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Nuclear Fuel Cycle Facility Accident Analysis Handbook

U.S. Nuclear Regulatory Commission

Office of Nuclear Material Safety and Safeguards

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EXECUTIVE SUMMARY

This Accident Analysis Handbook (AAH) was prepared jointly by Pacific Northwest Laboratory, Los Alamos National Laboratory, and the United States Nuclear Regulatory Commission (NRC). The NRC Office of Nuclear Material Safety and Safeguards, Division of Industrial and Medical Nuclear Safety, sponsored this work in a program to develop improved methods of evaluating the consequences of major accidents in fuel cycle facilities. This handbook will be used by NRC licensing staff and applicants for an NRC fuel cycle facility license or license amendment.

The AAH covers four generic facilities: fuel manufacturing, fuel reprocessing, waste storage/solidification, and spent fuel storage; and six accident types: fire, explosion, tornado, criticality, spill, and equipment failure. These are the accident types considered to make major contributions to the radiological risk from accidents in nuclear fuel cycle facility operations.

The AAH will enable the user to calculate source term releases from accident scenarios manually or by computer. A major feature of the AAH is development of accident sample problems using information from Chapters 2 and 3 to provide input to source term analysis methods in Chapter 4 and transport computer codes in Chapter 5. Sample problems and illustrative examples for different accident types are included in the AAH.

Chapter 2 covers the facility description. Section 2.7 introduces the sample problem. Here the facility descriptors required for input are itemized. Processes within the facility are described in Chapter 3. Section 3.5 is the continuing sample problem - here process parameters required for accident computer codes or hand calculation are detailed. They are added to the input from Section 2.7.

Chapter 4 develops the scenario and radioactive source terms for the continuing sample problems. Input from Sections 2.7 and 3.5 lead to the source

term developed in this chapter. Both hand and computer calculation of releases are illustrated.

Chapter 5 uses the source term information developed in Chapter 4 to calculate the transport of mass, energy, and material throughout the facility. The accident consequence assessment is determined by computer codes, which calculate the radioactive release to the environment and the spread of radioactivity throughout the facility.

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1.0 INTRODUCTION

The U.S. Nuclear Regulatory Commission (NRC) sponsored a research program to develop improved methods for realistically evaluating the consequences of major accidents in nuclear fuel cycle facilities. These methods, along with supporting information and illustrative examples, are provided in this handbook. It is anticipated that this handbook will be used by the NRC licensing staff and applicants for an NRC nuclear fuel cycle facility license or license amendment.

1.1 PURPOSE

The purpose of this handbook is to provide methods for determining the release of radioactive material to the atmosphere and within a p[illegible] resulting from potential accidents at nuclear fuel cycle facilities. Use of the methods contained in this handbook allows a determination of the amount and characteristics of radioactive material that may be released. Some of the information in this handbook has been available for many years, while some information has been developed by the NRC-sponsored research program associated with the handbook. The handbook provides step-by-step procedures for performing the accident analysis. In Chapters 2 and 3, the procedures are given for specifying the facility and processing parameters that are needed for accident evaluation.

In Chapter 4, guidelines are provided for establishing accident scenarios, and computational methods are given for calculating the resulting accident source term. In Chapter [illegible], the procedures for evaluating the transport of any airborne radioactive material through the facility's ventilation system are described. The facility's ventilation system is considered to be a primary pathway for release of accident-generated aerosols to the external environment. Several supporting documents are listed in Appendix A that include user's manuals for computer codes used in the accident analysis and other supplemental information. Throughout the handbook several examples are provided to illustrate the accident analysis methods. Primary sample problems (illustrative examples) are carried through the entire handbook. Secondary sample problems are chosen to illustrate source term calculational methods but are not carried through to Chapter 5.

1.2 SCOPE

1.2.1 Facilities

The fuel cycle facilities addressed in this handbook include selected facilities needed to support the light water reactor (LWR) fuel cycle as shown below:

- fuel fabrication
- spent fuel storage
- fuel reprocessing
- high-level waste storage/solidification.

1.2.2 Accidents

The accidents addressed in this handbook are those that can reasonably occur in a fuel cycle facility. They include:

- fires
- explosions
- tornadoes
- criticalities
- spills
- equipment failures.

These accidents were chosen as being the major contributors to the radiological accident risk from the operations of fuel cycle facilities.

1.2.3 Limitations

The methods described in this handbook provide for a determination of the phenomena and events occurring within the facility and the release of radioactive material from the facility as a result of hypothetical accidents. The methods do not address the atmospheric transport of the radioactive material once it has been released from the facility or the health physics calculations needed to determine the radiation exposure of the surrounding population. It is anticipated that once the radioactive source term from the facility is specified, standard atmospheric transport and radiological assessment would be used to complete the accident evaluation.

This handbook provides methods for calculating certain consequences of accidents in fuel cycle facilities; it does not provide methods for determining the probabilities that these accidents will occur. Therefore a complete analysis of risk is outside the scope of this handbook. However, the accident consequence assessment techniques, when coupled with probabilities of failure of structures, systems, and components, will be useful in evaluating fuel cycle facility accident risks.

1.3 USERS

This handbook has been developed for use by scientists and engineers. It has been assumed that the user has a level of knowledge and experience equivalent to an engineering or science bachelor's degree with some understanding of physics and chemistry.

The NRC licensing staff will use the methods contained in this handbook, as appropriate, to support safety and environmental evaluations for fuel cycle facilities and for performing accident consequence analyses. It is anticipated that applicants for an NRC nuclear fuel cycle facility license and existing licensees also may use the AAH in preparing accident evaluations to support their applications for a license or license amendment.

2.0 FACILITY/ACCIDENT DESCRIPTORS

This chapter guides users in selecting descriptors of their facility that are used in an analysis to estimate the radiological consequences of potential accidents in that facility. Some of these parameters are required as input for the source term models described in Chapter 4; the rest are used as input to flow dynamics and transport codes described in Chapter 5.

The following sections identify the specific facility descriptors needed and discuss how they affect accident consequences in each of the four types of fuel cycle facilities covered in this handbook: fuel manufacturing, fuel reprocessing, spent fuel storage, and waste solidification. A representative facility containing common descriptors from each of the four types is developed to simplify input to sample problems. These problems illustrate how Chapter 2 parameters are used in accident analysis scenarios. Sample problems are provided for each of the types of accidents considered: fire, explosion, tornado, spill, criticality, and equipment failure. Primary sample problems are carried through to Chapter 5 while secondary sample problems are not.

A discussion of general construction and process features that are required for source term calculation and input to accident analysis codes follows. This is followed by sections applicable to each of the four facility types covered in the AAH.

2.1 GENERAL CONSTRUCTION AND PROCESS FEATURES

The following sections discuss general construction and process features that may affect the outcome of an accident in a fuel cycle facility. Features developed are applicable to all facilities. They are discussed with emphasis on their use as input to source term and transport models described in Chapters 4 and 5. The facility description produced by these parameters is the setting from which an accident scenario is developed. Conditions in the facility during the accident are also determined by these parameters. The more detailed a description of the accident location within the plant, the more refined the estimate of accident consequences can become.

Parameters needed to describe a fuel cycle facility can be grouped under four major descriptors: accident compartment, vessels in that compartment, ventilation system, and alternate flow paths.

2.1.1 Description of the Accident Compartment

In an accident analysis, the location of the accident must be determined. The accident compartment referred to here is the immediate enclosure around the accident source. Major potential accident locations with potentially significant radiological consequences may be identified as being rooms (or areas) containing inventories of radioactive materials. Chapter 3 discusses inventories within the plant, and leads to selection of a potential accident compartment. Descriptors of the compartment needed for accident analysis are type and thickness of construction materials of walls, floors, and ceiling; dimensions of the room; and openings from the room such as ventilation ducts, doors, or alternate flow paths. The compartment can either be a room or an enclosure such as a glove box.

2.1.1.1 Material Type and Thickness

The type and thickness of construction material determines the integrity of the compartment, and also affects heat transfer from fires.

In high energy accidents such as fires, explosions, and tornadoes, the release of energy may be great enough to cause failure of compartment boundaries and lead to opening of alternate flow paths during the accident. Properties of the construction material pertaining to its strength and heat transfer capabilities must be known when developing the accident scenario. These properties include material type, thickness, density, conductivity, emissivity, and heat capacity.

2.1.1.2 Room Dimensions

The size of the accident compartment influences the dispersion of energy and particles generated by the accident. For example, room height is important in source term calculations for both spills and pressurized releases. Length, width, and height influence heat transfer during a fire, and affect reflection and dissipation of shock waves from an explosion. Volume and/or dimensions of the accident compartment, along with energy available for dispersion, can play a role in estimating the radionuclide concentration airborne from an event and, along with ventilation characteristics, define the input to the material transport through the facility. Volume and area of the accident compartment and of other compartments connected to the ventilation system are required as input to transport codes.

2.1.2 Description of Vessels in the Accident Compartment

Vessels (containers, enclosures, and other forms of containment) within the accident compartment may play a significant role in the accident scenarios. In fires, vessels may act as heat sinks, closed containers may become pressurized and rupture, and uncovered vessels of radioactive liquids may give up radioactive vapors. Explosions occurring within vessels may cause rupture. Tornadoes and explosions may generate enough energy to fail vessel walls or to cause vessels to be picked up and used as missiles. For spills, vessel elevation determines the spill height and thus energy generated in a spill. If vessels, enclosures, or portions of these items can be dislodged by an event (e.g., explosion, tornado) and impact solids containing radionuclides (e.g., grout, vitrified HLW), the total mass and fall height/velocity are required for estimating fragmentation by crush-impact. The piping path to and the volume of a geometrically unsafe vessel are used in the scenario and estimation of nuclides from nuclear criticality excursions from some types of facilities. The failure pressure of a vessel can be used in the airborne release of pressurized powders and liquids upon instantaneous venting.

To estimate the effect of these contributions to the source term, each vessel in the accident compartment should be described by type of construction material, dimensions, elevation, position in the compartment, volume, total weight, and weight when empty (or wall thickness and density). The failure pressure of closed vessels containing radioactive material should also be known.

2.1.2.1 Material Type

The type of construction material determines the integrity and heat transfer capability of the vessel. Properties of the construction material pertaining to strength and heat transfer capabilities may be needed for complete analysis.

2.1.2.2 Dimensions and Position

The vessel portion in the accident location determines the vessel parts that are exposed to the energy generated by the accident. This is used to calculate the area of the vessel which is impacted by direct radiative and convective heat transfer or by shock waves or pressure pulses. For a cylindrical vessel, the dimensions will be the height and diameter. For a rectangular box, the height and width are the appropriate dimensions. Distance of the vessel from an accident source should also be known, although for simplicity, the source term fire code FIRIN assumes the distance of all vessels from the fire are a designated nominal value for radiant heat calculations. Use of DETIN based upon Steindler and Seefeldt (1980) to estimate fragmentation and suspension of solids and liquids from detonations is only valid for materials in contact with the explosive charge. Therefore, the position of the charge and affected materials d termines the model used. Gas velocity over a thick bed (greater than 3 particle diameters in depth) is used in estimating airborne release of the powder by aerodynamic entrainment. For events such as explosions, initial velocity of the explosive gases and distance can be used to estimate gas velocities at various locations within the accident compartment.

2.1.2.3 Elevation

Elevation of the vessel also affects transfer of heat from fires, potential energy for spills and crush-impact, and vulnerability of vessel to pressure waves from explosions and tornadoes. Vessels may be on the floor in a glove box or suspended from the floor as part of process equipment.

2.1.2.4 Weight

Along with the properties determined by the construction material of the vessel, the weight of the empty vessel must be estimated to determine heat transfer capabilities and vessel integrity. If the weight of the empty vessel is not known, then wall thickness and density are needed to supply the same information. The total weight of the vessel and contents, if any, are used to estimate the potential energy for crush-impact.

2.1.2.5 Failure Pressure

If a pressurized release of radioactive powders or liquids is a possible consequence of the accident, the failure pressure of the vessels containing the radioactive material must be estimated. Failure pressure is the difference between the pressure (ΔP) inside and outside of the closed vessel at which the container ruptures. In an accident scenario, this parameter may be used to determine the time of failure, and the magnitude of release of radioactive materials.

Release pressure depends on the type and thickness of container construction material. Methods of calculating bursting pressures for vessels are given in Halverson and Mishima (1986). Figure 2.1 shows the bursting pressure for various materials and vessel diameters based on the hoop-stress equation detailed in Halverson and Mishima (1986).

2.1.3 Description of the Ventilation System

The configuration of the ventilation system must be described and used as input to codes modeling transport of accident-generated particles through the facility and to the environment. Ducts, dampers, fans, filters, and compartments make up the major units in heating, ventilation, and air conditioning (HVAC) systems (Burchsted, Kahn and Fuller 1976). They are the modeling components required by transport codes to estimate releases. Chapter 5 and the User Manuals for these codes show how a HVAC system schematic is constructed and used as input to the codes.

Besides the location and organization of the HVAC system components mentioned above, other descriptors of these components are required. These could include elevation of accident compartment inlet and outlet ducts, filter type and efficiency, blower curves, duct dimensions, duct wall properties, and room size.

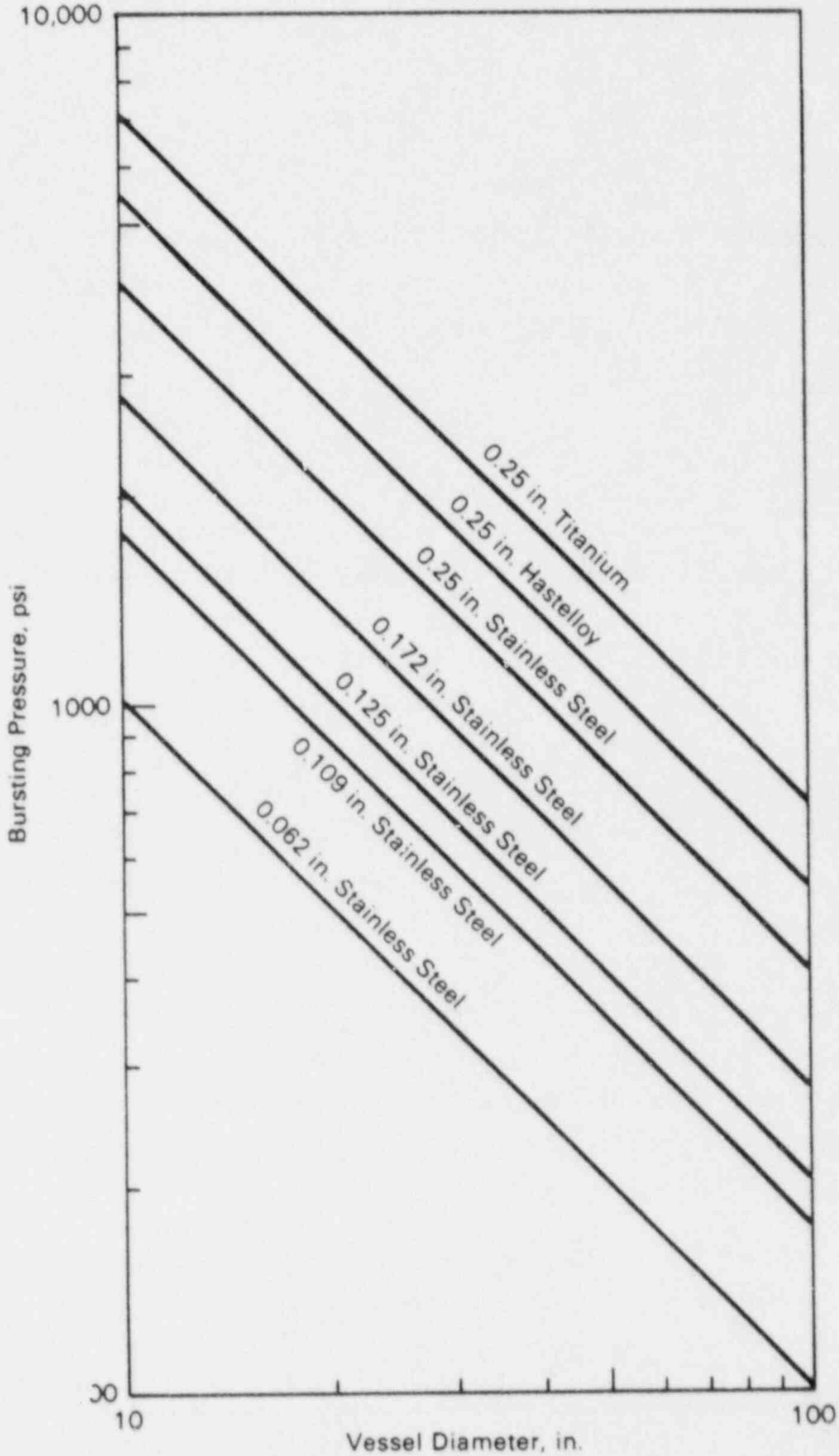

FIGURE 2.1. Bursting Pressure vs Vessel Diameter (Halverson and Mishima 1986)

2.1.3.1 Duct Elevation

Inlet air ducts are usually at higher elevations than exit ducts to a room so that radioactive particle suspension is minimized. The elevation of the midplane entry of the inlet and exit ducts to the accident compartment affect source term calculations for some source term codes and must be specified as input.

2.1.3.2 Filter Type and Efficiency

Filter type and efficiency are used as inputs to both source term and transport codes. The fire codes determine filter loading during the fire and thus flow restriction. FIRAC (the fire analysis code) requires input of a filter plugging factor, which is the mass accumulation on the filter. This accumulation increases the pressure drop at a given flow rate.

2.1.3.3 Blower Curves

The performance of fans in the HVAC system must be input to transport codes as part of the HVAC description. This information should be given as a number of points on a fan curve of flow (cfm) versus pressure head measured at standard conditions.

2.1.3.4 Duct Dimensions

Dimensions of the ducts must also be input to transport codes as part of the input data for the HVAC schematic. Duct height (midplane of entry) must be specified to use in estimating particulate material depletion; duct equivalent diameter and heat transfer area must be specified for heat transfer calculations to the duct for fires. Duct length and cross-sectional flow area are required for explosion analysis. In addition initial flow estimates are also needed.

2.1.3.5 Duct Wall Properties

The duct heat transfer model requires properties of the duct wall as input. These properties are outside wall emissivity and absorptivity, wall density, thermal conductivity, specific heat, and thickness. If the dimensions and construction materials of the ducts are known, these properties can be found in engineering handbooks (Burchsted, Kahn and Fuller 1976).

2.1.3.6 Room Sizes

Part of the HVAC schematic information required by the material transport codes is volumes of rooms, cells, and plenums connected to the system.

2.1.4 Description of Alternate Flow Paths

Flow paths of accident-generated particles and gases may be altered due to failure of barriers during the accident. Examples of alternate flow paths generated in accidents are burnup of gloves, gasketing material, or other substances forming part of the primary barrier; or overpressurization rupturing weak points in the barrier such as gloves and windows. Alternate flow paths may also include normal leakage of air through cracks and under doors. In the present analysis, opening of these alternate paths must be anticipated. Input to the source term code describing the alternate paths include the number of paths, time at which each path is generated, elevation of the path entry in the compartment, size of the opening given in diameter or equivalent diameter of a circular orifice, and pressure on the other side.

2.1.4.1 Number of Paths and Time of Generation

The number of paths and time at which each is generated varies with the scenario chosen. An estimated time history of pressures and temperatures in the compartment during the accident along with knowledge of weak points in the compartment boundaries aids in determining if and when alternate flow paths are generated. A preliminary analysis using Chapter 4 techniques may provide the temperature and pressure histories necessary to determine boundary failure. The scenario should then be reanalyzed with that information.

2.1.4.2 Elevation and Size of Path

The elevation of the entry of the opening from the accident compartment influences the quantity and size of source term particles escaping the confinement. Size of the opening and pressure differential determine the amount and velocity of flow going through. An open glove port may be 8 in. in diameter with a change in pressure of a fraction of an inch water gage under normal conditions.

Leak paths may also be built into the schematic of the HVAC system, that is input to transport codes. The path may be modeled as a damper leading to other compartments.

2.2 SUMMARY OF FACILITY PARAMETERS

General construction and process features for the fuel cycle facility that should be known for the analysis of accidents are summarized in Table 2.1. These descriptors are used to characterize the facility in scenarios developed by the user. Chapter 3 aids in identification of possible scenarios and discusses the descriptors needed to complete the scenario description.

2.3 FUEL MANUFACTURING FACILITY DESCRIPTION

The two major types of nuclear fuel manufacturing plants are mixed oxide (mixtures of plutonium and uranium oxides) and uranium oxide. Both provide protection from release of radioactive material through containment barriers and engineered safety systems such as fire protection and ventilation equipment. The number and type of barriers as well as components of the engineered safety systems must be taken into account in an accident analysis. This type of information is used in determining potential scenarios for the accident as well as developing consequences from these scenarios. Regulatory Guides have been issued to aid designers of fuel manufacturing facilities: Regulatory Guide 3.12 (U.S. Atomic Energy Commission, 1973b) addresses design of ventilation systems and Regulatory Guide 3.16 (U.S. Atomic Energy Commission, 1974c) is a general fire protection guide for fuel fabrication plants.

2.3.1 Mixed Oxide Facilities

Mixed oxide fuel plants contain plutonium as well as uranium and thus must provide an additional layer of containment to that of uranium plants. The American Standards Institute requires mixed oxide fuel facilities to have at least one barrier separating plutonium from operators within the plant and at least two barriers separating plutonium from the ambient environment (American Institute of Chemical Engineers 1978). Mixed oxide plants use glove boxes and

TABLE 2.1. Facility Description Input Options for Accident Analysis

Descriptor
Accident Compartment
Wall material
Ceiling material
Floor material
Thickness of wall
Thickness of ceiling
Thickness of floor
Length of room
Width of room
Height of room
Volume of room
Vessels in Accident Compartment
Type of vessel (pressurized, unpressurized)
Construction material
Height of vessel
Exposed width
Elevation of vessel
Weight of empty vessel (or wall thickness and density)
Failure pressure
Ventilation System
Schematic
Elevation of inlet duct to compartment
Filter type
Filter efficiency
Blower performance curve
Duct height
Duct equivalent diameter
Duct heat transfer area
Duct floor area
Duct length
Duct X-sectional flow area
Duct Wall properties
Outside emissivity
Outside absorptivity
Density
Thermal conductivity
Specific heat
Thickness
Volume of rooms, cells, plenums
Alternate Flow Paths
Time of generation
Elevation of path
Size of opening (equivalent area circular diameter)
Pressure on other side

canyons (a series of interconnected containments) to provide the barrier between the radioactive material and workers in the facility. Rooms within the facility may provide a secondary barrier.

The fabrication plant itself may range from 10,000 to 100,000 ft^2 (929 to 9290 m^2) in floor space. Operations are usually located on the ground floor although a basement may also contain radioactive material. If the facility has a second floor, it is usually used for HVAC equipment.

Individual room sizes range from 200 to 3,500 ft^2 (185 to 325 m^2) in area with ceiling height of 12 ft to over 30 ft (3.7 to 9.1 m). Operations are contained within glove boxes. An average room has about 1400 ft^2 (130 m^2) with 17 glove boxes.

Construction materials are generally concrete and steel. The basement, if provided, is reinforced concrete as are the floor slabs. Walls are usually reinforced concrete block, although some plants use less protective barriers such as corrugated steel and cement plaster for interior room partitions. The roof may be a metal deck supported by structural steel columns, or steel decking with concrete slab.

