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Limestone Concrete Aerosol Experiments in Steam-Air Atmospheres: NSPP Tests 521, 522, and 531, Data Record Report

M. L. Tobias
R. E. Adams

Prepared for the
U.S. Nuclear Regulatory Commission
Office of Nuclear Regulatory Research
Under Interagency Agreements DOE 0551-0551-A1

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DEPARTMENT OF ENERGY

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National Technical Information Service
Springfield, VA 22161

NUREG/CR-5017
ORNL/TM-10587
Dist. Category R7

Engineering Technology Division

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Manuscript Completed — September 25, 1987
Date Published — October 1987

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NRC FIN No. B0121

Prepared by the
OAK RIDGE NATIONAL LABORATORY
Oak Ridge, Tennessee 37831
operated by
MARTIN MARIETTA ENERGY SYSTEMS, INC.
for the
U.S. DEPARTMENT OF ENERGY
under Contract No. DE-AC05-84OR21400

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SUMMARY

This data record report summarizes the results from three tests in which the behavior of limestone concrete aerosols was studied. The tests were conducted in the Nuclear Safety Pilot Plant, which is part of the LWR Aerosol Release and Transport Program at the Oak Ridge National Laboratory. This research is sponsored by the Division of Reactor System Safety, Office of Nuclear Regulatory Research, U.S. Nuclear Regulatory Commission and the purpose is to provide a data base on the behavior of aerosols in containment under conditions assumed to occur in postulated LWR accident sequences. These data are to provide experimental validation of aerosol behavioral codes under development elsewhere.

In two of the three tests the concrete test aerosol was generated and introduced into a quasi-steady-state steam-air environment. The remaining test was conducted for comparison purposes in an air environment under more-or-less ambient conditions of temperature, pressure, and relative humidity. The primary experimental observation was aerosol mass concentration as a function of time. The maximum average aerosol mass concentrations in these three tests ranged from 0.4 to 1.5 g/m^3.

The data contained in this report should be utilized in preference to data contained in previous progress reports of the program. In particular, the aerosol mass concentration data contained in this report have been revised and are lower than those reported previously as the result of the correction of an error made in the method of calculating aerosol sample volumes.

In this report a brief description is given of each test together with the results in the form of tables and graphs. Included are data on aerosol mass concentration, aerosol fallout and plateout rates, total mass fallout and plateout, aerosol particle size, vessel atmosphere pressure, vessel atmosphere temperatures at various locations, temperature gradients near the vessel wall, and steam condensation rates on the vessel wall.

LIMESTONE CONCRETE AEROSOL EXPERIMENTS IN STEAM-AIR ATMOSPHERES:
NSPP TESTS 521, 522, AND 531, DATA RECORD REPORT

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ABSTRACT

This data record report summarizes the results from two tests involving limestone concrete test aerosol in a steam-air environment and one test in a dry air environment. This research sponsored by the U.S. Nuclear Regulatory Commission was conducted in the Nuclear Safety Pilot Plant at the Oak Ridge National Laboratory. The purpose of this project is to provide a data base on the behavior of aerosols in containment under conditions assumed to occur in postulated LWR accident sequences; this data base will provide experimental validation of aerosol behavioral codes under development. In the report a brief description is given of each test together with the results in the form of tables and graphs. Included are data on aerosol mass concentration, aerosol fallout and plateout rates, total mass fallout and plateout, aerosol particle size, vessel atmosphere pressure, vessel atmosphere temperatures, temperature gradients near the vessel wall, and steam condensation rates on the vessel wall.

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1. INTRODUCTION

The Nuclear Safety Pilot Plant (NSPP) project is part of the LWR Aerosol Release and Transport (ART) Program at the Oak Ridge National Laboratory, sponsored by the Division of Reactor System Safety, Office of Nuclear Regulatory Research, U.S. Nuclear Regulatory Commission. The purpose of the project is to provide a data base on the behavior of aerosols in containment under conditions assumed to occur in postulated LWR accident sequences. These data are intended to provide experimental validation of aerosol behavior codes under development elsewhere.

The test program provided for the study of the behavior, within containment, of simulated LWR accident aerosols emanating from fuel, reactor core structural materials, and from concrete-molten core materials interactions. Aerosols of U_3O_8 (fuel), Fe_2O_3 (core structure), and concrete were studied individually to establish the characteristics of their aerodynamic behavior. Various mixtures were then studied to establish their interactive and collective behavior. Tests were conducted in an environment of either dry air [relative humidity (RH) less than 20%] or steam-air [relative humidity (RH) ~100%] with aerosol mass concentration as a function of time being the primary observation. This report covers two tests in a steam-air environment and one test in a dry atmosphere with limestone concrete aerosol.

The data contained in this report should be utilized in preference to data contained in previous progress reports of the program. In particular, the aerosol mass concentration data contained herein have been revised and are lower in magnitude than those reported previously as the result of the correction of an error made in the method of calculating aerosol sample volumes.

2. NUCLEAR SAFETY PILOT PLANT (NSPP)

2.1 NSPP System

The NSPP is composed of a test vessel, aerosol generating equipment, analytical sampling equipment, and system parameter measuring equipment. A schematic representation of the system is given in Fig. 1. The NSPP vessel is a stainless steel cylinder with dished ends having a diameter of 3.05 m, a total height of 5.49 m, and a volume of 38.3 m^3. The wall thickness of the vessel is 9.53 mm, the floor area is 7.7 m^2, and the internal surface area (including top and floor) is 68.9 m^2. For calculation of fallout values, the total area of upward-facing horizontal surfaces is 10.3 m^2 and the total surface area for plateout within the vessel, including both vertical and horizontal internal structural surfaces, is 75.3 m^2. The vessel outer surface (with the exception of two 0.91 m diam flanges — one on the top and one on the sidewall of the vessel) is covered with insulation consisting of 13 mm of fiberglass and 76 mm of calcium silicate. The thermal conductivity values (k) are 43.3 (at 294 K) and 60.6 (at 311 K) mW/(m·K), respectively. The design temperature limitation is 423 K, and the design pressure limitation is 0.41 MPa gauge pressure.

Originally, aerosol studies in the NSPP related to the behavior of Na_2O_x and U_3O_8 aerosols released under assumed LMFBR accident conditions into dry secondary containment. To enable aerosol tests to be conducted in steam-air environments, as would be expected to occur in LWR accident situations, certain modifications of and additions to the facility were required. These modifications were completed before conduct of U_3O_8 aerosol tests and the Fe_2O_3 aerosol tests which were reported previously (1,2).

Most of the major components of the NSPP system were retained for application in the LWR aerosol studies. The only components removed were the sodium injection system and the sodium burn pan. The U_3O_8 aerosol generator, used previously, was retained. Steam is supplied to the NSPP by the ORNL plant supply system and is introduced into the vessel at a point ~0.6 m above the low point of the vessel floor. Instrumentation is included to measure the temperature and pressure of the steam at the steam injection nozzle.

In tests where steam injection continued over a number of hours, a significant amount of steam condensate was collected on the bottom of the vessel. The system has been arranged so that this condensate can be transferred from the vessel to the weighing tank without significant loss of vessel pressure.

A small fan was mounted near the bottom of the vessel to aid in uniformly dispersing the test aerosol in the vessel atmosphere.

2.1.1 Equipment for measurement of aerosol parameters

All of the aerosol sampling systems in the NSPP were originally designed for operation in a low humidity environment. For successful application in a steam-air environment some modifications were required,

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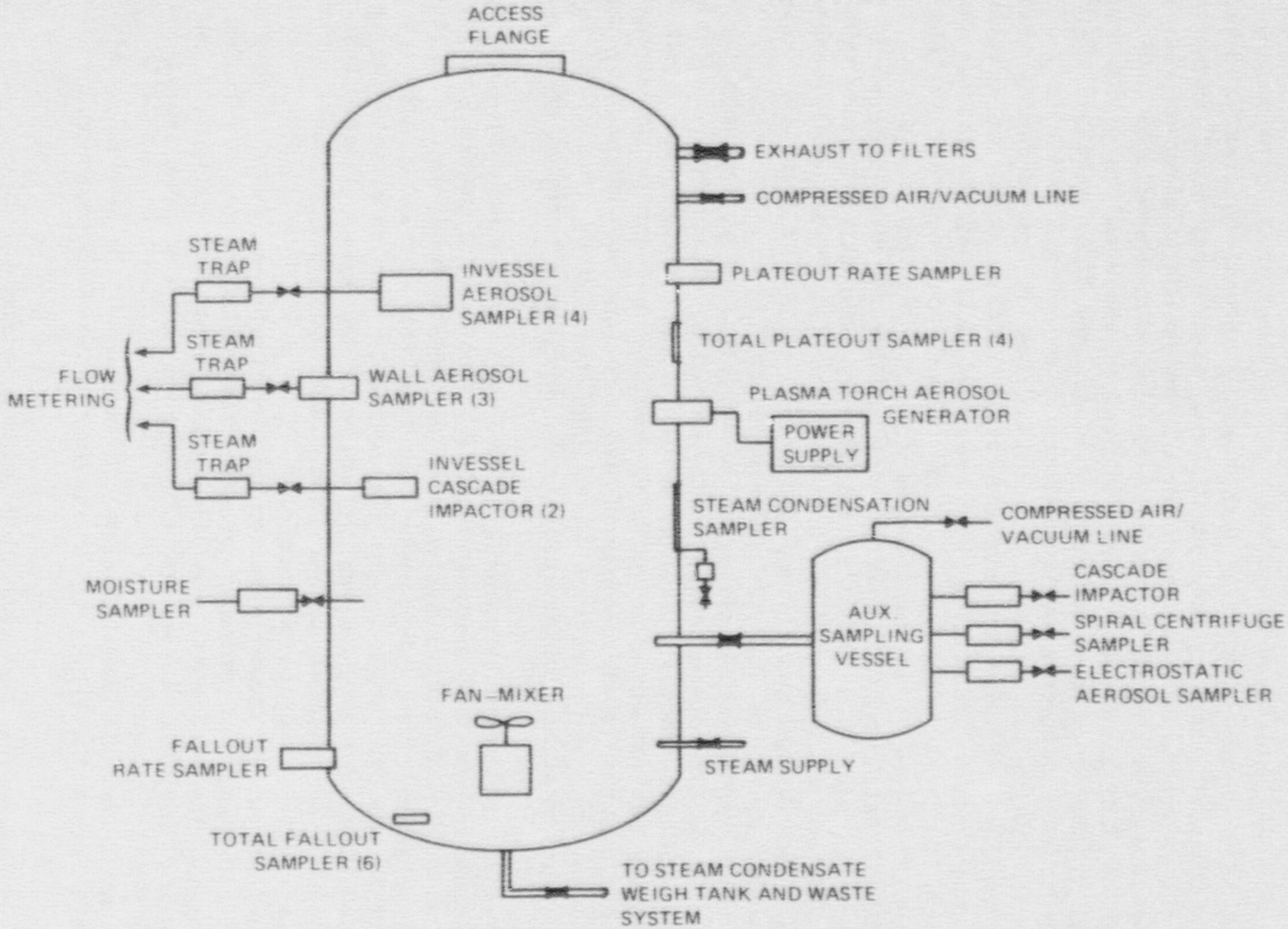

Fig. 1. Schematic of Nuclear Safety Pilot Plant (NSPP) Facility.

either in the system or in the method of operation; the primary problem in all the samplers was control of the steam condensate.

Aerosol mass concentration. Aerosol mass concentrations are obtained with two types of filter samplers. The in-vessel sampler is a self-contained unit with 12 filter tubes, a sequential valve, and a stepping motor; it is remotely operated from the control room. The wall aerosol sampler penetrates the vessel wall through a ball valve and flange arrangement; it is inserted and retrieved manually. These systems were modified by the addition of water traps and water adsorption tubes to prevent moisture from reaching the pressure- and flow-measuring devices. In addition, to prevent steam from penetrating the in-vessel sampling canisters; an externally controlled, pressurized air system keeps the interior of the canisters at a pressure slightly higher than the vessel atmosphere so that any leakage is outward from the canister. This feature protects the contact points of the small stepping motor which are very susceptible to moisture.

The sampling procedure for either type of sampler requires drawing a measured volume of containment vessel atmosphere through a sampling pack that contains four membrane filters in series. All aerosol mass concentration values are reported under the test conditions that existed within the vessel at the time that the sample was taken. The filter material is Millipore Fluoropore with a 0.5 μm-pore size.

The locations of the four in-vessel samplers and the three wall aerosol samplers are noted in Table 1.

Table 1. Locations of aerosol mass concentration samplers

Sampler name	Radial position	Elevation from lowest point (m)	Radial distance from centerline (m)
In-vessel 151	East	4.15	0.58
In-vessel 152	Southeast	4.15	1.06
In-vessel 153	East	2.80	1.09
In-vessel 154	Southeast	1.34	1.11
Wall 155	South	4.15	0.61
Wall 156	Southeast	2.80	(25 mm from wall)
Wall 157	Southwest	2.80	1.06

Aerosol fallout rate. Aerosol fallout rate is measured with an incremental, retrievable coupon sampler. This system also penetrates the vessel wall through a ball valve and flange arrangement. The sampler is located in the southwest quadrant at 51 mm from the vessel wall and is ~0.56 m above the low point of the vessel floor.

