1.52 (0)	1.86 (0)	3.45 (5)	2.40 (7)	8.02 (8)	2.28 (-4)
3×10^2	1.99 (2)	9.33 (-1)	2.49 (0)	1.85 (0)	3.64 (0)	2.97 (6)	5.78 (8)	3.34 (9)	1.16 (-4)
5×10^2	3.15 (2)	3.23 (0)	7.98 (0)	2.73 (0)	1.09 (1)	8.18 (6)	1.73 (10)	5.29 (9)	1.00 (-3)
9×10^2	3.56 92)	3.92 (0)	9.70 (0)	2.84 (0)	2.88 (1)	2.16 (7)	2.10 (11)	7.86 (9)	1.82 (-3)
1×10^3	2.52 (2)	7.03 (0)	1.74 (1)	2.73 (0)	4.77 (1)	2.46 (7)	2.98 (11)	8.43 (9)	4.23 (-3)
2×10^3	2.47 (1)	5.32 (0)	1.32 (1)	2.05 (0)	2.21 (1)	3.23 (7)	4.90 (11)	9.60 (9)	1.44 (-3)
5×10^3	2.47 (0)	3.90 (0)	9.63 (0)	1.65 90)	1.24 (1)	3.46 (7)	5.09 (11)	1.00 (10)	5.08 (-4)
1×10^4	4.75 (-1)	2.96 (0)	7.32 (0)	1.48 (0)	8.54 (1)	3.52 (7)	5.11 (11)	1.01 (10)	2.59 (-4)
3×10^4	1.92 (-2)	2.04 (0)	5.03 (0)	1.30 (0)	5.39 (1)	3.54 (7)	5.11 (11)	1.02 (10)	1.27 (-4)
1×10^5	1.83 (-4)					3.54 (7)	5.11 (11)		
2×10^5	3.67 (-5)					3.54 (7)	5.11 (11)		
4×10^5	2.85 (-6)					3.54 (7)	5.11 (11)		

(a)Numbers in parenthesis are exponents of 10.
(b)d_{sa} = aerodynamic settling mean diameter = AMMD $\exp(\ln^2 \sigma_g)$.

TABLE E-5

PRETEST PREDICTIONS OF ABCOVE TEST AB5, CODE CASE 5
BY BCL USING HAARM-3 CODE

Time (sec)	Suspended Mass Conc. ($\mu g/cm^3$)	AMMD (μm)	σ_g	Fractional Removal Rate (Sedimentation) (sec^{-1})	Leaked Mass (g)	Settled Mass (g)	Plated Mass (g)	Instantaneous Combined Removal Rate (g/s)
1.0×10^2	6.5×10^1	2.7	2.1	6.3×10^{-5}	3.6×10^{-1}	6.4×10^1	1.3×10^3	-3.7×10^1
3.0×10^2	7.5×10^1	19.	3.6	8.4×10^{-3}	1.9	$1.0\ 10^5$	7.4×10^3	-5.8×10^2
5.0×10^2	7.5×10^1	19.	3.6	8.7×10^{-3}	3.4	2.1×10^5	1.4×10^4	-5.8×10^2
9.0×10^2	7.5×10^1	19.	3.6	8.5×10^{-3}	5.8	4.3×10^5	2.7×10^4	-5.8×10^2
1.0×10^3	2.3×10^1	19. - 33.*	3.1	8.1×10^{-3}	6.1	4.6×10^5	2.7×10^4	-1.5×10^2
2.0×10^3	1.7	11.	2.2	1.1×10^{-3}	7.2	4.9×10^5	2.7×10^4	-1.8
5.0×10^3	2.1×10^{-1}	8.5	1.8	1.1×10^{-3}	7.5	4.9×10^5	2.7×10^4	-7.2×10^{-2}
1.0×10^4	4.6×10^{-2}	6.7	1.6	---	7.5	4.9×10^5	2.7×10^4	-8.1×10^{-3}
3.0×10^4	3.8×10^{-3}	4.3	1.4	---	7.5	4.9×10^5	2.7×10^4	-2.4×10^{-4}
1.0×10^5	2.0×10^{-4}	2.8	1.2	---	7.5	4.9×10^5	2.7×10^4	-7.2×10^{-7}
4.0×10^5	6.5×10^{-7}	1.9	1.2	---	7.5	4.9×10^5	2.7×10^4	-6.5×10^{-9}
4.32×10^5	4.3×10^{-7}	1.9	1.2	---	7.5	4.9×10^5	2.7×10^4	

*Rapid change over short duration.

TABLE E-6

PRETEST PREDICTIONS OF ABCOVE TEST AB5, CODE CASE 6, BY ORNL USING HAARM-3 CODE

Time (s)	Suspended Mass Concentration (μg/cc)	AMMD (μm)	σ_g	Settling Mean Diameter (μm)	Leaked Mass (g)	Settled Mass (g)	Plated Mass (g)	Combined Removal Rate (g/s)
100	.673 E+2	1.58	1.512	0.98	.332	1.793 E+1	5.75 E+2	13.6
300	.198 E+3	2.36	1.793	2.02	2.95	3.601 E+2	4.614 E+3	28.2
500	.324 E+3	5.24	2.392	6.06	8.105	4.207 E+3	8.99 E+3	86.9
900	.506 E+3[a]	7.30	2.532	8.90	24.70	7.344 E+4	1.63 E+4	300.8
1000	443 E+3	14.2	2.400	16.6	29.42	1.2611 E+5	1.746 E+4	765.0
2000	3.88	26.0	1.564	23.2	39.6	4.986 E+5	1.825 E+4	9.18
5000	.1035	14.0	1.516	b	39.8	5.018 E+5	1.825 E+4	.06
10000	.8623 E-2	10.60	1.241	8.8	39.8	5.019 E+5	1.825 E+4	2.6 E-3
30000	.5335 E-4	7.52	1.178	b	39.9	5.019 E+5	1.825 E+4	--
1.E5	.836 E-8	5.20	1.152	b	39.9	5.019 E+5	1.825 E+4	--
4.E5	.24 E-14	2.96	1.162	b	39.9	5.019 E+5	1.825 E+4	--

[a]Maximum suspended concentration computed
[b]Numerically uncertain result

TABLE E-7

PRETEST PREDICTIONS OF ABCOVE TEST AB5, CODE CASE 7
BY BCL USING QUICK CODE

Time (sec)	Suspended Mass Conc. (μg/cm^3)	AMMD (μm)	σ_g	Fractional Removal Rate (Sedimentation) (sec^{-1})**	Leaked Mass (g)	Settled Mass (g)	Plated Mass (g)	Instantaneous Combined Removal Rate (g/s)***
1.0×10^2	6.1×10^1	2.4	1.9	3.0×10^{-5}	3.3×10^{-1}	3.4×10^1	7.3×10^3	-1.7×10^2
3.0×10^2	7.6×10^1	3.5	4.7	5.4×10^{-3}	1.9	6.2×10^4	5.0×10^4	-5.8×10^2
5.0×10^2	7.6×10^1	3.5	4.7	5.4×10^{-3}	3.4	1.3×10^5	9.7×10^4	-5.8×10^2
9.0×10^2	7.6×10^1	3.5 - 5.*	4.7	$5\text{-}7 \times 10^{-3}$*	6.3	2.7×10^5	1.9×10^5	-5.8×10^2
1.0×10^3	2.5×10^1	7.3	4.4	5.4×10^{-3}	6.7	3.0×10^5	2.0×10^5	-1.2×10^2
2.0×10^3	2.2	5.9	2.9	9.0×10^{-4}	7.4	3.3×10^5	2.0×10^5	-2.2
5.0×10^3	5.7×10^1	4.8	2.2	2.5×10^{-4}	7.9	3.3×10^5	2.0×10^5	-1.4×10^{-1}
1.0×10^4	2.2×10^{-1}	4.1	2.0	1.1×10^{-4}	8.0	3.3×10^5	2.0×10^5	-2.3×10^{-2}
3.0×10^4	5.0×10^{-2}	3.1	1.7	---	8.4	3.3×10^5	2.0×10^5	-2.2×10^{-3}
1.0×10^5	7.0×10^{-3}	2.3	1.5	---	8.4	3.3×10^5	2.0×10^5	-1.5×10^{-4}
4.0×10^5	3.2×10^{-4}	1.5	1.3	---	8.4	3.3×10^5	2.0×10^5	-2.0×10^{-6}
4.32×10^5	2.7×10^{-4}	1.4	1.3	---	8.4	3.3×10^5	2.0×10^5	---

*Rapid change over short duration.
**Taken from graph of mass concentration.
***Hand calculated over coarse time intervals.

TABLE E-8

PRETEST PREDICTIONS OF ABCOVE TEST AB5, CODE CASE 8, BY ORNL USING QUICK CODE

Time (s)	Suspended Mass Concentration (μg/cc)	AMMD (μm)	σ_g	Settling Mean Diameter (μm)	Leaked Mass (g)	Settled Mass (g)	Plated Mass (g)	Combined Removal Rate (g/s)
10^2	0.687 E+2	1.65	1.57	n.a	.34	.263 E+2	.150 E+4	36.5
$3x10^2$	0.193 E+3	3.58	1.95		2.93	.971 E+3	.146 E+5	103.2
$5x10^2$	0.271 E+3[a]	6.33	3.54		7.71	.340 E+5	.344 E+5	761.6
900	0.250 E+3	5.28	3.38		17.6	.252 E+6	.737 E+5	600.0
$1x10^3$	0.185 E+3	7.13	3.09		19.7	.302 E+6	.804 E+5	509.3
$2x10^3$	0.252 E+2	7.70	2.36		26.3	.427 E+6	.925 E+5	22.4
$5x10^3$	0.545 E+1	6.04	1.91		29.6	.444 E+6	.932 E+5	1.3
$1x10^4$	0.194 E+1	5.04	1.70		31.2	.447 E+6	.932 E+5	.23
$3x10^4$	0.307	3.71	1.49		32.8	.449 E+6	.932 E+5	.01
$1x10^5$	0.206 E-1	2.49	1.35		33.5	.449 E+6	.932 E+5	.0
$4x10^5$	0.102 E-3	b	b		33.6	.449 E+6	.932 E+5	.0

[a]Maximum suspended concentration computed = 273.0 at 482s.
[b]These quantities uncertain; numerical significance lost at this low concentration.

TABLE E-9

PRETEST PREDICTIONS OF ABCOVE TEST AB5, CODE CASE 9
BY BCL USING MSPEC CODE

Time (sec)	Suspended Mass Conc. ($\mu g/cm^3$)	AMMD (μm)	σ_g	Fractional Removal Rate (Sedimentation) (sec^{-1})*	Leaked Mass (g)	Settled Mass (g)	Plated Mass (g)	Instantaneous Combined Removal Rate (g/s)
1.0×10^2	6.3×10^1	2.2	1.8	2.6×10^{-5}	3.3×10^{-1}	~0.0	7.2×10^3	-1.9×10^2
3.0×10^2	6.5×10^1	2.5	3.7	5.5×10^{-3}	1.6	6.3×10^4	6.4×10^4	-5.8×10^2
5.0×10^2	6.5×10^1	2.5	3.6	5.5×10^{-3}	3.0	1.2×10^5	1.5×10^5	-5.8×10^2
9.0×10^2	6.5×10^1	2.5	3.6	7.0×10^{-3}	5.4	2.5×10^5	2.3×10^5	-5.8×10^2
1.0×10^3	2.3×10^1	3.4	3.8	6.8×10^{-3}	5.9	2.7×10^5	2.4×10^5	-1.02×10^2
2.0×10^3	2.4	3.4	2.8	8.4×10^{-4}	6.4	2.8×10^5	2.4×10^5	-1.96
5.0×10^3	5.7×10^{-1}	3.3	2.2	2.5×10^{-4}	6.9	2.8×10^5	2.4×10^5	-1.3×10^{-1}
1.0×10^4	2.4×10^{-1}	3.2	2.0	1.2×10^{-4}	7.0	2.8×10^5	2.4×10^5	-2.6×10^{-2}
3.0×10^4	6.0×10^{-2}	2.9	1.7	4.5×10^{-5}	7.2	2.8×10^5	2.4×10^5	-2.2×10^{-3}
1.0×10^5	9.4×10^{-3}	2.3	1.5	1.8×10^{-5}	7.5	2.8×10^5	2.4×10^5	-1.6×10^{-4}
4.0×10^5	2.9×10^{-4}	1.5	1.3	7.1×10^{-6}	7.5	2.8×10^5	2.4×10^5	-2.1×10^{-6}
4.32×10^5	2.3×10^{-4}	1.5	1.3	6.7×10^{-6}	7.5	2.8×10^5	2.4×10^5	---

*Calculated by code.

TABLE E-10

PRETEST PREDICTIONS OF ABCOVE TEST AB5, CODE CASE 10, BY HEDL/CSA USING MAEROS CODE

Time (s)	Suspended Mass Concentration (g/m^3)	MMD (μm)(a)	Settled Mass (g)(b)	Plated Mass(b) (g)
1.0 (2)(c)	6.77 (1)	2.5	2.17 (2)	1.16 (1)
3.0 (2)	1.17 (2)	3.9	7.34 (4)	8.97 (2)
5.0 (2)	1.18 (2)	3.8	1.87 (5)	1.81 (3)
9.0 (2)	1.18 (2)	3.9	4.17 (5)	3.68 (3)
1.0 (3)	6.45 (1)	5.2	4.62 (5)	4.01 (3)
2.0 (3)	8.23 (0)	4.6	5.10 (5)	4.28 (3)
5.0 (3)	1.85 (0)	5.4	5.15 (5)	4.33 (3)
1.0 (4)	6.52 (-1)	3.0	5.16 (5)	4.34 (3)
3.0 (4)	1.06 (-1)	2.2	5.17 (5)	4.36 (3)
1.0 (5)	6.66 (-2)	1.5	5.17 (5)	4.36 (3)
4.0 (5)	1.37 (-5)	1.0	5.17 (5)	4.36 (3)

(a)MMD = Mass median diameter. Discrete values obtained by plotting the reported size distribution on log-probability paper.
(b)Cumulative total of incremental values reported.
(c)Numbers in parenthesis are exponents of ten.

TABLE E-11

PRETEST PREDICTIONS OF ABCOVE TEST AB5, CODE CASE 11, BY SNL USING CONTAIN CODE

Time (s)	Suspended Mass Concentration (kg/m3)	Particle Size[b] AMMD (m)	Particle Size[b] ASMD[a] (m)	Leaked Mass (kg)	Removal Rate (kg/s)
1.0 (2)	6.80 (-2)	0.113 (-5)	0.138 (-5)	0.33 (-3)	0.95 (-3)
3.0 (2)	1.69 (-1)	0.441 (-5)	0.351 (-4)	0.28 (-2)	0.13 (1)
5.0 (2)	1.50 (-1)	0.299 (-5)	0.241 (-4)	0.58 (-2)	0.56 (0)
1.0 (3)	8.75 (-2)	0.496 (-5)	0.266 (-5)	1.28 (-2)	0.41 (0)
2.0 (3)	8.94 (-3)	0.495 (-5)	0.115 (-4)	1.53 (-2)	0.78 (-2)
5.0 (3)	1.88 (-3)	0.372 (-5)	0.618 (-5)	1.64 (-2)	0.48 (-3)
1.0 (4)	6.73 (-4)	0.298 (-5)	0.430 (-5)	1.70 (-2)	0.85 (-4)
3.0 (4)	1.21 (-4)	0.212 (-5)	0.261 (-5)	1.75 (-2)	0.58 (-5)
1.0 (5)	1.14 (-5)	0.145 (-5)	0.161 (-5)	1.78 (-2)	0.22 (-6)
4.0 (5)	1.90 (-7)	0.917 (-6)	0.965 (-6)	1.78 (-2)	0.16 (-8)

(a)ASMD is aerodynamic settling mean diameter.
(b)Tables of suspended concentration for 20 size groups were furnished.

APPENDIX F

BLIND POST-TEST PREDICTIONS SUBMITTED BY CODE USERS

APPENDIX F

BLIND POST-TEST PREDICTIONS SUBMITTED BY CODE USERS

Blind post-test predictions were sent to the test performer and other ABCOVE program participants prior to release of test results of aerosol behavior. Copies of the tabular data submitted by each participant are presented in Tables F-1 through F-11 as follows:

Table	Code Case	Code	User
F-1	1	HAA-3B	GE
F-2	2	HAA-3C	HEDL/SSD
F-3	3	HAA-4	RI/ESG
F-4	4	HAARM-3	HEDL/SSD
F-5	5	HAARM-3	BCL
F-6	6	HAARM-3	ORNL
F-7	7	QUICK	BCL
F-8	8	QUICK	ORNL
F-9	9	MSPEC	BCL
F-10	10	MAEROS	HEDL/CSA
F-11	11	CONTAIN	SNL

TABLE F-1

BLIND POST-TEST PREDICTIONS OF ABCOVE TEST AB5, CODE CASE 1
BY GE USING HAA-3A CODE

Time (sec)	Suspended Mass Concentration ($\mu g/cm^3$)	Leaked Mass (g)	Settled Mass (g)	Plated Mass (g)	AMMD (μm)	σ_g
10^2	44.9	0.219	2.59	4.75×10^2	0.58	1.48
3×10^2	146.5	2.09	77.8	2.82×10^3	1.18	1.80
5×10^2	188.0	5.71	5.22×10^4	4.42×10^3	11.0	3.36
885	173.3	12.5	2.35×10^5	5.61×10^3	10.4	3.34
10^3	79.5	13.9	3.15×10^5	5.73×10^3	31.5	2.60
2×10^3	1.25	14.9	3.81×10^5	5.76×10^3	19.8	1.54
5×10^3	0.91	15.0	3.82×10^5	5.77×10^3	12.3	1.33
10^4	0.015	15.0	3.82×10^5	5.77×10^3	9.23	1.25

TABLE F-2

BLIND POST-TEST PREDICTIONS OF ABCOVE TEST AB5, CODE CASE 2,
BY HEDL/SSD USING HAA-3C CODE
(November 15, 1982)

Time (Sec)	Suspended Conc. ($\mu g/cm^3$)	Particle Size Distribution: r_{50} (μm)	Particle Size Distribution: AMMD (μm)	Particle Size Distribution: σg	d_{sa}(b) (μm)	Leaked Mass (g)	Settled Mass (g)	Plated Mass (g)	Removal Rate (sec^{-1})
100	4.49 (1)[a]	4.2 (-1)	5.94 (-1)	1.63	7.54 (-1)	2.06 (-1)	2.06 (0)	4.93 (2)	2.09 (-4)
300	1.46 (2)	8.44 (-1)	1.19 (0)	1.78	1.66 (0)	1.79 (0)	6.74 (1)	3.15 (3)	1.28 (-4)
500	2.15 (2)	8.55 (0)	1.21 (1)	3.38	5.33 (1)	5.86 (0)	2.82 (4)	5.46 (3)	2.76 (-3)
885	2.05 (2)	8.47 (0)	1.20 (1)	3.35	5.17 (1)	1.38 (1)	2.07 (5)	7.01 (3)	2.64 (-3)
1×10^3	1.00 (2)	2.66 (1)	3.76 (1)	2.63	9.58 (1)	1.55 (1)	2.96 (5)	7.26 (3)	9.39 (-3)
2×10^3	9.83 (-1)	1.58 (1)	2.23 (1)	1.50	2.63 (1)	1.67 (1)	3.80 (5)	7.32 (3)	1.70 (-3)
5×10^3	6.16 (-2)	9.64 (0)	1.36 (1)	1.31	1.47 (1)	1.68 (1)	3.81 (5)	7.32 (3)	5.83 (-4)
1×10^4	6.36 (-3)	7.58 (0)	1.07 (1)	1.24	1.12 (1)	1.68 (1)	3.81 (5)	7.32 (3)	3.59 (-4)
3×10^4	3.28 (-5)	5.58 (0)	7.89 (0)	1.17	8.09 (0)	1.68 (1)	3.81 (5)	7.33 (3)	3.41 (-5)
1×10^5	4.44 (-10)	4.16 (0)	5.88 (0)	1.12	5.96 (0)	1.68 (1)	3.81 (5)	7.33 (3)	
2×10^5	1.0 (-14)					1.68 (1)	3.81 (5)	7.33 (3)	
4×10^5						1.68 (1)	3.81 (5)	7.33 (3)	

(a) Numbers in parenthesis are exponents of 10.