Plants may contain a vault and/or a hot cell area, that are built more substantially than the rest of the plant. Hot cells have 2- to 3-ft thick (0.6 to 0.9 m) high-density concrete walls.

Mixed oxide facilities use from one to five stages of HEPA filters for the exhaust air. Glove boxes are generally kept at negative pressure with respect to the room. Airflow is always toward the areas of greater potential contamination.

2.3.2 Uranium Oxide Facilities

Uranium oxide fuel manufacturing plants are usually much larger than mixed oxide plants. Process equipment and storage containers provide primary barriers for radioactive material. Rooms in the facility may provide secondary confinement although some radioactive material is stored in containers outdoors.

Uranium oxide fabrication building sizes range from 127,000 to 300,000 ft^2 (1.2×10^4 to 2.8×10^4 m^2) and may use one or two floors. Processing operations are generally divided. UF_6 conversion involves from 10,000 to 200,000 ft^2 (929 to 1.9×10^4 m^2). Scrap recovery operations take up about 1,700 to 9,000 ft^2 (158 to 836 m^2) of space. Ceiling heights range from 25 to 35 ft (7.6 to 10.7 m) high.

Some of the facilities have cast concrete or concrete block walls, concrete floors, and a gypsum roof deck. Steel beams may be used for support.

These fabrication plants use scrubbers and HEPA filters to reduce release of airborne particles to the atmosphere. Scrubbers are used in the UF_6 conversion and scrap recovery operations. Prefilters are used prior to final filters in areas of heavy dust. Process areas are kept at negative pressure. Airflow is provided to give 7 to 24 air changes per hour. Air is recirculated through process areas.

2.4 REPROCESSING FACILITY DESCRIPTION

Reprocessing facilities separate reusable nuclear materials from waste and from each other. This requires fuel storage, reprocessing and waste/effluent management functions. They are designed to provide protection from the release of radioactive material to the environment. This is ensured through containment barriers and engineered safety systems such as ventilation equipment. The number and type of barriers and the components of the engineered safety systems must both be considered in an accident analysis. Some Regulatory Guides to aid designers of fuel reprocessing facilities are Regulatory Guide 3.6 (U.S. Atomic Energy Commission 1973a) on technical specifications, Regulatory Guide 3.32 (U.S. Nuclear Regulatory Commission 1975b) and 3.20 (U.S. Atomic Energy Commission 1974e) on ventilation and off-gas systems, Regulatory Guide 3.18 (U.S. Atomic Energy Commission 1974a) on confinement barriers, Regulatory Guide 3.31 (U.S. Nuclear Regulatory Commission 1975a) on Emergency Water Supply Systems, and Regulatory Guide 3.38 (U.S. Nuclear Regulatory Commission 1976) on general fire protection.

A fuel reprocessing facility is a large multifloored building having up to 330,000 ft^2 (3.1×10^4 m^2). Process operations exist on several floors. The Advanced Fuel Reprocessing Plant (AFRP) is the facility discussed here.

Processes are contained within shielded process cells and are operated remotely. The cells can be several modules, or as in the AFRP, two long cells. The hardened area (i.e., the area that will remain functional under all credible accident conditions) of the process building is 716 ft x 226 ft x 120 ft high (218 m x 68.9 m x 36.6 m). Some portions are below grade. Each of the process cells is 600 ft (183 m) long x 40 ft (12.2 m) wide and 85 to 125 ft (25.9 to 38.1 m) high. Spent fuel is delivered to the facility via a truck lock which is 360 ft (110 m) long by 70 ft (21.3 m) wide and 80 ft (24.4 m) high. This is attached to the side of the primary cell. A pool is provided for spent fuel storage.

Construction materials are generally concrete and stainless steel. The hardened area of the building is reinforced concrete. Cell wall thickness varies, depending on shielding requirements. There can be 2-, 4-, or 6-ft (0.6-, 1.2-, or 1.8-m) thick normal density concrete. Stainless steel usually lines the walls and floors.

The plant can have a MOX storage vault below grade to give added protection. These walls are typically 2.5 ft (0.8 m) thick normal density concrete.

Fuel reprocessing facilities can have roughing/HEPA or HEPA/sand/HEPA filter systems. If the process takes place in air the flow rate is high. The AFRP uses an inert N_2 atmosphere and low flow rates. The AFRP has a special system to remove NO_x, tritiated water, ruthenium, iodine, and krypton. Contaminated areas are sealed off from other portions of the facility.

2.5 WASTE STORAGE/SOLIDIFICATION FACILITY DESCRIPTION

The waste storage/solidification facility houses the solidification equipment such as the liquid fed ceramic melter (LFCM). The facility can have an operating area ~14,000 ft^2 (1300 m^2) and have several floors. However, the melting equipment space requirements are relatively small. The cell housing this equipment can be 400 ft^2 (37 m^2) to 2000 ft^2 (186 m^2), and typically 12 to 15 m (40 to 50 ft) high.

Cell shielding is equivalent to approximately 5 ft (1.5 m) of reinforced concrete. Higher density materials (high-density concrete, metal castings, etc.) are used where thinner walls are required. The cell floor and walls can be lined with 1/4 in. stainless steel. Waste solidification can be a canyon remote operation using cranes only or may employ master-slave manipulators, dependent on the size and complexity of the operation.

The floor of the cell can be sloped to a sump. Shielded cubicles are provided for making service connections.

Cubicles are operated at a slightly less negative pressure than the cell. The exhaust air is routed through an absolute filter and then into the cell.

The cell is maintained at a negative pressure in respect to the surrounding galleries. Sufficient airflow through the cell keeps the air exhaust temperature at less than 50°C when all the processing equipment is operating. Cell inlet and outlet ducts have HEPA filters protected by back flow dampers. The off gas will contain systems to remove particulate matter, and may also contact system for removal of volatiles such as iodine, and ruthenium and NO_x.

2.6 SPENT FUEL STORAGE FACILITY DESCRIPTION

Independent spent fuel storage installations (ISFSI) receive spent fuel for storage after a period of temporary storage at the reactor site. Thus, the fuel has reached lower decay heat levels than when freshly discharged.

These facilities provide for receipt of fuel shipping casks, cask preparation and unloading, and storage of the irradiated fuel assemblies. Regulatory Guides have been issued to aid designers of spent fuel storage facilities: Regulatory Guide 3.24 (U.S. Atomic Energy Commission 1974d) gives guidance on the license application, siting, design, and plant protection; Regulatory Guide 3.49 (U.S. Nuclear Regulatory Commission 1981) covers design of water basin storage pools. The American Nuclear Society (1981) has issued an approved fuel storage standard ANSI/ANS 57.7. Structures containing the fuel storage and cask unloading pools are designed to withstand a Region 1 Design-Basis Tornado as explained in Regulatory Guide 1.76. (U.S. Atomic Energy Commission 1974b).

Existing ISFSI facilities were initially built to provide storage at reprocessing plants. They would have a smaller capacity than a proposed monitored retrievable storage facility (MRS). Present (ISFSI) facilities range from 360 to 750 MTU capacity, the MRS has a 1500 MTU capacity or greater.

Cask unloading pools range from a single pool 312 ft^2 (29 m^2) to two pools 1200 ft^2 (111 m^2) each for a total 2400 ft^2 (223 m^2) at the RFSF. Fuel storage pool surface areas range from 2.2×10^3 to 1.84×10^4 ft^2 (204 to 1709 m^2).

Water capacity of the pool is from about 450,000 gallons (1.7×10^3 m^3) to 4 million gallons (1.5×10^4 m^3).

Pool wells can be 4 to 5 ft (1.2 to 1.5 m) thick concrete lined with 3/16-in. (0.5-cm) to 1.5-in. (3.8-cm)-thick stainless steel. The waste treatment area requires shielding which can be 2-ft (0.6-m)-thick concrete walls.

The ventilation system can be once-through or partial recirculation. The exhaust can be filtered (but is not necessarily) through sand or HEPA filters.

2.7 SAMPLE PROBLEMS

The purpose of the sample problems is to provide illustrative support for the accident analysis procedures identified in each chapter and to demonstrate how to select parameters required for analysis of specific scenarios.

This section characterizes the general construction and process features of a fuel cycle facility. The same descriptors can be used for a number of scenarios and are only varied in the sample problems to show options in the methods presented and sensitivity of the methods to variations.

Two general systems are used as a basis to illustrate primary sample problems: "simple" and "representative" facilities. These systems are described briefly here and in more detail in Section 5.5. Modifications to the systems are described in each primary sample problem in which modifications were made.

The "simple" facility is a straight-through system consisting of a main cell or room, inlet supply, and exhaust blowers, filters, filter plenum, dampers and exhaust stack. The main cell is 10 ft x 10 ft x 10 ft with an airflow rate of 1000 cfm. Other details of the ventilation system are given in Section 5.5. This system is used for all primary sample problems.

The "representative" facility consists of a large main cell (39 ft x 39 ft x 20 ft) with an airflow rate of 3969 cfm and a more complex ventilation system than the "simple" system. Features of the representative facility include natural bypass around rooms, recirculation, combinations of series and parallel component arrangements, rooms with multiple inlets and outlets, and 30 or more components and nodal points. Section 5.6.1.3 gives details of these components. This system is only used with one primary sample problem.

2.7.1 Primary Sample Problems

Four problems are chosen to show how to use both source term and consequence assessment analysis techniques. These are a fire in the slug press compartment of a MOX facility, a fire in the solvent extraction compartment of a fuel reprocessing plant, explosion in a glove box, and a tornado. These problems are designated primary problems. Secondary problems are those chosen for source term analysis only.

2.7.1.1 Slug Press Fire, MOX Fuel Fabrication

The scenario chosen for the mixed oxide fuel fabrication plant sample problem is a fire in a slug press enclosure. A slug press may contain both combustibles in the form of hydraulic fluid, solvent, and gloves; and dispersible radioactive materials in the form of mixed oxide powder. While larger, more complex fires may occur in a fuel fabrication plant (see Table 3.1), this fire was selected as a straight-forward event illustrating the elements of FIRAC estimating releases from a fire compartment.

To calculate the source term and conditions in the compartment at the time of the fire, the room and ventilation system is described. The fire compartment is assumed to be a canyon 6.7 m wide, 41.8 m long, and 8.8 m deep. The canyon has a 0.46-m-thick concrete ceiling, and 0.203-m-thick concrete floor. Walls are lined with 8- to 12-gage stainless steel plate on 0.305-m-thick concrete. In the simplest case, no vessels except a feed hopper are assumed to become involved in the fire, either as heat sinks or contributing to the radioactive release. The fire compartment in Figure 2.2 shows radioactive material that could potentially be released. This is surface contamination on the gloves and flat surfaces, and the feed hopper filled with powder. In this initial fire problem, fire temperatures do not reach levels sufficient to cause pressurization and rupturing of the hopper. The fire burns at ground level initiating from a spill of solvent and hydraulic fluid onto a 1-m^2 tray. The air inlet duct is located close to the ceiling while the exit duct is close to floor level as shown in Figure 2.2. Ducts are 0.61 m x 0.61 m (2 ft x 2 ft). No alternate flow paths are generated during the simplest sample fire problem. Table 2.2 lists the slug press fire facility descriptors used.

Transport of the FIRIN source term materials out of the fire compartment to other rooms and subsequently to the environment is predicted by FIRAC. This requires information on the fire compartment, ducts, duct dimensions, and ventilation system. This required information is

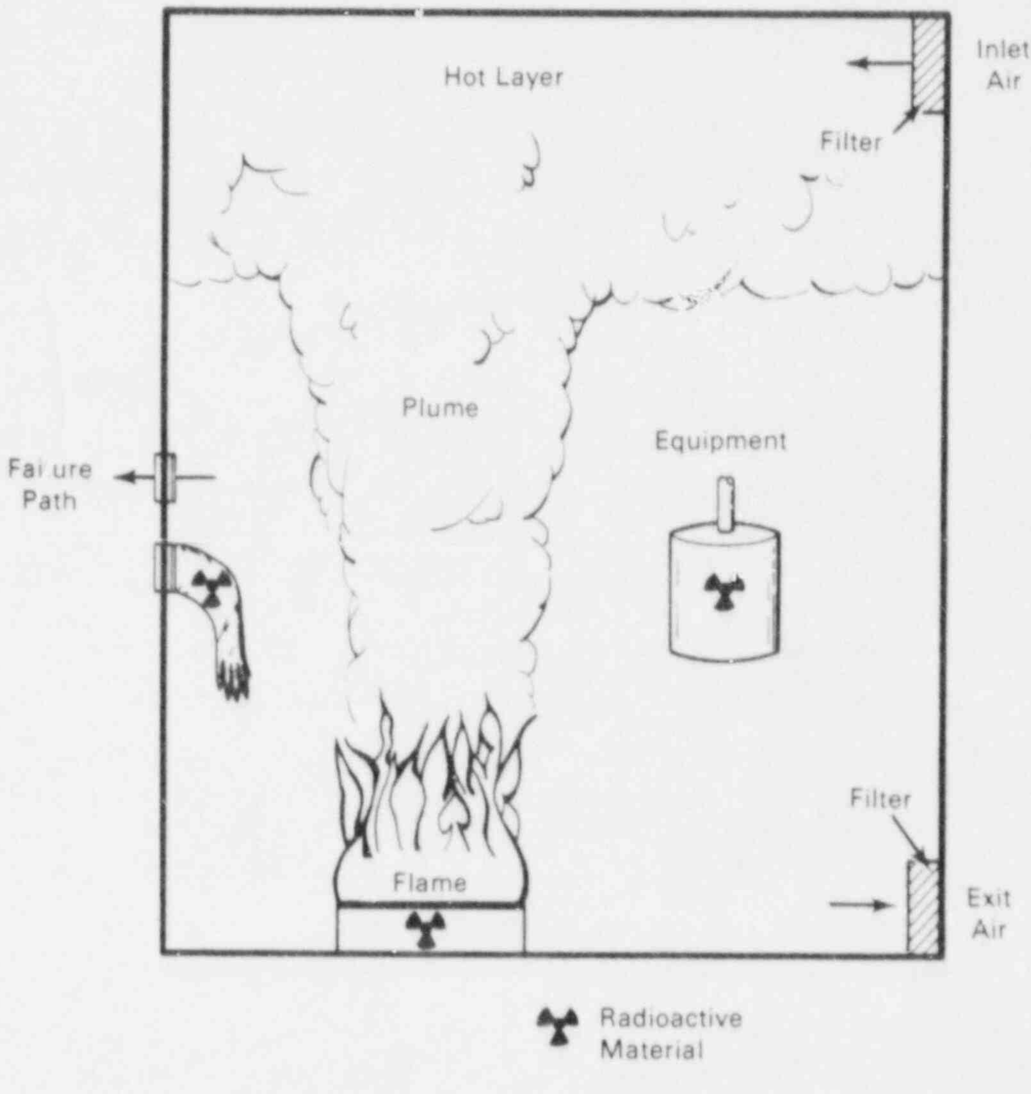

FIGURE 2.2. Fire Compartment

TABLE 2.2. Slug Press Fire Facility Descriptors

Wall material	Concrete
Ceiling material	Concrete
Floor material	Concrete
Thickness of wall	0.305 m
Thickness of ceiling	0.46 m
Thickness of floor	0.203 m
Length of room	41.8 m
Width of room	6.7 m
Height of room	8.8 m
Elevation of inlet duct	8.5 m (centerline of duct)
Elevation of exit duct	0.3 m (floor level)

1. fire compartment - This is in an 87,400 ft^3 (2.5 x 103 m^3) process canyon.
2. ducts - These are steel with properties listed in Table 2.3.
3. duct dimensions - The dimensions of the ducts transporting the release are given for the "simple" system in Section 5.5, where they are used in FIRAC.
4. ventilation system - The arrangement of ducts, dampers, fans, filters, and compartments in the facility are shown in Section 5.5 for the "simple" system of this handbook.

2.7.1.2 Solvent Extraction Fire, Fuel Reprocessing

A large amount of flammable liquid is used in fuel reprocessing plants to separate and purify uranium and plutonium from spent fuels. Thus, the potential exists for a major fire in these solvent extraction operations. Although solvent extraction can take place in a cell supplied with an inert gas atmosphere, it is assumed for this scenario that the cell is inadvertently filled with air when a column loaded with contaminated solvent breaks and spills its contents onto the floor. The solvent ignites and burns releasing radioactive particles to the air.

TABLE 2.3. Duct Properties

Outside emissivity	0.76
Outside absorptivity	0.76
Density	172.9 lb/ft^3
Thermal conductivity	331.5 Btu/(h)(ft)(°F)
Specific heat	0.6671 Btu/(lb)(°F)
Thickness	0.25 in.
k_{SS}	13.84 watts/m•k
$k_{concrete}$	1.878 watts/m•k
10 gage SS	0.125 in. (0.3 cm)
Stainless steel equivalent thickness	$0.125 + 48 \left(\frac{13.84}{1.878}\right) = 353.9$ in. = 9.0 m

Parameters from the Slug Press Fire (Section 2.7.1.1) are used as often as possible for this sample problem to clarify input requirements and problem-solving techniques. Therefore, the cell is assumed to have the same dimensions as the canyon in the Slug Press Fire and is 6.7 m wide, 41.8 m long, and 8.8 m deep. These are valid dimensions for process cells in the fuel reprocessing facility and using them enables us to change only the accident event in the sample problems.

Cells in reprocessing plants have more substantial barriers than those in fuel fabrication plants. The walls, floor, and ceiling are made of 1.22-m (4-ft)-thick concrete. In addition, walls and floor are lined with 10-gage (0.125-in.) stainless steel to aid in decontamination. FIRIN requires the type and thickness of materials of construction for heat transfer purposes. This combination of materials (concrete and stainless steel) can be specified by calculating stainless steel equivalent thickness as illustrated below using the thermal conductivity (k) of both materials.

Here the stainless steel is negligible, but provides a barrier against evolution of vapors from heating concrete. Therefore, the wall is modeled as stainless steel rather than concrete. Location and size of the inlet and exit air duct are the same as for the Slug Press Fire. Airflow rate through the cell is 24.6 m^3/s. No alternate plow paths are generated from this fire.

In heat transfer across composite solids it is often useful to treat the composite as a one component material of some equivalent thickness. There are three possible equivalents to choose from. These three result from three dimensionless numbers: Biot number, $Bi = hd/k$; Fourier number, $Fo = \alpha t/d^2$; and, the product of the two $BiFo = ht/\rho C_p d$.[a] Examples of the use of these follows:

1. The first number (Bi) is used for all steady-state cases, or cases where the temperature profile is approximately linear in unsteady-state cases (thin layers) (e.g., there is a thin layer of material "a" lining material "b"). To make "a" into equivalent "b"

$$Bi_b = Bi_a = d_a/k_a = d_b/k_b$$

   Then the equivalent thickness of "b" material (d_b) is $d_a(k_b/k_a)$.

2. The second number (Fo) is used when unsteady-state conductance is important and surface conductance (h) is unimportant. Here the equivalent thickness of "b" material obtained by setting $Fo_a = Fo_b$ is $d_b = d_a(\alpha_b/\alpha_b)1/2$.

3. The third number (BiFo) is used when unsteady-state conductance and surface conductance are important. Here the equivalent thickness of "b" material is obtained by setting $(BiFo)_a = (BiFo)_b$ is $d_b(\rho_a Cp_a/\rho_b Cp_b)$.

The feed tank to the column is assumed to be close enough to the fire to potentially be overpressurized by the heat. The tank has a capacity of 3600 ℓ with dimensions of 2.8 m diameter x 5.6 m high. The vessel is made of 0.0048 m (3/16 in.) stainless steel and is positioned about 3.66 m (12 ft) above the ground. From the diameter, height, and thickness of the vessel, total volume of stainless steel is calculated as 0.293 m^3. Stainless steel has a density of 7820 kg/m^3 so that the weight of the empty vessel is 2290 kg. Failure pressure

(a) Here H = surface conductance or heat transfer coefficient, d = length or thickness, k = thermal conductivity, t = time, ρ = density, Cp = heat capacity per unit mass, and α = thermal diffusivity = $k/\rho Cp$.

of the feed tank is assumed to be 6.8 atm (100 psi). Table 2.4 lists the source term descriptors for this chapter for the solvent extraction fire.

Properties and dimension of the ventilation ducts and layout of the ventilation system are the same as for the Slug Press Fire. Volume of this cell is 2.5×10^3 m^3. Ducts are steel with properties listed in Table 2.3. Duct dimensions and the arrangement of ducts, dampers, fans, filters, and compartment are given in Section 5.5 for the "simple" facility for input to FIRAC.

2.7.1.3 Glove Box Explosion

A small volume of cleaning solvent is spilled in a glove box and evaporates. The vapors mix with oxygen in the glove box atmosphere, are ignited, and deflagrate. The explosion disperses radioactive powder in the glove box and ruptures barriers allowing release of the powder to the room.

Glove box dimensions are 2.1 m x 1.1 m x 1.1 m or 2.4 m^3. The "simple" facility setup is used for consequence assessment with a slight variation to account for the glove box. Section 5.6.2 gives details of the new input to EXPAC. The can containing plutonium dioxide powder is 6 in. in diameter and 6 in. high and positioned on the glove box floor.

2.7.1.4 Tornado

The "simple" system is struck by a tornado that imposes a pressure drop of 50 in. of water at the exhaust of the facility. The pressure differential can entrain uncontained powder inside the 1000-ft^3 room. The arrangement of ducts, dampers, fans, filters, and compartments in the "simple" facility are shown in Section 5.5.

2.7.2 Secondary Sample Problems

A number of sample problems are chosen to illustrate source term analysis methods only. The facility descriptors for these secondary sample problems are described in the following sections. The accident type identified in parenthesis next to the section title is the accident type in Chapter 4 where the source term for the sample problem is computed.

2.7.2.1 Fire Flashing Spray (Fire)

The solvent extraction fire described previously (Section 2.7.1.2) heats a pipe, which has been blocked off and contains some standing liquid, or a tank of liquid radioactive material. The pipe overpressurizes and ruptures, flashing some of the solution into the room. Rupture pressure of the vessel is assumed to be 100 psig. Other facility descriptors are the same as those given in Section 2.7.1.2.

2.7.2.2 Pressurized Release of Powders (Explosion)

A can of radioactive material is sealed and stored. The material decomposes and builds up internal pressure and increased temperature within the can. The can eventually ruptures, releasing gases and some of the material to the atmosphere. Volume of the can is one liter, and failure pressure is assumed to be 15 psig. Height and airflow of the room are 10 ft and 1000 cfm respectively since the "simple" system is used.

2.7.2.3 Powder Spill (Spill)

A can containing radioactive powder is spilled from a height of 1.5 m. The "simple" facility with a volume of 1000 ft^3 and an airflow of 1000 cfm is used to determine entrainment of the powder to the ventilation system.

2.7.2.4 Liquid Spill (Spill)

A container of radioactive liquid falls from a height of 3 m onto the floor of the "simple" facility. Room volume is 1000 ft^3 and airflow is 1000 cfm.