Aerosol plateout rate. Aerosol plateout rate is measured with an incremental, retrievable coupon sampler; the coupon is in the form of a disk and fits flush with the vessel wall. This system penetrates the vessel wall through a ball valve and flange arrangement and is located in the northeast quadrant ~2.92 m above the low point of the vessel floor.

Total fallout (TFO) collectors. Total fallout is determined with six shallow dishes, 65-mm in diameter, placed along a vessel radius near the bottom of the vessel within the northwest quadrant. The dishes are placed ~30 mm apart; the edge of the first dish (TFO-1) is 13 mm from the wall. The exposed collectors are retrieved with remote tools at the end of test operations and before liquid spray decontamination of the interior of the vessel.

Total plateout (TPO) collectors. Total plateout is determined with four flat disks, 61-mm diam, mounted flat on the vessel wall. One disk (TPO-BE) is mounted on the east side of the vessel at an elevation of 0.76 m from the low point of the vessel bottom. Two disks (TPO-BW and TPO-TW) are mounted on the west side of the vessel, 0.76 m and 2.67 m, respectively, from the bottom of the vessel. The remaining disk (TPO-TN) is mounted on the north side of the vessel 2.67 m from the bottom of the vessel. These plateout disks are also retrieved with remote tools along with the total fallout collectors.

Aerosol particle size. Aerodynamic aerosol particle size is measured with two different instruments. One instrument used was a cascade impactor (Andersen Mark III Particle Sizing Stack Sampler). This eight-stage impactor operates at a gas flow rate of 236 mL/s and covers the aerodynamic mass median diameter (AMMD) range from 0.54 to 13.6 μm. The other instrument used was a modified version of the Stöber Spiral Duct Centrifuge by Research Developments, Los Alamos, NM, and designated as a Spiral Centrifuge Aerosol Spectrometer (3,4). This instrument was applied at a rotor speed of 3000 rpm with a gas sample flow rate of 8.5×10^{-6} m^3/s; useful range in this application was 0.2 to 6 μm aerodynamic mass median diameter.

Neither instrument can tolerate condensation of a vapor during measurement of the aerosol size distribution. One method by which a gas-aerosol sample (containing water vapor) can be processed external to the vessel is to dilute and "dry" the aerosol sample with instrument air before introduction into the sizing instrument. A small auxiliary sampling vessel (0.18 m^3 in volume) was installed for this purpose next to the NSPP vessel at an elevation of 2.9 m. The external impactors and the centrifuge draw samples from this auxiliary tank.

It is recognized that the AMMD of the "dried" aerosol is not necessarily the same as that of the aerosol existing within the vessel during the test. Operation of a cascade impactor within a steam-air environment is not a standard application and calibration data are not available. However, to be able to pursue an approximate measurement of AMMD within the vessel, a calibration curve was calculated using accepted mathematical relationships relating to impactor stage constants with corrections made for viscosity and slip factors (5). Gas flow rates were chosen so that the velocity of gas through the holes of the impactor plates of the internal impactors under test conditions would be approximately the same as that of the external impactors.

Two impactors were mounted within the vessel at elevations of 0.56 m (southwest quadrant) and 2.8 m (southeast quadrant). The impactors were installed before the start of the test and allowed to heat up and thermally equilibrate as the vessel was heated during the preliminary steam injection period.

Samples of aerosol for electron microscopy are also taken from the auxiliary sampling vessel. The aerosol is deposited onto carbon-coated copper grids using a Model 3100 Electrostatic Aerosol Sampler (Thermo-System, Inc.).

2.1.2 Equipment for measurement of system parameters

Temperature of the vessel atmosphere. Twelve thermocouples (3.2 mm diam sheathed Chromel-Alumel) are used for the measurement of the vessel atmospheric temperatures. At each of three elevations in the vessel, there are four thermocouples (one placed in each quadrant). The elevations are 1.22 m, 2.74 m, and 4.27 m. Table 2 identifies and locates each thermocouple. Thermocouple responses are recorded with strip-chart recorders and with a Digitrend data logger.

Wall temperature gradients. Two thermocouple arrays, each having five thermocouples (1.6 mm diam sheathed Chromel-Alumel) are mounted near the wall, one at 2.7 m elevation on the east radius and the other at 1.2 m elevation on the north radius. The thermocouples in each array are located at 10 mm, 5 mm, 2.5 mm, and 1.25 mm distance from the wall and on the wall surface; a sixth thermocouple is located on the outer surface of the vessel at approximately the same location. Thermocouple responses are recorded with strip-chart recorders and with the Digitrend data logger.

Vessel gas pressure. Vessel gas pressure is measured with a pressure cell, and the pneumatic signal is converted to an equivalent electrical signal and recorded on a strip-chart recorder and with the Digitrend data logger.

Table 2. Location of thermocouples for measurement of temperature of vessel atmosphere

Thermocouple No.	Elevation (m)	Quadrant	Radial distance (m)
4-1	4.27	N	0.48
4-2	4.27	W	1.07
4-3	2.74	N	0.48
4-4	2.74	S	0.97
4-5	2.74	W	1.22
4-6	1.22	W	1.07
4-7	4.27	S	0.97
4-20	1.22	S	0.61
4-21	4.27	E	0.48
4-22	1.22	E	0.81
4-23	2.74	E	0.99
4-24	1.22	N	1.37

Vessel atmosphere moisture sampler. The mass of steam per unit volume within the vessel was determined by removing a measured volume of gas through a treatment train where the steam was condensed and trapped in an absorbent column. The mass of steam was then determined by weighing.

This system produced rather imprecise data with a large spread in calculated values of relative humidity. Values for the various tests ranged in a random fashion from around 90% to about 110%. For this reason the values are not included in this report.

Steam condensation rate samples. The rate at which steam condensed on the vessel walls was measured by defining an area of the wall with perimeter seals. After steam condensed on this defined area the water flowed downward until it reached a funneling trough at the lower edge where it drained into a collecting tank outside the test vessel for subsequent volume measurement. The defined area was hexagonal in shape, covered 0.324 m^2, and was located at an approximate elevation of 2.7 m.

2.1.3 Aerosol generating equipment

The limestone concrete test aerosol was generated using a generator (6) which consists of a commercial plasma metalizing torch assembly (METCO 7M System) and a special high-temperature reaction chamber into which the concrete powder, together with argon and oxygen gases, was injected. The test aerosol is formed by vaporization of the concrete powder in the argon plasma flame. Introduction of the aerosol was by way of a flange on top of the vessel.

2.1.4 Chemical analysis of aerosol.

Analytical procedures for the chemical analysis of the aerosol produced by vaporization of powdered concrete involve treatment of the aerosol mass by lithium metaborate ($LiBO_3$) fusion followed by dissolution in dilute nitric acid. Elemental analysis for Fe, Si, Ca, Mg, and Al was accomplished on these solutions by inductively coupled plasma (ICP) spectrometry. X-ray diffraction analysis revealed that the aerosol is composed of oxides of the above metals, in varying quantities, plus some complex silicates involving Ca, Al, Fe, and Mg. For calculational purposes, the aerosol was considered to be composed of a simple mixture of Fe_2O_3, SiO_2, Al_2O_3, CaO, and MgO; this assumption should not introduce any large error in calculating the mass quantities of aerosol present in the various samples.

2.2 NSPP LWR Aerosol Test Procedures

Experiments 521 and 522 were in a steam-air environment, while experiment 531 was performed in dry air (RH $<20\%$) at ambient conditions. The basic steps in both of the steam-air aerosol tests were essentially the same. The vessel initially contained air significantly below ambient pressure. The vessel, and the captive air atmosphere, were heated by injecting steam into the vessel; after about 1 h the temperature of the vessel atmosphere reached the desired value. At this point the rate of steam injection was reduced to a level to match steam losses to the vessel wall. After a period of temperature equilibration, the steam condensate (produced during vessel heatup) was drained from the vessel and moved to the weigh tank. Aerosol generation commenced at this point with introduction into the semi-steady-state steam-air environment for a brief period. A small fan-mixer located near the bottom of the vessel was employed to augment thermal convection forces and aid in mixing. Steam injection at the low rate continued for 6 h after start of aerosol generation in these two tests. Total test duration was 24 h in all cases. The small fan-mixer operated for the first 10 h of each test.

At termination of test operations the steam condensate was removed from the vessel, weighed and transferred to the liquid waste system. The vessel was then opened and the various samplers were removed; decontamination of the vessel interior by liquid sprays complet the test procedures.

NSPP Test 531 was conducted to obtain data on the behavior of concrete aerosol under dry conditions for use in estimating the extent of influence of steam on the aerosol behavior. All steps, with the exception of steam injection, were the same as for the steam-air tests.

All of the sampling devices (filter packs, impactors, coupons, etc.) were disassembled, packaged, and submitted to the ORNL analytical laboratory for determination of the concrete content. The physical characteristics of the aerosol were studied by use of electron microscopy.

3. DESCRIPTION OF INDIVIDUAL AEROSOL TESTS

3.1 LWR Aerosol Test 521

This first concrete aerosol test of the LWR accident aerosol study was conducted in the following manner. Steam was introduced into the NSPP vessel, to raise its atmosphere from an initial absolute pressure of 36 kPa to an average temperature of 383 K and an absolute pressure of 204 kPa. This step required ~1 h; at this point, the rate of steam injection was reduced, and the accumulated steam condensate was removed to a holding vessel. Aerosol generation was then started and continued for 20 min. Steam injection at low rates was maintained for 6 h to balance steam losses caused by wall condensation. Over this period, the temperature and the absolute pressure slowly increased to 391 K and 257 kPa. The vessel was allowed to cool for 18 h after termination of steam injection.

During the test, measurements were made of aerosol mass concentration, particle size, fallout and plateout rates, vessel atmosphere temperatures, pressure, moisture content, and steam condensation rate at the vessel wall.

The maximum average concrete aerosol mass concentration measured was 0.45 g/cm^3 at 6 min before termination of aerosol generation. Aerosol mass concentration at the time of termination of aerosol generation (20 min) was estimated to be 0.38 g/cm^3. This latter aerosol mass concentration is determined by graphical estimation of the magnitude of the value at the time of termination of aerosol generation (if sampling operations were started before generator cutoff) or, by extrapolation of the concentration values to the time of termination of aerosol generation (if sampling operations were started after generator cutoff).

Despite operation of the small fan mixer installed in the lower part of the vessel, the aerosol-steam mixture was not as homogeneous as those noted in the U_3O_8 and Fe_2O_3 aerosol test series. Aerosol size measurements with the cascade impactor and centrifuge samplers were not successful. An insufficient mass of aerosol was collected on the centrifuge strip for chemical analysis; an error in the analytical chemistry procedures resulted in loss of data from the cascade impactor samples.

3.2 LWR Aerosol Test 522

Experiment 522 was the second limestone-aggregate concrete aerosol test in a quasi-steady-state steam-air environment. Steam was introduced into the vessel, which was initially at an absolute pressure of 29 kPa and ambient temperature of 296 K, to bring the vessel atmosphere (air and steam) to an absolute pressure of 158 kPa and an average temperature of 378 K. This heating step required about 1.2 h. At this point the rate of steam injection was reduced to a level which appeared sufficient to maintain vessel temperatures and pressure nearly constant. Also at this time, the small fan-mixer inside the vessel was turned on. Approximately 1 h later, the accumulated steam condensate in the NSPP vessel was removed to a holding tank, and concrete aerosol generation was started. The concrete aerosol was produced with the plasma torch aerosol generator with 524 g of concrete powder passed through the torch over a period of 31.4 min. The test environment was a mixture of air and steam at an absolute pressure of 181 kPa and a temperature of 380 K at the time of termination of aerosol generation. At the end of 6 h of low-level steam injection, the absolute pressure and temperature had increased to 185 kPa and 381 K, respectively. At this point, steam injection was terminated and the vessel was allowed to cool undisturbed for 18 h.

The first set of aerosol mass concentration samples was taken 3.8 min after termination of aerosol generation. Subsequent samples were obtained over a period of 24 h in accordance with the normal sampling procedures.

The mass concentration of concrete aerosol as a function of time was measured by the seven individual aerosol mass samplers. An offset in aerosol mass concentration values as determined by the in-vessel filter samplers and the wall filter samplers was noted. This behavior had not been encountered in the other concrete aerosol test; the values obtained by the two types of aerosol samplers have been in accord. Inspection of the raw data revealed that the calcium values were largely responsible for this misalignment. Rechecks on the analysis for calcium were requested on the samples taken by both the in-vessel samplers and the wall filter samplers. For the in-vessel samples the new calcium values were within 15% of the original values. Unfortunately, the samples from the wall filter samplers could not be rechecked because the solutions had already been discarded.

For comparison of these data with other results from concrete aerosol tests, it was assumed that the data for calcium were correct from the in-vessel samplers and incorrect (too large) from the wall samplers. The calcium data from the wall filter samples were reduced by a constant factor so that the offset between the data from the two filter samplers disappeared. Extrapolation of the data back to the time of aerosol generator cutoff (31.4 min) yields a value of 0.5 g/m^3.