(b) d_{sa} = aerodynamic settling mean diameter = AMMD $\exp(\ln^2 \sigma g)$.

TABLE F-3

BLIND POST-TEST PREDICTIONS OF ABCOVE TEST AB5, CODE CASE 3, BY ROCKWELL/ESG USING HAA-4 CODE

Time (sec)	C (g/m3)	AED (μm)	σg	AED_{set} (μm)	M_L (g)	M_s (g)	M_p (g)	R (g/s)	FNa
100	4.5 + 1	7.2 - 1	1.5	8.6 - 1	1.9 - 1	2.0 + 0	2.4 + 2	7.2 + 0	0.574
300	1.30 + 2	1.18 + 1	3.5	3.8 + 1	2.1 + 0	1.5 + 4	2.9 + 3	3.6 + 2	0.572
500	1.42 + 2	1.24 + 1	3.5	4.1 + 1	4.7 + 0	9.1 + 4	6.0 + 3	4.2 + 2	0.571
885	1.48 + 2	1.28 + 1	3.5	4.2 + 1	1.03 + 1	2.5 + 5	1.2 + 4	4.54 + 2	0.570
1000	5.6 + 1	4.6 + 1	2.6	7.8 + 1	1.15 + 1	3.3 + 5	1.3 + 4	6.2 + 2	0.570
2000	4.6 - 1	2.4 + 1	1.5	2.6 + 1	1.20 + 1	3.8 + 5	1.3 + 4	6.8 - 1	0.570
5000	2.7 - 2	1.48 + 1	1.3	1.5 + 1	1.20 + 1	3.8 + 5	1.3 + 4	1.4 - 2	0.570
10000	2.7 - 3	1.16 + 1	1.23	1.2 + 1	1.20 + 1	3.8 + 5	1.3 + 4	8.5 - 4	0.570

TABLE F-4

BLIND POST-TEST PREDICTIONS OF ABCOVE TEST AB5, CODE CASE 4
BY HEDL/SSD USING HAARM-3C CODE
(November 18, 1982)

Time (Sec)	Suspended Conc. ($\mu g/cm^3$)	Particle Size Distribution: r_{50} (μm)	AMMD (μm)	σ_g	d_{sa}(b) (μm)	Leaked Mass (g)	Settled Mass (g)	Plated Mass (g)	Removal Rate (sec^{-1})
100	4.49 (1)[a]	4.23 (-1)	1.39 (0)	1.48 (0)	1.62 (0)	1.98 (-1)	9.84 (0)	4.98 (2)	2.70 (-4)
300	1.47 (2)	7.99 (-1)	2.09 (0)	1.74 (0)	2.84 (0)	2.09 (0)	2.30 (2)	2.64 (3)	1.19 (-4)
500	2.47 (2)	1.60 (0)	3.77 (0)	2.19 (0)	6.97 (0)	5.99 (0)	1.73 (3)	4.73 (3)	1.24 (-4
885	3.38 (2)	4.31 (0)	1.02 (1)	2.85 (0)	3.05 (1)	1.76 (1)	9.33 (4)	7.20 (3)	1.36 (-3)
1×10^3	2.44 (2)	8.18 (0)	1.94 (1)	2.75 (0)	5.40 (1)	2.10 (1)	1.72 (5)	7.76 (3)	3.60 (-3)
2×10^3	2.64 (1)	5.80 (0)	1.37 (1)	2.09 (0)	2.36 (1)	2.89 (1)	3.57 (5)	8.76 (3)	1.41 (-3)
5×10^3	2.73 (0)	4.20 (0)	9.95 (0)	1.67 (0)	1.29 (1)	3.15 (1)	3.77 (5)	9.09 (3)	5.06 (-4)
1×10^4	5.26 (-1)	3.19 (0)	7.55 (0)	1.49 (0)	8.85 (1)	3.21 (1)	3.79 (5)	9.21 (3)	2.57 (-4)
3×10^4	2.32 (-2)	2.17 (0)	5.12 (0)	1.31 (0)	5.51 (1)	3.23 (1)	3.79 (5)	9.27 (3)	1.22 (-4)
1×10^5	1.91 (-4)					3.24 (1)	3.79 (5)		
2×10^5	3.85 (-5)					3.24 (1)	3.79 (5)		
4×10^5	3.03 (-6)					3.24 (1)	3.79 (5)		

(a) Numbers in parenthesis are exponents of 10.

(b) d_{sa} = aerodynamic settling mean diameter = AMMD $\exp(\ln^2 \sigma_g)$.

TABLE F-5

PRETEST PREDICTIONS OF ABCOVE TEST AB5, CODE CASE 5
BY BCL USING HAARM-3 CODE

Time (sec)	Conc. ($\mu g/cm^3$)	AMMD (μm)	σ_g	Leaked Mass (g)	Settled Mass (g)	Plated Mass (g)	Fractional Settling (sec^{-1})	Total Removal Rate (g/sec)
1.0×10^2	4.1 (1)(a)	1.7	1.7	0.18	1.7 (1)	6.9 (2)	1.9 (-5)	5.6 (1)
3.0×10^2	6.4 (1)	17	3.5	1.4	5.7 (4)	5.8 (3)	7.2 (-3)	4.4 (2)
5.0×10^2	6.4 (1)	17	3.5	2.5	1.3 (5)	1.1 (4)	7.1 (-3)	4.4 (2)
8.85×10^2	6.4 (1)	17	3.5	5.1	2.8 (5)	2.1 (4)	7.0 (-3)	4.4 (2)
1.0×10^3	1.8 (1)	21	3.0	5.5	3.2 (5)	2.2 (4)	6.5 (-3)	1.0 (2)
2.0×10^3	1.7 (0)	11	2.2	6.0	3.3 (5)	2.2 (4)	1.0 (-3)	1.7 (0)
5.0×10^3	2.1 (-1)	8.5	1.8	6.2	3.4 (5)	2.2 (4)	NA(b)	7.7 (-2)
1.0×10^4	4.6 (-2)	6.6	1.6	6.2	3.4 (5)	2.2 (4)	NA	8.3 (-3)
3.0×10^4	4.4 (-3)	4.3	1.4	6.2	3.4 (5)	2.2 (4)	NA	2.8 (-4)
1.0×10^5	2.1 (-4)	2.9	1.3	6.2	3.4 (5)	2.2 (4)	NA	5.5 (-6)
4.0×10^5	6.9 (-7)	1.9	1.2	6.2	3.4 (5)	2.2 (4)	NA	8.3 (-9)

(a) Number in parenthesis is exponent of 10
(b) NA -- Not available.

TABLE F-6

BLIND POST-TEST PREDICTIONS OF ABCOVE TEST AB5, CODE CASE 6, BY ORNL USING HAARM-3 CODE

Time (s)	Suspended Mass Concentration (μg/cc)	AMMD (μm)	σ_g	Settling Mean Diameter (μm)	Leaked Mass (g)	Settled Mass (g)	Plated Mass (g)	Combined Removal Rate (g/s)
100	45.5	1.64	1.66	n.a	0.195	12.9	9.98	13.5
300	136.3	7.98	2.81		2.044	1.17 E4	144.7	133.0
500	194.0	9.40	2.84		5.341	5.14 E4	466.2	261.6
885	241.5	10.47	2.86		13.78	1.816 E5	1118.	402.0
900	230.4	16.30	2.78		14.13	1.1911 E5	1136.	600.0
1000	1.6	13.86	1.63		15.25	3.855 E5	1166.	89.6
2000	1.0 E-4	40.98	1.19		15.26	3.869 E5	1166.	5.4 E-6
5000	1.46 E-8	28.24	1.13		15.26	3.869 E5	1166.	2.9 E-8
10000	2.75 E-12	22.52	1.12		15.26	3.869 E5	1166.	3.2 E-12
*23460	2.32 E-19	16.80	1.11		15.26	3.869 E5	1166.	1.9 E-18

*Calculation terminated on suspended concentration criterion.

TABLE F-7

BLIND POST-TEST PREDICTIONS OF ABCOVE TEST AB5, CODE CASE 7
BY BATTELLE-COLUMBUS USING QUICK CODE
(December 9, 1982)

Time (sec)	Conc. ($\mu g/cm^3$)	AMMD (μm)	σ_g	Leaked Mass (g)	Settled Mass (g)	Plated Mass (g)	Fractional Settling (sec^{-1})	Total Removal Rate (g/sec)
1.0×10^2	4.2 (1)(a)	1.8	1.7	0.19	1.1 (1)	4.0 (3)	1.3 (-5)	1.1 (2)
3.0×10^2	6.4 (1)	3.2	4.5	1.4	3.5 (4)	4.1 (4)	4.8 (-3)	4.6 (2)
5.0×10^2	6.4 (1)	3.3	4.6	2.7	8.5 (4)	8.1 (4)	4.6 (-3)	4.4 (2)
8.85×10^2	6.4 (1)	3.3	4.6	5.1	1.8 (5)	1.6 (5)	4.6 (-3)	4.5 (2)
1.0×10^3	2.9 (1)	6.8	4.4	5.6	2.1 (5)	1.6 (5)	6.8 (-3)	1.7 (2)
2.0×10^3	2.4 (0)	5.8	2.9	6.3	2.3 (5)	1.6 (5)	1.9 (-3)	8.4 (-1)
5.0×10^3	6.6 (-1)	4.7	2.3	6.7	2.3 (5)	1.6 (5)	6.5 (-4)	2.4 (-1)
1.0×10^4	2.7 (-1)	4.1	2.0	6.9	2.3 (5)	1.6 (5)	NA(b)	1.4 (-2)
3.0×10^4	7.7 (-2)	2.9	1.7	7.1	2.3 (5)	1.6 (5)	NA	4.1 (-3)
1.0×10^5	6.1 (-3)	2.3	1.5	7.2	2.3 (5)	1.6 (5)	NA	5.1 (-5)
4.0×10^5	3.3 (-4)	1.4	1.4	7.3	2.3 (5)	1.6 (5)	NA	2.7 (-6)

(a) Numbers in parenthesis is exponent of 10/
(b) NA -- Not available.

TABLE F-8

BLIND POST-TEST PREDICTIONS OF ABCOVE TEST AB5, CODE CASE 8, BY ORNL USING QUICK CODE

Time (s)	Suspended Mass Concentration (μg/cc)	AMMD (μm)	σ_g	Settling Mean Diameter (μm)	Leaked Mass (g)	Settled Mass (g)	Plated Mass (g)	Combined Removal Rate (g/s)
100	46.4	1.92	1.72	n.a.	0.20	15.4	44.1	1.07
300	75.3	3.86	5.13		1.6	6.62 E4	75.0	452.4
500	75.1	3.84	5.14		3.1	1.57 E5	1.21 E2	454.3
885	75.1	3.84	5.14		5.9	3.32 E5	2.72 E2	463.6
900	67.1	4.64	4.97		6.0	3.38 E5	2.76 E2	450.9
1000	28.2	7.08	4.50		6.5	3.72 E5	2.94 E2	174.0
2000	2.56	5.76	2.86		7.2	3.95 E5	3.15 E2	2.1
5000	0.578	4.67	2.29		7.6	3.96 E5	3.17 E2	0.13
10000	0.223	3.96	2.02		7.7	3.97 E5	3.17 E2	0.024
30000	0.0485	3.03	1.70		7.9	3.97 E5	3.17 E2	1.77 E-3
1.E5	6.86 E-3	2.19	1.49		8.1	3.97 E5	3.17 E2	9.33 E-5
4.E5	3.66 E-4	1.44	1.38		8.1	3.97 E5	3.17 E3	1.44 E-7

TABLE F-9

BLIND POST-TEST PREDICTIONS OF ABCOVE TEST AB5, CODE CASE 9
BY BATTELLE-COLUMBUS USING MSPEC CODE
(December 9, 1982)

Time (sec)	Conc. ($\mu g/cm^3$)	AMMD (μm)	σ_g	Leaked Mass (g)	Settled Mass (g)	Plated Mass (g)	Fractional Settling (sec-1)	Total Removal Rate (g/sec)
1.0×10^2	4.2 (1)(a)	1.7	1.6	0.18	1.1 (1)	3.3 (3)	1.11 (-5)	1.0 (2)
3.0×10^2	5.5 (1)	2.4	3.6	1.3	3.6 (4)	4.7 (4)	4.7 (-3)	4.5 (2)
5.0×10^2	5.4 (1)	2.4	3.6	2.3	8.0 (4)	9.4 (4)	4.6 (-3)	4.4 (2)
8.85×10^2	5.4 (1)	2.4	3.6	4.4	1.6 (5)	1.85 (5)	5.3 (-3)	4.5 (2)
1.0×10^3	2.2 (1)	3.3	3.8	4.8	1.8 (5)	1.9 (5)	6.4 (-3)	1.3 (2)
2.0×10^3	2.3 (0)	3.4	2.8	5.4	2.0 (5)	1.9 (5)	9.6 (-4)	2.0 (0)
5.0×10^3	5.9 (-1)	3.3	2.2	5.7	2.0 (5)	1.9 (5)	2.8 (-4)	1.4 (-1)
1.0×10^4	2.3 (-1)	3.1	1.9	5.9	2.0 (5)	1.9 (5)	1.4 (-4)	2.6 (-2)
3.0×10^4	6.4 (-2)	2.9	1.7	6.1	2.0 (5)	1.9 (5)	6.2 (-5)	3.2 (-3)
1.0×10^5	9.4 (-3)	2.3	1.4	6.3	2.0 (5)	1.9 (5)	1.9 (-5)	6.1 (-5)
4.0×10^5	3.2 (-4)	1.5	1.3	6.4	2.0 (5)	1.9 (5)	7.2 (-6)	2.0 (-6)

(a) Number in parenthesis is exponent of 10

TABLE F-10

BLIND POST-TEST PREDICTIONS OF ABCOVE TEST AB5, CODE CASE 10, BY HEDL/CSA USING MAEROS CODE

Time (s)	Suspended Mass Concentration (g/m3)	MMD (μm)(a)	Settled Mass (g)(b)	Plated Mass(b) (g)
1.0 (2)(b)	45.4	1.04	1.62 (1)	1.19 (1)
3.0 (2)	138.5	3.55	9.5 (3)	2.0 (2)
5.0 (2)	120.5	2.77	1.1 (5)	1.5 (3)
8.85 (2)	121.7	2.86	2.8 (5)	3.7 (3)
1.0 (3)	69.5	4.45	3.2 (5)	4.1 (3)
2.0 (3)	8.3	4.80	3.7 (5)	4.5 (3)
5.0 (3)	1.8	3.83	3.8 (5)	4.5 (3)
1.0 (4)	6.3 (-1)	3.18	3.8 (5)	4.5 (3)
3.0 (4)	1.0 (-1)	2.28	3.8 (5)	4.5 (3)
1.0 (5)	6.8 (-2)	1.57	3.8 (5)	4.5 (3)
4.0 (5)	1.5 (-5)	1.02	3.8 (5)	4.5 (3)

(a)MMD = Mass median diamter. Discrete values obtained by plotting the reported size distribution on log-probability paper.
(b)Numbers in parenthesis are exponents of ten.

TABLE F-11

BLIND POST-TEST PREDICTIONS OF ABCOVE TEST AB5, CODE CASE 11,
BY SNL USING CONTAIN CODE

Time (s)	Mass Concentration (kg/m3)	Particle Size[c] AMMD (m)	Particle Size[c] ASMD[a] (m)	Leaked Mass (kg)	Settled Mass (kg)	Plated Mass (kg)	Mass Removal Rate (kg/s)
1.0 (2)[b]	4.49 (-2)	0.134 (-5)	0.160 (-5)	0.19 (-3)	0.36 (-2)	0.54 (0)	0.12 (-1)
2.0 (2)	9.52 (-2)	0.246 (-5)	0.365 (-5)	0.89 (-3)	0.14 (0)	0.22 (1)	0.24 (-1)
3.0 (2)	1.39 (-1)	0.549 (-5)	0.323 (-4)	0.21 (-2)	0.53 (1)	0.44 (1)	0.39 (0)
4.0 (2)	1.10 (-1)	0.363 (-5)	0.389 (-4)	0.32 (-2)	0.72 (2)	0.66 (1)	0.44 (0)
5.0 (2)	1.14 (-1)	0.369 (-5)	0.369 (-4)	0.43 (-2)	0.11 (3)	0.87 (1)	0.41 (0)
8.85 (2)	1.15 (-1)	0.377 (-5)	0.384 (-4)	0.67 (-2)	0.27 (3)	0.16 (2)	0.45 (0)
1.0 (3)	6.44 (-2)	0.648 (-5)	0.417 (-4)	0.97 (-2)	0.32 (3)	0.17 (2)	0.20 (-2)
2.0 (3)	7.49 (-3)	0.671 (-5)	0.183 (-4)	0.12 (-1)	0.36 (3)	0.17 (2)	0.63 (-2)
5.0 (3)	1.68 (-3)	0.529 (-5)	0.979 (-5)	0.13 (-1)	0.37 (3)	0.17 (2)	0.41 (-3)
1.0 (4)	6.32 (-4)	0.437 (-5)	0.678 (-5)	0.13 (-1)	0.37 (3)	0.17 (2)	0.75 (-4)
3.0 (4)	1.26 (-4)	0.318 (-5)	0.409 (-5)	0.14 (-1)	0.37 (3)	0.17 (2)	0.56 (-5)
1.0 (5)	1.39 (-5)	0.219 (-5)	0.252 (-5)	0.14 (-1)	0.37 (3)	0.17 (2)	0.26 (-6)
4.0 (5)	2.61 (-7)	0.140 (-5)	0.154 (-5)	0.14 (-1)	0.37 (3)	0.17 (2)	0.21 (-8)

(a)ASMD = aerodynamic settling mean diameter.
(b)Numbers in paenthesis are exponents of ten.
(c)Tables of suspended concentration for 20 size groups were furnished.