2.7.2.5 Aerodynamic Entrainment of Powders from Thick Beds (Tornado)

A powder container inside the "simple" facility is improperly capped and placed in a precarious position during the cessation of operation following a tornado alert. The container falls to the floor spilling the contained powder on impact. Accelerated airflow through the enclosure from the tornado could entrain some of the powder. The "simple" facility is 1000 ft^3 with a duct 2 ft x 2 ft x 100 ft long leading to an outlet filter.

2.7.2.6 Fragmentation of Brittle Solids by Crush Impact (Tornado)

A concrete roof panel (2 ft x 12 ft x 0.5 ft thick) is displaced during a tornado. The panel orients itself and falls 18 ft to the floor where it impacts fuel pellets on the floor of the facility. Ventilated space is assumed to be 50 ft x 80 ft x 18 ft or 72,000 ft^3.

2.7.2.7 Inadvertent Critically in a Fuel Reprocessing Plant (Nuclear Criticality)

It is postulated that an excursion occurs in a vented vessel of unfavorable geometry containing dissolver solution. The vessel is located in the center of a 10 ft x 10 ft x 10 ft room (the "simple" facility) with an airflow of 1000 cfm.

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3.0 PROCESS ACCIDENT DESCRIPTORS

This chapter guides the user in selecting descrip. ᵉ ᵒ the processes in a facility that are used in an analysis to estimate the c uences of potential accidents in that facility. Process steps are brie outlined with emphasis on areas of greater potential accident consequences. To aid the user in selecting scenario for analysis, tables listing major postulated accidents are included. These tables include the accident, conditions required for occurrences, and possible consequences. Processes discussed include those in fuel manufacturing, fuel reprocessing, spent fuel storage, and waste storage and solidification facilities.

Chapter 3 identifies potential scenarios and energies available to interact in the scenarios. Descriptors from this chapter and Chapter 2 are combined in Chapter 4 to determine the source term for a chosen scenario. This source term is used as input to transport models in Chapter 5, that determine emission to the environment and within the facility.

The process descriptions are:

- Quantity, chemical, and physical form of radionuclides that could be impacted by the various events (material-at-risk)
- Quantity and characteristics of flammable and combustible materials in an accident to assess fire or explosion potential and to estimate releases if the event occurs
- Radionuclide content of materials with high fissile material content that could be involved in nuclear criticality excursions
- Characteristics of process equipment providing containment or confinement or those that could mitigate the airborne release (e.g., engineered control devices or systems)
- process parameters (e.g., use of heating devices, pressurized systems) that could enhance or mitigate airborne release.

Sample problems at the end of the chapter (carried over from Section 2.7) illustrate the selection of process descriptors for various accidents and scenarios. Six types of accidents are covered: fires, explosions, spills tornadoes, criticalities, and equipment failures. Primary sample problems are carried through to Chapter 5 while secondary sample problems are those chosen to illustrate analytical techniques in Chapter 4 and are not carried through to Chapter 5.

3.1 FUEL MANUFACTURING

The two major types of fuel produced by manufacturing operations are uranium oxide and mixed oxide fuel. Except for the head-end process step, many of the process steps are the same for both types of plants. However, because mixed oxide is a blend of plutonium and uranium, the mixed oxide operations are concerned with greater confinement of the plutonium. Therefore, they are of much smaller scale than uranium plants and usually employ an extra level of containment including glove boxes and process cells. The larger inventories of UO_2 fuel plants may allow larger scale accidents and greater mass releases of radioactive materials. However, the consequences of those accidents may not be as severe because of the lower level of specific radioactivity.

A brief description is given for both types of processes with emphasis on those steps which may have a greater risk of becoming involved in an accident scenario. Major accidents are identified for fuel manufacturing plants as well as the causes and potential consequences. The descriptors needed to identify major scenarios and required as input to source term models in Chapter 4 and transport models in Chapter 5 are then identified. Sample problems (a continuation from Section 2.7) show how these descriptors are used for various accidents.

3.1.1 Process Description

Mixed oxide (MOX) and UO_2 fuel fabrication plants use many of the same processes. Only the head-end process is different. Figure 3.1 is a flow chart for the fuel manufacturing process steps. MOX plants receive PuO_2 and UO_2 powders, that are blended together. An alternate, less common process involves blending of plutonium and uranium liquid compounds, that are then coprecipitated out of solution by the addition of ammonia. The precipitate is filtered, calcined, and milled to a uniform powder.

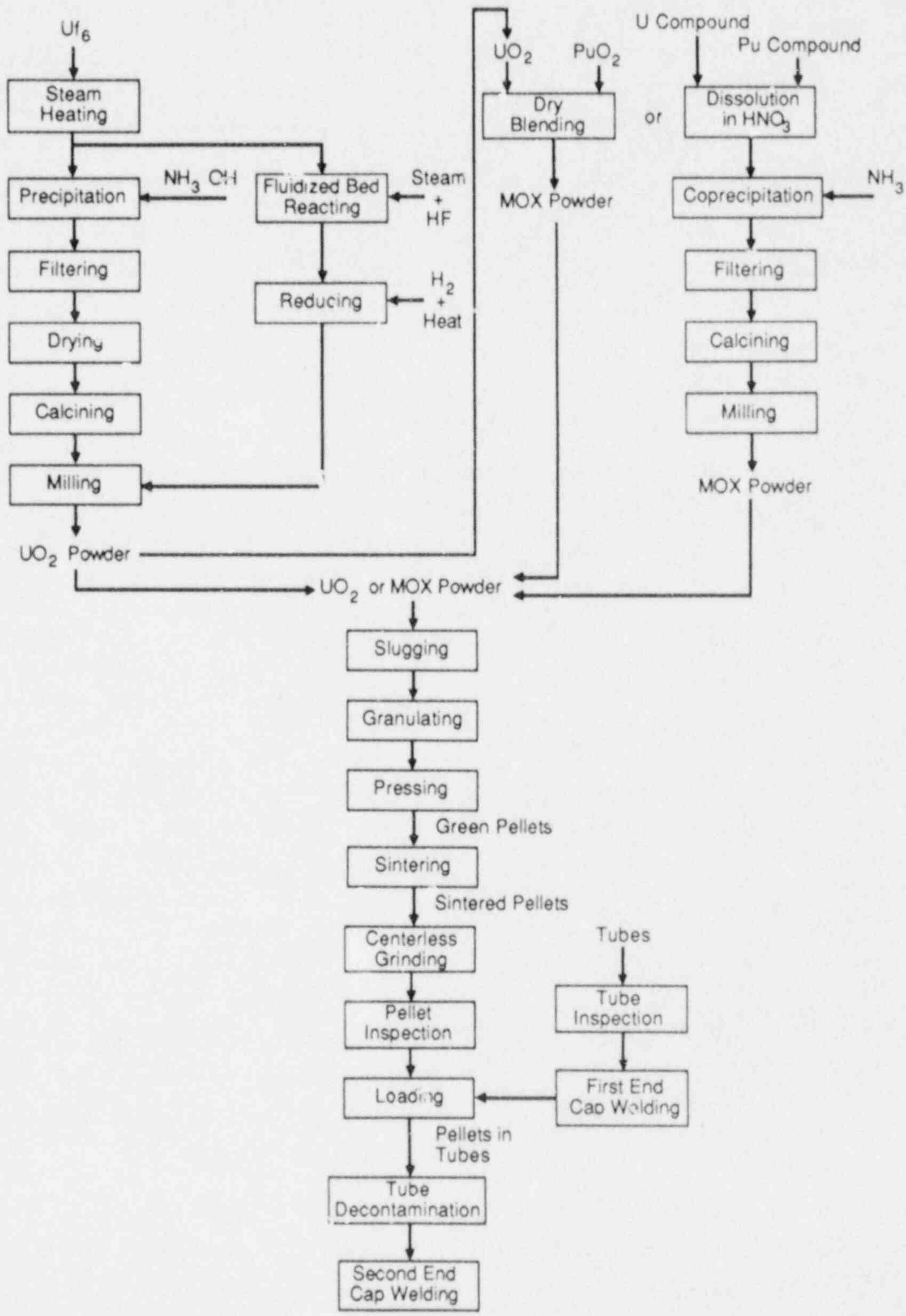

FIGURE 3.1. Fuel Manufacturing Process (Pellet-in-Tube)

Most UO_2 fuel fabrication plants receive feed material as UF_6 in cylinders. The substance is steam heated to a vapor and hydrolyzed with water to form uranyl fluoride (UO_2F_2). Ammonium hydroxide is added to precipitate ammonium diuranate (ADU) which is filtered, dried, reduced to uranium dioxide, calcined, and milled to a powder of uniform particle sizes. An alternate process involves direct conversion of vaporized UF_6 to UO_2 in a series of fluidized bed reactors.

After the feed preparation steps, UO_2 and MOX processes follow the same unit operations. These are slugging, granulating, pellet pressing, sintering, centerless grinding, and loading of the pellets into tubes. Tubes are decontaminated and welded shut. Then they are either shipped as tubes or formed into assemblies which are stored prior to shipping.

Fuel manufacturing plants frequently reprocess clean scrap through ion exchange or solvent extraction operations. These operations occur in a much larger scale in fuel reprocessing plants and are discussed in Section 3.2 of this report. Contaminated waste from processing and reprocessing operations may also be handled and stored temporarily in fuel manufacturing plants.

- Mixed Oxide Process - Process areas with the greatest risk of radioactive release are those areas holding the largest amounts of dispersible radioactive materials. For mixed oxide plants, large amounts of PuO_2 or mixed oxide powder (identified by a plant inventory) identify potentially hazardous locations. Mixed oxide in liquid nitrate, granule, green pellet, sintered pellet, or pellet-in-tube forms should give much smaller releases than the powder form for the same amount of energy generated in an accident. Radioactive powders are handled in the process steps from blending to granulating. Large inventories of powder may also be found in feed storage or storage of intermediate products in the process.
- Uranium Oxide Process - In the gaseous form UF_6 is the most dispersible radioactive material in uranium oxide fuel manufacturing plants. UF_6 is steam heated at the head end of the process subsequently converting UF_6 to UO_2 by precipitation. It is present as a vapor in the fluidized beds of the direct conversion process. Large amounts of

UF_6 are stored as a solid in cylinders. Potential heat sources next to these cylinders may provide energy to vaporize UF_6 if an accident occurs. UO_2 powder is also present in UO_2 plants up to the granulating stage. Powder may also be found stored in the plant as an intermediate product between steps.

The location of combustible, flammable, or potentially explosive materials in the plant identify potentially hazardous areas. Combustible fluids such as hydraulic fluid may be used in pressing or slugging operations.

Solvent extraction and scrap recovery operations use a large amount of flammable organic liquids and may produce a potentially explosive concentration. Ion exchange scrap recovery operations use organic ion exchange resins, which may be potentially explosive under high temperature, high nitrate conditions.

Combustible waste is stored in drums prior to incineration or removal. These storage areas may be the site of fires.

Hydrogen gas is used to provide a reducing atmosphere for calcining and sintering operations. If allowed to build up undetected, the gas may be a potential explosive.

Hazardous materials may also be used in welding and tube decontamination operations although in these steps the radioactive material is in a relatively nondispersible form and is contained in tubes. Pipes carrying natural gas, fuel oil, or other combustible or flammable materials through the plant, and storage locations of these materials, are potentially hazardous areas.

Plant ventilation systems provide multiple zones to confine radioactive materials as close to the source as possible. These zones are defined by Regulatory Guide 3.12 (U.S. Atomic Energy Commission 1973b) for plutonium processing and fuel fabrication plants. Facilities are designed so that accident-generated particles from primary zones have minimal chance of inadvertent release to less contained areas. These zones attenuate the release and are determined by the design of the plants and ventilation system as defined in Chapter 2.

Three factors must be considered in developing scenarios for major accidents: location of large amounts of dispersible radioactive materials; location of combustible, flammable, or explosive materials; and attenuation in pathways from zones. The factors are usually balanced in a plant so that dispersible radioactive materials are isolated away from combustibles and in zones of greatest protection. However, because of failure in administrative control or failure - safety features of the plants, an imbalance may occur leading to an accident.

3.1.2 Potential Accidents

Major potential accidents in a fuel manufacturing plant are listed in Tables 3.1 and 3.2 along with the conditions required for the accident to occur and the possible consequences of the accident.

The accidents considered in Tables 3.1 and 3.2, have either been experienced or can be realistically postulated for some facilities. However, no attempt was made to exhaustively analyze all conceivable accidents for fuel manufacturing, fuel reprocessing, spent fuel storage, or waste solidification facilities.

Facility and process parameters used in each facility type were examined with the objective of postulating potential major accidents, which might result in significant radiation hazard to either plant or offsite personnel. These accidents are mainly fires, explosions, and criticalities. Although spills, tornadoes, and equipment failures were also considered, few of them are listed in the table. Spills are a low energy event compared to the other accident types and do not normally result in major consequences. The effects of tornadoes on facilities can result in major consequences indirectly, by causing equipment or building failures. Equipment failures initiate or are initiated by the mechanisms covered in the study of airborne releases from fires, explosions, and spills.

3.1.3 Inventories and Process Descriptors

Process descriptors that are required for an accident analysis consist of an inventory of radioactive materials, an inventory of hazardous materials, and process parameters such as operating conditions for normal plant operation.

TABLE 3.1. Major Postulated Fires in MOX Facilities

Accident	Conditions Required for Occurrence[a]	Possible Consequences
General facility fire	Poor housekeeping/administrative control; Quantity of fuel at location; Strong ignition source	Loss of glove box (GB) integrity (loss of gloves, glass or plastic viewing windows); Potential loss of airflow via filter clogging; Failure of piping and equipment from thermal effects of pressurization of contents
Fire in stored combustible waste	Strong ignition source (in combustibles); Pathway from drum to drum; Violation of procedures (leaving drum uncovered)	Combustion of contaminated combustibles; Generation of heat and combustion products
Combustible fluids	Undetected leak; Very strong ignition source or elevated temperature of fluid and ignition source	As in general facility fire
Flammable gas or liquid	Unauthorized use (violation of administrative control); Or careless use (excess vapor generation); Or leak; Ignition source	Loss of GB integrity (loss of gloves, plastic or glass viewing windows); Heat/flame intrusion on equipment in box; Potential loss of GB filter (and ignition organics/lint in exhaust ducts); Potential clogging of filter and diffusion from glove box back into room
Organics/lint in exhaust ducts	Exhaust ducts not routinely cleaned; Ignition source	Loss of final HEPA filters; Loss of combustible exhaust ducts; Potential ignition source for fires in other areas

(a) Excluding any protection devices.

TABLE 3.2. Major Postulated Explosions in MOX Facilities

Accident	Conditions Required for Occurrence[(a)]	Possible Consequences
Solvent explosion in glovebox	Unauthorized use (violation of administrative control); Or careless use (excess vapor generation); Or leak; Accumulation of substantial quantity of flammable mixture	Catastrophic loss of glove box integrity; (loss of gloves, windows, inlet and outlet filters); Damage to adjacent glove boxes and equipment; Damage to structure; Damage to exhaust ducts or filters in glove box
Ion exchange resin	Nitration of resin; Ignition source	As in solvent explosion in glove box
Hydrogen explosion	Accumulation of quantity of flammable mixture prior to contact with ignition source (failure of several protection devices); Ignition source	As in solvent explosion in glove box; Dependent upon quantity of gas involved and location of explosion
Flammable gas explosion	Undetected leak in cylinder; accumulation of quantity of flammable mixture prior to contact with ignition source; Ignition source	Catastrophic to minor damage to enclosures, equipment and structure; Ignition of combustibles in area; Dependent upon quantity of gas involved and location of explosion
"Red Oil" in Concentrator from solvent extraction system	Undetected long range accumulation of solvent in concentrator; Nitration of solvent; Temperature exceeding 135°C after nitration	Loss of concentrator; Loss of nearby equipment and piping; Ignition of flammables and combustibles in area; Potential loss of structural components from blast and pressure effects
Ammonia explosion	As in flammable gas explosion	As in solvent explosion in glove box

(a) Excluding any protection devices.

The inventories aid in identifying areas of major accident potential to use for developing a scenario. They are also used as input to source term codes described in Chapter 4. Normal operating conditions and other process parameters are required as input to source term and transport codes to describe initial conditions prior to the accident. Information required on these descriptors are specified in the following sections.

3.1.3.1 Radioactive Material Inventories

To identify potential accident scenarios and provide input to source term codes in Chapter 4, an inventory of radioactive materials in the plant must be developed. The inventory should include the form, type of containment, location, quantity, and radioactivity of process materials. Radioactive materials in process, in storage, on combustible waste, and existing as surface contamination should be considered.

Form. The form of radioactive material, whether solid, liquid, or gas, must be specified since it affects the dispersibility of the material as well as the size of particles generated during an accident. In the fuel manufacturing plant, radioactive materials will be powders, nitrate solutions, or UF_6.

Containment. Containment of radioactive material may be in closed or open containers, on contaminated combustibles, or as surface contamination. If the scenario involves a possible increase in pressure or heating of closed containers of powders or liquids, the volume of gas must be estimated as well as the volume of powder or liquid. The volume of gas is the total volume of the container minus the volume of radioactive material it holds. These descriptors are required by source term models to determine if and when overpressurization occurs in an accident. Moisture content of radioactive powders and the volume of radioactive liquids in open containers must also be specified.

PuO_2 powder may be stored in containers of 2.25 kg or less in mixed oxide facilities. UO_2 may be stored in 55-gallon steel drums. Process equipment in MOX plants may range in size from quart-sized containers for PuO_2 storage to 5000-gallon vessels holding contaminated liquid waste.

Location. Some of the inventory is stored as completed fuel assemblies and therefore not in a dispersible form. Powders can be stored or in process. Contaminated waste may be stored in a central location.

Quantity. The mass quantity of radioactive material at the accident location is input to source term models. For fires, radioactive materials become airborne in several ways: by burning contaminated combustible solids or liquids, heating contaminated surfaces, heating unpressurized liquids, rupturing of heated closed containers holding radioactive powders or liquids, and spilling powders or liquids due to equipment failures caused by a fire.

For each release mechanism judged to occur for a chosen scenario the mass quantity of material at risk must be estimated. If a range of possible quantities is known, then most and least conservative cases can be calculated to give a range of possible consequences. Quantities of radioactive materials at risk in a MOX plant may range from 2.25 kg of PuO_2 to 225 kg of MOX powder. Pellets may be found in larger quantities of 675 kg or more. Surface contamination may be estimated at 7.5 g/m^2 (Mishima, Schwendiman, and Ayer, 1978) if no other information is available.

Properties. The density, viscosity, surface tension, molecular weight, and enthalpies of radioactive materials may be needed depending on accident type. These properties affect the ability of the material to become airborne under stresses generated during an accident.

Radioactivity. The radioactivity of materials should be identified to determine severity of the consequences of an accident. Fuel manufacturing facilities usually handle ^{235}U, ^{238}U, and ^{239}Pu. The amount of each of these involved in an accident scenario influences the degree of contamination resulting from an accident. Although the radioactivity of material does not affect the release rate or transport of particles during a accident, this parameter should be estimated so that public (environmental) and occupational (in plant) radiological consequences can be determined.

3.1.3.2 Hazardous and Nonradioactive Material Inventory

An inventory of hazardous materials should include the location, quantity, surface area, and type of chemicals, compounds, and other materials, that may initiate or add fuel to a fire or explosion. The list should include combustible and flammable materials as well as those that are potentially explosive. These include materials used in the process, for support services (heating or cleaning), or stored as waste prior to disposal.

Location. Hazardous materials may be stored in a central location within outside of the plants, or be contained in process equipment. A scenario can be developed from a leak or spill of that hazardous material from process equipment. Leaks or spills may also be produced by an accident in the same location and result in secondary source term effects. Fuel manufacturing plants store large quantities of process chemicals in a central storage location outside of the plant. Smaller quantities are piped into the plant where needed.

Quantity. The quantity of combustion material at the accident location influences the severity of an accident since it determines the quantity of energy released and time span of the accident. Mass quantity of fuels in a fire is required for source term calculations. Maximum and minimum source term cases for a given scenario can be determined from a likely range of mass quantity at the accident location. Quantities of process chemicals found at fuel manufacturing facilities range from thousands of gallons in outside storage tanks to less than a hundred gallons inside the plant.

Surface Area. Surface area of the combustion material must also be estimated for input to fire source term models. For burning liquids this area is the free surface area of the contained space occupied by the liquid, or may be estimated if an uncontained spill is part of the scenario. For combustible solids, the surface area may be the exposed face of a waste drum, or area of a plastic bag or rag. The surface area affects the burning rate of the material, thus determining the rate of energy given off and the length of time the fire burns.

Type. The composition of combustible, flammable, or explosive materials must be specified to determine properties of the substance and response of the material in an accident. To use the fire source term data base described in Chapter 4, the material should be classed under one of the headings in Table 3.3. The combustible types shown in this table are commonly found in fuel cycle facilities.

Table 3.3 lists common uses and properties of material types and is used to estimate the classification best suited to fuels identified in a fire scenario. One of the methods of classifying materials other than those listed in the table is to compare composition and chemical formula.

Energy. To calculate the mass ratio (MR) that determines the airborne release of solids and liquids from detonations and deflagration, both the energy (as an equivalent weight of TNT) and the inert mass fragmented are required. For condense phase explosives, calculation of the TNT equivalency may not be difficult. For known explosives, TNT equivalencies have been calculated and are shown in Table 3.4 (Baker et al. 1983). For other materials (e.g., flammable/combustible gases, physical explosions), calculating the TNT equivalency is more difficult and may not be possible. The calculated equivalency for some gases that have been involved in vapor cloud explosions are shown in Table 3.5 (Baker et al. 1983). For other flammable/combustible gases, a "bounding" value could be calculated by comparing the energy from a unit mass

TABLE 3.3. Classification of Combustible Materials, Uses and Formula

Classification	Uses	Chemical Formula
Polymethylmethacrylate (PMMA)	Glove box viewing window	Nonaromatic $(C_5H_8O)n$
Polystyrene (PS)	Ion exchange resin	Aromatic $(C_8H_8)n$
Polyvinylchloride (PVC)	Plastic bags, covers	Chlorinated $(C_4H_5Cl)n$
Elastomer (neoprene)	Gloves, gaskets	Chlorinated $(C_4H_5Cl)n$
Cellulose	Wood	$(C_6H_{10}O_5)n$
Cellulosic material	Paper, rags, cardboard	$(C_6H_{10}O_5)n$
Kerosene (Dodecane)	Solvents	$C_{10}H_{22}$
Polypropylene (PP)	Plastic bottles	Aliphatic $(C_3H_8)n$
Misc. Organic Fluids	Lubricants, solvents	---

TABLE 3.4. Conversion Factors (TNT Equivalence) for Some High Explosives (Baker et al. 1983)

Explosive	Mass Specific Energy, E/M, kJ/kg	TNT Equivalent, (E/M)$_x$/(E/M)TNT	Density, Mg/m^3	Detonation Velocity, km/s	Detonation Pressure, GPa
Amatol 80/20 (80% ammonium nitrate, 20% TNT)	2650	0.586	1.60	5.20	--
Baronal (50% barium nitrate, 35% TNT, 15% aluminum)	4750	1.051	2.32	--	--
Comp B (60% RDS, 40% TNT)	5190	1.148	1.69	7.99	29.5
RDS (cyclonite)	5160	1.183	1.65	8.70	34.0
Explosive (ammonium picrate)	3350	0.740	1.55	6.85	--
HMX	5680	1.256	1.90	9.11	38.7
Lead azide	1540	0.340	3.80	5.50	--
Lead stypanite	1910	0.423	2.90	5.20	--
Mercury fulminate	1790	0.395	4.43	--	--
Nitroglycerin (liquid)	6700	1.481	1.59	--	--
Nitroguanidine	3020	0.688	1.62	7.93	--
Octol, 70/30 (70, HMN 30% TNT)	4500	0.994	1.80	8.48	34.2
PETN	5800	1.282	1.77	8.26	34.0
Pentolite 50/50 (50% TETN, 50% TNT)	5110	1.129	1.66	7.47	28.0
Picric acid	4180	0.926	1.71	7.26	26.5
Silver azide	1890	0.419	5.10	--	--
Tetryl	4520	1.000	1.73	7.85	26.0
TNT	4520	1.000	1.60	6.73	21.0
Lorpex (42% RDS, 40% TNT, 18% Al)	7540	1.667	1.76	--	--
Tritonal (80% TNT, 20% Al)	7410	1.639	1.72	--	--
C-4 (91% RDS, 9% plasticizer)	4870	1.078	1.58	--	--
PBX 9404 (94% HDX, 3% nitrocellulose, 3% plastic binder)	5770	1.277	1.844	8.80	37.5
Blasting gelatin (91% nitroglycerin, 7.9% nitrocellulose, 0.9% antacid, 0.2% water)	4520				
60% Straight nitroglycerin Dynamite	2710	0.600	1.30	--	--

NOTE: The values for mass specific energy and TNT equivalence in this table are based on reported experimental values for specific heats of detonation or explosion. Calculated values are usually somewhat greater than those given in the first column of this table. Dobratz (1981) gives many calculated, and some experimental values for high explosives.