Aerosol size measurements were attempted with the cascade impactors but were not successful; an insufficient mass of aerosol was collected.

3.3 LWR Aerosol Test 531

This experiment was designed to be compared with No. 521. Whereas No. 521 was conducted in a steam-air environment, No. 531 was conducted in an air environment at more-or-less ambient conditions of temperature, pressure, and relative humidity.

The test aerosol was generated by introducing limestone concrete powder into the PT generator. The test atmosphere was an absolute pressure of 101 kPa and a temperature of 299 K at start of aerosol generation; at the termination of aerosol generation the absolute pressure was about 110 kPa and the temperature about 300 K. The period of aerosol generation was 33.5 min. Test duration was 24 h.

Analytical chemistry procedures and calculations were the same as in Run 521. The maximum average concrete aerosol mass concentration measured was 1.48 g/m^3 min into the aerosol generation period. The maximum concentration reached was estimated to have been 1.5 $g/^3$, occurring at the end of the total aerosol generation period of 33.5 min. Use of the fan-mixer in this test produced a slightly better mixed aerosol than in Run 521.

Samples of the aerosol for sizing measurement were processed with the cascade impactors and the centrifuge sampler. Results from the cascade impactor measurements at 35 min and 98 min indicate that the aerodynamic mass median diameter (AMMD) of the aerosol was below 0.5 μm; most of the aerosol mass was collected on the final stage filter. Results from the centrifuge sampler indicated an AMMD of about 0.8 μm, measured at 54 min after start of aerosol generation. Scanning electron microphotographs (SEMs) of concrete aerosols in both steam and dry atmospheres show the concrete aerosol in the dry atmosphere is typically chain agglomerated. Such an agglomerated aerosol is fragile and subject to break-up in cascade impactors; therefore, it is not unexpected that the measured AMMD of the aerosol in this test would be larger with the centrifuge sampler than with the cascade impactor.

4. RESULTS FROM INDIVIDUAL AEROSOL TESTS

The results from each test are summarized in this section in the form of tables and graphs. At the beginning of each subsection a summary sheet is presented listing information on aerosol source, vessel test atmosphere, aerosol parameters and system parameters for each test. Following this summary sheet are graphs and tables reporting aerosol mass concentrations, fallout and plateout rates, total fallout and plateout masses, aerosol particle sizes, absolute vessel pressure, vessel atmosphere temperatures, temperature gradients near the vessel wall, and steam condensation rates on the vessel walls. Time is measured from start of aerosol generation. To aid in the interpretation of these graphs and tables, the following comments are offered.

Mass concentration. Results from the seven mass concentration filter samplers are presented in two forms; a table lists the values obtained from each individual sampler, and a graph presents the numerical average value obtained by computation from the values from individual samplers operated at the same time period. Values of mass concentrations are for concrete aerosol within the vessel atmosphere computed under vessel atmospheric conditions existing at the time of the sample. The location of each sampler may be found in Table 1.

Aerosol fallout and plateout rates; cumulative values for fallout and plateout mass. The data reported in these tables were obtained from the coupon samplers. An average fallout or plateout rate was computed from the mass of aerosol deposited on the coupon over the time interval of exposure. The average elapsed time from the start of aerosol generation is taken as one-half of the time interval of exposure added to the elapsed time at the start of the coupon exposure.

Values for cumulative mass fallout or plateout were computed by summing the values obtained by multiplying the fallout and plateout rate by the time of exposure of the coupon and the appropriate area within the vessel.

Total aerosol fallout and plateout. Fallout cups placed near the bottom of the vessel and plateout coupons mounted on the vessel wall were exposed over the full term of each experiment. The mass of aerosol collected by these samplers is used to estimate the total fallout and plateout of aerosol within the vessel. Values determined in this manner should be comparable with the total values computed from results obtained from the rate samplers, but this is not true in every case. Difficulty in obtaining representative samples may be the cause of these inconsistent data.

Aerosol particle size. Data are available for experiment 531 only. The data presented were derived with an Andersen Mark III Particle Sizing Stack Sampler (cascade impactor) and a Spiral Centrifuge Aerosol Spectrometer. The raw data were processed to the extent necessary to produce the tables in this report. An aerodynamic mass median diameter (AMMD) may be determined by plotting on log probability paper the "percent smaller than" values against the calibrated aerodynamic diameter value for each stage and reading the AMMD value at 50%.

Vessel atmosphere pressure. For all tests, the vessel initially contained a captive volume of air at ambient pressure, or below. The increase in vessel pressure resulted from the steam injection and the hot gases introduced by the plasma torch aerosol generator. The graph depicts the absolute pressure as a function of time after start of aerosol generation.

Vessel atmosphere temperatures. Three graphs are presented displaying the temperatures within each of the four quadrants at three elevations. The elevations are 1.22 m, 2.74 m, and 4.27 m from the low point on the vessel floor; radial distance of each thermocouple from the vessel centerline is given on each graph. Some of the thermocouples at the 4.27 m level can sense the heat of the plasma torch generator and may temporarily indicate a temperature higher than others at this level during aerosol generation.

Temperature profile near vessel wall. Two tables are presented indicating the temperature profiles near the vessel wall on the north radius at an elevation of 1.22 m and on the east radius at an elevation of 2.74 m. One thermocouple is attached to the inner wall surface and five others are located at varying distances from the vessel wall. Sets of data are listed for various times after start of aerosol generation.

4.1 Summary and Data Listings for Test 521

Aerosol source

Mass of concrete powder into generator	0.9 kg
Duration of aerosol generation	20 min
Maximum measured aerosol concentration (at 14 min from start of aerosol generation)	0.45 g/m^3
Estimated average aerosol concentration at end of aerosol generation (under test conditions)	0.38 g/m^3

Vessel atmosphere

Absolute Vessel air pressure before steam injection	38.1 kPa
Relative humidity at start of aerosol generation	~100%
Duration of steam injection after start of aerosol generation	6 h
Mass of steam condensate collected after start of aerosol generation	125 kg

Aerosol parameters measured

Aerosol mass concentration (average)	Fig. 2
Aerosol mass concentration (individual samplers)	Tables 3-4
Aerosol fallout and plateout rates; cumulative fallout and plateout mass	Table 5
Aerosol integral fallout and plateout mass	Table 6

System parameters measured

Vessel atmosphere pressure	Fig. 3
Vessel atmosphere temperature	Figs. 4-6
Temperature gradient near wall	Tables 7-8
Steam condensation rate	Table 9

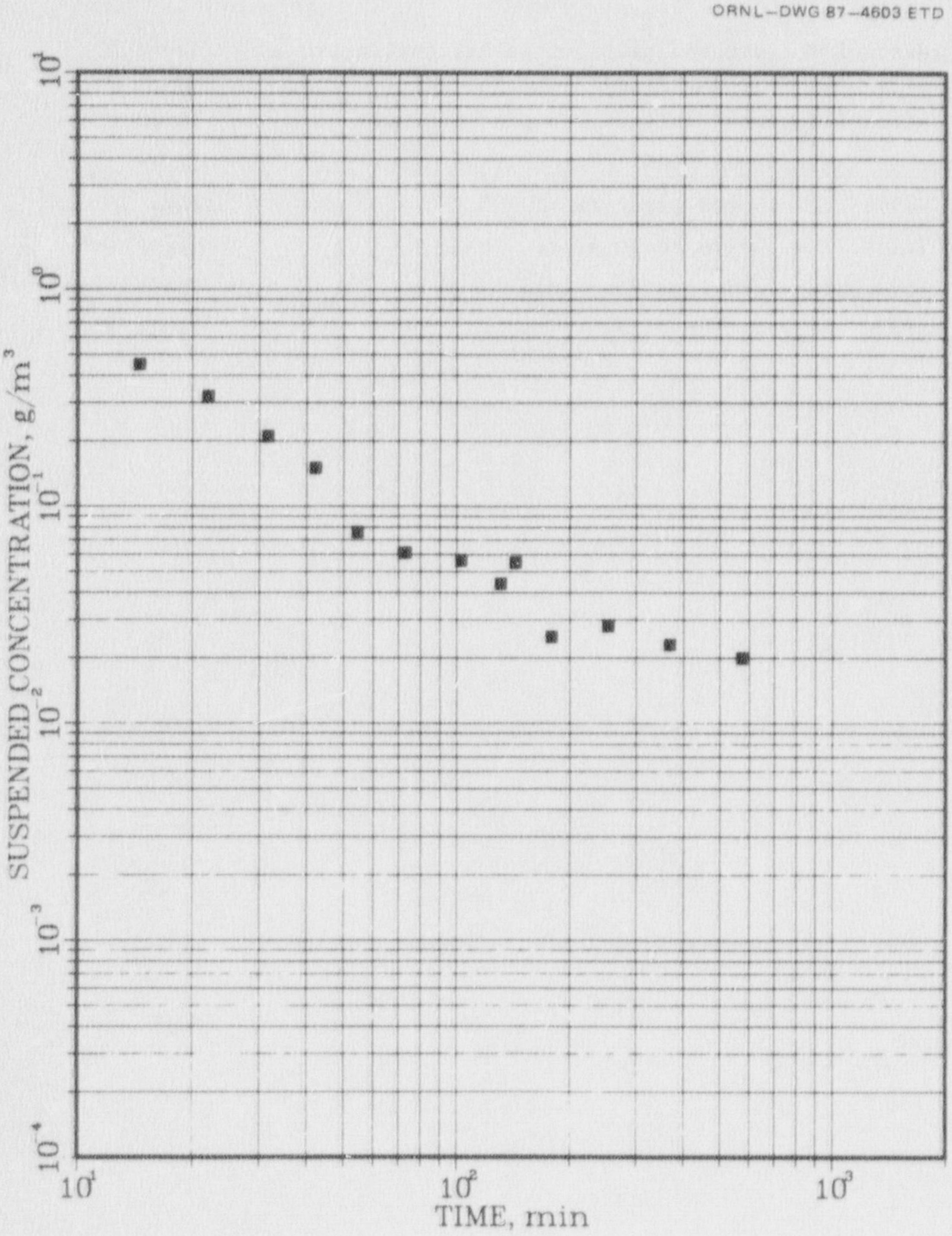

Fig. 2. Average aerosol mass concentration — NSPP Test 521.

Table 3. Aerosol mass concentration as determined with individual in-vessel samplers — Test 521

Sampler — Sample No.	Time[a] (min)	Mass[b] concentration (g/m^3)
151-1	13.3	0.36
152-1	13.5	0.28
153-1	14.9	0.34
154-1	15.2	0.80
151-2	20.9	0.29
152-2	21.2	0.25
153-2	22.8	0.22
154-2	23.0	0.52
151-3	30.1	0.17
152-3	30.3	0.17
153-3	32.8	0.23
154-3	33.0	0.26
151-4	41.4	0.12
152-4	42.2	0.12
153-4	42.4	0.18
154-4	42.7	0.18
151-5	54.0	0.067
152-5	54.3	0.077
153-5	54.5	0.083
154-5	54.8	
151-6	72.7	0.035
152-6	72.9	0.042
153-6	73.2	0.068
154-6	73.4	0.10
151-7	102.3	0.045
152-7	102.5	0.027
153-7	102.8	0.033
154-7	103.0	0.12
151-8	130.6	0.029
152-8	131.0	0.025
153-8	131.3	0.031
154-8	131.7	0.090
151-9	178.3	0.023
152-9	178.6	0.018
153-9	178.8	0.031
154-9	179.2	0.027

[a]Time measured from start of aerosol generation.

[b]Aerosol mass concentration in the vessel under test conditions that existed at time the sample was taken.

Table 4. Aerosol mass concentration as determined with individual wall filter samplers — Test 521

Sampler — Sample No.	Time[a] (min)	Mass[b] concentration (g/m^3)
155-1	142.8	0.056
156-1	143.6	—
157-1	144.5	0.054
155-2	196.3	0.026
156-2	196.7	—
157-2	196.9	0.017
155-3	253.0	0.028
156-3	253.3	0.040
157-3	253.5	0.016
155-4	368.0	0.017
156-4	368.0	0.030
157-4	368.0	0.023
155-5	574.0	0.027
156-5	574.0	0.020
157-5	574.0	0.013

[a]Time measured from start of aerosol generation.

[b]Aerosol mass concentration in the vessel under test conditions that existed at time the sample was taken.

Table 5. Aerosol fallout and plateout data; rate and cumulative mass vs time — NSPP Test 521

Sampler name	Midpoint of sampling time (min)	Duration of sample (min)	Fallout		Plateout	
			Rate	Cumulative	Rate	Cumulative
			[mg/(m^2·min)]	(g)	[mg/(m^2·min)]	(g)
FO-1	17.8	35.7	4.4	1.6		
PO-1	16.3	32.6			16	39.2
FO-2	47.6	17.8	17	4.7		
PO-2	42.6	15.5			8.9	49.6
FO-3	79.3	40.2	5.8	7.1		
PO-3	73.0	41.5			6.3	69.2
FO-4	134.3	65.4	2.3	8.6		
PO-4	129.5	66.5			2.4	81.1
FO-5	211.6	84.8	1.8	10.2		
PO-5	207.4	84.5			3.2	101.3
FO-6	418.3	324.2	0.24	11.0		
PO-6	413.8	324.1			0.50	113.6
FO-7	1011.5	856.7	0.014	12.3		
PO-7	1005.1	854.3			0.13	122.1

Table 6. Aerosol fallout and plateout data: integral samples — NSPP Test 521

Fallout		Plateout	
Sampler name	Sample mass (mg)	Sampler name	Sample mass (mg)
TFO-1	4.633	TPO-BW	0.91
TFO-2	2.518	TPO-BE	1.50
TFO-3	4.435	TPO-TW	0.39
TFO-4	3.916	TPO-TN	0.59
TFO-5	1.811		
TFO-6	18.68		
Average[a]	3.875	Average	0.85
Estimated[b] total fallout	8.49 g	Estimated[b] total plateout	20.5 g

[a]Average does not include samplers TFO-5 and TFO-6.