A P P E N D I X G

CODE COMPARISONS OF SUSPENDED MASS CONCENTRATION

TABLE G-1

SUSPENDED MASS CONCENTRATION AT 100 SECONDS

CODE	USER	CONCENTRATION [a] (g AEROSOL / CU M)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST [c]
HAA-3B	GE	6.5 (1) [b]	4.49 (1)	1.01	1.21
HAA-3C	HEDL / SSD	7.15 (1)	4.49 (1)	1.01	1.21
HAA-4	RI / ESG	6.7 (1)	4.5 (1)	1.02	1.22
HAARM-3	HEDL / SSD	6.84 (1)	4.49 (1)	1.01	1.21
HAARM-3	BCL	6.5 (1)	4.1 (1)	0.93	1.11
HAARM-3	ORNL	6.73 (1)	4.55 (1)	1.03	1.23
QUICK	BCL	6.1 (1)	4.2 (1)	0.95	1.14
QUICK	ORNL	6.87 (1)	4.64 (1)	1.05	1.25
MSPEC	BCL	6.3 (1)	4.2 (1)	0.95	1.14
MAEROS	HEDL / CSA	6.77 (1)	4.54 (1)	1.02	1.23
CONTAIN	SNL	6.80 (1)	4.49 (1)	1.01	1.21
AVERAGE		6.66 (1)	4.43 (1)		1.20

(a) EXPRESSED AS g TOTAL AEROSOL PER CU M AT CONTAINMENT CONDITIONS
(b) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(c) TEST AB5 RESULT = 37 ± 11 g AEROSOL / CU M

TABLE G-2

SUSPENDED MASS CONCENTRATION AT 300 SECONDS

CODE	USER	CONCENTRATION [a] (g AEROSOL / CU M)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST [c]
HAA-3B	GE	2.0 (2) [b]	1.46 (2)	1.29	1.04
HAA-3C	HEDL / SSD	2.00 (2)	1.46 (2)	1.29	1.04
HAA-4	RI / ESG	1.35 (2)	1.30 (2)	1.15	0.93
HAARM-3	HEDL / SSD	1.99 (2)	1.47 (2)	1.30	1.05
HAARM-3	BCL	7.5 (1)	6.4 (1)	0.57	0.46
HAARM-3	ORNL	1.98 (2)	1.36 (2)	1.20	0.97
QUICK	BCL	7.6 (1)	6.4 (1)	0.57	0.46
QUICK	ORNL	1.93 (2)	7.53 (1)	0.67	0.54
MSPEC	BCL	6.5 (1)	5.5 (1)	0.49	0.39
MAEROS	HEDL / CSA	1.17 (2)	1.385(2)	1.23	0.99
CONTAIN	SNL	1.69 (2)	1.39 (2)	1.23	0.99
AVERAGE		1.48 (2)	1.13 (2)		0.807

(a) EXPRESSED AS g TOTAL AEROSOL PER CU M AT CONTAINMENT CONDITIONS
(b) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(c) TEST AB5 RESULT = 140 ± 21 g AEROSOL / CU M

TABLE G-3

SUSPENDED MASS CONCENTRATION AT 500 SECONDS

CODE	USER	CONCENTRATION [a] (g AEROSOL / CU M)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST [c]
HAA-3B	GE	2.0 (2) [b]	1.88 (2)	1.40	1.71
HAA-3C	HEDL / SSD	2.12 (2)	2.15 (2)	1.60	1.95
HAA-4	RI / ESG	1.47 (2)	1.42 (2)	1.06	1.29
HAARM-3	HEDL / SSD	3.15 (2)	2.47 (2)	1.84	2.25
HAARM-3	BCL	7.5 (1)	6.4 (1)	0.48	0.58
HAARM-3	ORNL	3.24 (2)	1.94 (2)	1.45	1.76
QUICK	BCL	7.6 (1)	6.4 (1)	0.48	0.58
QUICK	ORNL	2.71 (2)	7.51 (1)	0.56	0.68
MSPEC	BCL	6.5 (1)	5.4 (1)	0.40	0.49
MAEROS	HEDL / CSA	1.18 (2)	1.205(2)	0.90	1.10
CONTAIN	SNL	1.50 (2)	1.14 (2)	0.85	1.04
AVERAGE		1.78 (2)	1.34 (2)		1.22

(a) EXPRESSED AS g TOTAL AEROSOL PER CU M AT CONTAINMENT CONDITIONS
(b) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(c) TEST AB5 RESULT = 110 ± 17 g AEROSOL / CU M

TABLE G-4

SUSPENDED MASS CONCENTRATION AT 885 SECONDS

CODE	USER	CONCENTRATION [a] (g AEROSOL / CU M)		RATIO	
		PRETEST [d]	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST [c]
HAA-3B	GE	1.95 (2) [b]	1.73 (2)	1.19	1.57
HAA-3C	HEDL / SSD	2.01 (2)	2.05 (2)	1.41	1.86
HAA-4	RI / ESG	1.50 (2)	1.48 (2)	1.02	1.35
HAARM-3	HEDL / SSD	3.56 (2)	3.38 (2)	2.33	3.07
HAARM-3	BCL	7.5 (1)	6.4 (1)	0.44	0.58
HAARM-3	ORNL	5.06 (2)	2.42 (2)	1.67	2.20
QUICK	BCL	7.6 (1)	6.4 (1)	0.44	0.58
QUICK	ORNL	2.50 (2)	7.51 (1)	0.52	0.68
MSPEC	BCL	6.5 (1)	5.4 (1)	0.37	0.49
MAEROS	HEDL / CSA	1.18 (2)	1.217(2)	0.84	1.11
CONTAIN	SNL		1.15 (2)	0.79	1.05
AVERAGE		1.99 (2)	1.45 (2)		1.32

(a) EXPRESSED AS g TOTAL AEROSOL PER CU M AT CONTAINMENT CONDITIONS
(b) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(c) TEST ABS RESULT = 110 ± 17 g AEROSOL / CU M
(d) PRETEST PREDICTIONS AT 900 SEC. (INTENDED END OF SOURCE)

TABLE G-5

SUSPENDED MASS CONCENTRATION AT 1000 SECONDS

CODE	USER	CONCENTRATION (a) (g AEROSOL / CU M)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST (c)
HAA-3B	GE	1.0 (2) (b)	7.95 (1)	1.23	1.22
HAA-3C	HEDL / SSD	9.26 (1)	1.00 (2)	1.54	1.54
HAA-4	RI / ESG	3.9 (1)	5.6 (1)	0.71	0.86
HAARM-3	HEDL / SSD	2.52 (2)	2.44 (2)	3.77	3.75
HAARM-3	BCL	2.3 (1)	1.8 (1)	0.28	0.28
HAARM-3	ORNL	4.43 (2)	1.6 (0)	0.025	0.025
QUICK	BCL	2.5 (1)	2.9 (1)	0.45	0.45
QUICK	ORNL	1.85 (2)	2.82 (1)	0.44	0.43
MSPEC	BCL	2.3 (1)	2.2 (1)	0.34	0.34
MAEROS	HEDL / CSA	6.45 (1)	6.95 (1)	1.07	1.07
CONTAIN	SNL	8.75 (1)	6.44 (1)	1.00	1.99
AVERAGE		1.01 (2)	6.47 (1)		1.00

(a) EXPRESSED AS g TOTAL AEROSOL PER CU M AT CONTAINMENT CONDITIONS
(b) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(c) TEST AB5 RESULT = 65 ± 10 g AEROSOL / CU M

TABLE G-6

SUSPENDED MASS CONCENTRATION AT 2000 SECONDS

CODE	USER	CONCENTRATION [a] (g AEROSOL / CU M)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST [c]
HAA-3B	GE	1.05 (0) [b]	1.25 (0)	0.26	0.18
HAA-3C	HEDL / SSD	1.00 (0)	9.83(-1)	0.20	0.14
HAA-4	RI / ESG	1.3 (-1)	4.6 (-1)	0.094	0.068
HAARM-3	HEDL / SSD	2.47 (1)	2.64 (1)	5.40	3.88
HAARM-3	BCL	1.7 (0)	1.7 (0)	0.35	0.25
HAARM-3	ORNL	3.88 (0)	1.0 (-4)	2.0 (-5)	1.5 (-5)
QUICK	BCL	2.2 (0)	2.4 (0)	0.49	0.35
QUICK	ORNL	2.52 (1)	2.56 (0)	0.52	0.38
MSPEC	BCL	2.4 (0)	2.3 (0)	0.47	0.34
MAEROS	HEDL / CSA	8.23 (0)	8.3 (0)	1.70	1.22
CONTAIN	SNL	8.94 (0)	7.49 (0)	1.53	1.10
AVERAGE		7.22 (0)	4.89 (0)		0.719

(a) EXPRESSED AS g TOTAL AEROSOL PER CU M AT CONTAINMENT CONDITIONS
(b) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(c) TEST AB5 RESULT = 6.8 ± 1 g AEROSOL / CU M

TABLE G-7

SUSPENDED MASS CONCENTRATION AT 5000 SECONDS

CODE	USER	CONCENTRATION [a] (g AEROSOL / CU M)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST [c]
HAA-3B	GE	8.3 (-2) [b]	9.1 (-1)	1.08	0.75
HAA-3C	HEDL / SSD	7.40(-2)	6.16(-2)	0.073	0.050
HAA-4	RI / ESG	4.0 (-3)	2.7 (-2)	0.032	0.022
HAARM-3	HEDL / SSD	2.47 (0)	2.73 (0)	3.25	2.24
HAARM-3	BCL	2.1 (-1)	2.1 (-1)	0.25	0.17
HAARM-3	ORNL	1.04(-1)	1.46(-8)	1.7 (-8)	1.2 (-8)
QUICK	BCL	5.7 (-1)	6.6 (-1)	0.78	0.54
QUICK	ORNL	5.45 (0)	5.78(-1)	0.69	0.47
MSPEC	BCL	5.7 (-1)	5.9 (-1)	0.70	0.48
MAEROS	HEDL / CSA	1.85 (0)	1.8 (0)	2.14	1.48
CONTAIN	SNL	1.88 (0)	1.68 (0)	2.00	1.38
AVERAGE		1.21 (0)	8.41(-1)		0.689

(a) EXPRESSED AS g TOTAL AEROSOL PER CU M AT CONTAINMENT CONDITIONS
(b) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(c) TEST AB5 RESULT = 1.22 ± 0.18 g AEROSOL / CU M

TABLE G-8

SUSPENDED MASS CONCENTRATION AT 10000 SECONDS

CODE	USER	CONCENTRATION (a) (g AEROSOL / CU M)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST (c)
HAA-3B	GE	1.0 (-2) (b)	1.5 (-2)	0.065	0.039
HAA-3C	HEDL / SSD	8.78(-3)	6.36(-3)	0.028	0.017
HAA-4	RI / ESG		2.7 (-3)	0.012	0.007
HAARM-3	HEDL / SSD	4.75(-1)	5.26(-1)	2.28	1.38
HAARM-3	BCL	4.6 (-2)	4.6 (-2)	0.20	0.12
HAARM-3	ORNL	8.62(-3)	2.75(-12)	1.2(-11)	7.2(-12)
QUICK	BCL	2.2 (-1)	2.7 (-1)	1.17	0.71
QUICK	ORNL	1.94 (0)	2.23(-1)	0.97	0.59
MSPEC	BCL	2.4 (-1)	2.3 (-1)	1.00	0.61
MAEROS	HEDL / CSA	6.52(-1)	6.3 (-1)	2.73	1.66
CONTAIN	SNL	6.73(-1)	6.32(-1)	2.74	1.66
AVERAGE		4.27(-1)	2.31(-1)		0.608

(a) EXPRESSED AS g TOTAL AEROSOL PER CU M AT CONTAINMENT CONDITIONS
(b) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(c) TEST AB5 RESULT = 0.38 ± 0.057 g AEROSOL / CU M

TABLE G-9

SUSPENDED MASS CONCENTRATION AT 30000 SECONDS

CODE	USER	CONCENTRATION (g AEROSOL / CU M) [a]		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST [c]
HAA-3B	GE	[b]			
HAA-3C	HEDL / SSD	6.36(-5)	3.28(-5)	5.9 (-4)	7.0 (-4)
HAA-4	RI / ESG				
HAARM-3	HEDL / SSD	1.92(-2)	2.32(-2)	0.42	0.49
HAARM-3	BCL	3.8 (-3)	4.4 (-3)	0.08	0.094
HAARM-3	ORNL	5.34(-5)			
QUICK	BCL	5.0 (-2)	7.7 (-2)	1.39	1.64
QUICK	ORNL	3.07(-1)	4.85(-2)	0.88	1.03
MSPEC	BCL	6.0 (-2)	6.4 (-2)	1.16	1.36
MAEROS	HEDL / CSA	1.06(-1)	1.0 (-1)	1.81	2.13
CONTAIN	SNL	1.21(-1)	1.26(-1)	2.27	2.68
AVERAGE		7.41(-2)	5.54(-2)		1.18

(a) EXPRESSED AS g TOTAL AEROSOL PER CU M AT CONTAINMENT CONDITIONS
(b) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(c) TEST AB5 RESULT = 0.047 ± 0.007 g AEROSOL / CU M

TABLE G-10

SUSPENDED MASS CONCENTRATION AT 100000 SECONDS

CODE	USER	CONCENTRATION (a) (g AEROSOL / CU M)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST (c)
HAA-3B	GE	(b)			
HAA-3C	HEDL / SSD	1.17(-9)	4.44(-10)	9.0 (-8)	1.1 (-7)
HAA-4	RI / ESG				
HAARM-3	HEDL / SSD	1.83(-4)	1.91(-4)	0.039	0.047
HAARM-3	BCL	2.0 (-4)	2.1 (-4)	0.043	0.051
HAARM-3	ORNL	8.36(-9)			
QUICK	BCL	7.0 (-3)	6.1 (-3)	1.24	1.49
QUICK	ORNL	2.06(-2)	6.86(-3)	1.39	1.67
MSPEC	BCL	9.4 (-3)	5.4 (-3)	1.10	1.32
MAEROS	HEDL / CSA	6.66(-3)	6.8 (-3)	1.38	1.66
CONTAIN	SNL	1.14(-2)	1.39(-2)	2.82	3.39
AVERAGE		6.16(-3)	4.93(-3)		1.20

(a) EXPRESSED AS g TOTAL AEROSOL PER CU M AT CONTAINMENT CONDITIONS
(b) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(c) TEST AB5 RESULT = 4.1(-3) ± 6.2(-4) g AEROSOL / CU M

TABLE G-11

SUSPENDED MASS CONCENTRATION AT 400000 SECONDS

CODE	USER	CONCENTRATION (a) (g AEROSOL / CU M)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST (c)
HAA-3B	GE	(b)			
HAA-3C	HEDL / SSD				
HAA-4	RI / ESG				
HAARM-3	HEDL / SSD		3.03(-6)	0.016	0.020
HAARM-3	BCL	6.5 (-7)	6.9 (-7)	0.004	0.0046
HAARM-3	ORNL	2.4(-15)			
QUICK	BCL	3.2 (-4)	3.3 (-4)	1.78	2.20
QUICK	ORNL	1.02(-4)	3.66(-4)	1.98	2.44
MSPEC	BCL	2.9 (-4)	3.2 (-4)	1.73	2.13
MAEROS	HEDL / CSA	1.37(-5)	1.5 (-5)	0.081	0.10
CONTAIN	SNL	1.90(-4)	2.60(-4)	1.41	1.73
AVERAGE		1.31(-4)	1.85(-4)		1.23

(a) EXPRESSED AS g TOTAL AEROSOL PER CU M AT CONTAINMENT CONDITIONS
(b) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(c) TEST AB5 RESULT = 1.5(-4) ± 4(-5) g AEROSOL / CU M (EXTRAPOLATED)

APPENDIX H

CODE COMPARISONS OF AERODYNAMIC MASS MEDIAN DIAMETER

TABLE H-1

AERODYNAMIC MASS MEDIAN DIAMETER AT 100 SECONDS

CODE	USER	AMMD (MICROMETERS)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST (a)
HAA-3B	GE	0.68	0.58	0.43	0.15
HAA-3C	HEDL / SSD	0.69	0.594	0.44	0.15
HAA-4	RI / ESG	1.1	0.72	0.53	0.18
HAARM-3	HEDL / SSD	1.62	1.39	1.03	0.35
HAARM-3	BCL	2.7	1.7	1.26	0.43
HAARM-3	ORNL	1.58	1.64	1.22	0.41
QUICK	BCL	2.4	1.8	1.34	0.45
QUICK	ORNL	1.65	1.92	1.42	0.48
MSPEC	BCL	2.2	1.7	1.26	0.43
MAEROS (b)	HEDL / CSA	3.62	1.44	1.07	0.36
CONTAIN	SNL	1.13	1.34	0.99	0.34
AVERAGE		1.76	1.35		0.338

(a) TEST AB5 CASCADE IMPACTOR DATA: AMMD = 4.0 ± 0.8 MICROMETERS
(b) CALCULATED FROM REPORTED SIZE DISTRIBUTION BY
AMMD = MMD (Sq. ROOT Rho/chi)

TABLE H-2

AERODYNAMIC MASS MEDIAN DIAMETER AT 300 SECONDS

CODE	USER	AMMD (MICROMETERS)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST (a)
HAA-3B	GE	1.70	1.18	0.21	0.16
HAA-3C	HEDL / SSD	1.70	1.19	0.21	0.17
HAA-4	RI / ESG	13.	11.8	2.12	1.64
HAARM-3	HEDL / SSD	2.49	2.09	0.38	0.29
HAARM-3	BCL	19.	17.	3.06	2.36
HAARM-3	ORNL	2.36	7.98	1.44	1.11
QUICK	BCL	3.5	3.2	0.58	0.44
QUICK	ORNL	3.58	3.86	0.69	0.54
MSPEC	BCL	2.5	2.4	0.43	0.33
MAEROS (b)	HEDL / CSA	5.64	4.92	0.88	0.68
CONTAIN	SNL	4.41	5.49	0.99	0.76
AVERAGE		5.44	5.56		0.772

(a) TEST AB5 CASCADE IMPACTOR DATA: AMMD = 7.2 ± 1.4 MICROMETERS
(b) CALCULATED FROM REPORTED SIZE DISTRIBUTION

TABLE H-3

AERODYNAMIC MASS MEDIAN DIAMETER AT 500 SECONDS

CODE	USER	AMMD (MICROMETERS)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST (a)
HAA-3B	GE	11.0	11.0	1.46	1.96
HAA-3C	HEDL / SSD	11.5	12.1	1.61	2.16
HAA-4	RI / ESG	14.	12.4	1.65	2.21
HAARM-3	HEDL / SSD	7.98	3.77	0.50	0.67
HAARM-3	BCL	19.	17.	2.26	3.04
HAARM-3	ORNL	5.24	9.40	1.25	1.68
QUICK	BCL	3.5	3.3	0.44	0.59
QUICK	ORNL	6.33	3.84	0.51	0.69
MSPEC	BCL	2.5	2.4	0.32	0.43
MAEROS	HEDL / CSA	5.42	3.84 (b)	0.51	0.69
CONTAIN	SNL	2.99	3.69	0.49	0.66
AVERAGE		8.13	7.52		1.34