TABLE 3.5. Heat of Combustion of Combustible Gases Involved in Vapor Cloud Accidents (Baker et al. 1983)

Material	Formula	Low Heat Value, MJ/kg	e_{HC}/e_{TNT}(a)
Paraffins			
Methane	CH_4	50.00	11.95
Ethane	C_2H_6	47.40	11.34
Propane	C_3H_8	46.40	11.07
n-Butane	C_4H_{10}	45.80	10.93
Isobutane	C_4H_{10}	45.60	10.90
Alkylbenzenes			
Benzene	C_6H_6	40.60	9.69
Alkylcyclohexanes			
Cyclohexane	C_6H_{12}	43.80	10.47
Mono Olefins			
Ethylene	C_2H_4	47.20	11.26
Propylene	C_3H_6	45.80	10.94
Isobutylene	C_4H_8	45.10	10.76
Miscellaneous			
Hydrogen	H_2	120.00	28.65
Ammonia	NH_3	18.61	4.45
Ethylene Oxide	C_2H_4O	26.70	6.38
Chlorobenzene	C_6H_5Cl	27.33	6.53
Acrolein	C_3H_4O	27.52	6.57
Butadiene	C_4H_6	46.99	11.22
HC Groups (est)	--	44.19	10.56

(a) Heat of combustion divided by heat of TNT based on a heat of detonation of 4187 kJ/kg for TNT.

of TNT and from the heat of combustion of a stoichiometric mixture of the gas. If the energy from a physical explosion can be estimated, the calculated value can be compared to the energy per mass for TNT and an equivalent TNT mass estimated.

The estimation of the total inert mass fragmented can also be difficult for detonation and deflagrations. For relatively thin depths of inert material, the entire mass of material can be used if it surrounds the explosive charge or the dimensions of the surface are less than the depth of penetration of the shock front into that material. The depth of penetration is measured from the boundaries of the explosive charge if the inert material is pressing against the explosive charge and, therefore, has the same shape as the explosive charge.

For depths of inert material greater than the depth of penetration of the shock front in that material, the total amount of material involved would be the actual material fragmented. (An explosive charge detonating on the ground digs a crater in the ground; it does not suspend all the dirt in all directions.) Since the basis for calculating the fragmentation is the creation of new surface area by fragmentation of the inert material, the total material involved is greater than just the material fragmented into discrete fragments but also includes the material cracked. Since the cracking of material is difficult if not impossible to determine, ignoring the mass of materials cracked would result in a finer size distribution for the fragmented material and would be conservative. Furthermore, the mass fraction of the powder or preexisting particle made airborne by detonations and deflagrations are not readily calculated by the model since no energy is used for the creation of new surfaces. For small particles, the relaxation times of the particle may be sufficiently short to prevent fragmentation or result only in gross fragmentation.

All the material affected should be considered in estimating the mass of inert material involved. If the solid or liquid containing the radioactive material is held in a container, some or all of the container would be fragmented. If the radioactive material only lies over or under the explosive charge and another inert material (e.g., dirt, steel, concrete) is also contiguous to the explosive charge, the total mass of both materials fragmented should be used in calculating the MR.

3.1.3.3 Process Parameters

The operating conditions before an accident are required as input to source term and transport codes. These descriptors include temperatures:

- in the compartment
- inside and outside of vessels containing radioactive materials
- in the duct.

Initial pressures that should be specified are in the:

- accident compartment
- inlet vent (prior to inlet filtering)
- exit vent (after exit filtering).

Temperature. The initial temperatures of the room and radioactive materials in the process are used in calculating heat transfer to walls and vessels. Radioactive powders or liquids may be heated during normal operations. The temperature of the powder or liquid in closed or open vessels must be estimated as well as the temperature outside of the vessel. Initial temperature of the duct walls must be specified to calculate duct heat transfer in the transport codes described in Chapter 5.

Pressures. The initial pressure in the accident compartment and inlet and exit ducts is required by the source term code for the mass balance calculations during the fire. These pressures can be estimated by assuming standard pressure of one atmosphere in the inlet duct and a reduction in pressure of 0.005 atmospheres (2 in. w.g.) after each filter. Thus, the initial room pressure is 0.995 atmospheres and the exit vent pressure is 0.990 atmospheres.

3.1.4 Summary of Fuel Manufacturing Process Parameters

Descriptors of the process in a fuel manufacturing facility that are required for the analysis of accidents are listed in Table 3.6. These descriptors aid in development of a accident scenario and provide input to source term models described in Chapter 4.

Process descriptors include information on inventories of radioactive and hazardous materials and operating conditions. These help determine potential scenarios with major consequences as well as providing input for the selected accident scenario.

3.2 FUEL REPROCESSING

Radiochemical reprocessing systems are designed to store and process spent reactor fuel. After a brief period in a fuel storage pool, spent fuel is processed, separating U and Pu for recycle into the nuclear fuel cycle. These

TABLE 3.6. Fuel Manufacturing Process Descriptors

	Descriptor
	Radioactive Material Inventories
	Form
	Containment
	Location
	Quantity
	Properties
	Radioactivity
	Radioactive Material in Containers
	Volume of Powder
	Moisture Content of Powder
	Volume of Air in Closed Containers
	Mass of Liquid
	Volume of Liquid
	Hazardous Material Inventories
	Location
	Quantity
	Surface Area
	Material Type
	Energy
	Process Parameters
	Initial Temperatures Compartment
	Radioactive Powders in Closed Containers
	Radioactive Liquids in Closed Containers
	Radioactive Liquids in Open Containers
	Outside of Vessels
	Duct Wall
	Initial Pressures in
	Inlet Duct
	Compartment
	Exit Duct

systems also solidify waste fission products prior to disposal. Reprocessing is discussed in this section, waste solidification is covered in Section 3.3, and fuel storage is covered in Section 3.4.

Figure 3.2 shows the fuel reprocessing system. It is a high-acid PUREX process with improved radioactivity confinements. Plutonium denatured with ^{238}U in a 75/25 U-Pu ratio is the primary fissile mixed oxide powder product. Nonfissile uranium oxide power is also produced.

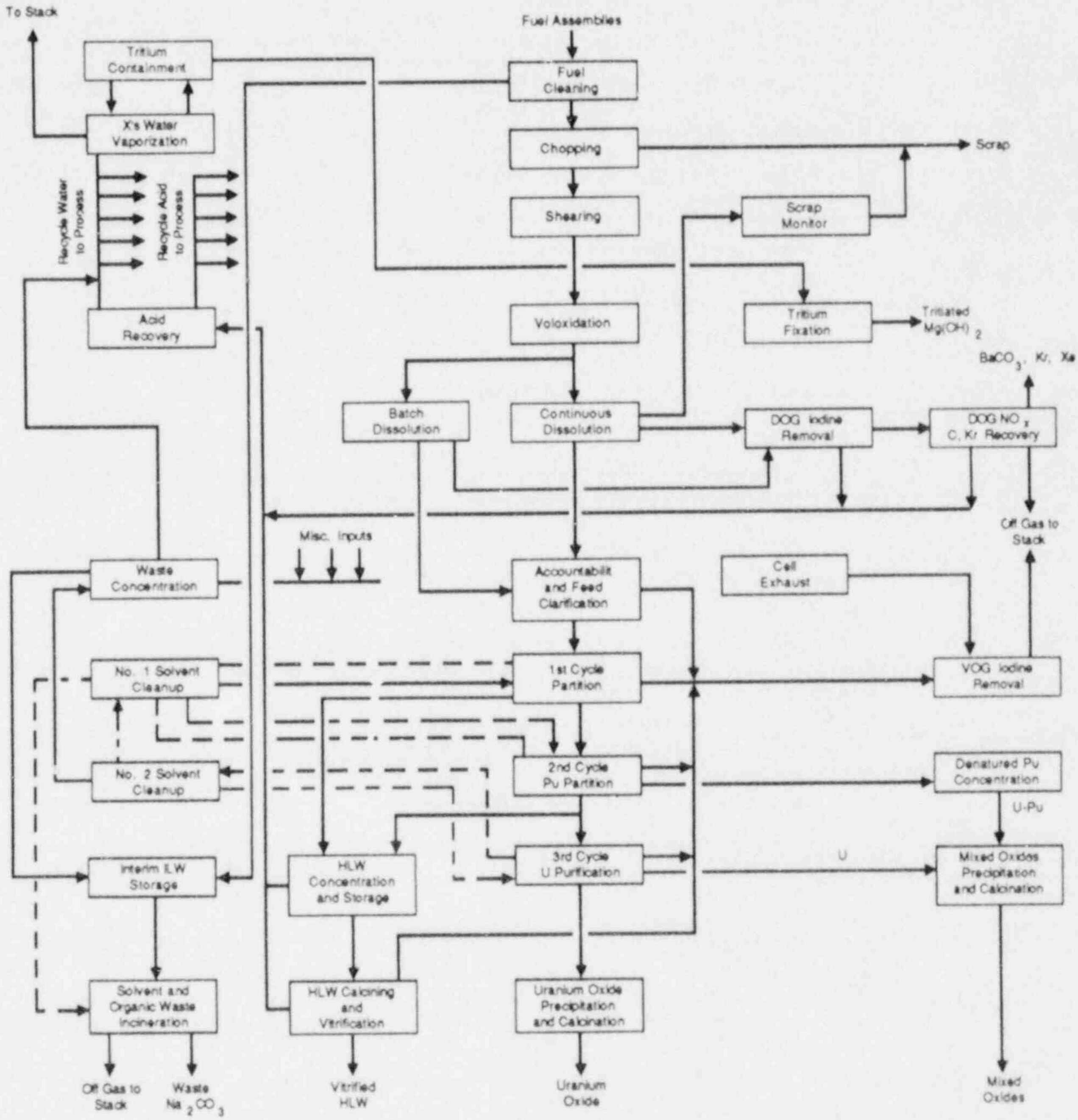

FIGURE 3.2. Fuel Reprocessing System (Dashed lines represent circumstance dependent options)

3.2.1 Process Description

In the first step of the process, the casks are monitored for leakage. Then they are washed, vented, and flushed to remove radioactive materials that would unnecessarily contaminate the fuel storage pool. Fuel elements are removed from the casks under water in a fuel unloading pool and are then stored in a water-cooled storage pool to allow for continued fission product decay. A minimum decay period for U-Pu fuel is 90 days after reactor discharge.

Following storage, the fuel elements are remotely transferred to a cell where the elements are sheared into small segments. The chopped fuel may then be voloxidized to collect tritium and noble gases, that are then recovered and stored. The fuel segments are dissolved in concentrated nitric acid and the resultant solution clarified to remove insoluble fission products and cladding fines. The solids are further treated with a strong acid in a secondary dissolver. Solutions are fed to the solvent extraction system where heavy metals are recovered and separated from fission products. Solvent extraction operations perform several cycles of separation and purification. The first cycle separates U, Pu, and other heavy metals in the fuel from the fission products. Further cycles separate either Pu from U, or a ratio of metals such as 75/25 U-Pu from the fissile material. A purification step follows. The columns operate by counter-current exchange of an aqueous acid with an organic solution. By heavy metal valence adjustment, the desired separations and purifications take place.

Conversion of the product solution to an oxide or mixed oxide is completed by peroxide or oxalate precipitation. The product is UO_2, PuO_2, or mixed oxide powder which is stored temporarily on site.

High-level liquid waste (HLLW) is stored until it can be be vitrified (about 2 years). Storage and solidification of these wastes are discussed in Section 3.3 of this report.

Other liquid wastes treated are degraded solvent (TBP in NPH), water, and HNO_3. Off gases are removed in the dissolver off gas (DOG) and vessel off-gas (VOG) systems. The DOG system removes NO_x, I_2, Kr, Ru and ^{14}C; the VOG, I_2.

As with fuel manufacturing facilities, the location of combustible, flammable, or potentially explosive materials identify potentially hazardous areas. Large amounts of solvent are used in the solvent extraction operations and can potentially lead to a fire within a cell. Ion exchange resins used in the process can potentially cause an explosion by nitration of the resin under certain conditions. It may also be a fire source. Combustible waste in storage can be the site of fires.

Significant volumes of hydrogen gases leaking into a process cell can be an explosion hazard if undetected.

Hazardous reactions in the normal process operations can potentially lead to explosions. Some potential explosions can be caused by:

- hydrogen produced by radiolysis of the feed solution
- solvent in the feed and loss of temperature control producing an uncontrolled reaction in an evaporator
- hydrazoic acid produced by an uncontrolled reaction
- "red oil" (nitrated TBP produced by solvent degradation) in an uncontrolled reaction.

Hazardous materials in reprocessing plants include solvents, HF, HNO_3, and hydrazine (which can explode or burn under certain conditions). Pipes in the facility can carry natural gas, fuel oil, or combustible materials that can be the site of an accident after leaking or rupturing.

As defined in Regulatory Guide 3.32 (U.S. Nuclear Regulatory Commission 1975), plant ventilation systems have several tasks. They are designed to supply properly conditioned air to the occupied and unoccupied areas of the building; confine air to a prescribed flow path discharging through a final filter or treatment system and stack; and ensure proper monitoring, filtration and treatment.

Pathways for accident-generated releases from the event site must be considered in developing scenarios. These are considered in conjunction with the location of large amounts of radioactive material and hazardous materials, both radioactive and nonradioactive. Barriers provide protection and mitigate the release. Figure 3.3 (U.S. Atomic Energy Commission 1973a) shows relationships of the barriers in a facility and conditions leading to successive releases. Several barriers must be breached to allow a release with some off-gas consequences. Barriers are also discussed in Chapter 2 of this report.

3.2.2 Potential Accidents

Major potential accidents in a fuel reprocessing plant are listed in the following tables along with the conditions required for the accident to occur and the possible consequences of the accidents. Table 3.7 lists the major accidents.

3.2.3 Inventories and Process Descriptors

For an accident analysis, process descriptions required include radioactive, hazardous and combustible material inventory, process parameters, and normal plant operating conditions. The inventories identify areas with maximum accident potential for the scenario and are input for the source terms described in Chapter 4. Normal operating conditions describe the initial conditions prior to an accident and are required as input to the source term code.

3.2.3.1 Radioactive Material Inventories

Radioactive material inventories are identified to provide input to the source term calculations in Chapter 4. This inventory should include the form, type of containment, location, quantity, radioactivity, and volatility of process materials. Radioactive materials in process, in storage, as contamination on combustible waste, or surface contamination should be considered.

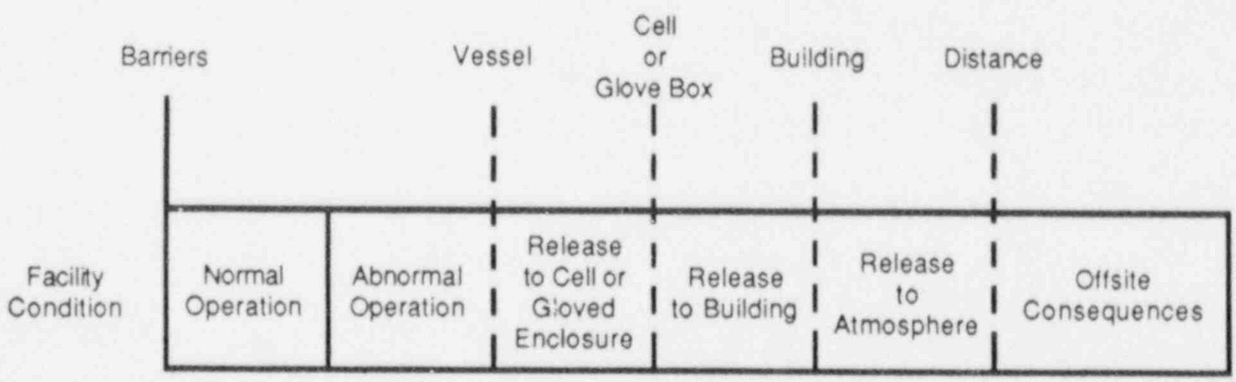

FIGURE 3.3. Relations Among Physical Barriers and Facility Conditions

TABLE 3.7. Major Postulated Accidents in Fuel Reprocessing Facilities (Perkins 1979)

Accident	Some Conditions Leading to Occurrence[a]	Possible Consequences
Solvent fires	High organic stream (HAP 1AU, 2SU) temperature	Airborne activity in process cell
	Solvent leak and vaporization	Possible overheating and plugging of cell ventilation filters
	Solvent sprays on hot equipment (e.g., steam line, evaporator reboiler)	Air reversal
		Loss of process control
	Steam jet leak in solvent recovery	Equipment damage
	Solvent cooler failure	Energy release by solvent burning somewhat limited by amount in process cells
	Solvent spill from: • skimmer overflow • flooded decanter • makeup tank overflow	
	Ignition source present	
	Cell atmosphere oxygen concentration above limit	
Fire or explosion associated with ion exchange resin	Self heating of resin due to abnormal conditions in column: • high nitric acid concentration • column overloading • dry resin in column • high column temperature	Column pressurization
		Column rupture
		Eruption
		Airborne activity in process cell, release of fission product to ventilation system
	Self heating of spent resin in waste	Possible plugging or overheating of VOG filters
	Spontaneous combustion of spilled resins	Waste fire
		Cell pressurization

TABLE 3.7. (contd)

Accident	Some Conditions Leading to Occurrence[a]	Possible Consequences
		Damage to equipment and to ventilation system
Sodium fire (in sodium handling)	Sodium leak and loss of control of cell atmosphere	Sodium smoke released to cell ventilation system with possible pressurization of cell, ventilation filter failure. Local temperature to 1250°C Any overheated fuel elements could release noble gases, iodine, and volatiles
Hydrogen explosion in tank or vessel vent system	Concentration of feed solution Hydrogen produced by radiolysis of feed solution. Loss of purge to feed tank Oxygen source Ignition source	Severe damage to equipment Potential damage to off-gas system Release of radioactive material to process cell
Evaporator explosion	Uncontrolled reaction in evaporator Solvent in feed and loss of temperature control Overpressurization of plutonium evaporator, hydrogen accumulation, and ignition source	Severe damage to equipment and VOG Missiles in process cell Airborne activity released to process cell Substantial amounts of aerosol generated, cell pressurization
Hydrazoic acid explosion	Uncontrolled reaction of hydrazine products used in solvent recovery	Damage to VOG system Fire in solvent recovery

TABLE 3.7. (contd)

Accident	Some Conditions Leading to Occurrence[a]	Possible Consequences
		Airborne activity in process cell
		Cell pressurization
Explosion in uranium evaporator - denitrator system or in concentrate evaporator	Uncontrolled reaction: • Excessive organic material in feed • Loss of temperature control in evaporator	Damage to equipment, nitrogen oxides (NOx) absorber, and vessel off-gas (VOG) system
	Oil leak into denitrator	Release of process material to cell and cell air
	Organic material in feed to concentrate evaporators	
		Cell pressurization
Hydrogen explosion in product storage tank	Hydrogen produced by radiolysis of product solutions	Damage to off-gas system and release of off gas
		Equipment damage
	Ignition source	Release of fissiles to cell floor
	Loss of vessel purge	
		Cell pressurization
Hydrogen explosion in vessel off-gas (VOG) header	High H_2 or HT content in VOG stream, air in stream, and ignition source	Aerosol release by filters
		Damage to VOG system
	Propagation from explosions in other equipment in cell	Pressurization of process cells via cell exhaust header
Hydrogen explosion in process cell	Ignition source present	Damage to shielding cell cell ventilation and VOG systems
	Excessive oxygen present in cell atmosphere	

TABLE 3.7. (contd)

Accident	Some Conditions Leading to Occurrence[a]	Possible Consequences
	Hydrogen release to cell from: • H_2 generator (e.g. leaks) or • purifier catalyst poisoned causing excess oxygen in cell Emergency hydrogen supply system leak into cell	Release of radioactive material from process cells to occupied areas Missiles Possible severe damage to equipment items in cell Initiation and development of additional major accident sequences (fires, etc.)
Red oil explosion in general purpose concentrator (GPC)	Simultaneous occurrence of all of the following: • Insufficient caustic added to GPC feed (acidic feed) • Excessive bottoms temperature (>130°C) • Heavy metal present (e.g., uranium from analytical laboratory) Solvent in feed	Release of intermediate level waste (ILW) to cell floor Airborne ILW in process cell and cell exhaust Missiles Damage to VOG system Cell pressurization, release to occupied areas Fire in cell
Hydrogen explosion (during fuel cleaning)	Uncontrolled sodium reaction in fuel cleaning vessel; overloaded catalytic oxidizer; ignition of H_2 in off gas Loss of inert cell atmosphere (humidity control) during unloading of Na-cooled fuel, uncontrolled Na-H_2O reaction in cell, or ignition of H_2 in cell	Damaged cell equipment Damaged off-gas system Possible rupture of fuel element being cleaned Release of airborne activity to process cell ventilation system

TABLE 3.7. (contd)

Accident	Some Conditions Leading to Occurrence[a]	Possible Consequences
Explosion in high level concentrator	Uncontrolled red oil reaction from all of the following:	Rupture of concentrator will cause possibly violent ejection of liquid, with formation of aerosol
	• Solvent in feed • Temperatures above 130°C • Heavy metal (U, Pu) present	Subsequent boil off of residual liquid with release of volatile species and additional aerosol may occur
	Hydrogen explosion from all of the following:	
	• H_2 accumulation • O_2 concentration above limit • Ignition source	Damage to VOG treatment system; release to process stack
	Pressure buildup from all of the following:	Cell pressurization; release to occupied areas
	• VOG vent pluggage • Loss of temperature control • Pressurization	Rupture producing missiles in process cell
Hydrogen explosion in HAF tank or in plutonium evaporator bottoms tank	Hydrogen produced by radiolysis of solution	Possibly severe damage to VOG system
	Equipment damage	
	Cell pressurization	
Hydrogen explosion in mixed-oxide calciner	Fissile material in locations	Damage to equipment and VOG system
	Flammable hydrogen mixture fed to calciner	Release of fissiles to cell and cell air
	Ignition source	Cell pressurization
	Wrong gas supplied to calciner	