[b]Calculated from vessel-to-sample area ratios.

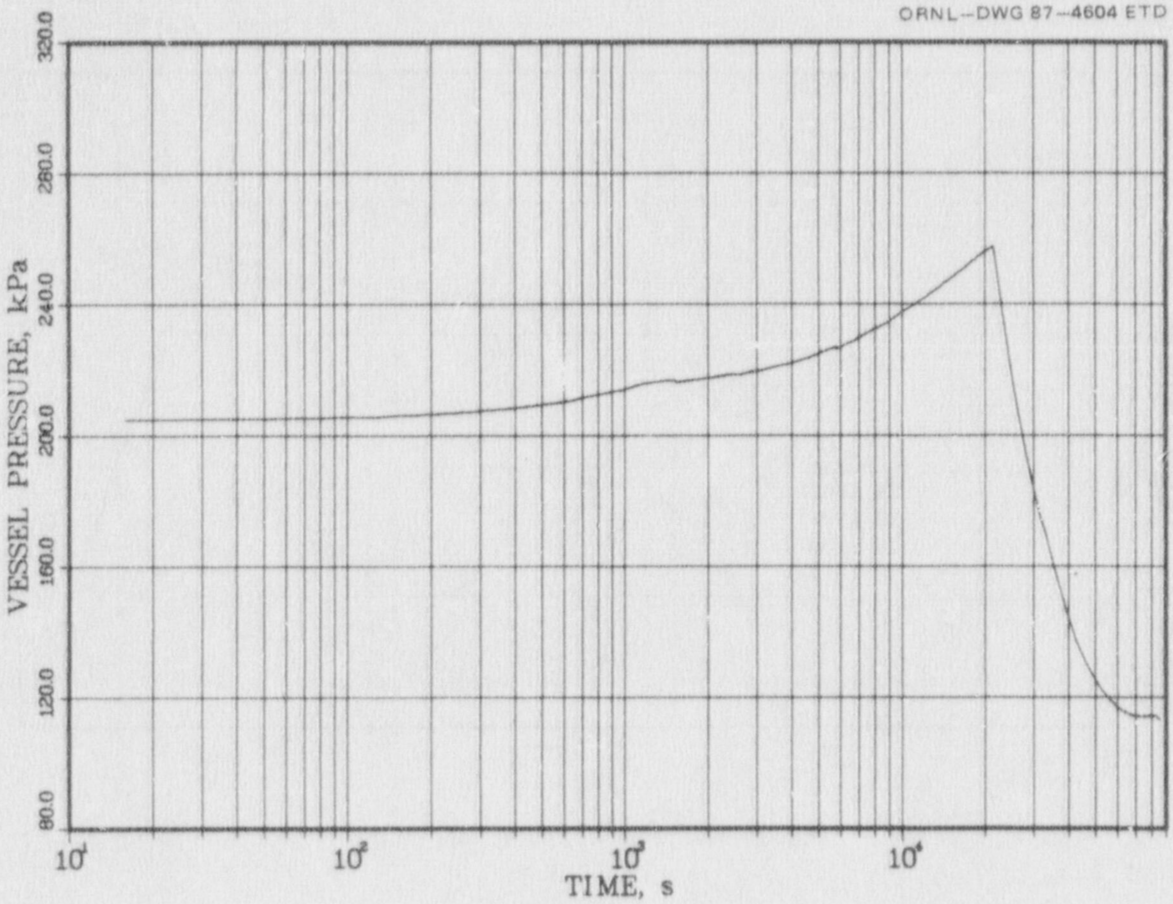

Fig. 3. Vessel atmosphere absolute pressure — NSPP Test 521.

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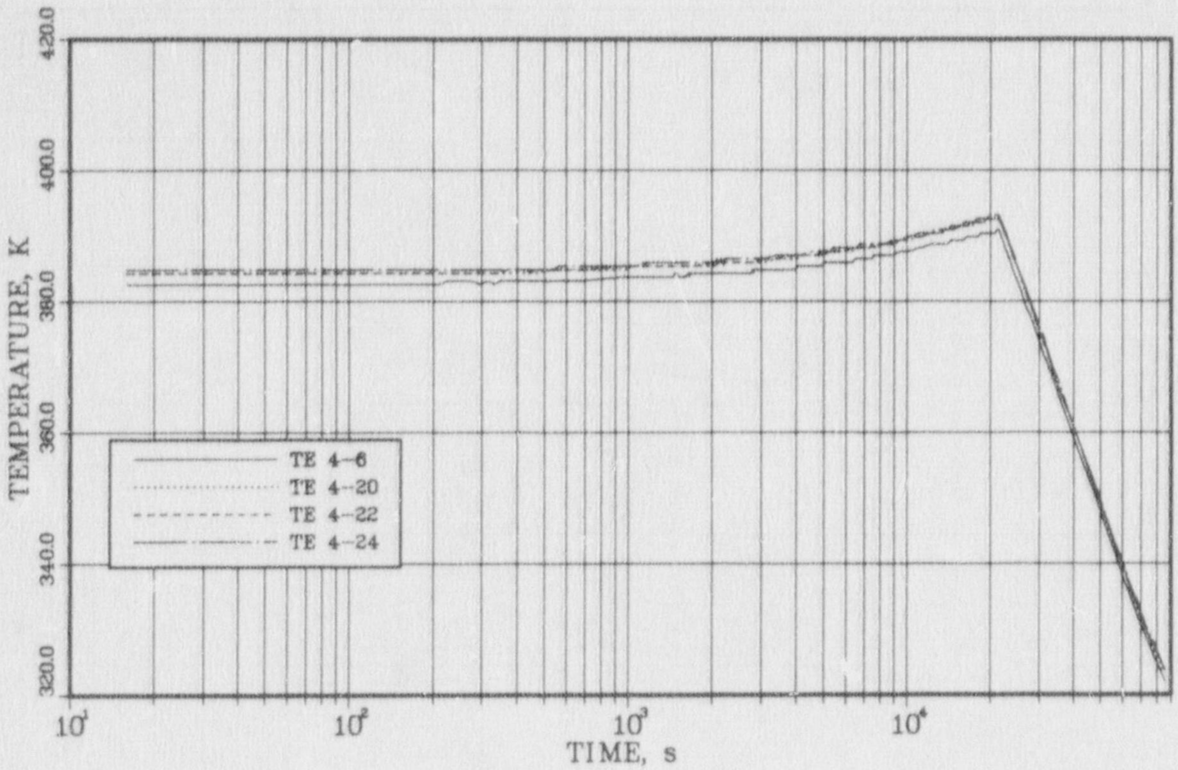

Fig. 4. Vessel atmosphere temperature at 1.22 m elevation — NSPP test 521.

ORNL-DWG 87-4606 ETD

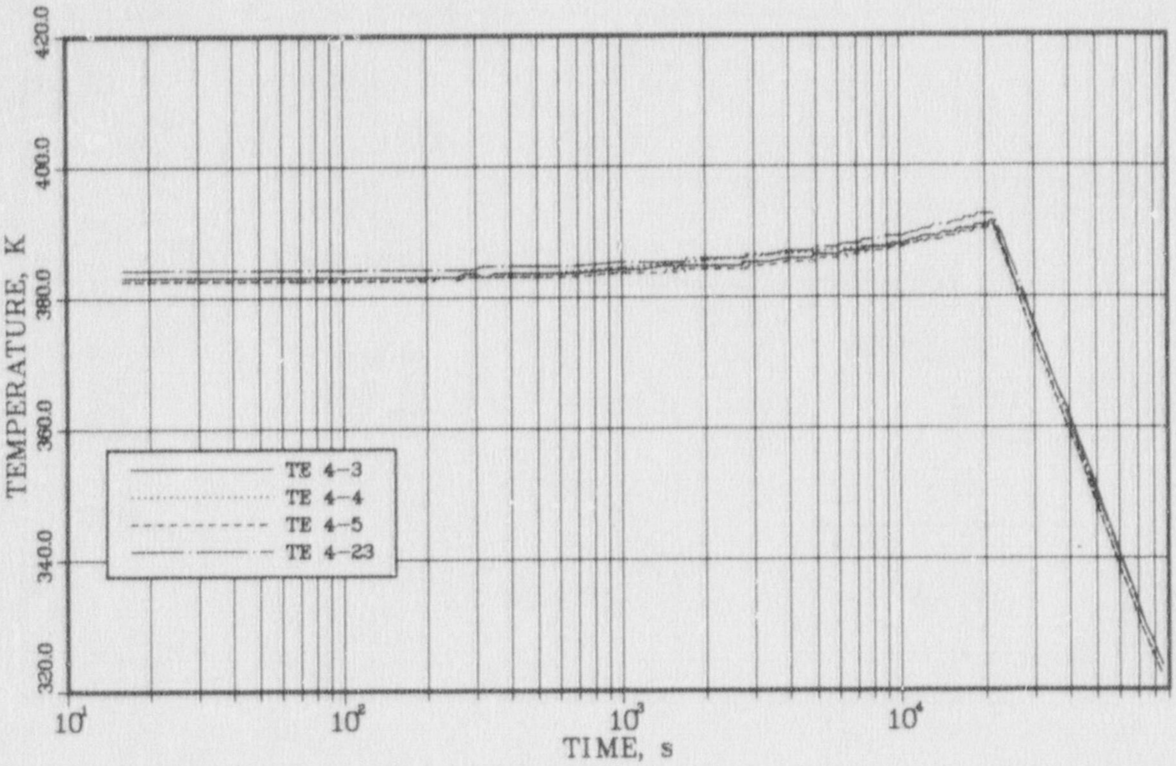

Fig. 5. Vessel atmosphere temperature at 2.74 m elevation — NSPP test 521.

ORNL–DWG 87–4607 ETD

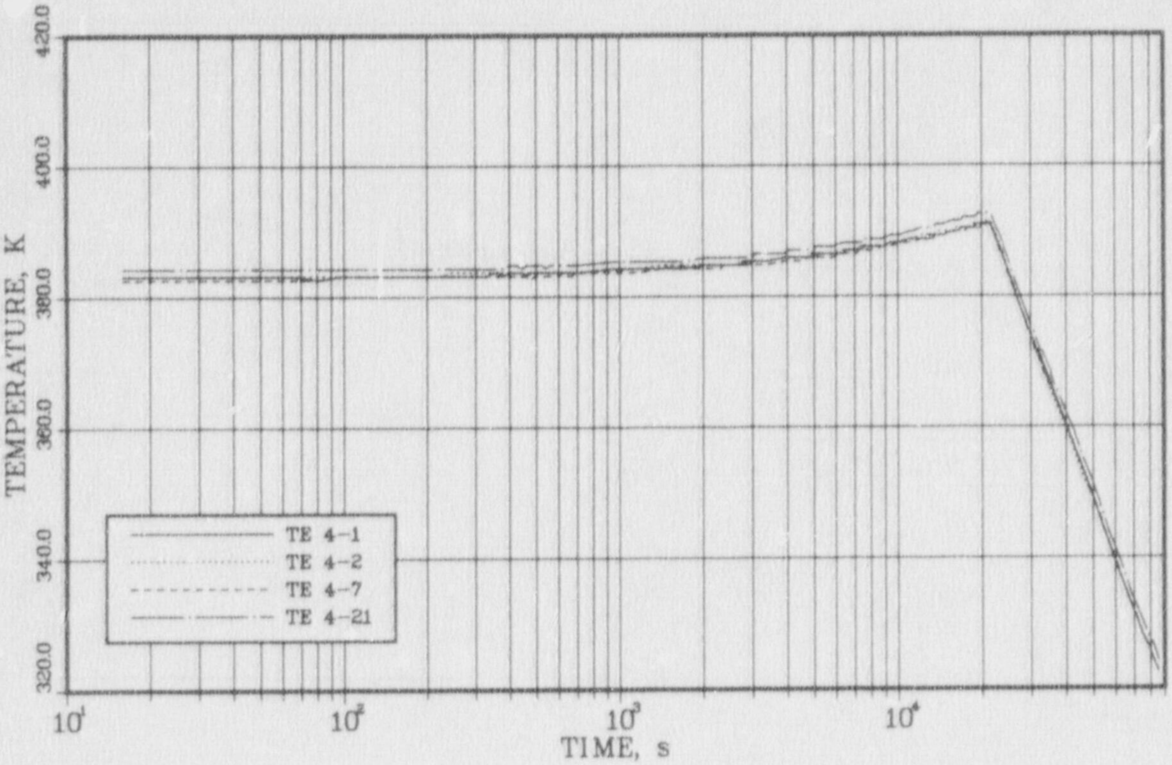

Fig. 6. Vessel atmosphere temperature at 4.27 m elevation — NSPP test 521.