(a) TEST AB5 CASCADE IMPACTOR DATA: AMMD = 5.6 ± 1.1 MICROMETERS
(b) CALCULATED FROM REPORTED SIZE DISTRIBUTION

TABLE H-4

AERODYNAMIC MASS MEDIAN DIAMETER AT 885 SECONDS

CODE	USER	AMMD (MICROMETERS)		RATIO	
		PRETEST [c]	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST [a]
HAA-3B	GE	10.5	10.4	1.27	1.89
HAA-3C	HEDL / SSD	11.1	12.0	1.46	2.18
HAA-4	RI / ESG	14.	12.8	1.56	2.33
HAARM-3	HEDL / SSD	9.70	10.2	1.24	1.85
HAARM-3	BCL	19.	17.	2.07	3.09
HAARM-3	ORNL	7.30	10.5	1.28	1.91
QUICK	BCL	3.5	3.3	0.40	0.60
QUICK	ORNL	5.28	3.84	0.47	0.70
MSPEC	BCL	2.5	2.4	0.29	0.44
MAEROS	HEDL / CSA	5.60	3.97 [b]	0.48	0.72
CONTAIN	SNL		3.77	0.46	0.69
AVERAGE		8.85	8.20		1.49

(a) TEST AB5 CASCADE IMPACTOR DATA: AMMD = 5.5 ± 1.1 MICROMETERS
(b) CALCULATED FROM REPORTED SIZE DISTRIBUTION
(c) PRETEST PREDICTIONS AT 900 SEC (INTENDED END OF SOURCE)

TABLE H-5

AERODYNAMIC MASS MEDIAN DIAMETER AT 1000 SECONDS

CODE	USER	AMMD (MICROMETERS)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST (a)
HAA-3B	GE	26.0	31.5	1.74	2.42
HAA-3C	HEDL / SSD	35.2	37.6	2.08	2.89
HAA-4	RI / ESG	72.	46.	2.54	3.54
HAARM-3	HEDL / SSD	17.4	19.4	1.07	1.49
HAARM-3	BCL	33.	21.	1.16	1.62
HAARM-3	ORNL	14.2	13.9	0.77	1.07
QUICK	BCL	7.3	6.8	0.38	0.52
QUICK	ORNL	7.13	7.08	0.39	0.54
MSPEC	BCL	3.4	3.3	0.18	0.25
MAEROS	HEDL / CSA	7.52	6.17 (b)	0.34	0.47
CONTAIN	SNL	4.96	6.48	0.36	0.50
AVERAGE		20.7	18.1		1.39

(a) TEST AB5 CASCADE IMPACTOR DATA: AMMD = 13 ± 2.6 MICROMETERS
(b) CALCULATED FROM REPORTED SIZE DISTRIBUTION

TABLE H-6

AERODYNAMIC MASS MEDIAN DIAMETER AT 2000 SECONDS

CODE	USER	AMMD (MICROMETERS)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST (a)
HAA-3B	GE	20.5	19.8	1.36	2.11
HAA-3C	HEDL / SSD	20.4	22.3	1.53	2.37
HAA-4	RI / ESG	26.	24.	1.64	2.55
HAARM-3	HEDL / SSD	13.2	13.7	0.94	1.46
HAARM-3	BCL	11.	11.	0.75	1.17
HAARM-3	ORNL	26.0	41.0	2.81	4.36
QUICK	BCL	5.9	5.8	0.40	0.63
QUICK	ORNL	7.70	5.76	0.39	0.61
MSPEC	BCL	3.4	3.4	0.23	0.36
MAEROS	HEDL / CSA	6.58 (b)	6.66 (b)	0.46	0.71
CONTAIN	SNL	4.95	6.71	0.46	0.71
AVERAGE		13.2	14.6		1.55

(a) TEST AB5 CASCADE IMPACTOR DATA: AMMD = 9.4 ± 1.9 MICROMETERS
(b) CALCULATED FROM REPORTED SIZE DISTRIBUTION

TABLE H-7

AERODYNAMIC MASS MEDIAN DIAMETER AT 5000 SECONDS

CODE	USER	AMMD (MICROMETERS)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST (a)
HAA-3B	GE	13.0	12.3	1.22	1.98
HAA-3C	HEDL / SSD	12.8	13.6	1.35	2.19
HAA-4	RI / ESG	17.	14.8	1.47	2.39
HAARM-3	HEDL / SSD	9.63	9.95	0.99	1.60
HAARM-3	BCL	8.5	8.5	0.84	1.37
HAARM-3	ORNL	14.0	28.2	2.79	4.55
QUICK	BCL	4.8	4.7	0.47	0.76
QUICK	ORNL	6.04	4.67	0.46	0.75
MSPEC	BCL	3.3	3.3	0.33	0.53
MAEROS	HEDL / CSA	7.8	5.31 (b)	0.53	0.86
CONTAIN	SNL	3.72	5.29	0.52	0.85
AVERAGE		9.14	10.1		1.63

(a) TEST AB5 CASCADE IMPACTOR DATA: AMMD = 6.2 ± 1.2 MICROMETERS
(b) CALCULATED FROM REPORTED SIZE DISTRIBUTION

TABLE H-8

AERODYNAMIC MASS MEDIAN DIAMETER AT 10000 SECONDS

CODE	USER	AMMD (MICROMETERS)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST (a)
HAA-3B	GE	10.0	9.23	1.15	1.85
HAA-3C	HEDL / SSD	10.2	10.7	1.34	2.1
HAA-4	RI / ESG		11.6	1.45	2.32
HAARM-3	HEDL / SSD	7.32	7.55	0.94	1.5
HAARM-3	BCL	6.7	6.6	0.82	1.32
HAARM-3	ORNL	10.6	22.5	2.81	4.5
QUICK	BCL	4.1	4.1	0.51	0.82
QUICK	ORNL	5.04	3.96	0.49	0.79
MSPEC	BCL	3.2	3.1	0.39	0.62
MAEROS	HEDL / CSA	4.41	4.41 (b)	0.55	0.88
CONTAIN	SNL	2.98	4.37	0.55	0.87
AVERAGE		6.46	8.01		1.60

(a) TEST AB5 CASCADE IMPACTOR DATA: AMMD = 5.0 ± 1.0 MICROMETERS
(b) CALCULATED FROM REPORTED SIZE DISTRIBUTION

TABLE H-9

AERODYNAMIC MASS MEDIAN DIAMETER AT 30000 SECONDS

CODE	USER	AMMD (MICROMETERS)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST (a)
HAA-3B	GE				
HAA-3C	HEDL / SSD	7.55	7.89	1.94	2.32
HAA-4	RI / ESG				
HAARM-3	HEDL / SSD	5.03	5.12	1.26	1.50
HAARM-3	BCL	4.3	4.3	1.06	1.26
HAARM-3	ORNL	7.52			
QUICK	BCL	3.1	2.9	0.71	0.85
QUICK	ORNL	3.71	3.03	0.75	0.89
MSPEC	BCL	2.9	2.9	0.71	0.85
MAEROS	HEDL / CSA	3.18	3.16 (b)	0.78	0.93
CONTAIN	SNL	2.12	3.18	0.78	0.94
AVERAGE		4.38	4.06		1.19

(a) TEST AB5 CASCADE IMPACTOR DATA: AMMD = 3.4 ± 0.68 MICROMETERS
(b) CALCULATED FROM REPORTED SIZE DISTRIBUTION

TABLE H-10

AERODYNAMIC MASS MEDIAN DIAMETER AT 100000 SECONDS

CODE	USER	AMMD (MICROMETERS)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST (a)
HAA-3B	GE				
HAA-3C	HEDL / SSD	5.68	5.88	2.06	2.45
HAA-4	RI / ESG				
HAARM-3	HEDL / SSD				
HAARM-3	BCL	2.8	2.9	1.02	1.21
HAARM-3	ORNL	5.20			
QUICK	BCL	2.3	2.3	0.81	0.96
QUICK	ORNL	2.49	2.19	0.77	0.91
MSPEC	BCL	2.3	2.3	0.81	0.96
MAEROS	HEDL / CSA	2.14	2.18 (b)	0.77	0.91
CONTAIN	SNL	1.45	2.19	0.77	0.91
AVERAGE		3.04	2.85		1.19

(a) TEST AB5 CASCADE IMPACTOR DATA: AMMD = 2.4 ± 0.48 MICROMETERS
(b) CALCULATED FROM REPORTED SIZE DISTRIBUTION

TABLE H-11

AERODYNAMIC MASS MEDIAN DIAMETER AT 400000 SECONDS

CODE	USER	AMMD (MICROMETERS)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST (a)
HAA-3B	GE				
HAA-3C	HEDL / SSD				
HAA-4	RI / ESG				
HAARM-3	HEDL / SSD				
HAARM-3	BCL	1.9	1.9	1.26	1.19
HAARM-3	ORNL	2.96			
QUICK	BCL	1.5	1.4	0.93	0.88
QUICK	ORNL		1.44	0.95	0.90
MSPEC	BCL	1.5	1.5	0.99	0.94
MAEROS	HEDL / CSA	1.45	1.41 (b)	0.93	0.88
CONTAIN	SNL	0.917	1.40	0.93	0.88
AVERAGE		1.70	1.51		0.944

(a) TEST AB5 CASCADE IMPACTOR DATA: AMMD = 1.6 ± 0.3 MICROMETERS
(b) CALCULATED FROM REPORTED SIZE DISTRIBUTION

APPENDIX I

CODE COMPARISONS OF GEOMETRIC STANDARD DEVIATION

TABLE I-1

GEOMETRIC STANDARD DEVIATION AT 100 SECONDS

CODE	USER	GEOMETRIC STD. DEVIATION [a]		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST [c]
HAA-3B	GE	1.5 (0) [b]	1.48 (0)	0.94	0.51
HAA-3C	HEDL / SSD	1.52 (0)	1.63 (0)	1.04	0.56
HAA-4	RI / ESG	1.9 (0)	1.5 (0)	0.96	0.52
HAARM-3	HEDL / SSD	1.52 (0)	1.48 (0)	0.94	0.51
HAARM-3	BCL	2.1 (0)	1.7 (0)	1.08	0.59
HAARM-3	ORNL	1.51 (0)	1.66 (0)	1.06	0.57
QUICK	BCL	1.9 (0)	1.7 (0)	1.08	0.59
QUICK	ORNL	1.57 (0)	1.72 (0)	1.10	0.59
MSPEC	BCL	1.8 (0)	1.6 (0)	1.02	0.55
MAEROS	HEDL / CSA [d]	1.74 (0)	1.41 (0)	0.90	0.49
CONTAIN	SNL [d]	1.52 (0)	1.42 (0)	0.90	0.49
AVERAGE		1.96 (0)	1.57 (0)		0.54

(a) DETERMINED FROM PLOTTING SIZE DISTRIBUTION ON LOG-NORMAL PAPER WHEN NOT REPORTED BY CODE USER
(b) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(c) TEST AB5 RESULT IS SIGMA = 2.9 ± 0.44 FROM CASCADE IMPACTOR DATA
(d) CALCULATED FROM REPORTED SIZE DISTRIBUTION

TABLE I-2

GEOMETRIC STANDARD DEVIATION AT 300 SECONDS

CODE	USER	GEOMETRIC STD. DEVIATION [a]		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST [c]
HAA-3B	GE	1.9 (0) [b]	1.80 (0)	1.56	0.51
HAA-3C	HEDL / SSD	2.00 (0)	1.78 (0)	0.56	0.51
HAA-4	RI / ESG	3.6 (0)	3.5 (0)	1.10	0.99
HAARM-3	HEDL / SSD	1.85 (0)	1.74 (0)	0.55	0.49
HAARM-3	BCL	3.6 (0)	3.5 (0)	1.10	0.99
HAARM-3	ORNL	1.79 (0)	2.81 (0)	0.88	0.79
QUICK	BCL	4.7 (0)	4.5 (0)	1.41	1.27
QUICK	ORNL	1.95 (0)	3.86 (0)	1.21	1.09
MSPEC	BCL	3.7 (0)	3.6 (0)	1.13	1.01
MAEROS	HEDL / CSA [d]	3.56 (0)	2.87 (0)	0.90	0.81
CONTAIN	SNL [d]	6.29 (0)	5.18 (0)	1.62	1.46
AVERAGE		3.18 (0)	3.19 (0)		0.899

(a) DETERMINED FROM PLOTTING SIZE DISTRIBUTION ON LOG-NORMAL PAPER WHEN NOT REPORTED BY CODE USER
(b) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(c) TEST AB5 RESULT IS SIGMA = 3.55 ± 0.53 FROM CASCADE IMPACTOR DATA
(d) CALCULATED FROM REPORTED SIZE DISTRIBUTION

TABLE I-3

GEOMETRIC STANDARD DEVIATION AT 500 SECONDS

CODE	USER	GEOMETRIC STD. DEVIATION [a]		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST [c]
HAA-3B	GE	3.35 (0) [b]	3.36 (0)	0.91	1.10
HAA-3C	HEDL / SSD	3.37 (0)	3.38 (0)	0.91	1.11
HAA-4	RI / ESG	3.6 (0)	3.5 (0)	0.94	1.15
HAARM-3	HEDL / SSD	2.73 (0)	2.19 (0)	0.59	0.72
HAARM-3	BCL	3.6 (0)	3.5 (0)	0.94	1.15
HAARM-3	ORNL	2.39 (0)	2.84 (0)	0.77	0.93
QUICK	BCL	4.7 (0)	4.6 (0)	1.24	1.51
QUICK	ORNL	3.54 (0)	3.84 (0)	1.04	1.26
MSPEC	BCL	3.6 (0)	3.6 (0)	0.97	1.18
MAEROS	HEDL / CSA [d]	3.47 (0)	3.97 (0)	1.07	1.30
CONTAIN	SNL [d]	5.79 (0)	6.07 (0)	1.64	1.99
AVERAGE		3.65 (0)	3.71 (0)		1.22

(a) DETERMINED FROM PLOTTING SIZE DISTRIBUTION ON LOG-NORMAL PAPER WHEN NOT REPORTED BY CODE USER
(b) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(c) TEST AB5 RESULT IS SIGMA = 3.05 ± 0.46 FROM CASCADE IMPACTOR DATA
(d) CALCULATED FROM REPORTED SIZE DISTRIBUTION

TABLE I-4

GEOMETRIC STANDARD DEVIATION AT 885 SECONDS

CODE	USER	GEOMETRIC STD. DEVIATION[a]		RATIO	
		PRETEST[e]	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST[c]
HAA-3B	GE	3.35 (0)[b]	3.34 (0)	0.88	1.11
HAA-3C	HEDL / SSD	3.36 (0)	3.35 (0)	0.89	1.12
HAA-4	RI / ESG	3.6 (0)	3.5 (0)	0.93	1.17
HAARM-3	HEDL / SSD	2.84 (0)	2.85 (0)	0.75	0.95
HAARM-3	BCL	3.6 (0)	3.5 (0)	0.93	1.17
HAARM-3	ORNL	2.53 (0)	2.86 (0)	0.76	0.95
QUICK	BCL	4.7 (0)	4.6 (0)	1.22	1.53
QUICK	ORNL	3.38 (0)	3.84 (0)	1.02	1.28
MSPEC	BCL	3.6 (0)	3.6 (0)	0.95	1.20
MAEROS	HEDL / CSA[d]	3.62 (0)	3.92 (0)	1.04	1.31
CONTAIN	SNL[d]		6.21 (0)	1.64	2.07
AVERAGE		3.46 (0)	3.78 (0)		1.26

(a) DETERMINED FROM PLOTTING SIZE DISTRIBUTION ON LOG-NORMAL PAPER WHEN NOT REPORTED BY CODE USER
(b) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(c) TEST AB5 RESULT IS SIGMA = 3.0 $\pm$ 0.45 FROM CASCADE IMPACTOR DATA
(d) CALCULATED FROM REPORTED SIZE DISTRIBUTION
(e) PRETEST PREDICTIONS AT 900 SEC (INTENDED END OF SOURCE)

TABLE I-5

GEOMETRIC STANDARD DEVIATION AT 1000 SECONDS

CODE	USER	GEOMETRIC STD. DEVIATION [(a)]		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST [(c)]
HAA-3B	GE	2.62 (0) [(b)]	2.60 (0)	0.78	0.74
HAA-3C	HEDL / SSD	2.61 (0)	2.63 (0)	0.79	0.75
HAA-4	RI / ESG	2.4 (0)	2.6 (0)	0.78	0.74
HAARM-3	HEDL / SSD	2.73 (0)	2.75 (0)	0.83	0.79
HAARM-3	BCL	3.1 (0)	3.0 (0)	0.90	0.86
HAARM-3	ORNL	2.40 (0)	1.63 (0)	0.49	0.47
QUICK	BCL	4.4 (0)	4.4 (0)	1.32	1.26
QUICK	ORNL	3.09 (0)	4.50 (0)	1.35	1.29
MSPEC	BCL	3.8 (0)	3.8 (0)	1.14	1.09
MAEROS	HEDL / CSA [(d)]	3.27 (0)	3.48 (0)	1.05	0.99
CONTAIN	SNL [(d)]	5.36 (0)	5.20 (0)	1.56	1.48
AVERAGE		3.25 (0)	3.33 (0)		0.95

(a) DETERMINED FROM PLOTTING SIZE DISTRIBUTION ON LOG-NORMAL PAPER WHEN NOT REPORTED BY CODE USER
(b) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(c) TEST ABS RESULT IS SIGMA = 3.5 ± 0.53 FROM CASCADE IMPACTOR DATA
(d) CALCULATED FROM REPORTED SIZE DISTRIBUTION

TABLE I-6

GEOMETRIC STANDARD DEVIATION AT 2000 SECONDS

CODE	USER	GEOMETRIC STD. DEVIATION (a)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST (c)
HAA-3B	GE	1.50 (0) (b)	1.54 (0)	0.68	0.47
HAA-3C	HEDL / SSD	1.50 (0)	1.50 (0)	0.66	0.45
HAA-4	RI / ESG	1.4 (0)	1.5 (0)	0.66	0.45
HAARM-3	HEDL / SSD	2.05 (0)	2.09 (0)	0.92	0.63
HAARM-3	BCL	2.2 (0)	2.2 (0)	0.97	0.67
HAARM-3	ORNL	1.56 (0)	1.19 (0)	0.53	0.36
QUICK	BCL	2.9 (0)	2.9 (0)	1.28	0.88
QUICK	ORNL	2.36 (0)	2.86 (0)	1.27	0.87
MSPEC	BCL	2.8 (0)	2.8 (0)	1.24	0.85
MAEROS	HEDL / CSA (d)	3.08 (0)	2.92 (0)	1.29	0.88
CONTAIN	SNL (d)	2.90 (0)	3.33 (0)	1.47	1.01
AVERAGE		2.20 (0)	2.26 (0)		0.68