TABLE 3.7. (contd)

Accident	Some Conditions Leading to Occurrence[a]	Possible Consequences
Rupture of a high-level liquid waste (HLLW) storage tank	Corrosion/erosion Mechanical stress from: • Overpressurization • Loss of cooling Simultaneous failure of the VOG system (e.g., by a H_2 explosion from loss of air sparge)	Release of HLLW to cell floor Airborne HLLW in process cell Potential for large release to process stack if safety features fail Self-heating liquid if undrained could boil away water and acid. Self heating of resulting solids could melt and damage containment in addition to producing fumes and aerosols Decay energy content of 75,000-ℓ tank could be 2.5×10^6 W
Criticality in fuel storage facility associated with reprocessing plant	Distortion of fuel storage array Fuel improperly stored Fuel assembly dropped into fuel storage array Fissile material on pool water filter	Damaged elements could release short-lived noble gasses and iodine Radiation and neutron locally high but largely shielded by pool water
Inadequate poison in dissolvent	Chemical makeup error: • Wrong chemical added • Poison concentration too weak	Criticality potential in: • Dissolver (in conjunction with undetected pluggage of liquid or solids)

TABLE 3.7. (contd)

Accident	Some Conditions Leading to Occurrence[a]	Possible Consequences
	Failure to add poison at correct volume ratio: • Pluggage • Pump failure • Operator error • Valving error • Metering malfunction	• Digestor (in conjunction with undetected accumulations of solids or with over-concentrated solution) Feed adjustment tank Accountability tank Surge tank Codecontamination feed tank
	Incorrect chemical analysis	
Criticality in mechanical processing and feed preparation operations	Inadequate poison in dissolvent	Criticality potential in above tanks
	Overconcentration of solution in digester or feed adjustment, followed by precipitation	Probable release of airborne activity, including noble gases and iodine to cell atmosphere and off-gas system
	Accumulation of fissile residue in digester or in solids recycle tank	Possible severe equipment damage
	Voloxidizer flooded with water	High radiation levels in cells
	Caustic added to feed	Mass and energy probably contained in cell
	Dissolver blockage in addition to loss of poison	Energy release 10^{18} fissions (32,000 kJ)
	Accumulation of chopped fuel on undetected stuck-shut voloxidizer and dissolver	

TABLE 3.7. (contd)

Accident	Some Conditions Leading to Occurrence[a]	Possible Consequences
Criticality in solvent extraction operations	Excessive fissiles in HA centrifuge bowl Fissile material in unintended location Damage to equipment Plutonium reflux in first, second, or plutonium purification cycle Plutonium precipitation Plutonium overevaporation Fissile uranium reflux Fissile material in solvent tank	High local radiation Release of gaseous fission products to cell or to VOG
Criticality in product-conversion operations	Transfer errors in solvent extraction or in product storage systems Overbatched peroxide precipitator Fissile material in UO_3 conversion systems No denaturant ^{238}U in feed to mixed-oxide system	High local radiation Release of gaseous fission products to cell or VOG system Damage to equipment
Criticality in miscellaneous systems	General purpose concentrator (GPC) bottoms-caustic-routed from rework decanter to digester in mechanical process; plutonium precipitation GPC bottoms routed from rework decanter to high level aqueous waste (HAW) concentrator	High local radiation levels Release of gaseous fission products to cell and VOG systems Damage to process equipment; possible loss of process control

TABLE 3.7. (contd)

Accident	Some Conditions Leading to Occurrence[(a)]	Possible Consequences
	Fissiles in HAW; plutonium precipitation	
	Excessive fissile accumulation in organic phase in rework decanter	
Loss of cooling (to fuel storage)	Loss of normal and emergency cooling water supply systems	Filled pool (50 MTHM) decay energy = 2.5×10^6 W
		Loss of water from storage pool
		Fuel element damage from over heating could release noble gases, volatiles, and semivolatiles
		Extreme overheating could produce additional fumes and aerosols
Dissolver off-gas krypton recovery; failure of a krypton cylinder	Defective cylinder, gauge, or valve (leak)	Release of krypton at cylinder loading station
	Impact (dropped cylinder)	Release of krypton in storage vault
	Fire in storage vault (overpressurization)	Possible release to process stack
		Composition, amount and pressure of noble gas in cylinders has not been established
		On the order of 10^5 Ci of ^{85}Kr if standard gas cylinders are used

(a) Excluding failure of protection devices.

Form. Radioactive material forms found in a fuel reprocessing plant include solids (metals and powders) liquids, and gases (off gas). Some radioactivity can be anticipated in the form of surface contamination, and some will be associated with ion exchangers and silica gel.

Location. Part of the inventory will be in process. Irradiated fuel is stored in water in a pool, and product is stored in a vault. High level solidified waste is stored under water in a pool. Noble gases (if recovered) can be stored in a vault.

Containment. Radioactive materials can be in closed or open containers or as surface contamination. When in the process they will be in shielded concrete cells. Spent silica gel beds can be contaminated with ruthenium. If it is recovered, iodine is stored as iodate in cans. High-level liquid wastes are stored in 20,000-gal tanks. For scenarios involving potential pressure increases or heating of closed containers of powders or liquids, both the gas and powder or liquid volume must be estimated. These descriptors are required to determine if and when overpressurization occurs in an accident. Moisture content of radioactive powders and radioactive liquid volumes must also be specified.

Quantity. The mass quantity of radioactive material at the accident location is input to the source term code. Radioactive materials become airborne several ways in fires: burning contaminated solids or liquids, rupturing of heated closed containers of radioactive powders or liquids, and spilling powders or liquids as a result of fire-related equipment failure. For each release mechanism judged to occur for a chosen scenario the mass quantity and the radioactivity associated with the material at risk must be estimated. When the range of quantities is known, the most and least conservative cases can be calculated to give a range of consequences.

Properties. The density, viscosity, surface tension, molecular weight, and enthalpies of radioactive materials may be needed depending on accident type. These properties affect the ability of the materials to become airborne under stresses generated during an accident.

Radioactivity. The radioactivity of materials is identified to determine the severity of accident consequences. Fuel reprocessing accident releases can include U, Pu, Ru, Rh, Zr, Nb, Cs, and Ce. Although the radioactivity of material does not affect the release rate or particle transport during an accident, this parameter does determine the public (environmental) and occupational (in plant) radiological consequence of an accident.

Radionuclide Volatility. In the fuel manufacturing facility, U and Pu were involved in the accident. They are nonvolatile and do not become airborne by heating in the fire accident scenario - some mechanical force is required to entrain them as particles. In the fuel reprocessing plant, volatiles (I), and semivolatiles (Ru, Cs, Ce) may be involved with the fire scenario. In a fire, they may become heated and released.

3.2.3.2 Hazardous and Nonradioactive Material Inventory

The hazardous material inventory should include the location, quantity, surface area, and type of chemicals, compounds, and other materials which may initiate or fuel a fire or explosion. The list should include combustible and flammable materials as well as those that are potentially explosive. These include materials used in the process, for support services (heating or cleaning), or stored waste prior to disposal.

Type. Hazardous and flammable materials in the fuel reprocessing plant will include some of those discussed in Section 3.1.3.2 for fires in fuel manufacturing facilities: cellulosics, plastics, ion exchange resins, solvents, etc. They are classified in Table 3.3. Fuel reprocessing facilities could also potentially contain liquid sodium, hydrazine, and diesel fuel.

Location. Hazardous materials may be stored in a central location inside or outside a facility. The AFRP has a diesel fuel storage room and a 1670 ft^2 (155 m^2) chemical storage room. Hazardous material can be contained in process equipment. A scenario can be developed from a leak or spill of that hazardous material from process equipment. Accidents may produce leaks or spills that could contribute to the scenario.

Quantity. The amount of combustible material at an accident location determines the energy released and time span of the accident and, consequently, the severity. As with fuel manufacturing, the mass quantity of combustibles in an accident are required input for source term models. A range of source terms maximum to minimum can be determined from the mass range at the accident site.

Surface Area. The surface area of combustible materials in a potential burn scenario must be estimated for source term calculations. A major fire event in a fuel reprocessing plant is solvent burning in the diked area at the bottom of a cell. The diked area in the sample problem is 132 ft^2 (1.23×10^5 cm^2) and thus sets a limit on the spread of the solvent. The solvent surface area is then 132 ft^2. A 100-ℓ spill as estimated in the solvent extraction fire scenario fills the dike to a depth of 0.8 cm. This may be the only combustible material (indicated) in the event.

Energy. See Section 3.1.3.2 for a full discussion of energy available for subdivision, deagglomeration, and dispersion during an accident.

3.2.3.3 Process Parameters

The operating conditions before an accident are required as input to the source term and transport codes. For fires these descriptors include temperatures:

- in the compartment (a cell in the fuel reprocessing plant)
- of the process solvent stream
- inside and outside of vessels containing radioactive materials
- in the duct.

Initial pressure that must be specified are in the:

- accident compartment (cell)
- solvent stream
- inlet vent upstream of filters
- exit vent downstream of filters.

Temperature. The initial temperature of the room and radioactive materials in process are used to calculate heat transfer to walls and vessels. Radioactive material may be at an elevated temperature during normal processing operations. The temperature of confined and unconfined materials must be estimated as well as the temperature outside the vessel. Initial temperature of the duct walls must be specified to calculate duct heat transfer in the transport code described in Chapter 5.

Pressures. The initial pressure in the accident compartment and inlet and exit ducts is required by the source term code for flow calculations during an accident. These pressures can be estimated by assuming a standard pressure of one atmosphere in the inlet ducts and a reduction in pressure of 0.005 atmospheres after each filter. Thus, the initial room pressure is 0.995 atmospheres and the exit vent pressure is 0.990 atmospheres. The difference between these pressures is 2-in. water gage.

3.2.4 Summary of Fuel Reprocessing Process Parameters

Descriptors of the required parameters for the analysis of accidents in a fuel reprocessing facility are listed in Table 3.8. They aid in development of a fire scenario and provide input to source term codes described in Chapter 4.

3.3 WASTE STORAGE AND SOLIDIFICATION

Waste storage/solidification facilities store high-level liquid wastes (HLLW) in tanks for a decay period, then solidify the waste. While many solidification methods are available liquid fed ceramic melting is the current reference U.S. technology for treating existing high-level liquid wastes and is selected for inclusion in the AAH.

3.3.1 Process Description

Figure 3.4 shows the HLLW solidification process for neutralized waste. In a commercial nuclear fuel waste storage facility, the wastes could be stored in large underground tanks as either a nitric acid solution or an alkaline liquid with a precipitated sludge. The alkaline liquid with a precipitated sludge results from neutralization of the HLLW in order to store it in carbon steel tanks. The solidification flow diagram for this process is more complex than for acidic waste and is provided for illustrative purposes. Soluble salts

TABLE 3.8. Fuel Reprocessing Process Descriptors

Descriptor
Radioactive Material Inventories
Form
Location
Containment
Quantity
Properties
Radioactivity
Radioactivity
Containment
Radioactive Material in Containers
Volume of Powder
Moisture Content of Powder
Volume of Air in Closed Containers
Mass of Liquid
Volume of Liquid
Hazardous Material Inventories
Energy
Location
Quantity
Surface Area
Material Type
Process Parameters
Initial Temperatures Compartment
Radioactive Powders in Closed Containers
Radioactive Liquids in Closed Containers
Radioactive Liquids in Open Containers
Outside of Vessels
Duct Wall
Solvent Stream
Initial Pressures in
Inlet Duct
Compartment
Exit Duct
Solvent Stream

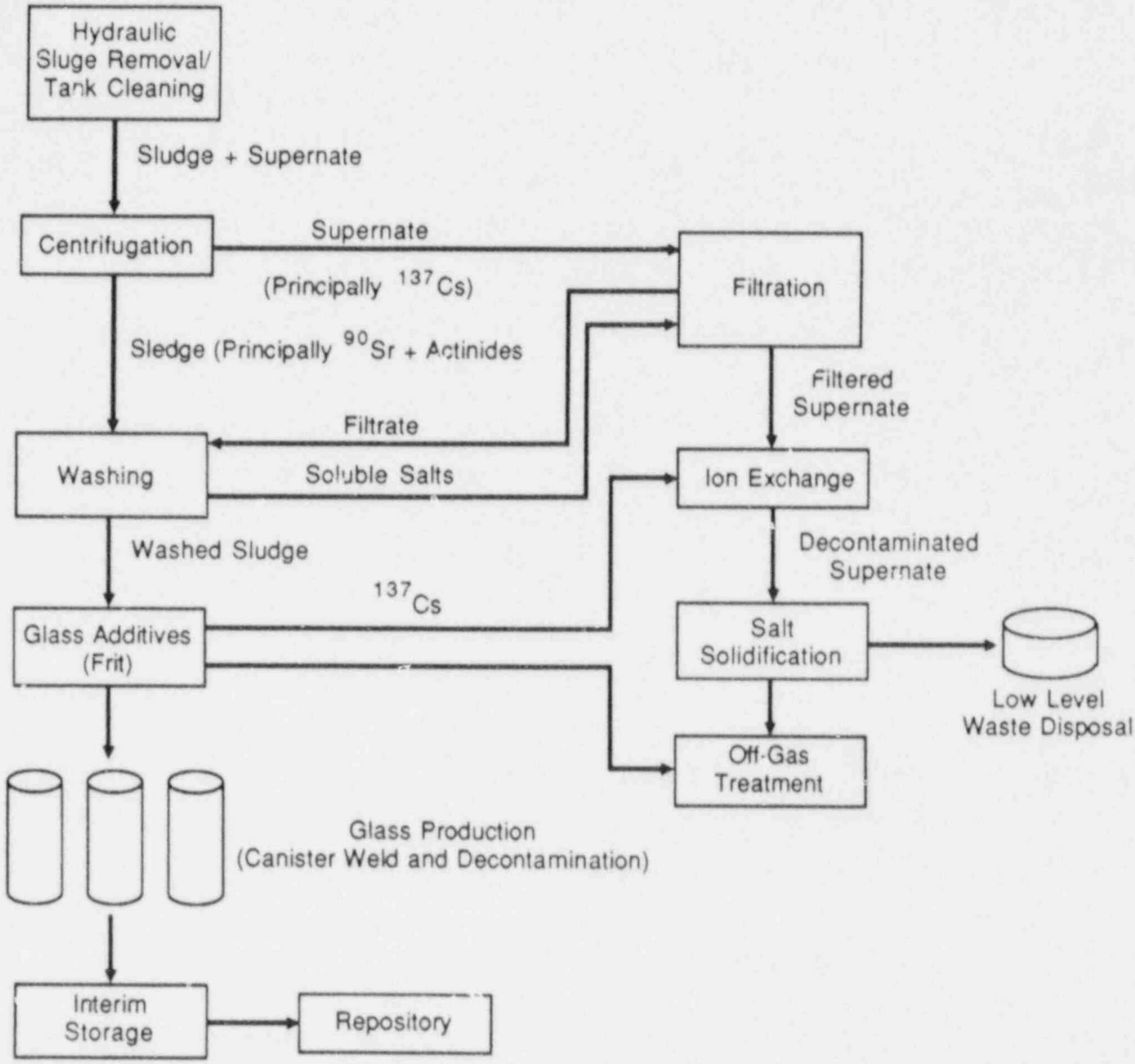

FIGURE 3.4. Process Flow for the Solidification of Neutralized High-Level Liquid Waste

are separated from the insoluble sludge by centrifugation, and washing or gravity settling, washing, and filtration. Cesium is removed from the salt solution (clarified supernate) using an ion exchange resin. The cesium may be eluted from the resin and blended with the washed sludgeor the resin directly blended. The decontaminated supernatant is solidified (typically by cementation) and disposed of as low-level waste.

The slurry is fed onto the surface of a molton glass pool. The liquid is evaporated and solids are vitrified molten glass. The molten glass is then poured into receiving canisters. A lid is welded onto the canisters and residual canister surface contamination is removed by either physical or chemical means. The canisters are stored on site for a period of time before shipping to a repository.

Off gases are treated to remove contaminants such as nuclides and toxic and hazardous materials.

The location of combustible, flammable, or potentially explosive materials in the plant and process identify potentially hazardous areas. The process reaches elevated temperatures (~1150°C) inside the furnace. The exterior is water cooled and thus the system should not present a potential ignition source unless the cooling system fails. The HLLW will contain several types of organic materials originating from solvent extraction, ion exchange, and other processing steps. These materials can ignite in the vapor phase (Larson 1980). Combustible material accumulations in a cell can ignite. Stored combustible waste is susceptible to fire.

The decomposition of certain organic species can lead to hydrogen generation in the melter. In this case, hydrogen can reach an explosive concentration in the off gas after condensation of the stream. Hydrogen could also accumulate in the feed tank or waste storage tank. "Red oil" explosions can potentially occur in the process. The elevated temperatures in the process and the presence of water in the feed mean a potential for a steam explosion in the furnace. Current analysis indicates that this accident may not be credible.

Factors in the plant process that are considered in developing major potential accidents are location of flammable, combustible, or explosive materials; large amounts of dispersible materials; elevated temperature operations; and attenuation in pathways from the accident site. The factors are usually balanced in a plant so that dispersible radioactive materials are isolated away from combustibles and in zones of greatest protection. However, due to failure in administrative control or failure in safety features of the plants, an imbalance may occur leading to an accident.

3.3.2 Potential Accidents

Major potential accidents in a waste storage/solidification facility are listed in the following tables along with the conditions required for the accident to occur and at the potential consequences of the accident. Table 3.9 lists the major accidents.

3.3.3 Inventories and Process Descriptors

For an accident analysis, process descriptors required include radioactive, hazardous and combustible material inventory, process parameters, and normal plant operating conditions. The inventories identify areas with maximum accident potential for the scenario and are input for the source terms described in Chapter 4. Normal operating conditions describe the initial conditions prior to an accident and are required as input to the source term code.

3.3.3.1 Radioactive Material Inventories

An inventory of radioactive materials in the plant must be developed to identify potential accident scenarios and provide input to source term codes in Chapter 4. This inventory should include the material form, type of containment, location, quantity and radioactivity of process materials. Radioactive materials in process, in storage, associated with combustible waste, and existing as surface contamination must be considered.

Form. The form of the material must be specified since it affects the dispersibility of the material, the consequences, and the size of particles generated in the accident. In the waste storage/solidification facility the radioactive material is found as a liquid, sludge, fine particles, molten glass, or cooled glass.

Containment. For waste storage/solidification facilities, the waste is in storage tanks, process equipment, or canisters. Surface contamination can be anticipated, and some activity will be associated with ion exchange resins.

TABLE 3.9. Major Postulated Accidents in a Waste Solidification (Spray Calciner) Facility (Larson 1980; U.S. Department of Energy 1979; 1981)

Accident	Some Conditions Leading to Occurrence[a]	Possible Consequences
Fire in cell	Accumulation of combustible materials in cell (i.e., plastics, dust, solvent leak, some cloth, grease, organic film) and ignition Cell window breaks and oil ignites	Cell filters clogged. All plastics in cell lose integrity. Cell pressurizes and radioactive material disperses to operating and services areas. Calcine transported to cell filters
Hydrogen or organic vapor explosion in feed tank and rupture	Red oil ignition Extended undetected loss of air purge, and hydrogen accumulation and ignition	Up to 7000 ℓ of feed slurry released to the cell floor and up to 2 kg of calcine to the cell atmosphere
Canister and liner rupture at molten glass temperature, with release of molten glass to cell floor	Canister and liner experience thermal excursion and loss of mechanical integrity due to loss of temperature control caused by controller failure or operator error	Approximately 350 kg (4-h release) of molten glass (at 1200°C) released to cell floor
Off-gas explosion	Presence of explosive (or flammable) concentration or mixture of hydrogen in off-gas system Ignition source	Cell off-gas (COG) seals fail. Possible COG equipment vessel failure. Rupture of HEPA filters, Ru bed retainer, or I bed retainer. Release of calcine, Ru, particulate or I on particulate some of which reaches cell filters
Hydrogen explosion in mixed-oxide calciner	Fissile material in unintended locations Flammable hydrogen mixture fed to calciner	Damage to equipment Release of fissiles to cell and cell air Cell pressurization

TABLE 3.9. (contd)

Accident	Some Conditions Leading to Occurrence[a]	Possible Consequences
	Ignition source	
	Wrong gas supplied to calciner	
Calciner pressurized and ruptured	Solvent buildup in feed tank and high concentration solvent feed to calciner	From 30 to 40 kg of calcine (density = 1 g/cm^3) released to cell
	Red oil detonation	
	Pressure relief system restricted.	
Steam explosion in canister containing molten glass	Continued addition of feed slurry to calciner after loss of heating elements	A large number of small particles could be generated by the explosion and scattered throughout the cell (requires appropriate study)
Break in calciner feed line or significant leak of high-pressure spraying type	Feed line impacted with piece of equipment	Approximately 50 ℓ of atomized feed released to cell atmosphere
	Improper feed piping installation	
	Piping corrosion	
	Connections work loose or gaskets deteriorate	
Canister distorted or breached by drop	Error in handling	Some glass breakage and loss from canister. Possibility of other equipment damage due to canister impact. Cell contamination from damaged equipment possible
	Handling equipment failure	

(a) Excluding failure of protection devices.

Since some scenarios involve heating closed containers of radioactive materials, the volume of gas must be estimated. Gas volume is the total container volume minus the volume of the contained radioactive liquid.

Location. Radioactive material will be in process equipment, or storage. The HLLW is held in tanks prior to solidification and the vitrified waste is stored onsite in canisters.

Quantity. The mass quantity of radioactive material at the accident location is input to the source term models. For fires, radioactive materials become airborne in several ways: burning contaminated combustible solids or liquids, heating contaminated surfaces, heating unpressurized liquids, rupturing of heated closed containers holding radioactive powders or liquids, and spilling powders or liquids due to equipment failure caused by a fire. In the waste solidification process molten contaminated glass can be a spilled material. For each release mechanism judged to occur for a specific scenario the mass at risk must be estimated. If a range of possible quantities is known, the most and least conservative cases can be calculated to give a range of possible consequences. Surface contamination may be estimated at 7.5 g/m^2 (Mishima, Schwendiman, and Ayer 1978) if no other information is available.

Properties. The density, viscosity, surface tension, molecular weight, and enthalpies of radioactive materials may be needed depending on accident type. These properties affect the ability of the material to become airborne under stresses generated during an accident.

Radioactivity. The radioactivity of the materials should be identified to determine the severity of the accident consequences. Waste storage facilities handle ^{137}Cs, ^{90}Sr, ^{106}Ru, ^{129}I, ^{144}Ce and other (unidentified) radionuclides. The amount of each of these involved in an accident scenario influences the degree of contamination resulting from that accident. Although the radioactivity of material does not affect the release rate or transport of particles during an accident, this parameter should be estimated so that public (environmental) and occupational (in plant) radiological consequences can be determined.

Radionuclide Volatility. In the fuel manufacturing facility, U and Pu are the radionuclides of concern. They are nonvolatile and do not become airborne by heating in a fire - some mechanical force is required to entrain them as particles. In the waste storage/solidification facility, volatiles (I) and semivolatiles (Cs, Sr, Ru, Ce) may be involved in a fire scenario. They may become airborne when process materials are heated in the fire.