Table 7. Temperature profile at 1.22 m elevation for various times after start of aerosol generation — NSPP Test 521

Time (s)	Temperature readings, K					
	Thermocouple locations — distance from vessel wall					
	On wall	1.25 mm	2.5 mm	5 mm	10 mm	255 mm
85	383	384	384	384	384	385
1076	384	385	385	385	385	385
2113	384	385	385	385	385	386
4063	385	386	386	386	386	387
5382	386	387	387	387	387	388
7299	386	388	388	388	388	389
11181	388	389	389	390	390	390
19035	390	392	392	392	392	393
29392	375	376	376	376	376	377
85472	322	323	323	323	323	324

Table 8. Temperature profile at 2.74 m elevation for various times after start of aerosol generation — NSPP Test 521

Time (s)	Temperature readings, K					
	Thermocouple locations — distance from vessel wall					
	On wall	1.25 mm	2.5 mm	5 mm	10 mm	533 mm
85	383	383	383	383	383	384
1076	384	384	384	384	384	385
2113	384	384	384	384	384	386
4063	385	385	385	385	385	387
5382	386	386	386	386	386	388
7299	387	387	387	387	387	389
11181	388	388	389	388	389	390
19035	390	390	390	390	390	393
29392	375	375	375	375	375	377
85472	322	322	323	322	323	324

Table 9. Steam condensation rates on vessel wall — Test 521

Sample No.	Sampling start time (min)	Sample duration (min)	Volume of condensate (cm^3)	Rate [$cm^3/(min \cdot m^2)$]
1	0	27.5	30	3.4
2	28.3	24.9	36	4.5
3	54.2	42.5	50	3.6
4	97.3	68.3	78	3.5
5	166.3	85.8	93	3.3
6	253.3	117.2	102	2.7
7	371.2	207.5	22	0.33
8	579.8	852.5	6.5	0.24

Area of sampler = 0.324 m^2.

4.2 Summary and Data Listings for Test 522

Aerosol source	
Mass of concrete powder into generator	0.7 kg
Duration of aerosol generation	31.4 min
Maximum average aerosol concentration (under test conditions)	0.5 g/m^3
Vessel atmosphere	
Vessel air pressure (absolute) before steam injection	29 kPa
Relative humidity at start of aerosol generation	~100%
Duration of steam injection after start of aerosol generation	6.0 h
Mass of steam condensate collected after start of aerosol generation	223 kg
Aerosol parameters measured	
Aerosol mass concentration (average)	Fig. 7
Aerosol mass concentration (individual samplers)	Tables 10-11
Aerosol fallout and plateout rates; cumulative fallout and plateout mass	Table 12
Aerosol integral fallout and plateout mass	Table 13
System parameters measured	
Vessel atmosphere pressure	Fig. 8
Vessel atmosphere temperature	Figs. 9-11
Temperature gradient near wall	Tables 14-15
Steam condensation rate	Table 16

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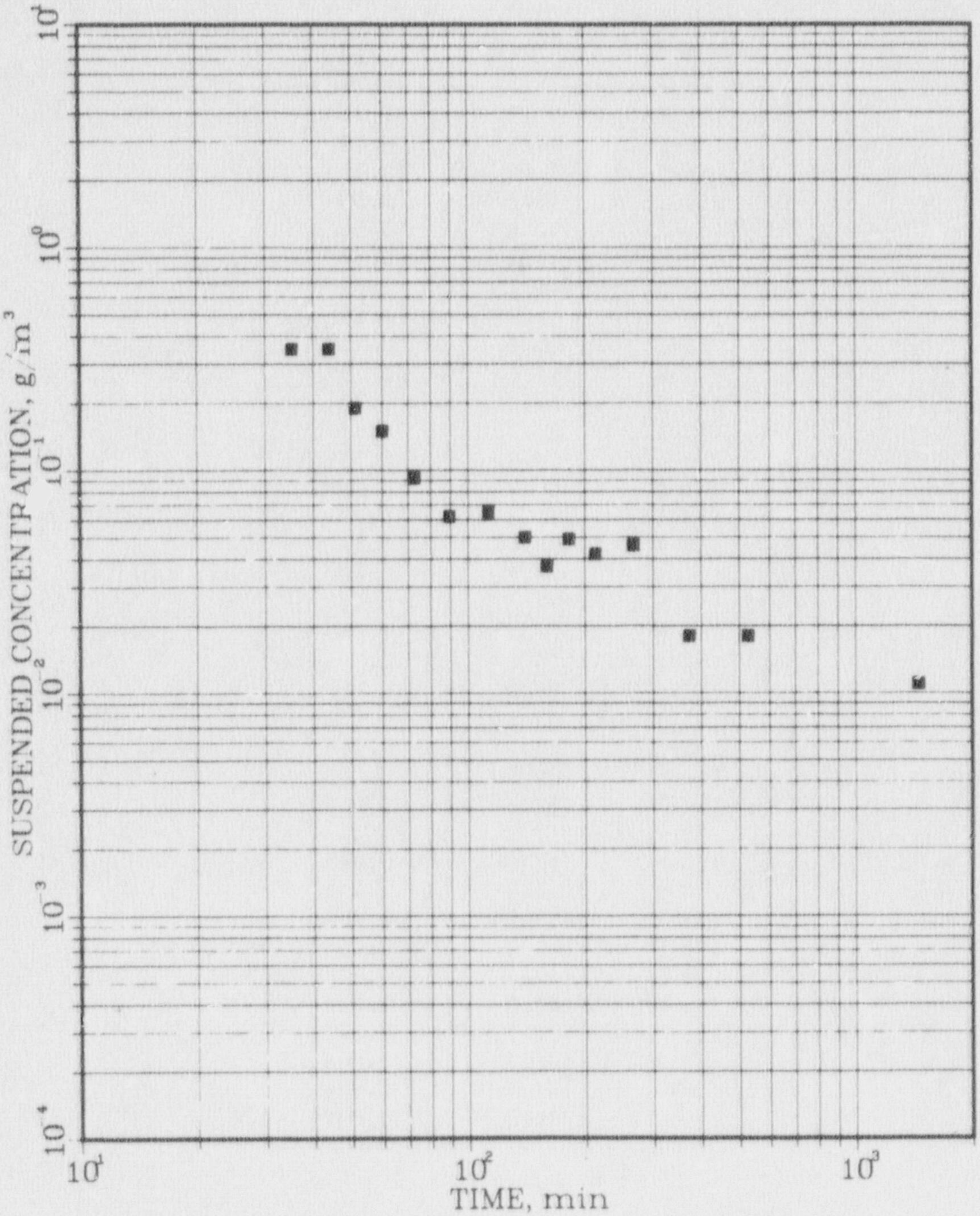

Fig. 7. Average aerosol mass concentration — NSPP test 522.

Table 10. Aerosol mass concentration as determined with individual in-vessel samplers — Test 522

Sampler — Sample No.	Time[a] (min)	Mass[b] concentration (g/m^3)
151-1	33.7	0.35
152-1	34.0	0.50
153-1	36.4	0.25
154-1	36.7	0.30
151-2	42.2	0.30
152-2	42.4	0.52
153-2	44.7	0.31
154-2	44.9	0.27
151-3	50.9	0.18
152-3	51.1	0.25
153-3	51.3	0.16
154-3	51.6	0.17
151-4	59.6	0.13
152-4	59.9	0.22
153-4	60.2	0.12
154-4	60.4	0.13
151-5	72.2	0.10
152-5	72.5	0.11
153-5	72.9	0.083
154-5	73.1	0.074
151-6	89.0	0.067
152-6	89.2	0.071
153-6	89.4	0.064
154-6	89.7	0.047
151-7	112.2	0.088
152-7	110.3	(0.61)[c]
153-7	113.0	0.065
154-7	113.4	0.041
151-8	139.5	0.058
152-8	140.0	0.064
153-8	140.4	0.053
154-8	140.8	0.027
151-9	181.1	0.075
152-9	181.5	0.064
153-9	182.0	0.026
154-9	182.2	0.032

[a]Time measured from start of aerosol generation.

[b]Aerosol mass concentration in the vessel under test conditions that existed at time the sample was taken.

[c]Doubtful value omitted in calculating average concentration.

Table 11. Aerosol mass concentration as determined with individual wall filter samplers — Test 522

Sampler — Sample No.	Time[a] (min)	Mass[b] concentration (g/m^3)
155-1	159.4	0.032
156-1	159.5	0.041
157-1	—	—
155-2	212.5	0.040
156-2	212.8	—
157-2	213.3	0.044
155-3	266.3	0.025
156-3	266.8	0.080
157-3	267.4	0.032
155-4	371.8	0.021
156-4	371.9	(0.12)[c]
157-4	372.5	0.014
155-5	526.1	0.015
156-5	526.5	0.027
157-5	527.1	0.012
155-6	1450.8	0.0098
156-6	1451.2	0.011
157-6	1451.6	0.013

[a]Time measured from start of aerosol generation.

[b]Aerosol mass concentration in the vessel under test conditions that existed at time the sample was taken.

[c]Doubtful value omitted in calculating average concentration.

Table 12. Aerosol fallout and plateout data; rate and cumulative mass vs time — NSPP Test 522

Sampler name	Midpoint of sampling time (min)	Duration of sample (min)	Fallout		Plateout	
			Rate [mg/(m^2·min)]	Cumulative (g)	Rate [mg/(m^2·min)]	Cumulative (g)
FO-1	27.2	54.3	8.9	3.5		
PO-1	23.6	47.3			0.80	2.6
FO-2	68.1	21.3	21	7.2		
PO-2	62.3	24.0			1.7	5.8
FO-3	102.6	42.3	9.5	10.4		
PO-3	97.5	43.0			0.69	8.0
FO-4	159.7	66.7	6.1	13.4		
PO-4	154.2	65.5			0.22	9.0
FO-5	235.6	77.5	4.0	15.8		
PO-5	227.8	77.6			0.22	10.2
FO-6	401.3	246.2	0.37	16.5		
PO-6	393.5	247.6			0.074	11.4
FO-7	982.4	909.2	0.096	17.1		
PO-7	975.8	911.8			0.028	13.2

Table 13. Aerosol fallout and plateout data: integral samples — NSPP Test 522

Fallout		Plateout	
Sampler name	Sample mass (mg)	Sampler name	Sample mass (mg)
TFO-1	1.13	TPO-BW	0.108
TFO-2	1.13	TPO-BE	0.089
TFO-3	1.15	TPO-TW	0.069
TFO-4	0.78	TPO-TN	0.056
TFO-5	0.24		
TFO-6	5.35		
Average	1.63	Average	0.081
Estimated total fallout	3.67 g	Estimated total plateout	2.29 g

ORNL-DWG 87-4609 ETD

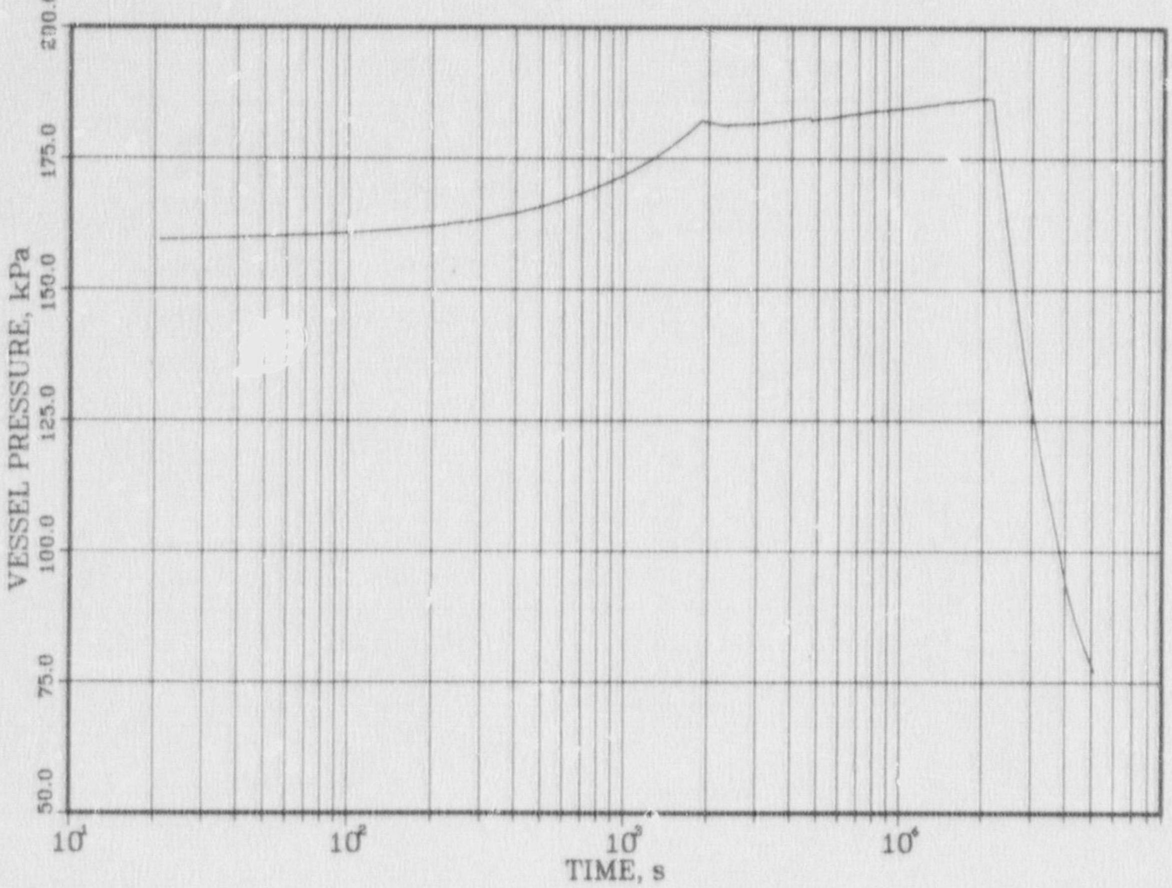

Fig. 8. Vessel atmosphere absolute pressure — NSPP test 522.