(a) DETERMINED FROM PLOTTING SIZE DISTRIBUTION ON LOG-NORMAL PAPER WHEN NOT REPORTED BY CODE USER
(b) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(c) TEST AB5 RESULT IS SIGMA = 3.3 ± 0.50 FROM CASCADE IMPACTOR DATA
(d) CALCULATED FROM REPORTED SIZE DISTRIBUTION

TABLE I-7

GEOMETRIC STANDARD DEVIATION AT 5000 SECONDS

CODE	USER	GEOMETRIC STD. DEVIATION [a]		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST [c]
HAA-3B	GE	1.35 (0) [b]	1.33 (0)	0.73	0.52
HAA-3C	HEDL / SSD	1.32 (0)	1.31 (0)	0.72	0.51
HAA-4	RI / ESG	1.24 (0)	1.3 (0)	0.71	0.51
HAARM-3	HEDL / SSD	1.65 (0)	1.67 (0)	0.92	0.65
HAARM-3	BCL	1.8 (0)	1.8 (0)	0.99	0.71
HAARM-3	ORNL	1.52 (0)	1.13 (0)	0.62	0.44
QUICK	BCL	2.2 (0)	2.3 (0)	1.26	0.90
QUICK	ORNL	1.91 (0)	2.29 (0)	1.26	0.90
MSPEC	BCL	2.2 (0)	2.2 (0)	1.21	0.86
MAEROS	HEDL / CSA [d]	2.11 (0)	2.25 (0)	1.24	0.88
CONTAIN	SNL [d]	2.19 (0)	2.41 (0)	1.32	0.95
AVERAGE		1.77 (0)	1.82 (0)		0.71

(a) DETERMINED FROM PLOTTING SIZE DISTRIBUTION ON LOG-NORMAL PAPER WHEN NOT REPORTED BY CODE USER
(b) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(c) TEST ABS RESULT IS SIGMA = 2.55 ± 0.38 FROM CASCADE IMPACTOR DATA
(d) CALCULATED FROM REPORTED SIZE DISTRIBUTION

TABLE I-8

GEOMETRIC STANDARD DEVIATION AT 10000 SECONDS

CODE	USER	GEOMETRIC STD. DEVIATION [a]		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST [c]
HAA-3B	GE	1.25 (0) [b]	1.25 (0)	0.77	0.57
HAA-3C	HEDL / SSD	1.24 (0)	1.24 (0)	0.77	0.56
HAA-4	RI / ESG		1.23 (0)	0.76	0.56
HAARM-3	HEDL / SSD	1.48 (0)	1.49 (0)	0.92	0.68
HAARM-3	BCL	1.6 (0)	1.6 (0)	0.99	0.73
HAARM-3	ORNL	1.24 (0)	1.12 (0)	0.69	0.51
QUICK	BCL	2.0 (0)	2.0 (0)	1.23	0.91
QUICK	ORNL	1.70 (0)	2.02 (0)	1.25	0.92
MSPEC	BCL	2.0 (0)	1.9 (0)	1.17	0.86
MAEROS	HEDL / CSA [d]	1.84 (0)	1.86 (0)	1.15	0.85
CONTAIN	SNL [d]	1.89 (0)	2.15 (0)	1.33	0.98
AVERAGE		1.62 (0)	1.62 (0)		0.736

(a) DETERMINED FROM PLOTTING SIZE DISTRIBUTION ON LOG-NORMAL PAPER WHEN NOT REPORTED BY CODE USER
(b) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(c) TEST AB5 RESULT IS SIGMA = 2.2 ± 0.33 FROM CASCADE IMPACTOR DATA
(d) CALCULATED FROM REPORTED SIZE DISTRIBUTION

TABLE I-9

GEOMETRIC STANDARD DEVIATION AT 30000 SECONDS

CODE	USER	GEOMETRIC STD. DEVIATION [a]		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST [c]
HAA-3B	GE	[b]			
HAA-3C	HEDL / SSD	1.17 (0)	1.17 (0)	0.77	0.59
HAA-4	RI / ESG				
HAARM-3	HEDL / SSD	1.30 (0)	1.31 (0)	0.86	0.66
HAARM-3	BCL	1.4 (0)	1.4 (0)	0.92	0.71
HAARM-3	ORNL	1.18 (0)			
QUICK	BCL	1.7 (0)	1.7 (0)	1.12	0.86
QUICK	ORNL	1.49 (0)	1.70 (0)	1.12	0.86
MSPEC	BCL	1.7 (0)	1.7 (0)	1.12	0.86
MAEROS	HEDL / CSA [d]	1.59 (0)	1.55 (0)	1.02	0.79
CONTAIN	SNL [d]	1.54 (0)	1.63 (0)	1.07	0.83
AVERAGE		1.45 (0)	1.52 (0)		0.772

(a) DETERMINED FROM PLOTTING SIZE DISTRIBUTION ON LOG-NORMAL PAPER WHEN NOT REPORTED BY CODE USER
(b) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(c) TEST AB5 RESULT IS SIGMA = 1.97 ± 0.30 FROM CASCADE IMPACTOR DATA
(d) CALCULATED FROM REPORTED SIZE DISTRIBUTION

TABLE I-10

GEOMETRIC STANDARD DEVIATION AT 100000 SECONDS

CODE	USER	GEOMETRIC STD. DEVIATION [a]		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST [c]
HAA-3B	GE	[b]			
HAA-3C	HEDL / SSD	1.12 (0)	1.12 (0)	0.82	0.62
HAA-4	RI / ESG				
HAARM-3	HEDL / SSD				
HAARM-3	BCL	1.2 (0)	1.3 (0)	0.96	0.72
HAARM-3	ORNL	1.15 (0)			
QUICK	BCL	1.5 (0)	1.5 (0)	1.10	0.83
QUICK	ORNL	1.35 (0)	1.49 (0)	1.10	0.83
MSPEC	BCL	1.5 (0)	1.4 (0)	1.03	0.78
MAEROS	HEDL / CSA [d]	1.34 (0)	1.32 (0)	0.97	0.73
CONTAIN	SNL [d]	1.36 (0)	1.40 (0)	1.03	0.78
AVERAGE		1.32 (0)	1.36 (0)		0.756

(a) DETERMINED FROM PLOTTING SIZE DISTRIBUTION ON LOG-NORMAL PAPER WHEN NOT REPORTED BY CODE USER

(b) NUMBER IN PARENTHESIS IS EXPONENT OF 10

(c) TEST AB5 RESULT IS SIGMA = 1.8 ± 0.27 FROM CASCADE IMPACTOR DATA

(d) CALCULATED FROM REPORTED SIZE DISTRIBUTION

TABLE I-11

GEOMETRIC STANDARD DEVIATION AT 400000 SECONDS

CODE	USER	GEOMETRIC STD. DEVIATION (a)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST (c)
HAA-3B	GE	(b)			
HAA-3C	HEDL / SSD				
HAA-4	RI / ESG				
HAARM-3	HEDL / SSD				
HAARM-3	BCL	1.2 (0)	1.2 (0)	0.92	0.71
HAARM-3	ORNL	1.16 (0)			
QUICK	BCL	1.3 (0)	1.4 (0)	1.08	0.82
QUICK	ORNL		1.38 (0)	1.06	0.81
MSPEC	BCL	1.3 (0)	1.3 (0)	1.00	0.76
MAEROS	HEDL / CSA (d)	1.21 (0)	1.26 (0)	0.97	0.74
CONTAIN	SNL (d)	1.20 (0)	1.25 (0)	0.96	0.74
AVERAGE		1.23 (0)	1.30 (0)		0.764

(a) DETERMINED FROM PLOTTING SIZE DISTRIBUTION ON LOG-NORMAL PAPER WHEN NOT REPORTED BY CODE USER
(b) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(c) TEST AB5 RESULT IS SIGMA = 1.7 $\pm$ 0.25 FROM CASCADE IMPACTOR DATA
(d) CALCULATED FROM REPORTED SIZE DISTRIBUTION

APPENDIX J

CODE COMPARISONS OF AERODYNAMIC SETTLING MEAN DIAMETER

TABLE J-1

AERODYNAMIC SETTLING MEAN DIAMETER AT 100 SECONDS

CODE	USER	AERO. SETTLING MEAN DIAM (MICROMETERS)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST (b)
HAA-3B	GE	0.82 (a)	0.676 (a)	0.42	
HAA-3C	HEDL / SSD	0.82 (a)	0.754 (a)	0.47	
HAA-4	RI / ESG	1.7	0.86	0.54	
HAARM-3	HEDL / SSD	1.93 (a)	1.62 (a)	1.01	
HAARM-3	BCL		2.81 (c)	1.76	
HAARM-3	ORNL	1.62			
QUICK	BCL		2.32 (c)	1.45	
QUICK	ORNL				
MSPEC	BCL		2.15 (c)	1.34	
MAEROS	HEDL / CSA				
CONTAIN	SNL	1.38	1.60	1.00	
AVERAGE		1.38	1.60		

(a) CALCULATED BY ASMD = AMMD EXP(ln SIGMA SQUARED).
(b) TEST AB5 RESULT IS INSUFFICIENTLY ACCURATE
(c) CALCULATED FROM REPORTED FRACTIONAL SETTLING RATE

TABLE J-2

AERODYNAMIC SETTLING MEAN DIAMETER AT 300 SECONDS

CODE	USER	AERO. SETTLING MEAN DIAM (MICROMETERS)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST (b)
HAA-3B	GE	2.3 (a)	1.67 (a)	0.058	0.064
HAA-3C	HEDL / SSD	2.75 (a)	1.66 (a)	0.057	0.064
HAA-4	RI / ESG	44.	38.	1.32	1.46
HAARM-3	HEDL / SSD	3.64 (a)	2.84 (a)	0.098	0.11
HAARM-3	BCL		58.9 (c)	2.04	2.27
HAARM-3	ORNL	3.33			
QUICK	BCL		48.1 (c)	1.67	1.85
QUICK	ORNL				
MSPEC	BCL		47.6 (c)	1.65	1.83
MAEROS	HEDL / CSA				
CONTAIN	SNL	35.1	32.3	1.12	1.24
AVERAGE		13.9	28.9		1.11

(a) CALCULATED BY ASMD = AMMD EXP(ln SIGMA SQUARED)
(b) TEST AB5 RESULT IS 26 ± 4.0 MICROMETERS
(c) CALCULATED FROM REPORTED FRACTIONAL SETTLING RATE

TABLE J-3

AERODYNAMIC SETTLING MEAN DIAMETER AT 500 SECONDS

CODE	USER	AERO. SETTLING MEAN DIAM (MICROMETERS)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST (b)
HAA-3B	GE	25. (a)	47.8 (a)	1.11	0.96
HAA-3C	HEDL / SSD	50.3 (a)	53.3 (a)	1.24	1.07
HAA-4	RI / ESG	46.	41.	0.95	0.82
HAARM-3	HEDL / SSD	21.9 (a)	6.97 (a)	0.16	0.14
HAARM-3	BCL		61. (c)	1.41	1.22
HAARM-3	ORNL	10.0			
QUICK	BCL		49. (c)	1.14	0.98
QUICK	ORNL				
MSPEC	BCL		49. (c)	1.14	0.98
MAEROS	HEDL / CSA				
CONTAIN	SNL	24.9	36.9	0.86	0.74
AVERAGE		29.7	43.1		0.862

(a) CALCULATED BY ASMD = AMMD EXP(ln SIGMA SQUARED)
(b) TEST AB5 RESULT IS 50 ± 7.5 MICROMETERS
(c) CALCULATED FROM REPORTED FRACTIONAL SETTLING RATE

TABLE J-4

AERODYNAMIC SETTLING MEAN DIAMETER AT 885 SECONDS

CODE	USER	AERO. SETTLING MEAN DIAM (MICROMETERS)		RATIO	
		PRETEST [d]	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST [b]
HAA-3B	GE	24. [a]	44.5 [a]	0.96	0.89
HAA-3C	HEDL / SSD	48.2 [a]	51.7 [a]	1.11	1.03
HAA-4	RI / ESG	47.	42.	0.91	0.84
HAARM-3	HEDL / SSD	28.8 [a]	30.5 [a]	0.66	0.61
HAARM-3	BCL		61. [c]	1.31	1.22
HAARM-3	ORNL	14.7			
QUICK	BCL		50. [c]	1.08	1.00
QUICK	ORNL				
MSPEC	BCL		53. [c]	1.14	1.06
MAEROS	HEDL / CSA				
CONTAIN	SNL		38.4	0.83	0.77
AVERAGE		32.5	46.4		0.928

(a) CALCULATED BY ASMD = AMMD EXP(ln SIGMA SQUARED)
(b) TEST ABS RESULT IS 50 ± 7.5 MICROMETERS
(c) CALCULATED FROM REPORTED FRACTIONAL SETTLING RATE
(d) PRETEST PREDICTIONS AT 900 SEC (INTENDED END OF SOURCE)

TABLE J-5

AERODYNAMIC SETTLING MEAN DIAMETER AT 1000 SECONDS

CODE	USER	AERO. SETTLING MEAN DIAM (MICROMETERS)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST (b)
HAA-3B	GE	40. (a)	78.5 (a)	1.20	1.67
HAA-3C	HEDL / SSD	88.3 (a)	95.8 (a)	1.47	2.03
HAA-4	RI / ESG	100.	78.1	1.20	1.66
HAARM-3	HEDL / SSD	47.7 (a)	54. (a)	0.83	1.15
HAARM-3	BCL		57.6 (c)	1.88	1.23
HAARM-3	ORNL	27.4			
QUICK	BCL		58.9 (c)	0.90	1.25
QUICK	ORNL				
MSPEC	BCL		57.2 (c)	0.88	1.22
MAEROS	HEDL / CSA				
CONTAIN	SNL	25.6	41.7	0.64	0.89
AVERAGE		54.8	65.2		1.39

(a) CALCULATED BY ASMD = AMMD EXP(ln SIGMA SQUARED)
(b) TEST AB5 RESULT IS 47 ± 7.0 MICROMETERS
(c) CALCULATED FROM REPORTED FRACTIONAL SETTLING RATE

TABLE J-6

AERODYNAMIC SETTLING MEAN DIAMETER AT 2000 SECONDS

CODE	USER	AERO. SETTLING MEAN DIAM (MICROMETERS)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST (b)
HAA-3B	GE	33. (a)	23.9 (a)	1.04	1.20
HAA-3C	HEDL / SSD	24. (a)	26.3 (a)	1.14	1.31
HAA-4	RI / ESG	27.	26.	1.13	1.30
HAARM-3	HEDL / SSD	22.1 (a)	23.6 (a)	1.02	1.18
HAARM-3	BCL		19.8 (c)	0.86	0.99
HAARM-3	ORNL	33.2			
QUICK	BCL		27.3 (c)	1.18	1.37
QUICK	ORNL				
MSPEC	BCL		19.4 (c)	0.84	0.97
MAEROS	HEDL / CSA				
CONTAIN	SNL	11.5	18.3	0.79	0.92
AVERAGE		25.1	23.1		1.16

(a) CALCULATED BY ASMD = AMMD EXP(ln SIGMA SQUARED)
(b) TEST ABS RESULT IS 20 ± 3.0 MICROMETERS
(c) CALCULATED FROM REPORTED FRACTIONAL SETTLING RATE

TABLE J-7

AERODYNAMIC SETTLING MEAN DIAMETER AT 5000 SECONDS

CODE	USER	AERO. SETTLING MEAN DIAM (MICROMETERS)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST (b)
HAA-3B	GE	18.5 (a)	13.3 (a)	1.02	1.21
HAA-3C	HEDL / SSD	13.8 (a)	14.7 (a)	1.12	1.34
HAA-4	RI / ESG	17.	15.	1.15	1.36
HAARM-3	HEDL / SSD	12.4 (a)	12.9 (a)	0.98	1.17
HAARM-3	BCL				
HAARM-3	ORNL				
QUICK	BCL		15.7 (c)	1.20	1.43
QUICK	ORNL				
MSPEC	BCL		10.3 (c)	0.79	0.94
MAEROS	HEDL / CSA				
CONTAIN	SNL	6.18	9.79	0.75	0.89
AVERAGE		13.5	13.1		1.19

(a) CALCULATED BY ASMD = AMMD EXP(ln SIGMA SQUARED)
(b) TEST AB5 RESULT IS 11 ± 1.7 MICROMETERS
(c) CALCULATED FROM REPORTED FRACTIONAL SETTLING RATE

TABLE J-8

AERODYNAMIC SETTLING MEAN DIAMETER AT 10000 SECONDS

CODE	USER	AERO. SETTLING MEAN DIAM (MICROMETERS)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST (b)
HAA-3B	GE	14. (a)	9.70 (a)	1.04	1.24
HAA-3C	HEDL / SSD	10.7 (a)	11.2 (a)	1.21	1.44
HAA-4	RI / ESG		12.	1.29	1.54
HAARM-3	HEDL / SSD	8.54 (a)	8.85 (a)	0.95	1.13
HAARM-3	BCL				
HAARM-3	ORNL	14.5			
QUICK	BCL				
QUICK	ORNL				
MSPEC	BCL		7.2 (c)	0.78	0.92
MAEROS	HEDL / CSA				
CONTAIN	SNL	4.30	6.78	0.73	0.87
AVERAGE		10.4	9.29		1.19

(a) CALCULATED BY ASMD = AMMD EXP(ln SIGMA SQUARED)
(b) TEST AB5 RESULT IS 7.8 ± 1.2 MICROMETERS
(c) CALCULATED FROM REPORTED FRACTIONAL SETTLING RATE

TABLE J-9

AERODYNAMIC SETTLING MEAN DIAMETER AT 30000 SECONDS

CODE	USER	AERO. SETTLING MEAN DIAM (MICROMETERS)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST (b)
HAA-3B	GE				
HAA-3C	HEDL / SSD	7.74 (a)	8.09 (a)	1.45	1.72
HAA-4	RI / ESG				
HAARM-3	HEDL / SSD	5.39 (a)	5.51 (a)	0.98	1.17
HAARM-3	BCL				
HAARM-3	ORNL				
QUICK	BCL				
QUICK	ORNL				
MSPEC	BCL		4.7 (c)	0.84	1.00
MAEROS	HEDL / CSA				
CONTAIN	SNL	2.61	4.09	0.73	0.87
AVERAGE		5.24	5.60		1.19

(a) CALCULATED BY ASMD = AMMD EXP(ln SIGMA SQUARED)
(b) TEST AB5 RESULT IS 4.7 ± 0.70 MICROMETERS
(c) CALCULATED FROM REPORTED FRACTIONAL SETTLING RATE