3.3.3.2 Hazardous and Nonradioactive Material Inventory

An inventory of hazardous materials should include the location, quantity, surface area, and type of chemicals, compounds, and other materials which may initiate or add fuel to a fire or explosion. The list should include combustible and flammable materials as well as those that are potentially explosive. These include materials used in the process, for support services (heating and cleaning), or stored as waste prior to disposal.

Type. Hazardous and flammable materials in the waste storage/solidification plant will include some of those discussed in Section 3.1.3.2 for fuel manufacturing facilities: cellulosics, plastics, ion exchange resins, etc. These materials are classified in Table 3.3. Waste solidification facilities can also contain oxalic acid, welding gases, and ammonia.

Location. Hazardous materials may be stored in a central location within or outside of the plants, or contained in the process equipment. Piping, for example natural gas lines, can contain hazardous material. A scenario can be developed from a leak or spill of that hazardous material from process equipment. Leaks or spills may be produced by an accident in the same location and result in secondary source term effects.

Quantity. The quantity of combustible material at the accident location influences the severity since it determines the amount of energy released and time span of the accident. Mass quantity of combustibles in a fire is required as input to source term fire models. Maximum and minimum source term cases for a given scenario can be determined from a likely range of mass quantity at the accident location.

Surface Area. Surface area of the combustible must also be estimated for fire model input. For burning liquids this area is the surface area of the contained space occupied by the liquid. The surface area of molten glass is required if it is involved in a scenario. For combustible solids, the surface area may be the exposed face of a waste drum, or area of a plastic bag or rag.

The major fire in the waste facility is a fire in a cell with the principal combustibles electric cabling insulation and oil in the shielding windows. The assumption may be made that the fire is coincident with a molten glass spill covering an area of 7.1 m^2 (Larson 1980). The slow leak postulates new hot glass continually expelled over a large surface area. This area affects the energy and nuclides given off.

Energy. See Section 3.1.3.2 for a full discussion of energy available for subdivision, deagglomeration, and dispersion during an accident.

3.3.3.3 Process Parameters

The operating conditions before an accident are required as input to the source term and transport codes. These include temperatures:

- in cells
- in a process stream
- inside and outside of vessels containing radioactive materials
- on a spilled glass surface
- in the duct.

and initial pressures in the:

- fire compartment (cell)
- process stream
- inlet vent upstream of filters
- exit vent downstream of filters.

Temperature. The initial temperature of the room and radioactive materials in process are used to calculate heat transfer to walls and vessels. Radioactive materials may be at an elevated temperature during normal processing operations. The temperature of confined and unconfined materials must be estimated as well as the temperature outside the vessel. Glass surface temperature controls volatile radionuclide releases. Initial temperature of the duct walls must be specified to calculate duct heat transfer in the transport code described in Chapter 5.

Pressures. The initial pressure in the accident compartment and inlet and exit ducts is required for flow calculations during the accident. These pressures can be estimated by assuming a standard pressure of one atmosphere in the inlet duct and a reduction in pressure of 0.005 atmospheres after each filter. Thus the initial room may be 0.995 atmospheres with inlet pressure 1.000 atmospheres and outlet pressure of 0.990 atmospheres. This estimation assumes sufficient filter loading to require 2-in. water gage pressure across the filters.

3.3.4 Summary of Waste Storage/Solidification Process Parameters

Description of the required parameters for the analysis of accidents in a waste storage and solidification facility are listed in Table 3.10. They aid in development of an accident scenario and provide input to source term codes described in Chapter 4.

3.4 SPENT FUEL STORAGE

The fuel storage mode selected for inclusion in the AAH is water storage of spent fuel away from the reactor. Other potential fuel storage modes could be considered. These options are storage at a reactor, dry storage, and mixed storage. Dry storage (if used) begins after 5 years of water basin storage. All fuel elements will thus have a period of water basin storage so a safety assessment is required for this mode. During this storage period fission products will decay, so radioactivity levels in the fuel elements decrease. Hence the radioactive impacts of accidental releases from fuel storage facilities will be lower after 5 years of storage.

3.4.1 Process Description

Figure 3.5 is a flow diagram showing the operation of a representative fuel storage operation. Irradiated fuel assemblies contained in a cask are received at the facility, then monitored for contamination and washed with high pressure water. Casks are then removed from the transporter, vented and cooled, then transferred to the cask unloading section of the pond.

TABLE 3.10. Waste Storage/Solidification Process Descriptors

Descriptor
Radioactive Material Inventories
Form
Containment
Location
Quantity
Properties
Radioactivity
Radionuclide Volatility
Radioactive Material in Containers
Volume of Powder
Moisture Content of Powder
Volume of Air in Closed
Mass of Liquid
Volume of Liquid Containers
Hazardous Material Inventories
Location
Quantity
Surface Area
Material Type
Energy
Process Parameters
Initial Temperatures Compartment
Radioactive Powders in Closed Containers
Radioactive Liquids in Closed Containers
Radioactive Liquids in Open Containers
Outside of Vessels
Glass Surface
Duct Wall
Initial Pressures in
Inlet Duct
Compartment
Exit Duct

The cask lid is removed while the cask is underwater. Individual fuel assemblies are then removed from the cask and placed in a multiple-assembly storage canister. The lid is replaced and the empty cask is removed from the pool.

Fuel and cask pool water are purified by filtering and demineralizing. Fuel pool water is cooled to remove decay-produced heat. The fuel pool

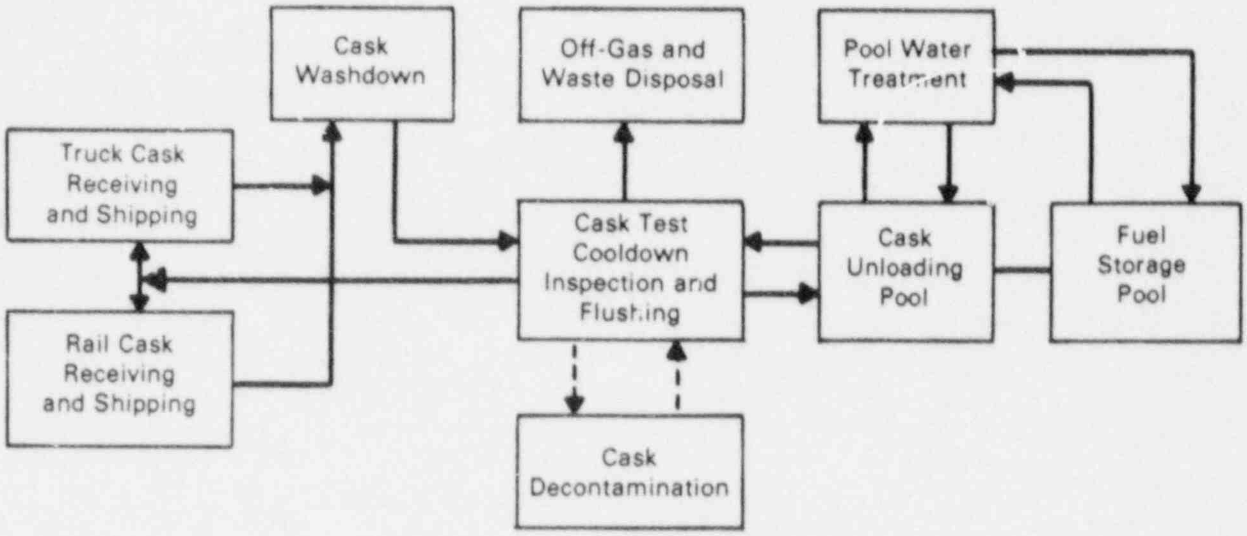

FIGURE 3.5. Representative Fuel Storage Facility Operations

prefilters and demineralizers accumulate radioactive materials. The demineralizer resin is replaced when the decontamination factor drops below a predetermined level.

Gaseous effluents are collected in the off-gas system.

Liquid and solid radioactive wastes are collected, treated, packaged, stored, and disposed of property. Radioactive contaminants are fission and activation products from the fuel surface and defects in the fuel cladding.

The location of combustible, flammable, and potentially explosive materials in the plant and process identify potentially hazardous areas. The wastes contain potentially combustible material: ion exchange resin, filters, clothing, plastic, paper, wood, and rubber.

Radioactive decay heat can raise the fuel pool water temperature significantly, making this a potential accident site. The fuel pool cooling system may remove a heat load of 30 million Btu/h, maintaining pool temperature at 120°F and less. Radiolytic hydrogen can be produced and could present an explosion hazard. The plant ventilation system ensures flow paths to control airborne contaminants. Airflow is exhausted through filters to the atmosphere.

Factors to consider in developing major accident scenarios are: location of large amounts of radioactive materials; location of combustibles, flammable, or explosive materials; and attenuation in pathways from the accident site. Failure in administrative control or operational systems can lead to accidents in these plants.

3.4.2 Potential Accidents

Corresponding to earlier process description sections (3.1, 3.2, and 3.3) potential major accidents in the facility should be listed here along with conditions required for the accident to occur. However, in the spent fuel storage facility no major accidents have been postulated.

Process descriptors and inventories have been included for determining the consequences of moderate or minor accidents in a spent fuel storage facility.

3.4.3 Inventories and Process Descriptors

Process descriptors that are required for an accident analysis consist of an inventory of radioactive materials, and process parameters such as operating conditions for normal plant operation. The inventories aid in identifying areas of accident potential to use for developing a scenario. They are also used as input to source term codes described in Chapter 4. Normal operating conditions and other process parameters are required as input to source term and transport codes to describe initial conditions prior to an accident. Information required on these descriptors are specified in the following sections.

3.4.3.1 Radioactive Material Inventories

To identify potential accident scenarios and provide input to source term codes in Chapter 4, an inventory of radioactive materials in the plant must be developed. The inventory should include the form, type of containment, the location, quantity and radioactivity of process materials. Radioactive materials in process, in storage, on combustible waste, and existing as surface contamination should be considered.

Form. The form of radioactive material, whether solid, liquid, or gas, must be specified since it affects the dispersibility of the material as well as the size of particles generated in an accident. In a spent fuel storage facility the radioactivity may be in the order of a billion curies or more, but very little is in a dispersible form (Smith 1978). This large inventory is in the spent fuel itself.

Some radioactivity will be associated with fuel pool water contaminated by leaking fuel elements. Ion exchange resins, cellulosic materials, rubber gloves, filters, and surfaces will all have some low level of radioactive contamination. Suspended and bottom deposited radioactive solids are present in the fuel storage pool.

Containment. The fuel is in casks on arrival at the facility. Individual fuel assemblies contain the bulk of the radioactivity. A low level of contamination will be associated with contaminated combustibles, in the storage pool water, and as surface contamination.

Location. Radioactivity is primarily located in the spent fuel pool.

Quantity. The mass quantity of radioactivity at the accident location is input to source term models.

The design fuel pool heat load corresponds to storage of 12 cores of PWR fuel, with exposure equivalent to 33,000 MWd/MTU and these decay periods; following shutdown and prior to transfer to the storage pool:

- three cores with a 1-yr decay period
- three cores with a 2-yr decay period
- three cores with a 3-yr decay period
- three cores with a 4-yr decay period.

Because not as many BWR cores can be stored in the fuel pool due to space limitations, the fuel pool heat load would be approximately two-thirds of that calculated based on 12 cores of PWR fuel. Thus, the criteria for establishing the design heat load also represents the "inventory at risk."

Properties. The density, viscosity, surface tension, molecular weight, and enthalpies of radioactive materials may be needed depending on accident type. These properties affect the ability of the material to become airborne under stresses generated during an accident.

Radioactivity. The radioactivity of the materials should be identified to determine the severity of the consequences of an accident. In older stored spent fuel, volatile and nonvolatile radionuclides with short half-lives will have decayed to negligible levels.

3.4.3.2 Hazardous and Nonradioactive Material Inventory

An inventory of hazardous materials should include the location, quantity, surface area, and type of chemical compounds, and other materials, that may initiate or add fuel to a fire or explosion. The list should include combustible and flammable materials as well as those that are potentially explosive. These include materials used in the process, for support services (heating and cleaning), or stored as waste prior to disposal.

Type. Hazardous and/or flammable materials in the spent fuel pool include cellulosics (rags and paper) and ion exchange resins. If natural gas heating is used, it is a material with hazardous potential. Propane heaters can also be used. Fuel classifications are listed in Table 3.1.4.

Location. Hazardous materials are used in the process location within or outside of the plants, or are contained in process equipment. For example, natural gas pipe lines contain a hazardous material.

Quantity. The quantity of combustible material at the accident location influences the severity since it determines the amount of energy released and time span of the accident. Materials to fuel a fire are minimal in a spent fuel facility.

Surface Area. If a fire is postulated, the surface area of the combustibles must be estimated.

Energy. See Section 3.1.3.2 for a full discussion of energy available for subdivision, deagglomeration, and dispersion during an accident.

3.4.3.3 Process Parameters

Since no major fire was postulated for a spent fuel storage facility, fire descriptors are not included. These descriptors are normal operating temperatures and pressures.

3.4.4 Summary of Spent Fuel Storage Process Parameters

If an analysis of accidents in a spent fuel storage facility is de-ired, refer to Table 3.11 for de--riptions of the required parameters.

TABLE 3.11. Spent Fuel Storage Process Descriptors

Descriptor
Radioactive Material Inventories
Form
Containment
Location
Quantity
Properties
Radioactivity
Radioactive Material in Containers
Volume of Air in Closed Containers
Mass of Liquid
Volume of Liquid
Hazardous Material Inventories
Location
Quantity
Surface Area
Material Type
Energy
Process Parameters
Initial Temperatures
Compartment
Radioactive Powders in Closed Containers
Radioactive Liquids in Closed Containers
Radioactive Liquids in Open Containers
Outside of Vessels
Duct Wall
Initial Pressures in
Inlet Duct
Compartment
Exit Duct

3.5 SAMPLE PROBLEMS

The continuing sample problems supply illustrative support for the accident analysis procedures identified in this chapter. The problems demonstrate how to select descriptors of the process in the facility for analysis of specific accidents.

Six types of accidents: fires, explosions, tornadoes, criticalities, equipment failures, and spills are included in this handbook.

3.5.1 Primary Sample Problems

Primary sample problems are those chosen to show analysis methods for source term and consequence assessment. Process accident descriptions for the four primary accidents first discussed in Section 2.7.1 are given here.

3.5.1.1 Slug Press Fire (MOX Fuel Manufacturing)

The slug press fire (see Section 2.7.1.1) is a fire in the slug press enclosure of a mixed oxide fuel fabrication plant. The slug press enclosure was chosen as the site of a mixed oxide facility fire because it may contain flammable and combustible materials (solvents, hydraulic fluids, and rubber gloves) and a relatively large amount of mixed oxide powder, a dispersible form of radioactive material.

Contrary to procedures, one pint of a flammable solvent, acetone or methanol, is assumed to be present in the slug press enclosure, for a cleanup and maintenance effort. Combustible hydraulic fluid is assumed to leak from the slug press onto a tray of about 1 m^2. The spill amounts to one quart of the fluid present at the initiation of the fire. The solvent is assumed to spill onto the hydraulic fluid, and because of its greater volatility, burns completely before igniting the hydraulic fluid. The hydraulic fluid, in turn, burns, then the four rubber gloves (227 g) attached to the enclosure ignite and burn. Figure 2.2 shows the smoke plume rising to the ceiling where it forms a hot layer.

Radioactive materials in the room during the fire are mixed oxide powder on the floor and walls at a surface contamination level of 7.5 g MOX/m^2, and the same level of surface contamination on the gloves. The size of surface contaminated area affected by the fire is unknown, but since the fire is limited in size, it is assumed that 10 m^2 or about one wall of the enclosure is affected. Thus, a maximum of 75 g of MOX powder is at risk as surface contamination. The gloves, weighing 227 g, with an exposed surface area of about 0.5 m^2 each are contaminated with 3.75 g of MOX powder. This assumes that only the surface interfacing with the glove box atmosphere is contaminated. A hopper to the slug press contains a maximum of 225 kg of mixed oxide powder in a closed container. For the simplest case the assumption is made that an overpressurization does not occur. The fire source term code can be used to determine whether the container ruptures.

Initial temperature in the slug press compartment and canyon above (see Section 2.5.1.1 for a facility description) is 298K. Initial pressure in the inlet duct is one atmosphere. Pressure inside the compartment and exit duct is 0.995 and 0.990 atmospheres, respectively. Table 3.12 lists the input process descriptors for this sample problem. All descriptors are used as input to the source term code FIRIN for this scenario. FIRIN provides the needed input to the transport code FIRAC.

TABLE 3.12. Fire Source Term Descriptors (MOX Fuel Manufacturing)

Radioactive Material	MOX	MOX	MOX
Quantity	75g (wall)	225 kg (hopper)	15 g (gloves)
Form	Powder	Powder	Powder
Radioactivity	6% Pu	6% Pu	6% Pu
Containment	Surface contamination	Closed container	Combustible solid
Fuel	Solvent	Hydraulic fluid	Rubber gloves
Quantity	385 g (1 pint)	711 g (1 quart)	908 g (4 gloves)
Surface Area	1 m^2	1 m^2	2 m^2
Type	Organic fluid	Organic fluid	Elastomer

Initial Compartment Temperature	298K
Initial Pressures	
Inlet Duct	1.0 atm
Compartment	0.995 atm
Exit Duct	0.990 atm

Section 4.2.3.1 combines the descriptors from the sample problem set up in Chapters 2 and 3 to provide a source term. Chapter 5 takes the source term and Chapter 2 descriptors and predicts consequences of the accident scenario.

3.5.1.2 Solvent Extraction Fire (Fuel Reprocessing)

The solvent extraction fire (see Section 2.7.1.2) is a fire in the solvent extraction operations of a fuel reprocessing plant. A large amount (100 ℓ) of solvent loaded with U, Pu, and minor quantities of other fission products spills from a solvent extraction [illegible]. The cell in which the system is located is inadvertently filled with air and the flammable liquid ignites. The solvent burns, releasing radioactive particles to the air. The solvent extraction fuel tank, 80% full of radioactive nitric solution, is heated during the fire and potentially overpressurizes, thus contributing to the radioactive source term.

The concentration and total amount of radioactive materials in the spilled solvent are shown in Table 3.13.

It is assumed that 99.9% of the nongaseous fission products and 0.5% of the uranium, plutonium, and thorium are separated from the feed in the feed tank and the column. The composition of radioactive materials in the feed tank is calculated and shown in Table 3.14. The feed tank has a capacity of 3600 ℓ and is assumed to be 80% full. Thus, it contains 2900 ℓ. Table 3.14 also shows that the total quantity of radioactive materials in the feed assuming a concentration of 5.6 g/ℓ fissile.

TABLE 3.13. Radioactive Materials in Loaded Solvent

	Concentration, g/ℓ	Qty. in 100 ℓ, g
$^{239}Pu\ (NO_3)_4$	5.4	540
$^{238}UO\ (NO_3)_2$	11.1	1110
$^{232}Th\ (NO_3)_4$	64.	6400
^{106}Ru	2 x 10-4	0.2
^{106}Rh	6 x 10-4	0.06
^{93}Zr	1.8 x 10-3	0.018
^{95}Nb	1 x 10-5	0.001
^{44}Ce	1.7 x 1-3	0.17
^{137}Cs	2.7 x 10-3	0.27

TABLE 3.14. Radioactive Materials in Feed Tank to Column

	Qty in Feed[(a)], g	Materials in Composition, %	Feed Tank To Column Qty in 2900 ℓ, g
Pu $(NO_3)_4$	543	6.1	990
UO_2 $(NO_3)_4$	1,116	12.4	2,010
Th $(NO_3)_4$	6,432	71.7	11,640
Ru	200	2.2	360
Rh	60	0.7	110
Zr	180	2.0	320
Nb	1	--	--
Ce	170	1.9	310
Cs	270	3.0	490

(a) Feed corresponding to 100 ℓ of loaded solvent assuming 99.9% removal of fission products and 0.5% removal of U, Pu, and Th.

The primary combustible in the fire is 100 ℓ of solvent (30 volume % tributyl phosphate in dodecane). The solvent spills into a diked area at the base of the cell forming a 3.5-m x 3.5-m pool. Other combustibles may be present in small quantities but are considered to make an insignificant contribution to the fire as compared to the solvent. At a density of 0.86 g/cm^3, a total of 86 kg of solvent is in the pool.

Operating conditions in the cell are 3'.2 K (120°F) maximum temperature and 0.994 atmospheres (-2.5 in. water gage) pressure during normal operations. The change in pressure across the filters is assumed to be 0.005 atmospheres. Therefore, the pressure at the duct inlet is 0.999 and pressure at the outlet duct is 0.989 atmospheres. The feed solution to the column is assumed to be at cell temperature of 322 K. Table 3.15 lists the descriptors from this chapter for the solvent extraction fire.

3.5.1.3 Glove Box Explosion

In this postulated event, a small volume of solvent in a glove box holding plutonium dioxide powder spills, evaporates, mixes with oxygen in the glove box

TABLE 3.15. Solvent Extraction Fire Source Term Descriptors

Parameters	Quantity, g	Form
Radioactive Material		
Spilled Solvent:		
Pu $(NO_3)_4$	540	Nitrate
UO_2 $(NO_3)_4$	1,100	Nitrate
Th $(NO_3)_4$	6,400	Nitrate
Ru	0.02	Semivolatile
Rh	0.06	Semivolatile
Zr	0.18	Nonvolatile
Nb	0.001	Nonvolatile
Ce	0.17	Nonvolatile
Cs	0.27	Semivolatile
Feed Tank:		
Pu $(NO_3)_4$	990	Nitrate
UO_2 $(NO_3)_4$	2,010	Nitrate
Th $(NO_3(_4)$	11,640	Nitrate
Ru	360	Semivolatile
Rh	110	Semivolatile
Zr	320	Nonvolatile
Nb	---	Nonvolatile
Ce	310	Nonvolatile
Cs	490	Semivolatile
Fuel	TBP in dodecane	
Quantity	86,000 g (100 ℓ)	
Surface Area	12.3 m^2	
Type	Organic Fluid	
Initial Temperatures		
Compartment	322 K	
Liquid in Feed Tank	322 K	
Air Outside of Feed Tank	322 K	
Initial Pressures		
Inlet Duct	0.999 atm	
Compartment	0.994 atm	
Exit Duct	0.989 atm	

atmosphere, is ignited, and deflagrates. The pressure impulse from the explosion ruptures gloves allowing some of the powder to escape. It is assumed that a single portable container of 50 mℓ of acetone is involved in the accident. Properties of acetone are density = 0.79 g/mℓ

molecular weight = 58.05 g/gmole

heat of combustion = 426.8 kcal/gmole

The amount of plutonium dioxide powder at risk is 2000 g.

3.5.1.4 Tornado

A powder container inside an enclosure is improperly capped and placed in a precarious position during the cessation of operation following a tornado alert. The container topples to the floor of the enclosure and the cap is dislodged upon impact. The powder spills from the container onto the floor and is subjected to the accelerated airflow through the enclosure during the passage of a tornado vortex over the exhaust outlet (stack) of the facility. The powder forms a 10-cm-thick layer on the surface on which it is spilled.