ORNL-DWG 87-4610 ETD

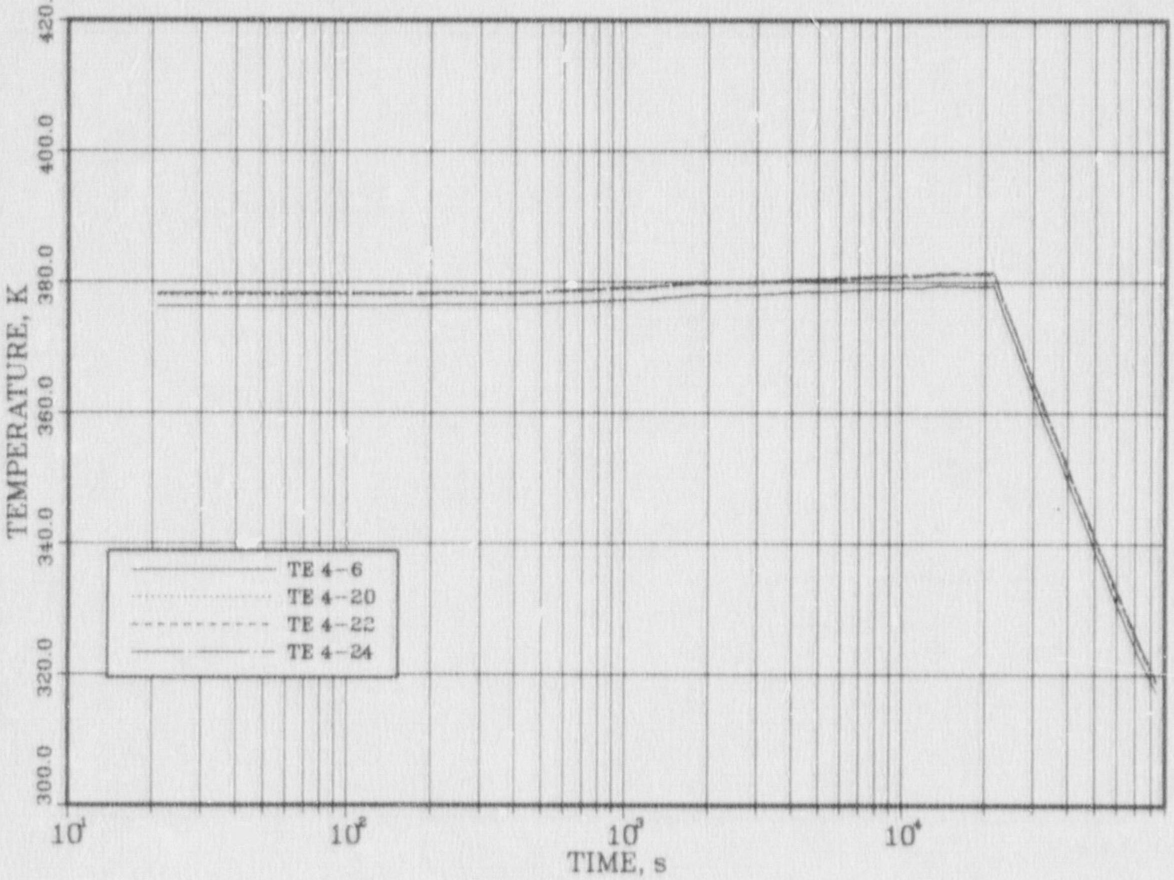

Fig. 9. Vessel atmosphere temperature at 1.22 m elevation — NSPP test 522.

ORNL-DWG 87-4611 ETD

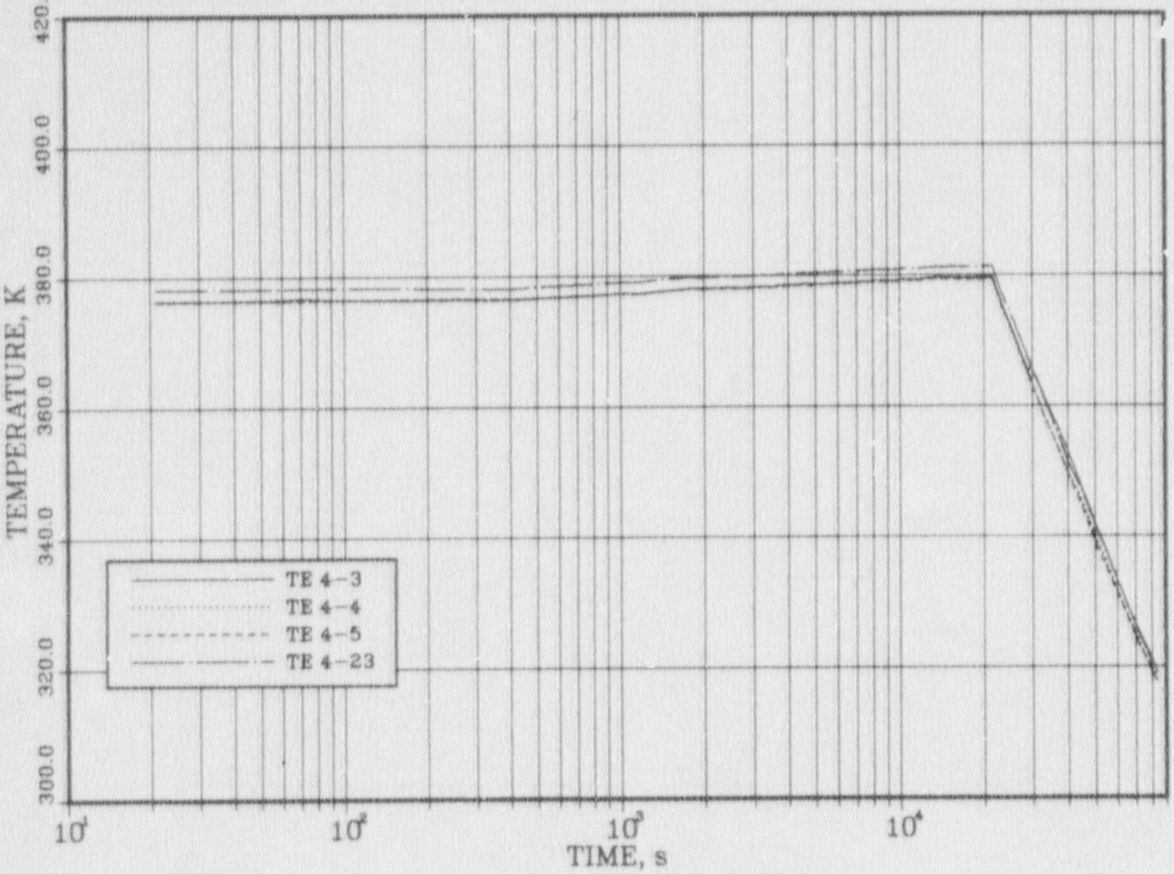

Fig. 10. Vessel atmosphere temperature at 2.74 m elevation — NSPP test 522.

ORNL-DWG 87-4612 ETD

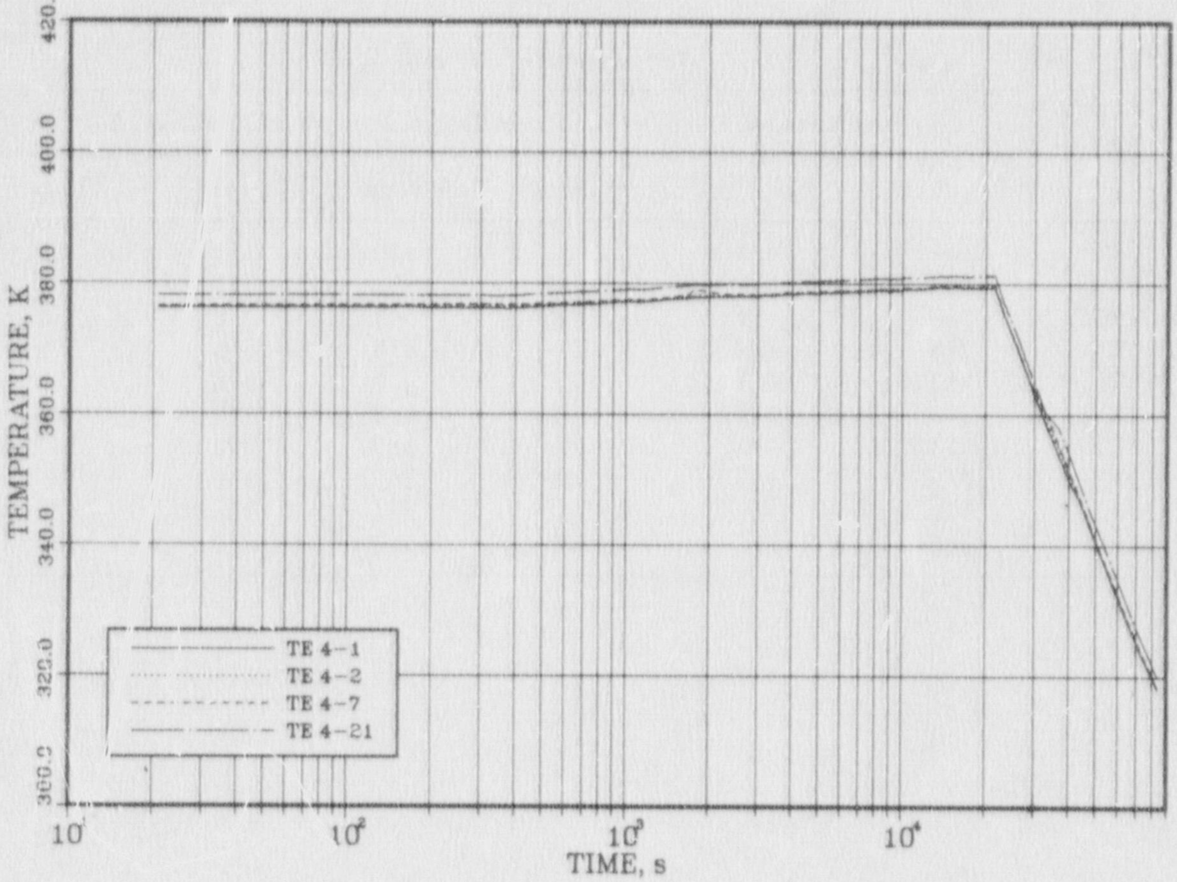

Fig. 11. Vessel atmosphere temperature at 4.27 m elevation — NSPP test 522.

Table 14. Temperature profile at 1.22 m elevation for various times after start of aerosol generation — NSPP Test 522

Time (s)	Temperature readings, K					
	Thermocouple locations — distance from vessel wall					
	On wall	1.25 mm	2.5 mm	5 mm	10 mm	255 mm
180	306	310	310	310	310	313
1080	330	332	332	331	331	333
1980	348	349	349	349	349	350
3780	375	376	376	376	376	376
5580	377	378	378	378	378	379
7380	377	378	378	378	378	378
10750	378	380	380	380	380	380
18777	379	380	380	381	381	381
30712	376	377	377	377	377	377
96114	316	317	317	317	317	317

Table 15. Temperature profile at 2.74 m elevation for various times after start of aerosol generation — NSPP Test 522

Time (s)	Temperature readings, K					
	Thermocouple locations — distance from vessel wall					
	On wall	1.25 mm	2.5 mm	5 mm	10 mm	533 mm
120	306	309	309	309	309	311
1080	330	331	331	331	331	332
1980	348	348	348	348	348	350
3780	375	375	375	375	375	376
5580	377	377	377	377	377	379
7380	376	376	377	376	377	378
10750	378	378	378	378	379	380
18777	379	380	380	380	380	381
30712	375	375	375	375	376	377
96114	316	316	316	316	316	318

Table 16. Steam condensation rates on vessel wall — Test 522

Sample No.	Sampling start time (min)	Sample duration (min)	Volume of condensate (cm^3)	Rate [$cm^3/(min \cdot m^2)$]
1	0	51.7	12	0.72
2	53.5	23.6	12	1.6
3	77.7	44.4	18	1.2
4	122.5	67.1	31	1.4
5	190.0	80.7	38	1.4
6	271.1	100.6	62	1.9
7	373.1	147.9	50	1.0
8	522.3	911.5	1	0.003

Area of sampler = 0.324 m^2.