TABLE J-10

AERODYNAMIC SETTLING MEAN DIAMETER AT 100000 SECONDS

CODE	USER	AERO. SETTLING MEAN DIAM (MICROMETERS)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST (b)
HAA-3B	GE				
HAA-3C	HEDL / SSD	5.75 (a)	5.96 (a)	1.63	2.13
HAA-4	RI / ESG				
HAARM-3	HEDL / SSD				
HAARM-3	BCL				
HAARM-3	ORNL				
QUICK	BCL				
QUICK	ORNL				
MSPEC	BCL		2.5 (c)	0.68	0.89
MAEROS	HEDL / CSA				
CONTAIN	SNL	1.61	2.52	0.69	0.90
AVERAGE		3.68	3.66		1.31

(a) CALCULATED BY ASMD = AMMD EXP(ln SIGMA SQUARED)
(b) TEST AB5 RESULT IS 2.8 ± 0.42 MICROMETERS
(c) CALCULATED FROM REPORTED FRACTIONAL SETTLING RATE

TABLE J-11

AERODYNAMIC SETTLING MEAN DIAMETER AT 400000 SECONDS

CODE	USER	AERO. SETTLING MEAN DIAM (MICROMETERS)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST (b)
HAA-3B	GE				
HAA-3C	HEDL / SSD				
HAA-4	RI / ESG				
HAARM-3	HEDL / SSD				
HAARM-3	BCL				
HAARM-3	ORNL				
QUICK	BCL				
QUICK	ORNL				
MSPEC	BCL		1.53 (a)	1.00	1.02
MAEROS	HEDL / CSA				
CONTAIN	SNL	0.965	1.54	1.00	1.03
AVERAGE		0.965	1.54		1.02

(a) CALCULATED FROM REPORTED FRACTIONAL SETTLING RATE
(b) TEST AB5 RESULT IS 1.5 ± 0.22 MICROMETERS

APPENDIX K

CODE COMPARISONS OF LEAKED MASS

TABLE K-1

LEAKED MASS AT 100 SECONDS

CODE	USER	LEAKED MASS (g AEROSOL) [a]		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST [c]
HAA-3B	GE	3.2 (-1) [b]	2.19(-1)	1.12	1.10
HAA-3C	HEDL / SSD	3.3 (-1)	2.06(-1)	1.06	1.03
HAA-4	RI / ESG	3.3 (-1)	1.9 (-1)	0.97	0.95
HAARM-3	HEDL / SSD	3.45(-1)	1.98(-1)	1.02	0.99
HAARM-3	BCL	3.6 (-1)	1.8 (-1)	0.92	0.90
HAARM-3	ORNL	3.32(-1)	1.95(-1)	1.00	0.98
QUICK	BCL	3.3 (-1)	1.9 (-1)	0.97	0.95
QUICK	ORNL	3.4 (-1)	2.0 (-1)	1.03	1.00
MSPEC	BCL	3.3 (-1)	1.8 (-1)	0.92	0.90
MAEROS	HEDL / CSA				
CONTAIN	SNL	3.34(-1)	1.95(-1)	1.00	0.98
AVERAGE		3.35(-1)	1.95(-1)		0.98

(a) ASSUMING AEROSOL LEAKS AT CONSTANT 1% PER DAY
(b) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(c) TEST AB5 RESULT = 0.20 ± 0.060 g AEROSOL

TABLE K-2

LEAKED MASS AT 300 SECONDS

CODE	USER	LEAKED MASS (g AEROSOL) [a]		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST [c]
HAA-3B	GE	3.0 (0) [b]	2.09 (0)	1.17	1.04
HAA-3C	HEDL / SSD	2.95 (0)	1.79 (0)	1.00	0.89
HAA-4	RI / ESG	2.5 (0)	2.1 (0)	1.17	1.05
HAARM-3	HEDL / SSD	2.97 (0)	2.09 (0)	1.17	1.04
HAARM-3	BCL	1.9 (0)	1.4 (0)	0.78	0.70
HAARM-3	ORNL	2.95 (0)	2.04 (0)	1.14	1.01
QUICK	BCL	1.9 (0)	1.4 (0)	0.78	0.70
QUICK	ORNL	2.93 (0)	1.6 (0)	0.89	0.80
MSPEC	BCL	1.6 (0)	1.3 (0)	0.73	0.65
MAEROS	HEDL / CSA				
CONTAIN	SNL	2.84 (0)	2.06 (0)	1.15	1.02
AVERAGE		2.55 (0)	1.79 (0)		0.90

(a) ASSUMING AEROSOL LEAKS AT CONSTANT 1% PER DAY
(b) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(c) TEST AB5 RESULT = 2.0 ± 0.030 g AEROSOL

TABLE K-3

LEAKED MASS AT 500 SECONDS

CODE	USER	LEAKED MASS [a] (g AEROSOL)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST [c]
HAA-3B	GE	7.3 (0) [b]	5.71 (0)	1.34	1.14
HAA-3C	HEDL / SSD	7.26 (0)	5.86 (0)	1.37	1.18
HAA-4	RI / ESG	5.3 (0)	4.7 (0)	1.10	0.94
HAARM-3	HEDL / SSD	8.18 (0)	5.99 (0)	1.40	1.20
HAARM-3	BCL	3.4 (0)	2.5 (0)	0.59	0.50
HAARM-3	ORNL	8.10 (0)	5.34 (0)	1.25	1.07
QUICK	BCL	3.4 (0)	2.7 (0)	0.63	0.54
QUICK	ORNL	7.71 (0)	3.1 (0)	0.73	0.62
MSPEC	BCL	3.0 (0)	2.3 (0)	0.54	0.46
MAEROS	HEDL / CSA				
CONTAIN	SNL	5.84 (0)	4.33 (0)	1.01	0.87
AVERAGE		5.95 (0)	4.27 (0)		0.854

(a) ASSUMING AEROSOL LEAKS AT CONSTANT 1% PER DAY
(b) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(c) TEST AB5 RESULT = 5.0 ± 0.75 g AEROSOL

TABLE K-4

LEAKED MASS AT 885 SECONDS

CODE	USER	LEAKED MASS [a] (g AEROSOL)		RATIO	
		PRETEST [d]	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST [c]
HAA-3B	GE	1.55 (1) [b]	1.25 (1)	1.30	1.31
HAA-3C	HEDL / SSD	1.53 (1)	1.38 (1)	1.43	1.45
HAA-4	RI / ESG	1.12 (1)	1.03 (1)	1.07	1.08
HAARM-3	HEDL / SSD	2.16 (1)	1.76 (1)	1.82	1.85
HAARM-3	BCL	5.8 (0)	5.1 (0)	0.53	0.54
HAARM-3	ORNL	2.47 (1)	1.38 (1)	1.43	1.45
QUICK	BCL	6.3 (0)	5.1 (0)	0.53	0.54
QUICK	ORNL	1.76 (1)	5.9 (0)	0.61	0.62
MSPEC	BCL	5.4 (0)	4.4 (0)	0.46	0.46
MAEROS	HEDL / CSA				
CONTAIN	SNL		8.67 (0)	0.90	0.91
AVERAGE		1.37 (1)	9.65 (0)		1.02

(a) ASSUMING AEROSOL LEAKS AT CONSTANT 1% PER DAY
(b) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(c) TEST AB5 RESULT = 9.5 ± 1.4 g AEROSOL
(d) PRETEST PREDICTIONS AT 900 S (INTENDED END OF SOURCE)

TABLE K-5

LEAKED MASS AT 1000 SECONDS

CODE	USER	LEAKED MASS (g AEROSOL) (a)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST (c)
HAA-3B	GE	1.75 (1) (b)	1.39 (1)	1.28	1.46
HAA-3C	HEDL / SSD	1.68 (1)	1.55 (1)	1.42	1.48
HAA-4	RI / ESG	1.21 (1)	1.15 (1)	1.06	1.10
HAARM-3	HEDL / SSD	2.46 (1)	2.10 (1)	1.93	2.21
HAARM-3	BCL	6.1 (0)	5.5 (0)	0.50	0.52
HAARM-3	ORNL	2.94 (1)	1.52 (1)	1.39	1.60
QUICK	BCL	6.7 (0)	5.6 (0)	0.51	0.53
QUICK	ORNL	1.97 (1)	6.5 (0)	0.60	0.68
MSPEC	BCL	5.9 (0)	4.8 (0)	0.44	0.46
MAEROS	HEDL / CSA				
CONTAIN	SNL	1.28 (1)	9.67 (0)	0.89	1.02
AVERAGE		1.52 (1)	1.09 (1)		1.05

(a) ASSUMING AEROSOL LEAKS AT CONSTANT 1% PER DAY
(b) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(c) TEST AB5 RESULT = 10.5 ± 1.6 g AEROSOL

TABLE K-6

LEAKED MASS AT 2000 SECONDS

CODE	USER	LEAKED MASS (g AEROSOL) (a)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST (c)
HAA-3B	GE	1.8 (1) (b)	1.49 (1)	1.19	1.16
HAA-3C	HEDL / SSD	1.78 (1)	1.67 (1)	1.34	1.30
HAA-4	RI / ESG	1.24 (1)	1.20 (1)	0.96	0.94
HAARM-3	HEDL / SSD	3.23 (1)	2.89 (1)	2.31	2.26
HAARM-3	BCL	7.2 (0)	6.0 (0)	0.48	0.47
HAARM-3	ORNL	3.96 (1)	1.53 (1)	1.22	1.20
QUICK	BCL	7.4 (0)	6.3 (0)	0.50	0.49
QUICK	ORNL	2.63 (1)	7.2 (0)	0.58	0.56
MSPEC	BCL	6.4 (0)	5.4 (0)	0.43	0.43
MAEROS	HEDL / CSA				
CONTAIN	SNL	1.53 (1)	1.16 (1)	0.93	0.91
AVERAGE		1.82 (1)	1.25 (1)		0.977

(a) ASSUMING AEROSOL LEAKS AT CONSTANT 1% PER DAY
(b) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(c) TEST AB5 RESULT = 12.8 ± 1.9 g AEROSOL

TABLE K-7

LEAKED MASS AT 5000 SECONDS

CODE	USER	LEAKED MASS (g AEROSOL) [a]		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST [c]
HAA-3B	GE	1.8 (1) [b]	1.50 (1)	1.15	1.10
HAA-3C	HEDL / SSD	1.78 (1)	1.68 (1)	1.29	1.24
HAA-4	RI / ESG	1.24 (1)	1.20 (1)	0.92	0.88
HAARM-3	HEDL / SSD	3.46 (1)	3.15 (1)	2.42	2.32
HAARM-3	BCL	7.5 (0)	6.2 (0)	0.48	0.46
HAARM-3	ORNL	3.98 (1)	1.53 (1)	1.18	1.12
QUICK	BCL	7.9 (0)	6.7 (0)	0.52	0.49
QUICK	ORNL	2.96 (1)	7.6 (0)	0.58	0.56
MSPEC	BCL	6.9 (0)	5.7 (0)	0.44	0.42
MAEROS	HEDL / CSA				
CONTAIN	SNL	1.64 (1)	1.26 (1)	0.97	0.93
AVERAGE		1.91 (1)	1.30 (1)		0.955

(a) ASSUMING AEROSOL LEAKS AT CONSTANT 1% PER DAY
(b) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(c) TEST AB5 RESULT = 13.6 ± 2.0 g AEROSOL

TABLE K-8

LEAKED MASS AT 10000 SECONDS

CODE	USER	LEAKED MASS (g AEROSOL) [a]		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST [c]
HAA-3B	GE	1.8 (1) [b]	1.50 (1)	1.14	1.08
HAA-3C	HEDL / SSD	1.79 (1)	1.68 (1)	1.27	1.21
HAA-4	RI / ESG	1.24 (1)	1.20 (1)	0.91	0.86
HAARM-3	HEDL / SSD	3.52 (1)	3.21 (1)	2.43	2.31
HAARM-3	BCL	7.5 (0)	6.2 (0)	0.47	0.45
HAARM-3	ORNL	3.98 (1)	1.53 (1)	1.16	1.10
QUICK	BCL	8.0 (0)	6.9 (0)	0.52	0.50
QUICK	ORNL	3.12 (1)	7.7 (0)	0.58	0.55
MSPEC	BCL	7.0 (0)	5.9 (0)	0.45	0.42
MAEROS	HEDL / CSA				
CONTAIN	SNL	1.70 (1)	1.31 (1)	0.99	0.94
AVERAGE		1.94 (1)	1.32 (1)		0.950

(a) ASSUMING AEROSOL LEAKS AT CONSTANT 1% PER DAY
(b) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(c) TEST AB5 RESULT = 13.9 ± 2.1 g AEROSOL

TABLE K-9

LEAKED MASS AT 30000 SECONDS

CODE	USER	LEAKED MASS (a) (g AEROSOL)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST (c)
HAA-3B	GE	1.8 (1) (b)	1.50 (1)	1.13	1.06
HAA-3C	HEDL / SSD	1.79 (1)	1.68 (1)	1.26	1.18
HAA-4	RI / ESG	1.24 (1)	1.20 (1)	0.90	0.85
HAARM-3	HEDL / SSD	3.54 (1)	3.23 (1)	2.43	2.27
HAARM-3	BCL	7.5 (0)	6.2 (0)	0.47	0.44
HAARM-3	ORNL	3.99 (1)	1.53 (1)	1.15	1.08
QUICK	BCL	8.4 (0)	7.1 (0)	0.53	0.50
QUICK	ORNL	3.28 (1)	7.9 (0)	0.59	0.56
MSPEC	BCL	7.2 (0)	6.1 (0)	0.46	0.43
MAEROS	HEDL / CSA				
CONTAIN	SNL	1.75 (1)	1.36 (1)	1.02	0.96
AVERAGE		1.97 (1)	1.33 (1)		0.937

(a) ASSUMING AEROSOL LEAKS AT CONSTANT 1% PER DAY
(b) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(c) TEST AB5 RESULT = 14.2 ± 2.1 g AEROSOL

TABLE K-10

LEAKED MASS AT 100000 SECONDS

CODE	USER	LEAKED MASS (g AEROSOL) [a]		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST [c]
HAA-3B	GE	1.8 (1) [b]	1.50 (1)	1.12	1.05
HAA-3C	HEDL / SSD	1.79 (1)	1.68 (1)	1.25	1.17
HAA-4	RI / ESG	1.24 (1)	1.20 (1)	0.90	0.84
HAARM-3	HEDL / SSD	3.54 (1)	3.24 (1)	2.42	2.27
HAARM-3	BCL	7.5 (0)	6.2 (0)	0.46	0.43
HAARM-3	ORNL	3.99 (1)	1.53 (1)	1.14	1.07
QUICK	BCL	8.4 (0)	7.2 (0)	0.54	0.51
QUICK	ORNL	3.35 (1)	8.1 (0)	0.60	0.57
MSPEC	BCL	7.5 (0)	6.3 (0)	0.47	0.44
MAEROS	HEDL / CSA				
CONTAIN	SNL	1.78 (1)	1.39 (1)	1.04	0.97
AVERAGE		1.98 (1)	1.34 (1)		0.937

(a) ASSUMING AEROSOL LEAKS AT CONSTANT 1% PER DAY
(b) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(c) TEST AB5 RESULT = 14.3 ± 2.1 g AEROSOL

TABLE K-11

LEAKED MASS AT 400000 SECONDS

CODE	USER	LEAKED MASS (g AEROSOL) (a)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST (c)
HAA-3B	GE	1.8 (1) (b)	1.50 (1)	1.12	1.05
HAA-3C	HEDL / SSD	1.79 (1)	1.68 (1)	1.25	1.17
HAA-4	RI / ESG	1.24 (1)	1.20 (1)	0.90	0.84
HAARM-3	HEDL / SSD	3.54 (1)	3.24 (1)	2.42	2.26
HAARM-3	BCL	7.5 (0)	6.2 (0)	0.46	0.43
HAARM-3	ORNL	3.99 (1)	1.53 (1)	1.14	1.07
QUICK	BCL	8.4 (0)	7.3 (0)	0.54	0.51
QUICK	ORNL	3.36 (1)	8.1 (0)	0.60	0.56
MSPEC	BCL	7.5 (0)	6.4 (0)	0.48	0.45
MAEROS	HEDL / CSA				
CONTAIN	SNL	1.78 (1)	1.40 (1)	1.04	0.98
AVERAGE		1.98 (1)	1.34 (1)		0.937

(a) ASSUMING AEROSOL LEAKS AT CONSTANT 1% PER DAY
(b) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(c) TEST AB5 RESULT = 14.3 ± 2.1 g AEROSOL

A P P E N D I X L

CODE COMPARISONS OF SETTLED MASS

TABLE L-1

SETTLED MASS AT 100 SECONDS

CODE	USER	SETTLED MASS (g AEROSOL)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST (b)
HAA-3B	GE	4.3 (0) (a)	2.59 (0)	0.26	
HAA-3C	HEDL / SSD	5.0 (0)	2.06 (0)	0.21	
HAA-4	RI / ESG	7.4 (0)	2.0 (0)	0.20	
HAARM-3	HEDL / SSD	2.40 (1)	9.84 (0)	0.99	
HAARM-3	BCL	6.4 (1)	1.7 (1)	1.71	
HAARM-3	ORNL	1.79 (1)	1.29 (1)	1.29	
QUICK	BCL	3.4 (1)	1.1 (1)	1.10	
QUICK	ORNL	2.63 (1)	1.54 (1)	1.55	
MSPEC	BCL	~ 0	1.1 (1)	1.10	
MAEROS	HEDL / CSA		1.62 (1)	1.63	
CONTAIN	SNL		9.64 (0)	0.97	
AVERAGE		2.03 (1)	9.97 (0)		

(a) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(b) TEST AB5 RESULT IS NOT MEASURED

TABLE L-2

SETTLED MASS AT 300 SECONDS

CODE	USER	SETTLED MASS (g AEROSOL)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST (b)
HAA-3B	GE	1.7 (2) (a)	7.78 (1)	0.004	
HAA-3C	HEDL / SSD	1.85 (2)	6.74 (1)	0.003	
HAA-4	RI / ESG	5.1 (4)	1.5 (4)	0.70	
HAARM-3	HEDL / SSD	5.78 (2)	2.30 (2)	0.011	
HAARM-3	BCL	1.0 (5)	5.7 (4)	2.67	
HAARM-3	ORNL	3.60 (2)	1.17 (4)	0.55	
QUICK	BCL	6.2 (4)	3.4 (4)	1.59	
QUICK	ORNL	9.71 (2)	6.62 (4)	3.10	
MSPEC	BCL	6.3 (4)	3.6 (4)	1.69	
MAEROS	HEDL / CSA		9.5 (3)	0.44	
CONTAIN	SNL		5.31 (3)	0.25	
AVERAGE		3.09 (4)	2.14 (4)		

(a) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(b) TEST AB5 RESULT IS NOT MEASURED