3.5.2 Secondary Sample Problems

Several sample problem are chosen to illustrate source term analysis methods only. These problems are carried only to Chapter 4 where the source term is calculated. Process descriptors for these secondary sample problems are described in the following sections. The accident type under which they are analyzed in Chapter 4 is identified in parenthesis next to the section heading.

3.5.2.1 Flashing Spray

The solvent extraction fire in a fuel reprocessing plant (Section 3.5.1.2) may heat a pipe which has been blocked off and contains some standing liquid or may heat a tank of radioactive liquid. The pipe or tank may then overpressurize and rupture, flashing some of the solution into the room. The radioactive liquid involved is assumed to be plutonium nitrate. Enthalpies of plutonium nitrate solution and vapor at 100 psig (the assumed rupture pressure) and 14.7 psi (the assumed pressure of the room at release) are assumed to be the same as water since the partial pressure of water vapor is more than ten times greater than that of nitric acid for up to 50% nitric acid solutions at temperatures over 100°C (Perry and Chilton 1973). The following data are used for source term calculations:

Enthalpy of solution at 100 psig = 717 J/g
Enthalpy of solution at 14 psig = 418 J/g
Heat of vaporization at 14.7 psig = 2251 J/g

3.5.2.2 Pressurized Release of Powders (Explosion)

A can of plutonium oxide converted from plutonium nitrate is sealed and stored. Due to incomplete conversion, some of the nitrate remains in the can. The nitrate decomposes to NOX gases, that build up and cause the can to rupture, releasing powder to the storage room. The can contains 500 g of powder with a theoretic density of 11 g/cm^3.

3.5.2.3 Powder Spill (Spills)

A 1-kg container of radioactive powder is spilled from a height of 1.5 m. Properties of the powder and the air are

powder bulk density = 1 g/cm^3
air density (300 K) = 1.18 kg/m^3
air viscosity (300 K) = 1.85×10^{-5} Pa s

3.5.2.4 Liquid Spill (Spills)

A container holding 5 kg of plutonium nitrate is assumed to fall, spilling the solution 3 m onto the floor. Solution density and viscosity are 1.6 g/cm^3 and 3.1 cp respectively. Liquid volume is 3125 mℓ. Air density is 0.00118 g/cm^3.

3.5.2.5 Aerodynamic Entrainment of Powders from Thick Beds (Tornado)

The scenario is assumed to be the same as that described in Section 3.5.1.4. No additional information is needed for source term calculations.

3.5.2.6 Fragmentation of brittle Solids by Crush Impact (Tornado)

A concrete roof panel is assumed to be displaced during the passage of a tornado over a facility. The panel orients itself end-on and falls to the floor where it impacts uranium dioxide fuel pellets on the floor of the facility.

The concrete panel has dimensions of 2 ft x 12 ft x 0.5 ft or 12 ft^3 (3.4 E+5 cm^3). Density is 2.31 g/cm^3. Thus, weight of the panel is

$$3.4 \text{ E+5 cm}^3 \times 2.31 \text{ g/cm} = 7.8 \text{ E+5 g.}$$

Individual uranium dioxide fuel pellets are 0.835 cm diameter x 0.953 cm long. Properties of the unirradiated uranium dioxide are

theoretical density = 10.96 g/cm^3
density of pellets = 96% theoretical = 10.6 g/cm^3

3.5.2.7 Inadvertent Criticality in a Fuel Reprocessing system (Nuclear Criticality)

An excursion is assumed to occur in a vented vessel of unfavorable geometry containing dissolver solution with a concentration of 400 g/ℓ uranium enriched to less than 5% ^{235}U. The solution is assumed to contain all the transuranic elements and fission products listed in Table 4.27 (Section 4.6.3.1). The scenario is fully described in Section 4.6.3.1, which is based on NRC Regulatory Guide 3.33 (U.S. Nuclear Regulatory Commission 1977).

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4.0 SCENARIO AND SOURCE TERM DEFINITION

This chapter guides the user in estimating source terms resulting from potential accidents in the facility. Model equations for the source terms of interest are provided along with information on various levels of accident analysis. Information in Chapters 2 and 3 serve as stepping stones for accidents leading to the analysis in Chapter 4 by guiding users in selecting appropriate facility and process descriptors. Source terms generated for a chosen scenario are then used as input parameters to transport models described in Chapter 5.

In the following sections, a general description of scenario considerations and source terms is first presented, then the analytical methods to describe individual events (fire, explosion, spill, tornado, nuclear criticality and equipment failure) are given. Various calculational techniques to estimate the airborne release of radioactive materials will be illustrated for each accident type. Some of the calculational techniques described pertain primarily to a single event (e.g., the airborne release during the burning of contaminated combustible materials during a fire, airborne release from nuclear criticality) but others (e.g., the aerodynamic entrainment of powders, the fragmentation of brittle solids by crush-impact) are more generally applicable. The calculational techniques that are applicable to more than one type of event will only be illustrated once, but their potential use for other accident types will be mentioned. One technique, the Bounding Equation, is applicable to almost any event where the quantity and characteristics of the airborne material can be related to the energy to mass ratio and provides a conservative estimate in the absence of adequate accident condition definition.

4.1 GENERIC DESCRIPTION OF SOURCE TERMS

The source term is the initial amount of material and energy injected into the air during an accident or event. From an estimate of the source term, transport models can predict the amount of materials released to the atmosphere. The accuracy of the final evaluation of accident consequences to the environment is highly dependent on the accuracy of the source term.

Three elements contribute to the source term: scenario, energy considerations, and airborne materials. The scenario describes the occurrence of events leading to the accident and the materials involved. Energy involved in the accident determines forces acting on materials at risk and exerted on protective barriers. Airborne materials are the amount, form, and characteristics of particles, dispersed gases, and vapors in the air from the accident. These three elements are described further in the following sections.

4.1.1 Scenario Considerations

The scenario is the sequence of events leading up to an accident and description of what takes place during the accident. Scenario definition begins by identifying high risk areas. This could be, for example, a room containing large amounts of combustibles as well as a significant amount of radioactive materials. Knowledge of plant operations is required to compile inventories of hazardous and radioactive materials and identify processes with accident potential.

Development of a scenario is required to lend credibility to an accident. Assumptions are made about how materials at the location of the accident interact. Plants generally have multiple safeguards for preventing or mitigating accidents. Therefore, failure of one or more of these safety systems may be assumed to be a significant part of an accident scenario. For example failure to follow administrative procedures may result in leaving a combustible in a room containing radioactive materials. An ignition source in the room may ignite the combustible resulting in a fire. Failure of the fire extinguishing system may also be assumed with some loss of credibility to the accident scenario.

4.1.2 Energy Considerations

The initial force acting on materials at risk is estimated to determine the amount and characteristic of airborne particles generated in an accident. Forces also determine if protective barriers fail in an accident situation. To determine these forces, input energies are estimated.

In the case of fires and chemical explosions, forces may be determined from chemical energy stored in combustibles, flammables, and explosives at the accident location. The quantities and types of hazardous materials as well as how they are distributed influence the amount of input energy to a fire or explosion. Energy influencing the event is present as heat, air motion, shock waves, and pressure transients.

Tornado forces are in the form of high winds and changing pressures. The energy is external to the plant and must be enough to cause some failure of barriers in order to generate a source term. Wind speeds of tornadoes are assumed and consequences calculated based on that assumption.

Input energy to criticalities is stored within materials at risk. An accident situation depends upon moderation and reflection to fissile radioactive materials and so that an uncontrolled chain reaction develops.

Potential energy from spill height and forces from air currents are important factors in the fraction of material becoming airborne in a spill. Equipment failures may involve many of the forces mentioned above as well as impact from falling equipment.

Energy released in an accident affects transport and behavior of airborne particles and gases by changing temperature, pressure, radiation level, flow velocity or other factors that influence particle behavior. Several particle behavior mechanisms are described in Table 4.1 along with factors that influence them.

4.1.3 Airborne Materials

Airborne materials of concern in the source term consist of radioactive and nonradioactive particles, gases, and vapors. Flow of air through the facility is normally regulated with building heating, ventilation, and air conditioning (HVAC) systems. These systems include filters, that remove most of the airborne particles from exhaust air. In an accident, normal flow may be disrupted resulting in an increased flow of gases causing particles to become airborne, and a less attenuated pathway to the environment.

Gases additional to the normal airflow can be generated by combustion processes, explosions, criticalities, tornadoes, and breaks in process gas lines or gas cylinders. These gases increase airflow from the scene of the accident carrying additional particles with them as they eventually exhaust to

TABLE 4.1. Particle Behavior Mechanisms

Mechanism	Description	Influencing Elements
Diffusion	Movement of particles due to random gas molecular collisions and microscopic eddies in air	Particle size Temperature
Settling	Effect of gravity upon airborne particles	Particle size Turbulence Induced gas flow
Coagulation	The adherence of a particle to another upon collision to produce a particle of larger size and, for solids, less dense	Number of particles Eddy velocity Particle size
Condensation	Particle Generation (condensation of vapors upon condensate nuclei), or particle growth (condensation of vapors on existing particles)	Type of vapor Local temperature Particle size
Agglomeration	Same as coagulation (for colloids) and coalescence (for liquids)	Number of particles Eddy velocity Particle size
Scavenging	The removal of airborne particles by materials falling through a fluid volume	Particle size
Diffusiophoresis	Movement of particles caused by concentration gradients in the gas phase	Vapor condensation rate
Thermophoresis	Movement of particles down a temperature gradient	Temperature gradient

the environment. Examples are soot, smoke, and vapors from fires and explosions, and evaporation products from liquid solutions in a criticality event.

Nonradioactive particles are generated in fires, explosions, and criticalities. Dust and nonradioactive powders may become resuspended from the surfaces of an enclosure during an accident. Winds from a tornado could cause particles from outside the facility to be brought in and, hence, affect particle behavior mechanisms.

Radioactive particles may become airborne in several ways. Rupture of primary barriers can cause release of inventories and radioactive materials, some of which may be aerodynamically entrained. Powders can be spilled and entrained before particles hit the floor, or resuspended from the floor after a spill. In a fire, thermal updrafts may cause particles to be carried with the airflow. Particles may form when liquids are sparged, boiled, or flashed. Impacts on pellets may cause particles to become airborne through comminution. Contaminated combustibles release radioactive particles when they are burned.

Because airborne particles affect one another by various mechanisms (see Table 4.1) an estimate of the quantity and size distribution of particles generated must be included in the source term.

4.2 FIRES

The process of burning, as pertaining to uncontrolled fires, involves the oxidation of vapors. The vapors may come from the release of flammable gases or the release of vapors from liquids or solids. The consequences of the release of gases, vapors, solids, and heat from the burning process may have various deleterious effects upon the other materials present. This section presents information on some of these effects that may result in the airborne release of radioactive materials.

Calculational techniques to estimate the airborne release from three mechanisms are presented--the airborne release during the burning of contaminated, combustible solids, combustible liquids, and from "flashing sprays" resulting from the heating of aqueous solutions held in unvented vessels.

The basic components of fire source terms are

- the quantity of size characteristics of radioactive particles given off in a fire (the radioactive source term)
- the quantity and size characteristics of smoke particles given off in a fire (these may plug filters, or agglomerate with radioactive particles)
- the rate of energy given off during a fire (this may affect ventilation flow rates and transport of particles).

The calculational techniques presented for fire source terms are organized in the following manner:

- In Section 4.2.2.1 the quickest and easiest procedures for estimating the radioactive particle release and size distribution are given. Then methods for hand calculating smoke mass and particle size are shown. A more detailed way (which makes use of some of the equations presented for smoke calculations) to hand calculate the radioactive source term follows. Hand calculations for estimating energy produced during the fire is then described.
- Section 4.2.2.2 describes input for FIRIN. This computer code which combines much of the information presented under hand calculations with heat transfer, hot/cold layer modeling and airflows during the fire is a much more complex tool to use to estimate the source term from fires. A detailed knowledge of the fire compartment is needed. However, a more refined estimate of the source term can be obtained from FIRIN than from hand calculations. FIRIN is a subroutine to FIRAC that is described in Chapter 5. Inputs to this subroutine are given in this chapter, as well as a general discussion of how source terms calculated by FIRIN compare with hand calculations.
- Methods for calculating the source term from flashing sprays are shown in the hand calculation section and emphasized again in Section 4.2.2.3 because they may occur as a result of accidents other than fires.

Sample problems illustrating uses of many of the fire source term calculational methods are given in Section 4.2.3. These are carried over from descriptions in Chapters 2 and 3.

4.2.1 Scenario Considerations

The data required to estimate the course of an uncontrolled fire and resulting airborne release of materials is extensive. The specific data requirements are covered in the appropriate sections but pertain to the type, surface, and quantity of the fuel; the characteristics of the compartment in which the event occurs; and the characteristics of the radioactive materials involved. Once airborne, the radioactive materials are impacted by the airflow within the space in which they are released and the other materials present. The following fire source terms must be calculated as input parameters to the transport model, FIRAC:

- smoke mass generation rate
- smoke particle characteristics
- net energy rate to gas
- mass loss rates or burn rates from combustibles
- radioactive particle mass generation rate
- radioactive particle characteristics.

Smoke and radioactive particles are considered separately because they follow separate mechanisms of release even through they may be attached to each other when airborne.

Two methods of estimating these are

- FIRIN Computer Code (a subroutine of FIRAC) - a computer program written to perform high-speed calculations utilizing the existing models and the effects of the fire environment on radioactive materials at risk.

- Hand Calculation - hand calculations utilize simple models and concepts on fire and its influence on radioactive materials.

Further details of these methods are provided in Section 4.2.2. The discussion on rationale for the course of a fire is in Section 4.2.2.2. Fire sample problems are given in Section 4.2.3 demonstrating source term development using these methods. In these sample problems, the parameters developed for the fire scenario described in Sections 2.7 and 3.5 are applied.

When available, the option to estimate the airborne release of radioactive materials by hand calculation or computer code calculation will be provided for all calculational techniques to estimate the source terms. If a computer code is not available, only estimation by hand calculation is provided. Such is the case for the third mechanism, flashing sprays.

4.2.2 Calculational Techniques Illustrated

Fire source term releases can be calculated using either computer or hand calculational methods. Both methods use facility and process parameters described in Chapters 2 and 3 as well as state-of-the-art combustion and radioactive release data.

In addition to the total source term, the FIRIN computer code can estimate transient source terms corrected for fire compartment effects. These include:

- heat loss to walls and equipment acting as heat sinks
- heat transfer to vessels which can overpressurize, rupture, and release radioactive materials
- water and CO_2 mass loss rates from concrete walls
- oxygen depletion which changes the burning mode and reduces the mass burning rate.

Hand methods cannot provide sufficient transient compartment effects. Both methods can generate fire source terms to use as input parameters to the transport model FIRAC. Hand-calculated values can be adequate for small simple fires.

FIRIN replaces multiple tedious hand calculations with rapid computer calculations. Thus, it has advantages of efficiency and accuracy. This is especially true when complicated scenarios are analyzed. These scenarios could involve a large number of combustibles and radioactive materials at risk.

The computer code is recommended for use when: 1) more than two or three combustibles and radioactive materials are at risk, 2) heat and mass transfer are important (especially important in large fires in small enclosures), and 3) the fire duration might be limited by oxygen availability.

Manual calculations are suggested for use in only the smallest and most basic fire scenarios (e.g., a small waste basket fire of well-ventilated combustibles). These would not disrupt normal ventilation flow nor would the gases, energy, and particles released significantly affect the fire itself or the final radioactivity release at the stack boundary.

4.2.2.1 Hand Calculations

Radioactive and nonradioactive source term releases from simple fires can be calculated using manual techniques. The nonradioactive release hand calculations use the model equations set forth by Tewarson (1980). This method becomes tedious and time consuming when a complex fire is considered. The complex fire is one having large combustible inventories, radioactive material at risk in vessels requiring unsteady state heat transfer calculations, or new failure path flows.

The radioactive source term can be estimated with hand calculations using the release factors in Table 4.2. These release factors are conservative

TABLE 4.2. Release Factors and Particle Size Information for Hand Calculations of Radioactive Source Term

Release Mechanism	Release Factor, %	Airborne Particle Size: MMD, µm	Airborne Particle Size: σ_g
Burning of Contaminated Combustible Solids			
Powder contaminant	0.053	21	6.4
Liquid contaminant	0.015	21	6.4
Burning of Contaminated Combustible Liquids			
U or Pu Powder[a]	1.3	2.4	3.8
U or Pu liquid[a]	11.4	2.4	3.8
U or Pu nitrate	0.3	2.4	3.8
Nonvolatiles other than U or Pu	0.77	2.4	3.8
Semivolatiles	1.0	2.4	3.8
Volatiles	84.3	2.4	3.8
Heating of Noncombustible Contaminated Surfaces	2.5 x 10-4/s	2.5	1.3
Heating of Unpressurized Radioactive Liquids			
Preboiling	1.06 x 10-8/s	20	1.5
Boiling	4.76 x 10-5/s	20	1.5
Burning Radioactive Pyrophoric Metal	8.9x 10-6/s	4.2	1.1
Pressurized Releases (Flashing Sprays)	$30\ MF_g^{0.91}$[b]	6.8	3.3

(a) Combustible liquid is spilled over large amount of radioactive material, then ignited.
(b) MF_g = mole fraction of pressurizing gas or vapor.

values from accident-generated radioactive release experiments. The values in this table are based on experimental work of Mishima (1965, 1969, 1973, 1976), Mishima and Schwendiman (1969a, 1969b, 1973a, 1973b, 1973c), Sutter, Mishima and Schwendiman (1974), and Ballinger, Sutter and Hodgson (1987).

Manual calculations are performed by determining which of the mechanisms listed best applies to the scenario, then multiplying the quantity of radioactive material at risk by the release factor and dividing by 100. For release factors given as a straight percent, and not as percent per second, this quantity is divided by total burn time to get a release rate. Total burn time for burning contaminated liquids and solids is calculated by T = mass of fuel/fuel burn rate. Table 4.2 also gives airborne particle size information which may be used to represent the release from these hand calculations.

The burn fuel rate in the previous paragraph is equal to the mass loss rate of fuel, $\dot{M}_b$ (Tewarson 1980). This can be calculated by:

$$\dot{M}_b = (\dot{q}_e'' + \dot{q}_{fc}'' + \dot{q}_{fr}'' - \dot{q}_{rr}'')\ A/L \qquad (4.1)$$

where $\dot{q}_e''$ = external heat flux per unit fuel surface area, kW/m^2
$\dot{q}_{fc}''$ = flame convective heat flux, kW/m^2
$\dot{q}_{fr}''$ = flame radiative heat flux, kW/m^2
$\dot{q}_{rr}''$ = surface radiation heat loss, kW/m^2
A = burning surface area of fuel, m^2
L = heat required to generate a unit mass of fuel vapors, kJ/g

In this equation, $\dot{q}_{rr}''$ and L are functions of the type of combustible burned. $\dot{q}_{fc}''$ and $\dot{q}_{fr}''$ are functions of material type and burn mode. If oxygen depletion occurs during a fire, the burn mode will change from flaming combustion to smoldering. Both A and $\dot{q}_e''$ are functions of the scenario chosen. For hand calculations, $\dot{q}_e''$ may be assumed negligible and the fuel is assumed to have sufficient oxygen for flaming combustion. Table 4.3 gives values of $\dot{q}_{fc}''$, $\dot{q}_{fr}''$, $\dot{q}_{rr}''$, and L for combustible materials commonly found in fuel cycle facilities. For fuels other than those listed, the chemical and physical properties

TABLE 4.3. Combustible Material Burn Characteristics (Steciak, Tewarson and Newman 1983)

Material	L, kJ/g	$\dot{q}_{rr}''$, kW/m^2	$\dot{q}_{fc}''$, kW/m^2	$\dot{q}_{fr}''$, kW/m^2	H_t, kJ
Polymethylmethacrylate	1.6	11	12	40	25
Polyvinylchloride	2.5	21	26	37	16
Polystyrene	1.7	14	13	66	39
Cellulose	3.2	12	18	40	14
Polychloroprene	2.4	8	38	34	25 to 27[a]
Kerosene	1.5	8	11	14	46 to 47.9[a]
Wood	3.6	16	18	40	18

(a) Low values are recommended since they are based on experiments. However, high values have been found in the literature. Therefore, a range is given.

as well as melting or charring reactions when exposed to heat should be compared to materials listed, and the data for the combustible most similar to the fuel with unknown burn characteristics should be used.

If a slightly more detailed hand calculation is desired, the equations in Table 4.4 may be used to determine the amount airborne from burning contaminated combustibles. These equations are derived from data reported by Halverson, Ballinger and Dennis (1987). To use the equations for cellulose, an external heat flux must be estimated and the air velocity through the room must be calculated.

Smoke release rate ($\dot{G}_s$) can be calculated as shown in

$$\dot{G}_s = Y_s \dot{M}_b \qquad (4.2)$$

where Y_s is the fractional yield of smoke. Y_s equals 0.38 and 0.087 for polychloroprene and TBP/kerosene respectively (Table 4.5).

TABLE 4.4. Radioactive Source Term Equations for Burning Contaminated Combustibles

Combustible Material	Contaminant Form	Equation	AMMD, µM	σg
Cellulose	Air-dried UNH	$\dot{M}_r = 7.40E{-}7 \times W_r \times \dot{M}_b \times QT$	(a)	
	UNH liquid	$M_r = 6.08E{-}8 \times W_r \times M_b \times QT$		
	DUO powder-flaming combustion	$M_r = 1.18E{-}9 \times W_r \times M_b \times V \times UC \times QT$		
	DUO powder-smoldering combustion	$\dot{M}_r = 5.64E{-}6 \times \dot{M}_b \times W_r$		
Polychloroprene	UNH liquid	$\dot{M}_r = 0.385 \times W_r \times S_r$	19.9	4.6
	DUO powder, air-dried UNH	$M_r = 0.058 \times W_r \times S_r$	19.9	4.6
Polystyrene	UNH liquid	$M_r = 0.02 \times W_r$	1.7	3.8
Polymethyl methacrylate	Air-dried UNH	$M_r = 0.007 \times W_r$	3.7	3.0
	UNH liquid	$M_r = 0.02 \times W_r$	3.7	3.0
	DUO powder	$M_r = 0.05 \times W_r$	3.7	3.0
30% TBP/kerosene	Uranium	$\dot{M}_r = 1.38 \times (S_r) \times W_r$	0.6	3.1

$\dot{M}_r$ = mass release rate of radioactive particles, g/s.
M_r = mass release of radioactive particles, g.
M_b = mass loss rate of fuel, g/s.
QT = external heat flux to the combustible, kW.
S_r = smoke release rate, g/s, divided by total g of fuel.
UC = uranium concentration, g U/g combustible.
V = air velocity, cm/s.
W_r = mass of radioactive material, g.

(a) 90% of airborne particles were less than 0.1 micron

TABLE 4.5. Smoke and Energy Burn Characteristics

Material	X_a	X_c	Y_s
Polymethylmethacrylate	0.94	0.64	0.21
Polyvinylchloride	0.35	0.19	0.086
Polystyrene	0.68	0.40	0.15
Cellulose	1.00	0.80	0.001
Polychloroprene	0.41	0.24	0.15 to 0.38[a]
Kerosene	0.91	0.57	0.002 to 0.087[a]
Wood	0.70	0.44	0.015

(a) High values are recommended since they are based on experimental data. However, low values have been found in the literature. Therefore, a range is given.