4.3 Summary and Data Listings for Test 531

(Dry Atmosphere)

Aerosol source	
Mass of concrete powder into generator	0.34 kg
Duration of aerosol generation	33.5 min
Maximum average aerosol concentration (under dry conditions)	1.5 g/m^3
Vessel atmosphere	
Vessel air pressure at start of aerosol generation	Ambient
Relative humidity at start of aerosol generation	<20%
Aerosol parameters measured	
Aerosol mass concentration (average)	Fig. 12
Aerosol mass concentration (individual samplers)	Tables 17-18
Aerosol fallout and plateout rates; cumulative fallout and plateout mass	Table 19
Aerosol integral fallout and plateout mass	Table 20
Andersen impactor data	Table 21
Spiral centrifuge aerosol sample data	Table 22
System parameters measured	
Vessel atmosphere pressure	Fig. 13
Vessel atmosphere temperature	Figs. 14-16
Temperature gradient near wall	Tables 23-24

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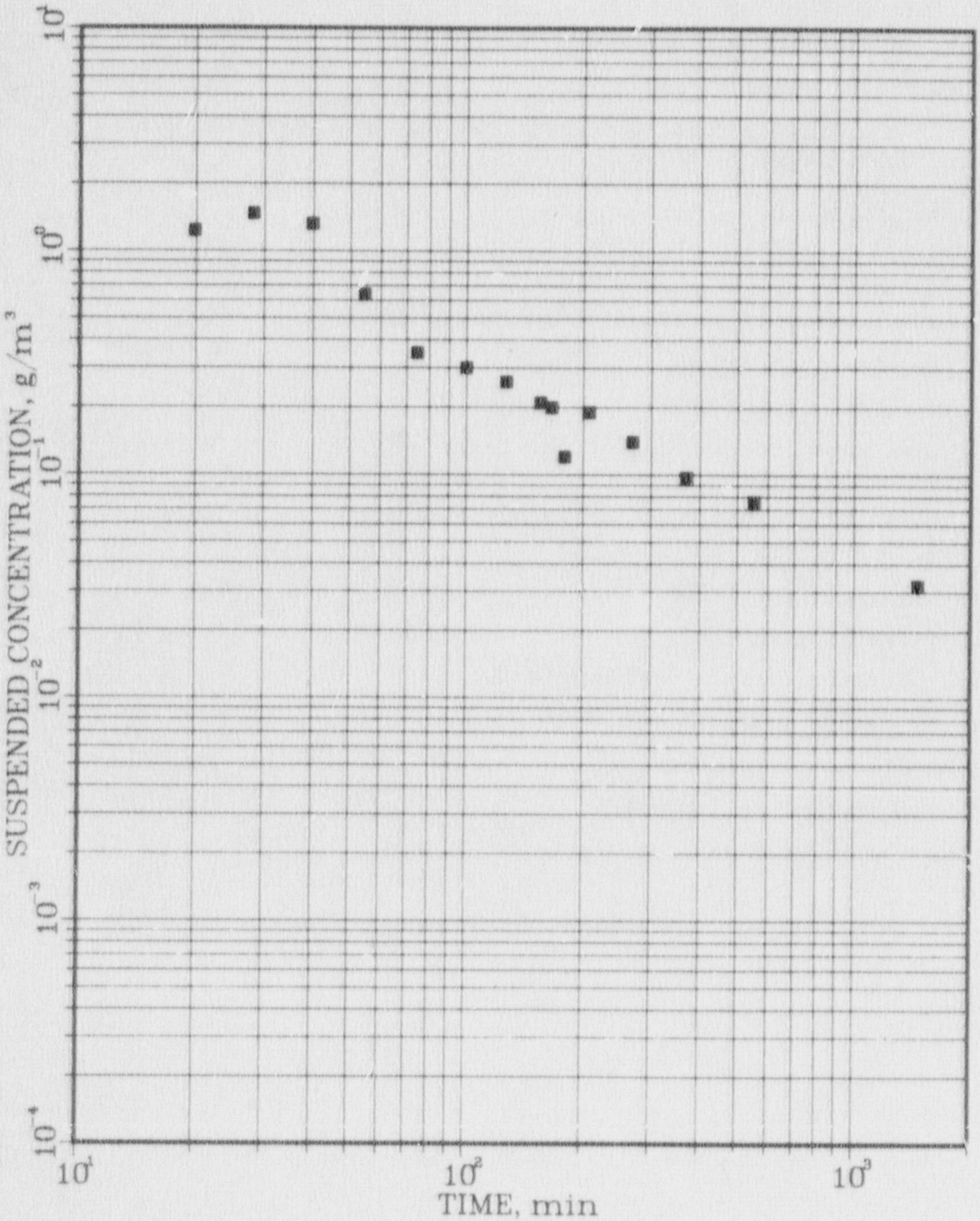

Fig. 12. Average aerosol mass concentration — NSPP test 531.

Table 17. Aerosol mass concentration as determined with individual in-vessel samplers — Test 531

Sampler — Sample No.	Time[a] (min)	Mass[b] concentration (g/m)
151-1	18.4	2.01
152-1	18.7	0.69
153-1	20.8	0.93
154-1	21.1	1.28
151-2	26.8	1.81
152-2	27.1	1.57
153-2	29.0	1.07
154-2	29.3	1.42
151-3	38.4	1.78
152-3	38.8	1.42
153-3	40.8	0.68
154-3	41.1	1.40
151-4	54.1	0.63
152-4	54.3	0.85
153-4	54.7	0.53
154-4	54.9	0.55
151-5	74.1	0.32
152-5	74.3	0.39
153-5	74.7	0.29
154-5	74.9	0.39
151-6	99.3	0.19
152-6	99.8	0.41
153-6	100.0	0.24
154-6	100.3	0.35
151-7	126.2	0.26
152-7	126.4	0.31
153-7	126.7	0.23
154-7	126.9	0.22
151-8	154.8	0.19
152-8	155.2	0.24
153-8	155.5	0.20
154-8	155.8	0.22
151-9	179.1	0.14
152-9	179.4	0.11
153-9	179.8	0.16
154-9	180.0	0.082

[a]Time measured from start of aerosol generation.

[b]Aerosol mass concentration in the vessel under test conditions that existed at time the sample was taken.

Table 18. Aerosol mass concentration as determined with individual wall filter samplers — Test 531

Sampler — Sample No.	Time[a] (min)	Mass[b] concentration (g/m^3)
155-1	166.0	0.19
156-1	166.3	0.20
157-1	166.9	0.21
155-2	206.7	—
156-2	206.9	0.21
157-2	207.2	0.16
155-3	268.3	0.12
156-3	268.5	0.13
157-3	268.8	0.16
155-4	369.8	0.094
156-4	370.3	0.17
157-4	370.8	(1.10)[c]
155-5	511.3	0.083
156-5	551.8	0.071
157-5	552.0	0.073
155-6	1464.0	0.027
156-6	1464.0	(0.069)[c]
157-6	1464.0	0.037

[a]Time measured from start of aerosol generation.

[b]Aerosol mass concentration in the vessel under test conditions that existed at time the sample was taken.

[c]Doubtful value omitted in calculating average concentration.

Table 19. Aerosol fallout and plateout data; rate and cumulative mass vs time — NSPP Test 531

Sampler name	Midpoint of sampling time (min)	Duration of sample (min)	Fallout		Plateout	
			Rate	Cumulative	Rate	Cumulative
			[mg/(m^2·min)]	(g)	[mg/(m^2·min)]	(g)
FO-1	21.8	43.6	3.4	1.51		
PO-1	23.1	46.2			3.3	11.4
FO-2	58.2	24.3	4.4	1.11		
PO-2	61.4	25.0			5.8	22.3
FO-3	94.5	42.7	2.0	0.86		
PO-3	97.8	42.3			4.9	37.8
FO-4	145.4	54.2	2.0	1.10		
PO-4	148.3	54.8			2.7	49.1
FO-5	217.8	85.7	1.10	0.97		
PO-5	221.0	86.3			1.6	59.5
FO-6	409.8	292.2	0.33	0.99		
PO-6	413.6	292.6			0.51	70.8
FO-7	994.4	870.8	0.14	1.27		
PO-7	999.2	872.0			0.15	80.9

Table 20. Aerosol fallout and plateout data: integral samples — NSPP Test 531

Fallout		Plateout	
Sample No.	Sample mass (mg)	Sample No.	Sample mass (mg)
TFO-1	2.07	TPO-BW	0.95
TFO-2	1.95	TPO-BE	0.31
TFO-3	2.73	TPO-TW	0.11
TFO-4	2.33	TPO-TN	0.12
Average	2.27	Average	0.37
Estimated total fallout	4.97 g	Estimated total plateout	8.96 g

Table 21. Andersen impactor data — Test 531

Percent of total sampled aerosol mass made up of particles smaller than the aerodynamic diameter listed									
Sample No.	Time (min)	Aerodynamic diameter (μm)							
		14.2	8.9	6.0	4.1	2.6	1.3	0.82	0.61
1	36.0	95.6	93.3	91.1	88.9	85.7	82.9	80.5	77.2
2	98.0	96.3	94.2	92.4	89.1	83.8	77.3	73.4	70.8

Table 22. Spiral centrifuge aerosol sampler data — Test 531

Percent of total sampled aerosol mass made up of particles smaller than the aerodynamic diameter listed

Sample No.	Time (min)	Aerodynamic diameter (μm)							
		4.4	3.0	1.5	1.0	0.78	0.67	0.6	0.52
1	54.0	90.2	83.8	69.0	55.6	38.8	20.5	12.4	3.1

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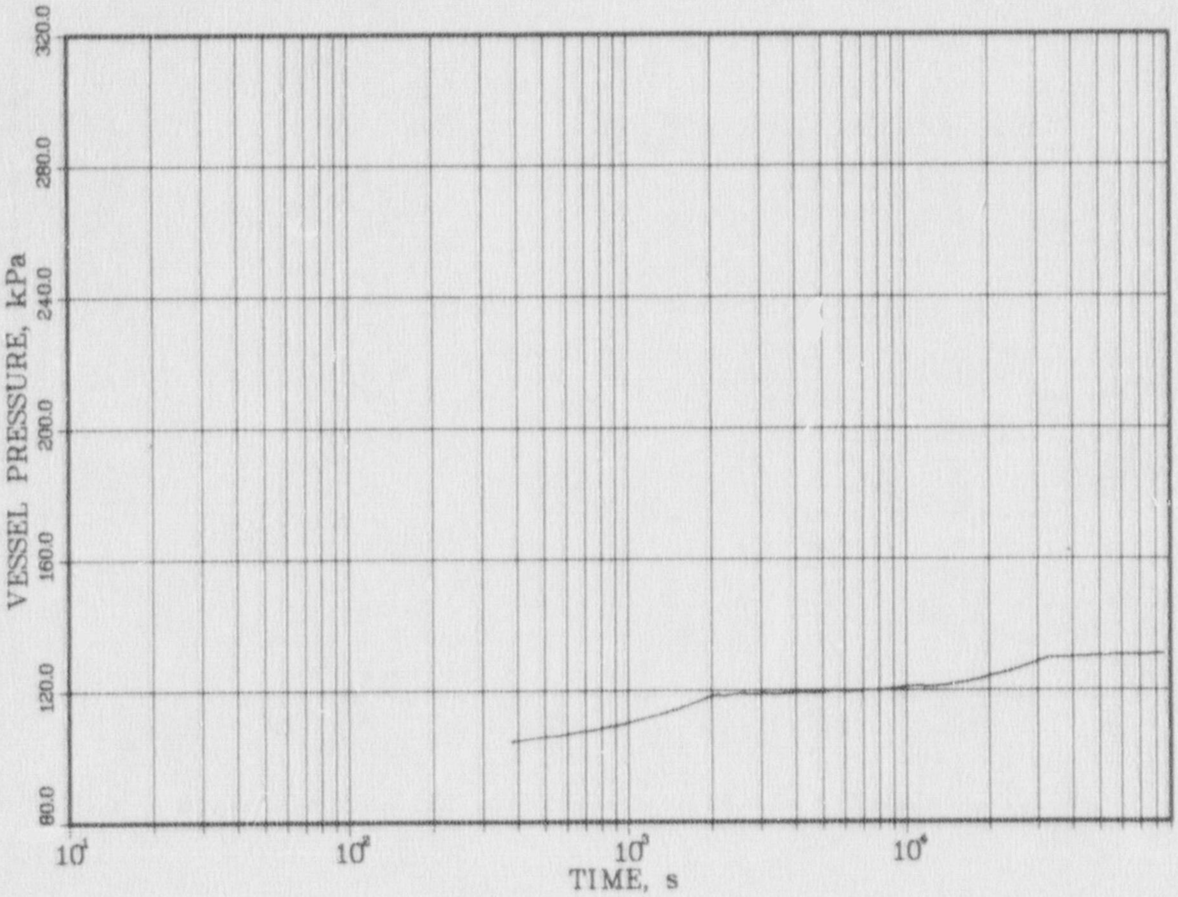

Fig. 13. Vessel atmosphere absolute pressure — NSPP test 531.