TABLE L-3

SETTLED MASS AT 500 SECONDS

CODE	USER	SETTLED MASS (g AEROSOL)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST [b]
HAA-3B	GE	1.00 (5) [a]	5.22 (4)	0.64	
HAA-3C	HEDL / SSD	1.03 (5)	2.82 (4)	0.35	
HAA-4	RI / ESG	1.5 (5)	9.1 (4)	1.12	
HAARM-3	HEDL / SSD	1.73 (4)	1.73 (3)	0.02	
HAARM-3	BCL	2.1 (5)	1.3 (5)	1.59	
HAARM-3	ORNL	4.21 (3)	5.14 (4)	0.63	
QUICK	BCL	1.3 (5)	8.5 (4)	1.04	
QUICK	ORNL	3.40 (4)	1.57 (5)	1.92	
MSPEC	BCL	1.2 (5)	8.0 (4)	0.98	
MAEROS	HEDL / CSA		1.1 (5)	1.35	
CONTAIN	SNL		1.11 (5)	1.36	
AVERAGE		9.69 (4)	8.16 (4)		

(a) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(b) TEST AB5 RESULT IS NOT MEASURED

TABLE L-4

SETTLED MASS AT 885 SECONDS

CODE	USER	SETTLED MASS (g AEROSOL)		RATIO	
		PRETEST (c)	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST (b)
HAA-3B	GE	3.4 (5) (a)	2.35 (5)	1.04	
HAA-3C	HEDL / SSD	3.43 (5)	2.07 (5)	0.92	
HAA-4	RI / ESG	3.6 (5)	2.5 (5)	1.11	
HAARM-3	HEDL / SSD	2.10 (5)	9.33 (4)	0.41	
HAARM-3	BCL	4.3 (5)	2.8 (5)	1.24	
HAARM-3	ORNL	7.34 (4)	1.82 (5)	0.81	
QUICK	BCL	2.7 (5)	1.8 (5)	0.80	
QUICK	ORNL	2.52 (5)	3.32 (5)	1.48	
MSPEC	BCL	2.5 (5)	1.6 (5)	0.71	
MAEROS	HEDL / CSA		2.8 (5)	1.24	
CONTAIN	SNL		2.74 (5)	1.22	
AVERAGE		2.81 (5)	2.25 (5)		

(a) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(b) TEST AB5 RESULT IS NOT MEASURED
(c) PRETEST PREDICTIONS AT 900 SEC (INTENDED END OF SOURCE)

TABLE L-5

SETTLED MASS AT 1000 SECONDS

CODE	USER	SETTLED MASS (g AEROSOL)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST (b)
HAA-3B	GE	4.4 (5)(a)	3.15 (5)	1.08	
HAA-3C	HEDL / SSD	4.35 (5)	2.96 (5)	1.01	
HAA-4	RI / ESG	4.5 (5)	3.3 (5)	1.13	
HAARM-3	HEDL / SSD	2.98 (5)	1.72 (5)	0.59	
HAARM-3	BCL	4.6 (5)	3.2 (5)	1.09	
HAARM-3	ORNL	1.26 (5)	3.86 (5)	1.32	
QUICK	BCL	3.0 (5)	2.1 (5)	0.72	
QUICK	ORNL	3.02 (5)	3.72 (5)	1.27	
MSPEC	BCL	2.7 (5)	1.8 (5)	0.61	
MAEROS	HEDL / CSA		3.2 (5)	1.09	
CONTAIN	SNL		3.16 (5)	1.08	
AVERAGE		3.42 (5)	2.93 (5)		

(a) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(b) TEST AB5 RESULT IS NOT MEASURED

TABLE L-6

SETTLED MASS AT 2000 SECONDS

CODE	USER	SETTLED MASS (g AEROSOL)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST [(b)]
HAA-3B	GE	5.1 (5) [(a)]	3.81 (5)	1.11	
HAA-3C	HEDL / SSD	5.13 (5)	3.80 (5)	1.10	
HAA-4	RI / ESG	4.8 (5)	3.8 (5)	1.10	
HAARM-3	HEDL / SSD	4.90 (5)	3.57 (5)	1.04	
HAARM-3	BCL	4.9 (5)	3.3 (5)	0.96	
HAARM-3	ORNL	4.99 (5)	3.87 (5)	1.13	
QUICK	BCL	3.3 (5)	2.35 (5)	0.68	
QUICK	ORNL	4.27 (5)	3.95 (5)	1.15	
MSPEC	BCL	2.8 (5)	2.0 (5)	0.58	
MAEROS	HEDL / CSA		3.7 (5)	1.08	
CONTAIN	SNL		3.65 (5)	1.06	
AVERAGE		4.47 (5)	2.44 (5)		

(a) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(b) TEST ABS RESULT IS NOT MEASURED

TABLE L-7

SETTLED MASS AT 5000 SECONDS

CODE	USER	SETTLED MASS (g AEROSOL)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST (b)
HAA-3B	GE	5.1 (5) (a)	3.82 (5)	1.10	
HAA-3C	HEDL / SSD	5.14 (5)	3.81 (5)	1.09	
HAA-4	RI / ESG	4.8 (5)	3.8 (5)	1.09	
HAARM-3	HEDL / SSD	5.09 (5)	3.77 (5)	1.08	
HAARM-3	BCL	4.9 (5)	3.4 (5)	0.98	
HAARM-3	ORNL	5.02 (5)	3.87 (5)	1.11	
QUICK	BCL	3.3 (5)	2.35 (5)	0.68	
QUICK	ORNL	4.44 (5)	3.96 (5)	1.14	
MSPEC	BCL	2.8 (5)	2.0 (5)	0.57	
MAEROS	HEDL / CSA		3.8 (5)	1.09	
CONTAIN	SNL		3.70 (5)	1.06	
AVERAGE		4.51 (5)	3.48 (5)		

(a) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(b) TEST AB5 RESULT IS NOT MEASURED

TABLE L-8

SETTLED MASS AT 10000 SECONDS

CODE	USER	SETTLED MASS (g AEROSOL)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST [b]
HAA-3B	GE	5.15 (5)[a]	3.82 (5)	1.10	1.00
HAA-3C	HEDL / SSD	5.14 (5)	3.81 (5)	1.09	1.00
HAA-4	RI / ESG	4.8 (5)	3.8 (5)	1.09	0.99
HAARM-3	HEDL / SSD	5.11 (5)	3.79 (5)	1.09	0.99
HAARM-3	BCL	4.9 (5)	3.4 (5)	0.98	0.89
HAARM-3	ORNL	5.02 (5)	3.87 (5)	1.11	1.01
QUICK	BCL	3.3 (5)	2.35 (5)	0.68	0.62
QUICK	ORNL	4.47 (5)	3.97 (5)	1.14	1.04
MSPEC	BCL	2.8 (5)	2.0 (5)	0.57	0.52
MAEROS	HEDL / CSA		3.8 (5)	1.09	0.99
CONTAIN	SNL		3.71 (5)	1.07	0.97
AVERAGE		4.53 (5)	3.48 (5)		0.911

(a) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(b) TEST ABS RESULT IS 3.82(5) ± 3.8(4) g AEROSOL, OR 2.20(5) ± 2.2(4) g SODIUM

TABLE L-9

SETTLED MASS AT 30000 SECONDS

CODE	USER	SETTLED MASS (g AEROSOL)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST (b)
HAA-3B	GE	5.15 (5) (a)	3.82 (5)	1.10	1.00
HAA-3C	HEDL / SSD	5.14 (5)	3.81 (5)	1.09	0.997
HAA-4	RI / ESG	4.8 (5)	3.8 (5)	1.09	0.995
HAARM-3	HEDL / SSD	5.11 (5)	3.79 (5)	1.09	0.992
HAARM-3	BCL	4.9 (5)	3.4 (5)	0.98	0.89
HAARM-3	ORNL	5.02 (5)	3.87 (5)	1.11	1.013
QUICK	BCL	3.3 (5)	2.35 (5)	0.68	0.615
QUICK	ORNL	4.49 (5)	3.97 (5)	1.14	1.039
MSPEC	BCL	2.8 (5)	2.0 (5)	0.57	0.524
MAEROS	HEDL / CSA		3.8 (5)	1.09	0.995
CONTAIN	SNL		3.71 (5)	1.07	0.971
AVERAGE		4.53 (5)	3.48 (5)		0.912

(a) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(b) TEST AB5 RESULT IS 3.82(5) ± 3.8(4) g AEROSOL, OR 2.20(5) ± 2.2(4) g SODIUM

TABLE L-10

SETTLED MASS AT 100000 SECONDS

CODE	USER	SETTLED MASS (g AEROSOL)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST (b)
HAA-3B	GE	5.15 (5) (a)	3.82 (5)	1.10	1.00
HAA-3C	HEDL / SSD	5.14 (5)	3.81 (5)	1.09	0.997
HAA-4	RI / ESG	4.8 (5)	3.8 (5)	1.09	0.995
HAARM-3	HEDL / SSD	5.11 (5)	3.79 (5)	1.09	0.992
HAARM-3	BCL	4.9 (5)	3.4 (5)	0.98	0.89
HAARM-3	ORNL	5.02 (5)	3.87 (5)	1.11	1.013
QUICK	BCL	3.3 (5)	2.35 (5)	0.68	0.615
QUICK	ORNL	4.49 (5)	3.97 (5)	1.14	1.039
MSPEC	BCL	2.8 (5)	2.0 (5)	0.57	0.524
MAEROS	HEDL / CSA		3.8 (5)	1.09	0.995
CONTAIN	SNL		3.71 (5)	1.07	0.971
AVERAGE		4.53 (5)	3.48 (5)		0.912

(a) NUMBER IN PARENTHESIS IS EXPONENT OF 10

(b) TEST AB5 RESULT IS 3.82(5) ± 3.8(4) g AEROSOL, OR 2.20(5) ± 2.2(4) g SODIUM

TABLE L-11

SETTLED MASS AT 400000 SECONDS

CODE	USER	SETTLED MASS (g AEROSOL)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST (b)
HAA-3B	GE	5.15 (5) (a)	3.82 (5)	1.10	1.00
HAA-3C	HEDL / SSD	5.14 (5)	3.81 (5)	1.09	0.997
HAA-4	RI / ESG	4.8 (5)	3.8 (5)	1.09	0.995
HAARM-3	HEDL / SSD	5.11 (5)	3.79 (5)	1.09	0.992
HAARM-3	BCL	4.9 (5)	3.4 (5)	0.98	0.89
HAARM-3	ORNL	5.02 (5)	3.87 (5)	1.11	1.013
QUICK	BCL	3.3 (5)	2.35 (5)	0.68	0.615
QUICK	ORNL	4.49 (5)	3.97 (5)	1.14	1.039
MSPEC	BCL	2.8 (5)	2.0 (5)	0.57	0.524
MAEROS	HEDL / CSA		3.8 (5)	1.09	0.995
CONTAIN	SNL		3.71 (5)	1.07	0.971
AVERAGE		4.53 (5)	3.48 (5)		0.912

(a) NUMBER IN PARENTHESIS IS EXPONENT OF 10

(b) TEST AB5 RESULT IS 3.82(5) ± 3.8(4) g AEROSOL, OR 2.20(5) ± 2.2(4) g SODIUM

APPENDIX M

CODE COMPARISONS OF PLATED MASS

TABLE M-1

PLATED MASS AT 100 SECONDS

CODE	USER	PLATED MASS (g AEROSOL)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST (b)
HAA-3B	GE	7.0 (2) (a)	4.75 (2)	0.51	
HAA-3C	HEDL / SSD	8.0 (2)	4.93 (2)	0.53	
HAA-4	RI / ESG	1.2 (3)	2.4 (2)	0.26	
HAARM-3	HEDL / SSD	8.02 (2)	4.98 (2)	0.53	
HAARM-3	BCL	1.3 (3)	6.9 (2)	0.74	
HAARM-3	ORNL	5.75 (2)	9.98 (0)	0.01	
QUICK	BCL	7.3 (3)	4.0 (3)	4.27	
QUICK	ORNL	1.50 (3)	4.41 (1)	0.05	
MSPEC	BCL	7.2 (3)	3.3 (3)	3.52	
MAEROS	HEDL / CSA	1.16 (1)	1.19 (1)	0.01	
CONTAIN	SNL		5.43 (2)	0.58	
AVERAGE		2.14 (3)	9.37 (2)		

(a) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(b) TEST AB5 RESULT IS NOT MEASURED

TABLE M-2

PLATED MASS AT 300 SECONDS

CODE	USER	PLATED MASS (g AEROSOL)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST (b)
HAA-3B	GE	3.8 (3)[(a)]	2.82 (3)	0.28	
HAA-3C	HEDL / SSD	3.8 (3)	3.15 (3)	0.32	
HAA-4	RI / ESG	7.8 (3)	2.9 (3)	0.29	
HAARM-3	HEDL / SSD	3.34 (3)	2.64 (3)	0.26	
HAARM-3	BCL	7.4 (3)	5.8 (3)	0.58	
HAARM-3	ORNL	4.61 (3)	1.45 (2)	0.01	
QUICK	BCL	5.0 (4)	4.1 (4)	4.11	
QUICK	ORNL	1.46 (4)	7.50 (1)	0.01	
MSPEC	BCL	6.4 (4)	4.7 (4)	4.71	
MAEROS	HEDL / CSA	8.97 (2)	2.0 (2)	0.02	
CONTAIN	SNL		4.45 (3)	0.45	
AVERAGE		1.60 (4)	9.98 (3)		

(a) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(b) TEST AB5 RESULT IS NOT MEASURED

TABLE M-3

PLATED MASS AT 500 SECONDS

CODE	USER	PLATED MASS (g AEROSOL)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST [b]
HAA-3B	GE	4.9 (3)[a]	4.22 (3)	0.21	
HAA-3C	HEDL / SSD	4.9 (3)	5.46 (3)	0.28	
HAA-4	RI / ESG	1.6 (4)	6.0 (3)	0.30	
HAARM-3	HEDL / SSD	5.29 (3)	4.73 (3)	0.24	
HAARM-3	BCL	1.4 (4)	1.1 (4)	0.56	
HAARM-3	ORNL	8.99 (3)	4.66 (2)	0.02	
QUICK	BCL	9.7 (4)	8.1 (4)	4.11	
QUICK	ORNL	3.44 (4)	1.21 (2)	0.01	
MSPEC	BCL	1.5 (5)	9.4 (4)	4.77	
MAEROS	HEDL / CSA	1.81 (3)	1.5 (3)	0.08	
CONTAIN	SNL		8.72 (3)	0.44	
AVERAGE		3.37 (4)	1.97 (4)		

(a) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(b) TEST AB5 RESULT IS NOT MEASURED

TABLE M-4

PLATED MASS AT 885 SECONDS

CODE	USER	PLATED MASS (g AEROSOL)		RATIO	
		PRETEST [c]	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST [b]
HAA-3B	GE	6.3 (3) [a]	5.61 (3)	0.15	
HAA-3C	HEDL / SSD	6.4 (3)	7.01 (3)	0.18	
HAA-4	RI / ESG	3.3 (4)	1.2 (4)	0.31	
HAARM-3	HEDL / SSD	7.86 (3)	7.20 (3)	0.19	
HAARM-3	BCL	2.7 (4)	2.1 (4)	0.55	
HAARM-3	ORNL	1.63 (4)	1.12 (3)	0.03	
QUICK	BCL	1.9 (5)	1.6 (5)	4.19	
QUICK	ORNL	7.37 (4)	2.72 (2)	0.01	
MSPEC	BCL	2.3 (5)	1.85 (5)	4.84	
MAEROS	HEDL / CSA	3.68 (3)	3.7 (3)	0.10	
CONTAIN	SNL		1.70 (4)	0.45	
AVERAGE		5.94 (4)	3.82 (4)		

(a) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(b) TEST AB5 RESULT IS NOT MEASURED
(c) PRETEST PREDICTIONS AT 900 SEC (INTENDED END OF SOURCE)

TABLE M-5

PLATED MASS AT 1000 SECONDS

CODE	USER	PLATED MASS (g AEROSOL)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST (b)
HAA-3B	GE	6.4 (3) (a)	5.73 (3)	0.15	
HAA-3C	HEDL / SSD	6.64 (3)	7.26 (3)	0.19	
HAA-4	RI / ESG	3.5 (4)	1.3 (4)	0.33	
HAARM-3	HEDL / SSD	8.43 (3)	7.76 (3)	0.20	
HAARM-3	BCL	2.7 (4)	2.2 (4)	0.57	
HAARM-3	ORNL	1.75 (4)	1.17 (3)	0.03	
QUICK	BCL	2.0 (5)	1.6 (5)	4.11	
QUICK	ORNL	8.04 (4)	2.94 (2)	0.01	
MSPEC	BCL	2.4 (5)	1.9 (5)	4.88	
MAEROS	HEDL / CSA	4.01 (3)	4.1 (3)	0.11	
CONTAIN	SNL		1.70 (4)	0.44	
AVERAGE		6.25 (4)	3.89 (4)		

(a) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(b) TEST ABS RESULT IS NOT MEASURED

TABLE M-6

PLATED MASS AT 2000 SECONDS

CODE	USER	PLATED MASS (g AEROSOL)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST [b]
HAA-3B	GE	6.4 (3) [a]	5.76 (3)	0.15	
HAA-3C	HEDL / SSD	6.70 (3)	7.32 (3)	0.19	
HAA-4	RI / ESG	3.5 (4)	1.3 (4)	0.33	
HAARM-3	HEDL / SSD	9.60 (3)	8.76 (3)	0.22	
HAARM-3	BCL	2.7 (4)	2.2 (4)	0.56	
HAARM-3	ORNL	1.82 (4)	1.17 (3)	0.03	
QUICK	BCL	2.0 (5)	1.6 (5)	4.09	
QUICK	ORNL	9.25 (4)	3.15 (2)	0.01	
MSPEC	BCL	2.4 (5)	1.9 (5)	4.86	
MAEROS	HEDL / CSA	4.28 (3)	4.5 (3)	0.12	
CONTAIN	SNL		1.70 (4)	0.44	
AVERAGE		6.40 (4)	3.91 (4)		

(a) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(b) TEST AB5 RESULT IS NOT MEASURED

TABLE M-7

PLATED MASS AT 5000 SECONDS

CODE	USER	PLATED MASS (g AEROSOL)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST (b)
HAA-3B	GE	6.4 (3)[a]	5.77 (3)	0.15	
HAA-3C	HEDL / SSD	6.70 (3)	7.32 (3)	0.19	
HAA-4	RI / ESG	3.5 (4)	1.3 (4)	0.33	
HAARM-3	HEDL / SSD	1.00 (4)	9.09 (3)	0.23	
HAARM-3	BCL	2.7 (4)	2.2 (4)	0.56	
HAARM-3	ORNL	1.83 (4)	1.17 (3)	0.03	
QUICK	BCL	2.0 (5)	1.6 (5)	4.09	
QUICK	ORNL	9.32 (4)	3.17 (2)	0.01	
MSPEC	BCL	2.4 (5)	1.9 (5)	4.86	
MAEROS	HEDL / CSA	4.33 (3)	4.5 (3)	0.12	
CONTAIN	SNL		1.70 (4)	0.43	
AVERAGE		6.41 (4)	3.91 (4)		