ORNL-DWG 87-4615 ETD

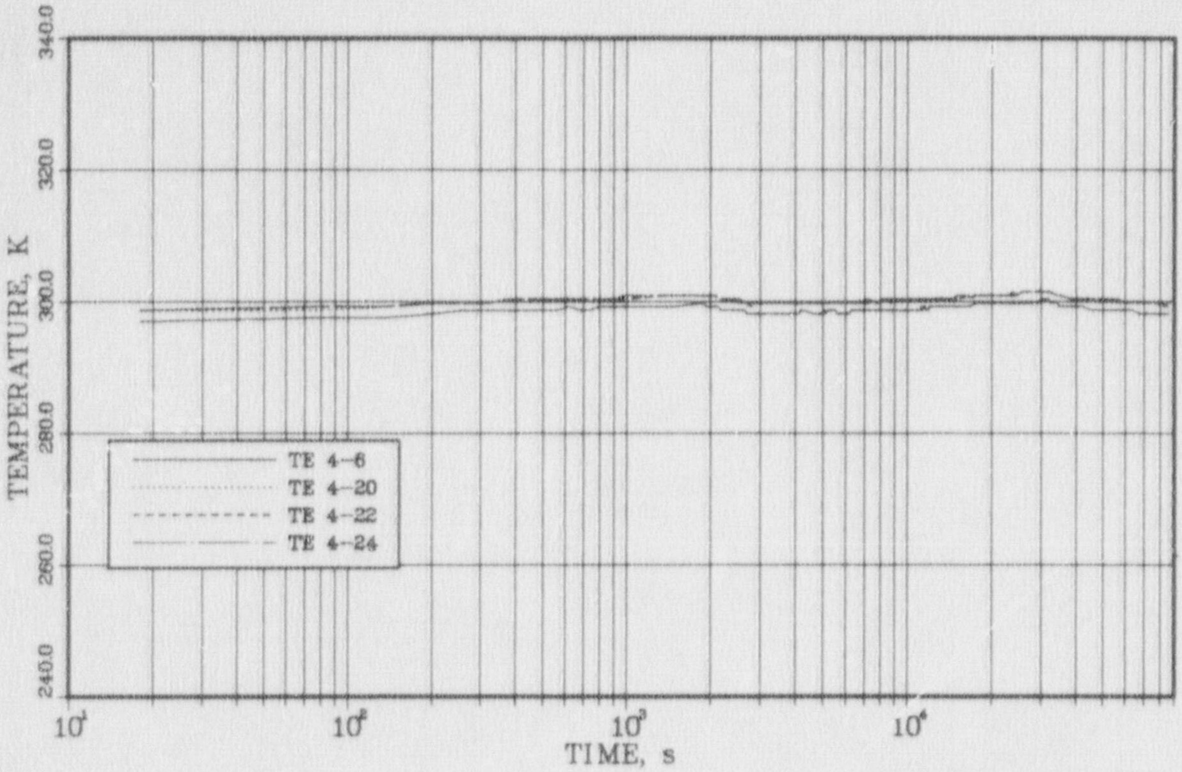

Fig. 14. Vessel atmosphere temperature at 1.22 m elevation — NSPP test 531.

ORNL–DWG 87–4616 ETD

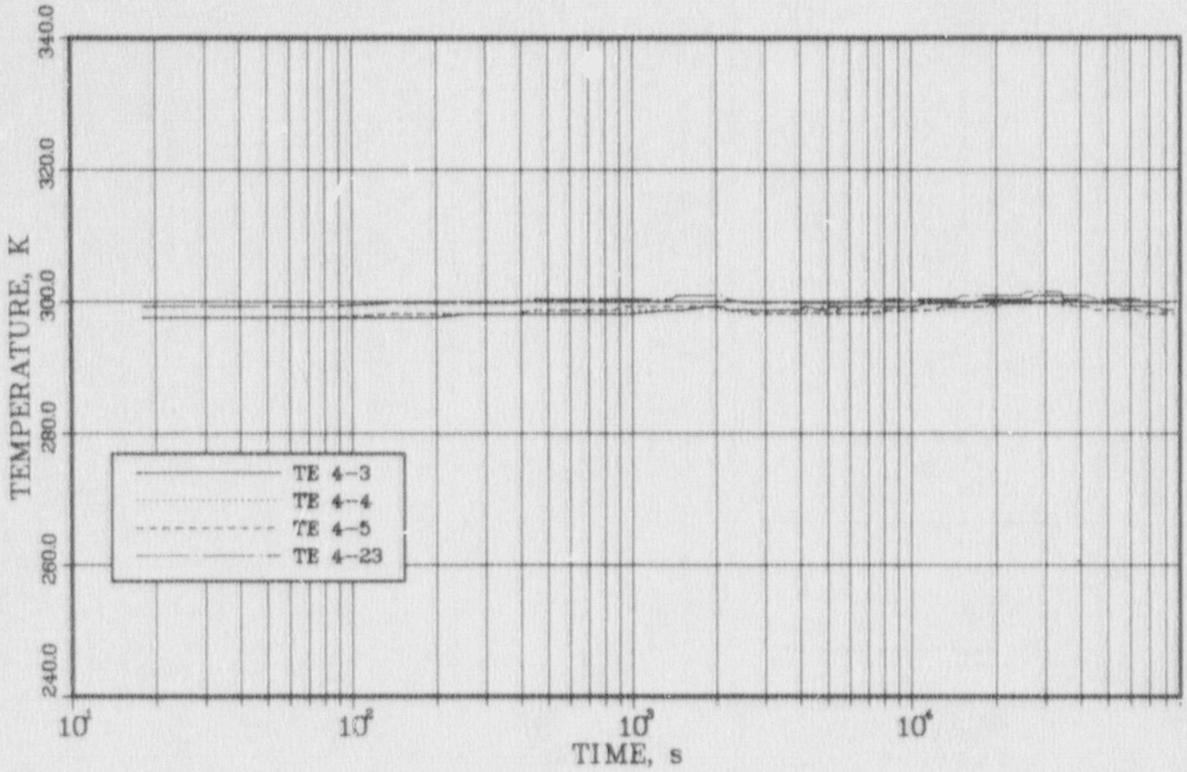

Fig. 15. Vessel atmosphere temperature at 2.74 m elevation — NSPP test 531.

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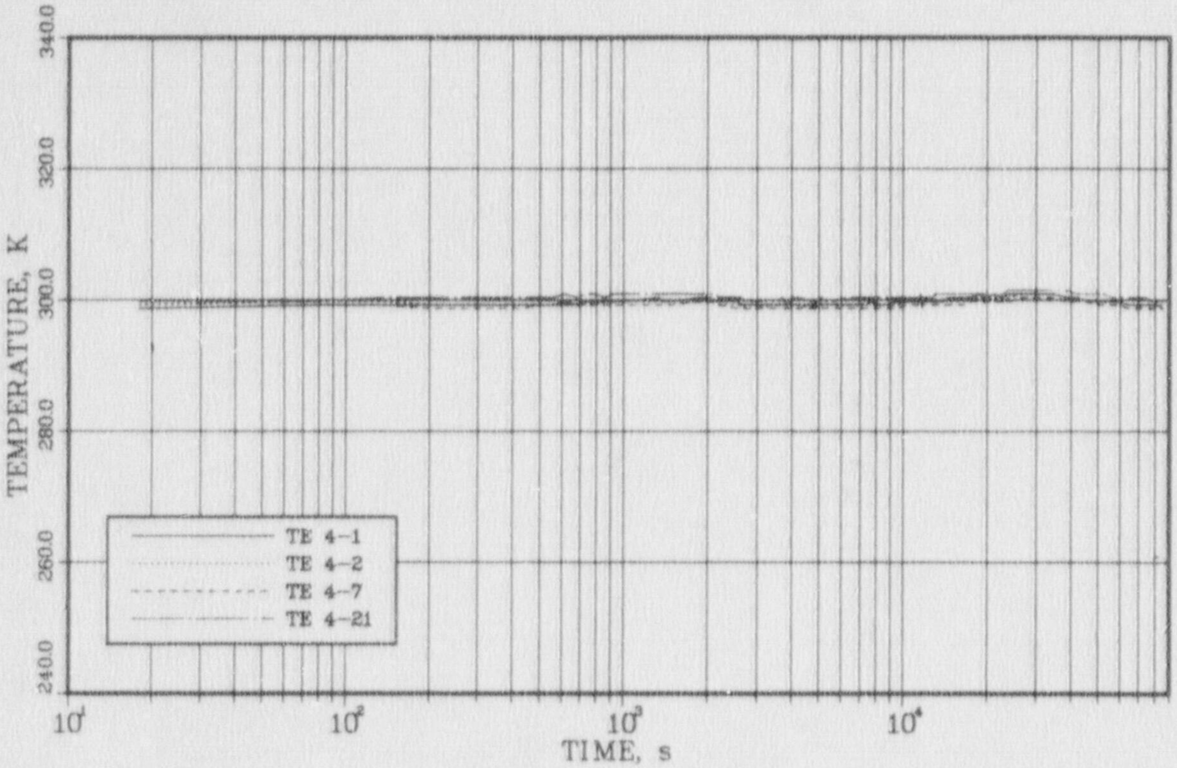

Fig. 16. Vessel atmosphere temperature at 4.27 m elevation — NSPP test 531.

Table 23. Temperature profile at 1.22 m elevation for various times after start of aerosol generation — NSPP Test 531

Time (s)	Temperature readings, K					
	Thermocouple locations — distance from vessel wall					
	On wall	1.25 mm	2.5 mm	5 mm	10 mm	255 mm
78	297	298	298	2981	298	299
978	298	298	298	298	299	301
2121	298	298	299	299	299	301
3699	298	299	299	299	299	300
5536	298	299	299	299	299	300
8159	298	299	299	299	299	300
11196	299	299	299	299	299	300
20248	299	300	300	300	300	301
29200	300	300	300	300	300	302
189227	298	299	299	299	299	300

Table 24. Temperature profile at 2.74 m elevation for various times after start of aerosol generation — NSPP Test 531

Time (s)	Temperature readings, K					
	Thermocouple locations — distance from vessel wall					
	On wall	1.25 mm	2.5 mm	5 mm	10 mm	533 mm
78	297	297	297	298	298	299
978	298	298	298	298	298	300
2121	298	299	299	299	299	301
3699	298	298	298	298	298	300
5536	298	298	298	298	298	300
8159	298	299	299	299	299	300
11196	298	299	299	300	300	301
20243	299	299	299	300	300	301
29200	300	300	300	300	300	302
89227	298	298	298	298	298	300

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1. REPORT NUMBER (Assigned by TIDC, add Vol. No., if any)

NUREG/CR-5017
ORNL/TM-10587

2. TITLE AND SUBTITLE

LIMESTONE CONCRETE AEROSOL EXPERIMENTS IN STEAM-AIR ATMOSPHERES: NSPP TESTS 521, 522, AND 531, DATA RECORD REPORT

3. LEAVE BLANK

4. DATE REPORT COMPLETED

MONTH	YEAR
September	1987

5. AUTHOR(S)

M. L. Tobias R. E. Adams

6. DATE REPORT ISSUED

MONTH	YEAR

7. PERFORMING ORGANIZATION NAME AND MAILING ADDRESS (Include Zip Code)

Oak Ridge National Laboatory
P.O. Box Y
Oak Ridge, TN 37831

8. PROJECT/TASK/WORK UNIT NUMBER

9. FIN OR GRANT NUMBER

B0121

10. SPONSORING ORGANIZATION NAME AND MAILING ADDRESS (Include Zip Code)

Division of Reactor Accident Analysis
Office of Nuclear Regulatory Research
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

11a. TYPE OF REPORT

Technical

b. PERIOD COVERED (Inclusive dates)

12. SUPPLEMENTARY NOTES

13. ABSTRACT (200 words or less)

This data record report summarizes the results from two tests involving limestone concrete test aerosol in a steam-air environment and one test in a dry air environment. This research sponsored by the U.S. Nuclear Regulatory Commission was conducted in the Nuclear Safety Pilot Plant at the Oak Ridge National Laboratory. The purpose of this project is to provide a data base on the behavior of aerosols in containment under conditions assumed to occur in postulated LWR accident sequences; this data base will provide experimental validation of aerosol behavioral codes under development. In the report a brief description is given of each test together with the results in the form of tables and graphs. Included are data on aerosol mass concentration, aerosol fallout, and plateout rates, total mass fallout and plateout, aerosol particle size, vessel atmosphere pressure, vessel atmosphere temperatures, temperature gradients near the vessel wall, and steam condensation rates on the vessel wall.

14. DOCUMENT ANALYSIS – a. KEYWORDS/DESCRIPTORS

b. IDENTIFIERS/OPEN-ENDED TERMS

15. AVAILABILITY STATEMENT

unlimited

16. SECURITY CLASSIFICATION

(This page)

unclassified

(This report)

unclassified

17. NUMBER OF PAGES

18. PRICE

120555078877 1 1AN1R7
US NRC-OARM-ADM
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