(a) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(b) TEST ABS RESULT IS NOT MEASURED

TABLE M-8

PLATED MASS AT 10000 SECONDS

CODE	USER	PLATED MASS (g AEROSOL)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST (b)
HAA-3B	GE	6.4 (3) (a)	5.77 (3)	0.15	
HAA-3C	HEDL / SSD	6.70 (3)	7.32 (3)	0.19	
HAA-4	RI / ESG	3.5 (4)	1.3 (4)	0.33	
HAARM-3	HEDL / SSD	1.01 (4)	9.21 (3)	0.24	
HAARM-3	BCL	2.7 (4)	2.2 (4)	0.56	
HAARM-3	ORNL	1.83 (4)	1.17 (3)	0.03	
QUICK	BCL	2.0 (5)	1.6 (5)	4.09	
QUICK	ORNL	9.32 (4)	3.17 (2)	0.01	
MSPEC	BCL	2.4 (5)	1.9 (5)	4.86	
MAEROS	HEDL / CSA	4.34 (3)	4.5 (3)	0.12	
CONTAIN	SNL		1.70 (4)	0.43	
AVERAGE		6.41 (4)	3.91 (4)		

(a) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(b) TEST AB5 RESULT IS NOT MEASURED

TABLE M-9

PLATED MASS AT 30000 SECONDS

CODE	USER	PLATED MASS (g AEROSOL)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST (b)
HAA-3B	GE	6.4 (3) (a)	5.77 (3)	0.15	
HAA-3C	HEDL / SSD	6.70 (3)	7.33 (3)	0.19	
HAA-4	RI / ESG	3.5 (4)	1.3 (4)	0.33	
HAARM-3	HEDL / SSD	1.02 (4)	9.27 (3)	0.24	
HAARM-3	BCL	2.7 (4)	2.2 (4)	0.56	
HAARM-3	ORNL	1.83 (4)	1.17 (3)	0.03	
QUICK	BCL	2.0 (5)	1.6 (5)	4.09	
QUICK	ORNL	9.32 (4)	3.17 (2)	0.01	
MSPEC	BCL	2.4 (5)	1.9 (5)	4.86	
MAEROS	HEDL / CSA	4.36 (3)	4.5 (3)	0.12	
CONTAIN	SNL		1.70 (4)	0.43	
AVERAGE		6.41 (4)	3.91 (4)		

(a) NUMBER IN PARENTHESIS IS EXPONENT OF 10.
(b) TEST AB5 RESULT IS NOT MEASURED

TABLE M-10

PLATED MASS AT 100000 SECONDS

CODE	USER	PLATED MASS (g AEROSOL)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST (b)
HAA-3B	GE	6.4 (3) (a)	5.77 (3)	0.15	
HAA-3C	HEDL / SSD	6.70 (3)	7.33 (3)	0.19	
HAA-4	RI / ESG	3.5 (4)	1.3 (4)	0.33	
HAARM-3	HEDL / SSD	1.02 (4)	9.27 (3)	0.24	
HAARM-3	BCL	2.7 (4)	2.2 (4)	0.56	
HAARM-3	ORNL	1.83 (4)	1.17 (3)	0.03	
QUICK	BCL	2.0 (5)	1.6 (5)	4.09	
QUICK	ORNL	9.32 (4)	3.17 (2)	0.01	
MSPEC	BCL	2.4 (5)	1.9 (5)	4.86	
MAEROS	HEDL / CSA	4.36 (3)	4.5 (3)	0.12	
CONTAIN	SNL		1.70 (4)	0.43	
AVERAGE		6.41 (4)	3.91 (4)		

(a) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(b) TEST AB5 RESULT IS NOT MEASURED

TABLE M-11

PLATED MASS AT 400000 SECONDS

CODE	USER	PLATED MASS (g AEROSOL)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST (b)
HAA-3B	GE	6.4 (3) (a)	5.77 (3)	0.15	0.32
HAA-3C	HEDL / SSD	6.70 (3)	7.33 (3)	0.19	0.40
HAA-4	RI / ESG	3.5 (4)	1.3 (4)	0.33	0.71
HAARM-3	HEDL / SSD	1.02 (4)	9.27 (3)	0.24	0.51
HAARM-3	BCL	2.7 (4)	2.2 (4)	0.56	1.20
HAARM-3	ORNL	1.83 (4)	1.17 (3)	0.03	0.064
QUICK	BCL	2.0 (5)	1.6 (5)	4.09	8.74
QUICK	ORNL	9.32 (4)	3.17 (2)	0.01	0.017
MSPEC	BCL	2.4 (5)	1.9 (5)	4.86	10.4
MAEROS	HEDL / CSA	4.37 (3)	4.5 (3)	0.12	0.25
CONTAIN	SNL		1.70 (4)	0.43	0.93
AVERAGE		6.41 (4)	3.91 (4)		2.14

(a) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(b) TEST ABS RESULT IS 1.83(4) ± 3.7(3) g AEROSOL

A P P E N D I X   N

CODE COMPARISONS OF INSTANTANEOUS REMOVAL RATE

TABLE N-1

REMOVAL RATE AT 100 SECONDS

CODE	USER	REMOVAL RATE [c] (FRACTION PER SEC)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST [a]
HAA-3B	GE	[b]			
HAA-3C	HEDL / SSD	1.75(-4)	2.09(-4)	0.21	
HAA-4	RI / ESG	4.39(-4)	1.9 (-4)	0.19	
HAARM-3	HEDL / SSD	2.28(-4)	2.70(-4)	0.27	
HAARM-3	BCL	6.70(-4)	1.6 (-3)	1.63	
HAARM-3	ORNL	2.38(-4)	3.49(-4)	0.35	
QUICK	BCL	3.28(-3)	3.1 (-3)	3.15	
QUICK	ORNL	6.25(-4)	2.71(-5)	0.028	
MSPEC	BCL	3.5 (-3)	2.8 (-3)	2.85	
MAEROS	HEDL / CSA				
CONTAIN	SNL	1.65(-5)	3.09(-4)	0.31	
AVERAGE		1.03(-3)	9.84(-4)		

(a) TEST AB5 RESULT IS INSUFFICIENTLY ACCURATE
(b) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(c) COMBINED INSTANTANEOUS REMOVAL OF SUSPENDED AEROSOL

TABLE N-2

REMOVAL RATE AT 300 SECONDS

CODE	USER	REMOVAL RATE [c] (FRACTION PER SEC)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST [a]
HAA-3B	GE	[b]			
HAA-3C	HEDL / SSD	1.15(-4)	1.28(-4)	0.028	0.098
HAA-4	RI / ESG	4.10(-3)	3.3 (-3)	0.72	2.54
HAARM-3	HEDL / SSD	1.16(-4)	1.19(-4)	0.026	0.092
HAARM-3	BCL	9.10(-3)	8.1 (-3)	1.77	6.2
HAARM-3	ORNL	1.68(-4)	1.15(-3)	0.25	0.885
QUICK	BCL	8.98(-3)	8.5 (-3)	1.85	6.5
QUICK	ORNL	6.29(-4)	7.07(-3)	1.54	5.44
MSPEC	BCL	1.05(-2)	9.6 (-3)	2.09	7.4
MAEROS	HEDL / CSA				
CONTAIN	SNL	9.24(-3)	3.28(-3)	0.72	2.52
AVERAGE		4.77(-3)	4.58(-3)		3.52

(a) TEST ABS RESULT = 1.3(-3) ± 2.6(-4) PER SEC
(b) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(c) COMBINED INSTANTANEOUS REMOVAL OF SUSPENDED AEROSOL

TABLE N-3

REMOVAL RATE AT 500 SECONDS

CODE	USER	REMOVAL RATE (FRACTION PER SEC) [c]		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST [a]
HAA-3B	GE	[b]			
HAA-3C	HEDL / SSD	3.60(-3)	2.76(-3)	0.55	0.575
HAA-4	RI / ESG	4.48(-3)	3.5 (-3)	0.70	0.73
HAARM-3	HEDL / SSD	1.00(-3)	1.24(-4)	0.024	0.026
HAARM-3	BCL	9.10(-3)	8.1 (-3)	1.62	1.69
HAARM-3	ORNL	3.16(-4)	1.59(-3)	0.32	0.33
QUICK	BCL	8.98(-3)	8.1 (-3)	1.62	1.69
QUICK	ORNL	3.31(-3)	7.12(-3)	1.42	1.48
MSPEC	BCL	1.05(-2)	9.6 (-3)	1.91	2.00
MAEROS	HEDL / CSA				
CONTAIN	SNL	4.44(-3)	4.24(-3)	0.85	0.88
AVERAGE		5.08(-3)	5.01(-3)		1.04

(a) TEST AB5 RESULT = 4.8(-3) ± 9.6(-4) PER SEC
(b) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(c) COMBINED INSTANTANEOUS REMOVAL OF SUSPENDED AEROSOL

TABLE N-4

REMOVAL RATE AT 885 SECONDS

CODE	USER	REMOVAL RATE (FRACTION PER SEC) [c]		RATIO	
		PRETEST [d]	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST [a]
HAA-3B	GE	[b]			
HAA-3C	HEDL / SSD	3.42(-3)	2.64(-3)	0.47	0.550
HAA-4	RI / ESG	4.52(-3)	3.6 (-3)	0.66	0.75
HAARM-3	HEDL / SSD	1.82(-3)	1.36(-3)	0.24	0.283
HAARM-3	BCL	9.10(-3)	8.1 (-3)	1.46	1.69
HAARM-3	ORNL	6.99(-4)	1.96(-3)	0.35	0.408
QUICK	BCL	8.98(-3)	8.3 (-3)	1.49	1.73
QUICK	ORNL	2.82(-3)	7.26(-3)	1.31	1.51
MSPEC	BCL	1.05(-2)	9.8 (-3)	1.76	2.04
MAEROS	HEDL / CSA				
CONTAIN	SNL		4.57(-3)	0.82	0.952
AVERAGE		5.23(-3)	5.56(-3)		1.16

(a) TEST AB5 RESULT = 4.8(-3) ± 9.6(-4) PER SEC
(b) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(c) COMBINED INSTANTANEOUS REMOVAL OF SUSPENDED AEROSOL
(d) PRETEST PREDICTIONS AT 900 SEC. (INTENDED END OF SOURCE)

TABLE N-5

REMOVAL RATE AT 1000 SECONDS

CODE	USER	REMOVAL RATE (c) (FRACTION PER SEC)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST (a)
HAA-3B	GE	(b)			
HAA-3C	HEDL / SSD	1.13(-2)	9.39(-3)	0.68	2.18
HAA-4	RI / ESG	2.14(-2)	1.3 (-2)	0.94	3.02
HAARM-3	HEDL / SSD	4.23(-3)	3.60(-3)	0.26	0.84
HAARM-3	BCL	7.67(-3)	6.5 (-3)	0.47	1.51
HAARM-3	ORNL	7.03(-3)	6.59(-2)	4.76	15.3
QUICK	BCL	5.65(-3)	6.9 (-3)	0.50	1.60
QUICK	ORNL	3.24(-3)	7.26(-3)	0.51	1.69
MSPEC	BCL	5.22(-3)	7.0 (-3)	0.51	1.63
MAEROS	HEDL / CSA				
CONTAIN	SNL	5.46(-3)	5.13(-3)	0.37	1.19
AVERAGE		7.34(-3)	1.39(-2)		3.23

(a) TEST AB5 RESULT = 4.3(-3) ± 8.6(-4) PER SEC
(b) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(c) COMBINED INSTANTANEOUS REMOVAL OF SUSPENDED AEROSOL

TABLE N-6

REMOVAL RATE AT 2000 SECONDS

CODE	USER	REMOVAL RATE (FRACTION PER SEC) [c]		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST [a]
HAA-3B	GE	[b]			
HAA-3C	HEDL / SSD	1.62(-3)	1.70(-3)	1.63	1.54
HAA-4	RI / ESG	1.99(-3)	1.7 (-3)	1.63	1.54
HAARM-3	HEDL / SSD	1.44(-3)	1.41(-3)	1.36	1.28
HAARM-3	BCL	1.25(-3)	1.2 (-3)	1.15	1.09
HAARM-3	ORNL	2.78(-3)	6.35(-5)	0.006	0.057
QUICK	BCL	1.18(-3)	4.1 (-4)	0.39	0.37
QUICK	ORNL	1.05(-3)	9.65(-4)	0.93	0.88
MSPEC	BCL	9.61(-4)	1.0 (-3)	0.96	0.91
MAEROS	HEDL / CSA				
CONTAIN	SNL	1.05(-3)	9.92(-4)	0.95	0.90
AVERAGE		1.48(-3)	1.04(-3)		0.945

(a) TEST AB5 RESULT = 1.1(-3) ± 2.2(-4) PER SEC
(b) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(c) COMBINED INSTANTANEOUS REMOVAL OF SUSPENDED AEROSOL

TABLE N-7

REMOVAL RATE AT 5000 SECONDS

CODE	USER	REMOVAL RATE (c) (FRACTION PER SEC)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST (a)
HAA-3B	GE	(b)			
HAA-3C	HEDL / SSD	5.50(-4)	5.83(-4)	0.92	1.66
HAA-4	RI / ESG	8.24(-4)	6.1 (-4)	0.96	1.74
HAARM-3	HEDL / SSD	5.08(-4)	5.06(-4)	0.79	1.45
HAARM-3	BCL	4.03(-4)	4.3 (-4)	0.68	1.23
HAARM-3	ORNL	6.82(-4)	2.34(-3)	3.67	6.68
QUICK	BCL	2.89(-4)	4.3 (-4)	0.68	1.23
QUICK	ORNL	2.81(-4)	2.65(-4)	0.42	0.76
MSPEC	BCL		2.8 (-4)	0.44	0.80
MAEROS	HEDL / CSA				
CONTAIN	SNL	3.02(-4)	2.89(-4)	0.45	0.83
AVERAGE		4.80(-4)	6.37(-4)		1.82

(a) TEST AB5 RESULT = 3.5(-4) ± 7.0(-5) PER SEC
(b) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(c) COMBINED INSTANTANEOUS REMOVAL OF SUSPENDED AEROSOL

TABLE N-8

REMOVAL RATE AT 10000 SECONDS

CODE	USER	REMOVAL RATE (FRACTION PER SEC) (c)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST (a)
HAA-3B	GE	(b)			
HAA-3C	HEDL / SSD	3.37(-4)	3.59(-4)	1.07	2.11
HAA-4	RI / ESG		3.7 (-4)	1.10	2.18
HAARM-3	HEDL / SSD	2.59(-4)	2.57(-4)	0.76	1.51
HAARM-3	BCL	2.07(-4)	2.1 (-4)	0.63	1.23
HAARM-3	ORNL	3.55(-4)	1.37(-3)	4.08	8.06
QUICK	BCL	1.23(-4)	6.1 (-5)	0.18	0.36
QUICK	ORNL	1.39(-4)	1.27(-4)	0.38	0.75
MSPEC	BCL	1.27(-4)	1.3 (-4)	0.39	0.76
MAEROS	HEDL / CSA				
CONTAIN	SNL	1.48(-4)	1.40(-4)	0.42	0.82
AVERAGE		2.12(-4)	3.36(-4)		1.98

(a) TEST AB5 RESULT = 1.7(-4) ± 3.4(-5) PER SEC
(b) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(c) COMBINED INSTANTANEOUS REMOVAL OF SUSPENDED AEROSOL

TABLE N-9

REMOVAL RATE AT 30000 SECONDS

CODE	USER	REMOVAL RATE (FRACTION PER SEC) (c)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST (a)
HAA-3B	GE	(b)			
HAA-3C	HEDL / SSD	8.12(-5)	3.41(-5)	0.53	0.60
HAA-4	RI / ESG				
HAARM-3	HEDL / SSD	1.27(-4)	1.22(-4)	1.90	2.14
HAARM-3	BCL	7.43(-5)	7.5 (-5)	1.17	1.32
HAARM-3	ORNL				
QUICK	BCL	5.18(-5)	6.3 (-5)	0.98	1.11
QUICK	ORNL	3.83(-5)	4.29(-5)	0.67	0.75
MSPEC	BCL	4.31(-5)	5.9 (-5)	0.92	1.04
MAEROS	HEDL / CSA				
CONTAIN	SNL	5.65(-5)	5.27(-5)	0.82	0.92
AVERAGE		6.75(-5)	6.41(-5)		1.12

(a) TEST AB5 RESULT = 5.7(-5) ± 1.1(-5) PER SEC
(b) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(c) COMBINED INSTANTANEOUS REMOVAL OF SUSPENDED AEROSOL

TABLE N-10

REMOVAL RATE AT 100000 SECONDS

CODE	USER	REMOVAL RATE (c) (FRACTION PER SEC)		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST (a)
HAA-3B	GE	(b)			
HAA-3C	HEDL / SSD				
HAA-4	RI / ESG				
HAARM-3	HEDL / SSD				
HAARM-3	BCL	4.23(-6)	3.1 (-5)	1.80	1.41
HAARM-3	ORNL				
QUICK	BCL	2.52(-5)	9.8 (-6)	0.57	0.45
QUICK	ORNL		1.60(-5)	0.93	0.73
MSPEC	BCL	2.00(-5)	7.6 (-6)	0.44	0.35
MAEROS	HEDL / CSA				
CONTAIN	SNL	2.30(-5)	2.16(-5)	1.26	0.98
AVERAGE		1.81(-5)	1.72(-5)		0.78

(a) TEST AB5 RESULT = 2.2(-5) ± 4.4(-6) PER SEC
(b) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(c) COMBINED INSTANTANEOUS REMOVAL OF SUSPENDED AEROSOL

TABLE N-11

REMOVAL RATE AT 400000 SECONDS

CODE	USER	REMOVAL RATE (FRACTION PER SEC) [c]		RATIO	
		PRETEST	BLIND POST-TEST	CODE TO AVERAGE	CODE TO TEST [a]
HAA-3B	GE	[b]			
HAA-3C	HEDL / SSD				
HAA-4	RI / ESG				
HAARM-3	HEDL / SSD				
HAARM-3	BCL	1.18(-5)	1.4 (-5)	1.70	2.00
HAARM-3	ORNL				
QUICK	BCL	7.35(-6)	9.6 (-6)	1.17	1.37
QUICK	ORNL		4.63(-7)	0.056	0.066
MSPEC	BCL	8.52(-6)	7.4 (-6)	0.90	1.06
MAEROS	HEDL / CSA				
CONTAIN	SNL	9.63(-6)	9.73(-6)	1.18	1.39
AVERAGE		6.41(-6)	8.24(-6)		1.18

(a) TEST AB5 RESULT = 7.0(-6) ± 1.4(-6) PER SEC
(b) NUMBER IN PARENTHESIS IS EXPONENT OF 10
(c) COMBINED INSTANTANEOUS REMOVAL OF SUSPENDED AEROSOL

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