The polystyrene and polymethylmethacrylate radioactive particle releases occur prior to flaming combustion while the materials are melting and bubbling. In experiments reported by Halverson, Ballinger and Dennis (1987) this period was about 40 percent of the burn time. For hand calculations, the burn time for PMMA and PS can be calculated by dividing mass of fuel by fuel burn rate. This time can be multiplied by two-thirds and the radioactive is release assumed to occur uniformly over the preburn time. Size distribution of radioactive aerosols are also reported by Halverson, Ballinger and Dennis (1987) and may be used for hand calculations.

Actual heat release ($\dot{Q}_a$) from the fire is some fraction (X_a) of the total theoretical heat release.

$$\dot{Q}_a = X_a \, H_t \, \dot{M}_b \tag{4.3}$$

where H_t is the heat of combustion in kJ/g. X_a is a function both of combustible material type, and burn mode (or oxygen availability). H_t depends on the combustible. Values for H_t and X_a for flaming combustion are given in Tables 4.3 and 4.5, respectively. Similarly, the amount of convective heat generated (heat in the combustion gases) may be computed by

$$\dot{Q}_c = X_c H_t \dot{M}_b \tag{4.4}$$

where X_c is the convective fraction. Values of X_c for flaming combustion are also provided in Table 4.5.

The rate of smoke given off from the burning material is a function of material type and burn mode. Smoke fractions (Y_s) have been measured by Tewarson (1980). These values are given in Table 4.5 for flaming combustion.

Other accidents may occur as side effects of a fire. Thermal stress or pressure increases caused by the fire may lead to spills or pressurized releases of radioactive materials. Methods for analyzing releases from spills are covered in detail in Section 4.4; pressurized releases are covered in Section 4.2.

The size of smoke particles from the combustible materials has been reported (Chan and Mishima 1983). At the point measured (several feet from the flame) smoke particle size does not seem to vary with type of material burned. The average aerodynamic equivalent diameter (AED) of smoke particles is about 1.0 micron with a geometric standard deviation of 2. Figure 4.1 shows the size distribution of log normally distributed smoke particles with these characteristics.

4.2.2.2 FIRIN Computer Code Calculations

This section discusses modeling the course of a fire. First, the major uncertainties in a fire are identified. Then three general approaches to modeling a fire are explained in the context of these uncertainties. Finally, the reasons for the approach of FIRIN are explained. By using two fire scenarios, progressive and simultaneous burning order, FIRIN can bound the outcome of a compartment fire.

An accidental fire is a complex phenomenon which is highly probabilistic in nature. Conceptually, the time history of compartment fires have been resolved into four periods: initiation, growth, fully-developed burning, and decay. An accurate description of the course of this fire type presently cannot be derived purely from first principles (basic laws). Much of the fire growth model incorporated into existing codes is empirical.

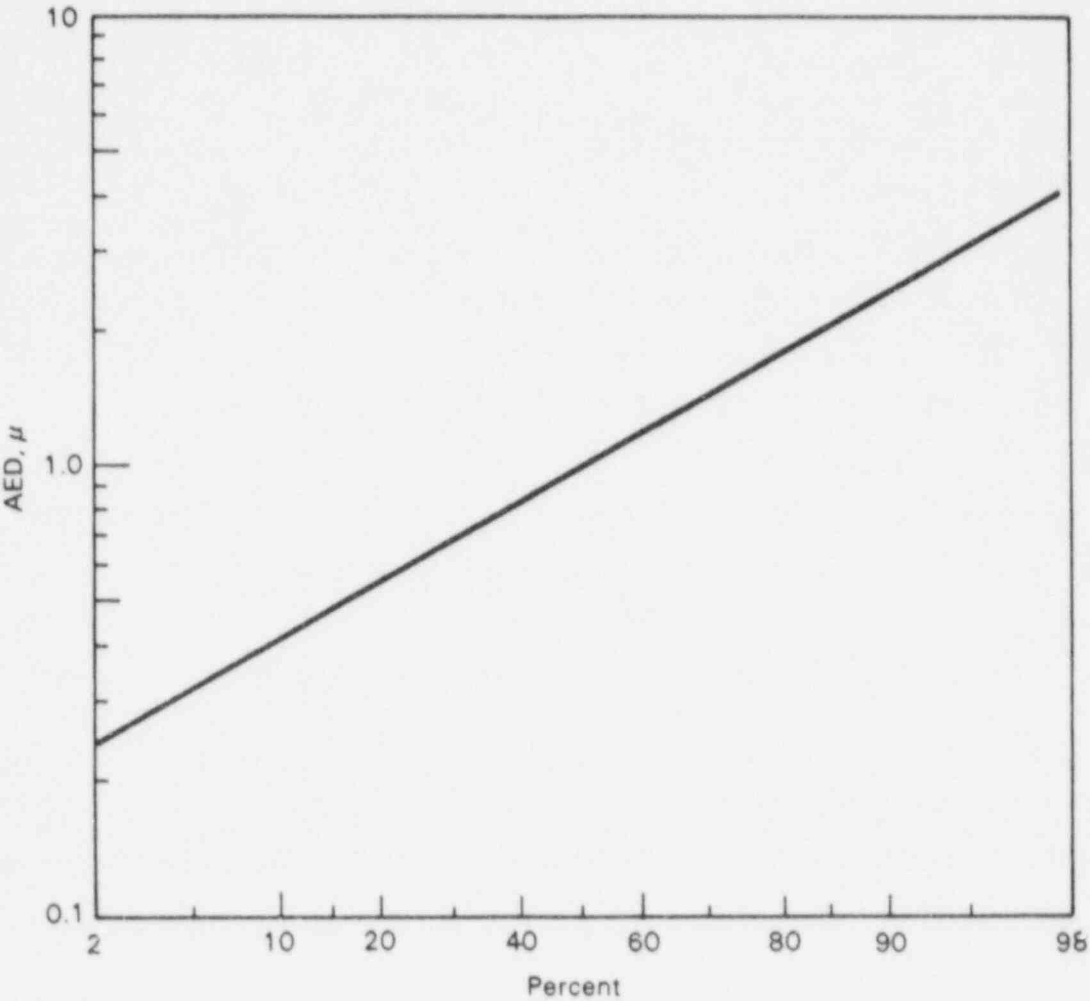

FIGURE 4.1. Average Size Distribution of Log Normally Distributed Smoke Particles

The ultimate goal in the science of fire modeling is to develop a model with minimum input and output parameter uncertainties. Major uncertainties encountered in predicting the source term components in fuel cycle fires are

- ignition point and source
- path of fire spread
- completeness of combustion and burn mode
- equipment failure (e.g., for a pressure vessel: where will it break? At what pressure? How severe will the break be?)

- radioactive and combustible material inventories involved in the fire
- time-of-occurrence of fire events.

An approach to handling these uncertainties in the FIRIN analysis is explained as follows.

Three levels of model development can be used to approach the ultimate model. These levels are, in order of increasing complexity and sophistication:

1. Idealized Reference Burning Model (IRM)
2. Deterministic Reference Burning Model (DRM)
3. Probabilistic Burning Model (PBM).

An IRM emphasizes basic physical behavior of fires that have reached the fully developed period of burning. The emphasis is due to the relative simplicity of the analysis and its importance to general fire safety engineering. During the fully developed burning, the temperature and heat flux levels in the fire compartment tend to be fairly uniform. IRM is our immediate tool for the basic level of fire analysis that will provide all necessary inputs for FIRAC Computer Code. We have designated our IRM as code FIRIN. In this model, fire growth of the burning object is not considered, although a progressive burning sequence is permitted. This concept of burning order can approximate fire growth without involving complex input parameters.

A DRM considers physical situations where fire spreads over the fuel bed by continuous flame front movement, by radiation and convection, and sometimes by direct transport of burning fuel (sparks, firebrands). During this period of fire growth, the heat fluxes in the compartment are highly nonuniform functions of space. The essence of the DRM is the positive feedback loops of heat from heated walls, hot ceiling smoke layer, etc. This leads to an acceleration of the fire growth rate. This rate may become so large that the entire compartment becomes involved in the fire in an almost instantaneous period called flashover. There are several of these DRMs available. Because deterministic f re growth adds a serious burden of detailed position inputs and because the exact ignition point becomes an important consideration, the DRM is considered to be impractical for the fi st level of modeling here. These complexities (position and ignition) add to the uncertainty in picking the correct fire for safety analysis.

The PBM (Siu 1981) can evolve from modification of the DRM by including probabilistic fire behavior. Thus, it would probably come as close as possible to an ultimate fire model. A comprehensive PBM should consider the four periods of fire compartment time history identified earlier. Relevant data to aid in modeling uncertainty distributions are inadequate, therefore, judgment is required to develop input for a PBM modeling effort.

FIRIN was developed for the IRM level of analysis because it provides a balanced approach between the uncertainties of the fire event. No undue sophistication is given to any part of analysis. Thus, the course of a fire is modeled in an IRM sense. However, the compartment effects, including the response of inlet and outlet flows, pressure, temperature, filter loadings, and effects of underventilation are included in the analysis in the deterministic sense. They are modeled both on first principles, wherever possible, and empirically elsewhere. The user must exercise some judgment in developing the fire scenario. However, by using a progressive burning order and all combustibles burning at once, he can bracket the fire outcome with two FIRIN runs. This approach incorporates the uncertainties of ignition point, source of ignition, and fire time spread into two scenarios.

FIRIN also may determine fire growth through an external-radiative-ignition concept. If the user chooses this option, FIRIN checks the heat flux levels generated by the initial burning combustibles. If the heat flux reaches a sufficient level, other combustibles in the room auto-ignite, spreading the fire.

The user must define the range of quantities involved for his analysis and the point-of-vessel failure (failure pressure), where the vessel will fail and how big the break will be. FIRIN then will compute the timing of essential events and compute degree of combustion and burn mode (a fully developed, over or underventilated fire). Thus, in a limited sense, with FIRIN and user judgment involving two bracketing scenarios, many of the uncertainties in the fire outcome are bounded.

There are advantages and disadvantages to the FIRIN approach. The major advantage is simplicity. Disadvantages include the lack of knowledge of the exact fire history and the full extent of radiation fluxes in the flashover fire.

4.2.2.3 FIRIN Code

Input requirements for calculating fire source terms using FIRIN are described briefly in this section. Details on code development and equations used in calculations are described in User's Manual for FIRIN, a Computer Code to Characterize Accidental Fire Radioactive Source Terms in Nuclear Fuel Cycle Facilities (Chan et al. 1987).

Major assumptions and features of FIRIN are

- fire growth approximated by burn order and ignition energy
- fuel burning at a rate depending on surface area, oxygen concentration and type of combustible
- flaming combustion as the principal mode of burning
- radioactive source terms based on empirical models
- particle behavior considered only at the source
- correction for underventilated conditions
- correction for heat losses to structure and equipment
- correction for H_2O and CO_2 produced from heated concrete
- corrections for scale.

All of these items are discussed in detail in the User's Manual.

The following discussion covers input requirements and options, which are summarized in the FIRAC User's Manual (Nichols and Gregory 1986). The four categories of information input to FIRIN are scenario control specification, fire source nonradioactive release computation, compartment effects, and radioactive release computation. These categories are described in the following paragraphs.

Scenario Control Specification. After a fire scenario has been developed, a user begins his accident analysis by preparing input data. The first category of input provides information on how a desired analysis is computed within the designed program capabilities and options. Therefore an analyst should be familiar with the FIRAC User's Manual before attempting to develop a fire scenario.

Input information includes amount and type of equipment at risk, desired scenario duration for source term computation, and required output data frequency (printout of time step). Some of these specifications control the level of detail for input requirements for other categories mentioned above. The input format is given in pages 75 to 79 of the FIRAC User's Manual, where detailed descriptions of the control specifications are found.

Fire Source Nonradioactive Release Computations. Nonradioactive components, mass generation rate of smoke, mass loss rate of combustibles, and net energy rate to gas of the fire source term are calculated in the code. Two input parameters, the quantity and surface area of each combustible, are required for fire source release computations. See page 82 and 83 of the FIRAC User's Manual for details on this category of input format and parameter description.

The equations used in fire source releases computation are based on Tewarson's combustion theory (Tewarson and Pion 1976, Tewarson 1980). He derived rate equations by applying steady-state heat balance on the surface of a burning element. These equations are expressed in terms of physical/chemical and pyrolysis/combustion properties of a combustible. A database containing these properties for the major combustible/flammable materials commonly found in fuel cycle facilities is included in FIRIN. Most of the information in this basic database is for flaming overventilated combustion measured by Tewarson, Lee and Pion (1981). Values used for underventilated combustion is approximated by assuming a linear relationship between combustion properties and depleted oxygen concentration.

Compartment Effects Computations. The description of the fire compartment and ventilation system identified in Sections 2.1.1 and 2.1.3, respectively, are necessary parameters for this input category. These parameters are fire compartment size and construction material, initial compartment condition, elevation of inlet/outlet ducts, and filter plugging factors. More details on these parameters are described in pages 84 and 85 cf the FIRAC User's Manual.

Compartment heat transfer and fluid flow contribute significant dynamic feedback to both radioactive and nonradioactive components of fire source term calculation. The heat balance in the fire compartment determines net heat transferred to the gases, while a mass balance (in particular the oxygen balance) determines the burning mode. Heat transfer to the concrete walls of the fire compartment can cause releases of water and CO_2 in addition to those generated from fuel combustion. Heating of vessels and containers can also lead to rupture caused by overpressurization. The net result of all these compartment effects enable an estimate of fire source terms as functions of time.

Radioactive Release Computations. Radioactive particles may be released to the air through seven different mechanisms that may occur during a fire

1. burning contaminated combustible solids
2. burning contaminated combustible liquids
3. heating noncombustible contaminated surfaces
4. unpressurized heating radioactive liquids
5. pressurized releases of radioactive powders
6. pressurized releases of radioactive liquids
7. burning radioactive pyrophoric metals.

The User's Manual for FIRIN gives examples of how these different mechanisms can occur in a fire and describes the equations used to calculate the radioactive source terms. The user must decide which mechanisms apply to the accident scenario under analysis.

For all mechanisms the quantity of radioactive material at risk must be specified. This information was discussed in Chapter 3. An inventory of radioactive material in the facility provides the user with this input. All mechanisms also require that the user assign an identification code number to each type of radioactivity. For example mixed oxide fuel plants contain plutonium oxide (PuO_2), uranium oxide (UO_2), and mixed oxide (MOX). The user may wish to examine the separate effects of each of these materials in a scenario in which all three are released. The code or I.D. number identifying the type of radioactivity released from PuO_2 may be 1; UO_2, 2; and MOX, 3. The output is labeled with one of these numbers so that the user can separately examine the release of each. Each type of radioactive material must later be converted to its equivalent in curies to determine health effects.

The following paragraphs describe specific input requirements for each of the seven mechanisms listed above.

Mechanisms 1 and 2 are the release of radioactive particles from burning contaminated solids or liquids. Input requirements are the quantity of radioactive contaminant on the combustible material, the type of combustible material as specified by the fuel classification, the burning order of the combustible, the form of radioactive material (solid or liquid), and a number identifying the radioactivity of the contaminant.

Mechanism 3 requires only an estimate of the quantity of radioactive material as surface contamination affected by the fire, and a number identifying the radioactivity.

Mechanisms 4, 5, and 6 require the quantity of radioactive material in the vessel, the number identifying the vessel, and the number identifying the type of radioactivity as input. A description of the specified vessels as listed on pages 88 to 90 of the FIRIN User's Manual must be input. Contents of the vessels such as volumes of gas, liquid, or powder, and moisture content of powders, are also requested.

Mechanism 7 requires the quantity of radioactive material, the burn order of the material, and a number identifying the type of radioactivity as input.

Input data is obtained by gathering descriptors specified in Chapters 2 and 3. Specifically, an estimate of the inventory of radioactive material in the facility (Section 3.1.3.1), an estimate of the inventory of combustible material in the facility (Section 3.1.3.2), and a description of vessels in the fire compartment (Section 2.1.2) should provide the user with all the data needed as input requirements for the radioactive source term computation.

Section IV.C of FIRAC User's Manual gives the actual input parameters, their units, and the format in which they must be prepared. Table 4.6 summarizes FIRIN input.

4.2.2.4 Hand Calculations of Flashing Sprays

Probably the most effective mechanism for the generation of particulate airborne materials from the venting of a liquid is the phenomenon known as "flashing sprays." Flashing sprays are a type of pressurized release and, can be classified as an explosive release mechanism. This release mechanism can

TABLE 4.6. Summary of FIRIN Input Requirements

Combustible Material	- type - quantity - surface area - burn order
Radioactive Material	- quantity - mechanism of release - form (powder/liquid) - location (in specified equipment) - volatility (only for burning solvents)
Fire Compartment	- dimensions - type of construction materials - thickness of wall, floor, and ceiling - initial temperatures and pressures - filter efficiency - ventilation flow rate - elevation of filters - fire elevation
Equipment in Compartment	- type - contents - dimensions - elevation - construction material - weight when empty - initial temperatures
Alternate Flow Paths	- dimensions - time at which they are opened - pressures

result from fire-induced heating of process solutions in unvented containers. The calculational technique is not incorporated in a computer code and only manual calculations will be shown.

Flashing sprays result from the release of a solution heated beyond the boiling point of the solvent. When released, internal bulk vaporization causes the released liquid to fragment into droplets of a limited size range. The size range of the airborne material can continue to change from the further evaporation of the solvent.

Based upon classic thermodynamics and previous published experimental data, Halverson and Mishima (1986) provided methods to calculate the fraction of liquid vaporized and the particle size distribution of the resulting droplets.

An equation, based upon experimental data, is presented in Table 4.2 to calculate the quantity of particles made airborne release from the release of pressurized, heated liquids:

$$\% \text{ release} = 30\ MF_g^{0.91}$$

where MF_g = mole fraction flashed to vapor at release temperature and pressure.

A sample problem illustrating the use of the equation is shown in Section 4.2.3.2.

4.2.3 Sample Problems

This section is a continuation of the illustrative sample problems begun in Sections 2.7.1 and 3.5.1. Construction, process features, and input parameters to the code have been demonstrated in earlier sections. Source terms for specific accidents are calculated using these features and parameters.

Simple accident scenarios can be analyzed using hand calculations to give a conservative estimate of the radioactive source term. For more complex accidents or if more information (for example, compartment effects) should be included, computer methods are used. Therefore, both methods are given to estimate releases for the sample problems.

4.2.3.1 Primary Sample Problems

Slug Press Fire (MOX Fuel Manufacturing). First, the general scenario parameters are itemized. Hand calculation of the radioactive component release from the slug press fire is illustrated followed by FIRIN calculations for the fire. FIRIN first calculates a simultaneous burning where all the combustibles burn at the same time. This is considered similar to the hand calculation, with the addition of compartment effects. Finally a sequential burning scenario release is calculated by FIRIN, probably the most realistic scenario. This is followed by a final section discussing the calculational results.

- Scenario Information

  It is postulated that an open can of flammable solvent (acetone or methanol) used for cleaning is in the slug press enclosure, contrary to procedure. The can of solvent overturns, spilling the liquid into a tray located under the slug press to collect leaked hydraulic fluid. Heat from the slug press ignites the solvent and a fire ensues.

  The fire compartment - is postulated to be a canyon 6.7 m wide, 41.8 m long, and 8.8 m deep. Canyon concrete ceilings are 0.457 m thick and the floor is 0.203 m thick. Walls are 8- to 12-gage stainless steel plate covering 0.305-m-thick concrete. While there is a vessel in the fire compartment it is assumed not to become involved in the fire, either as a heat sink or contributing to the radioactive release. The ventilation rate is about 4 m^3/s (9000 cfm); the inlet duct is located near the ceiling, the exit duct at floor level. Both ducts are equipped with HEPA filters.

  Energy Sources - are rubber gloves, solvent, and hydraulic fluid. One can containing one pint of acetone (385 g) is spilled into a 1-m^2 tray. One quart (~711 g) of hydraulic fluid has accumulated on the tray. Four gloves are attached to the enclosure, with an exposed contaminated surface area of ~1 m^2,[a] and weight about 1/2 lb (227 g) each.

Radioactive materials - in the fire compartment are fixed surface contamination and mixed oxide powder in a closed container. The floor, walls, and glove surface exposed to the compartment atmosphere have a contamination level of 7.5 g MOX/m^2 (ceiling contamination is negligible). The compartment contaminated surface area subjected to fire stresses is unknown, but since the fire is of limited size, the affected surface is assumed at 10 m^2, equivalent to one wall of the enclosure. The contaminated glove surface is approximately 2 m^2. Total MOX contamination is therefore 90 g: 75 g on wall surfaces, 15 g on the gloves. These materials are subject to thermal and aerodynamic stresses produced by heating contaminated surfaces and burning contaminated fuels. Subsequently some of the radioactive materials may become airborne. The closed container of radioactive powder is a hopper to the slug press containing a maximum of 275 kg MOX powder. In the elementary case, it is assumed that the hopper does not overpressurize.

Heat of combustion - of kerosene is 11.6 kcal/g. The only combustible liquid data in FIRIN is for kerosene. The heat of combustion of acetone is 7.4 kcal/g; hydraulic fluid (type dependent) can have a value of 11 kcal/g. Based on the kerosene heat of combustion, these liquids are assumed to have similar burning characteristics.

- Hand Calculation

For a quick order-of-magnitude estimate of releases from the fire, Table 4.2 is used. Of the 15 g of MOX on the gloves, 0.053 percent

(a) Although each glove has an outside surface area of 0.5 m^2, for the sample problem we assume that only half of the outside surface is exposed to the fire. This gives a total surface area for the four gloves of (4 x 0.25 m = 1 m^2). Thus, 1 m^2 is used as the fire-exposed surface area to determine duration of the burn while 2 m^2 is the surface area determining amount of contamination on the gloves.

of it or 0.008 g is made airborne. Of the 75 g on wall surfaces, the release fraction is 2.5×10^{-4}/s or 0.9 percent per hour. In one hour, 0.7 g can be made airborne assuming the fire lasts that long.

An estimate of total burning time can be quickly calculated using $t = (\text{mass of fuel})/\dot{M}_b$ and $\dot{M}_b$ can be calculated using Equation (4.1). Assuming no external heat flux ($\dot{q}_e'' = 0$), no oxygen deficiency (oxygen remains above 15% during the fire), and using the properties listed in Table 4.7:

$$\dot{M}_b \text{ (burning liquids)} = (24.5 \text{ kW/m}^2 - 8 \text{ kW/m}^2)\ (1.0 \text{ m })/(1.5 \text{ kJ/g}) \qquad (4.5)$$

$$= 11.0 \text{ g/s} = 87.2 \text{ lb/h}$$

$$\dot{M}_b \text{ (gloves)} = (72\text{kW/m}^2\text{-}8\text{kW/m}^2)\ (1.0\text{m}^2)/(2.4\text{kJ/g})$$

$$= 27.2 \text{ g/s} = 215.7 \text{ lb/h}$$

The liquids burn in 1096 g/(11 g/s) = 99 s and gloves burn in 908 g/(27.2 g/s) = 33 s. If all materials burn simultaneously, then radioactive release from the gloves (0.008 g) takes place over the first 33 s and release from heating surfaces (2.5×10^{-6}/s x 75 g x 99 s = 0.02 g) takes place over 99 s. Total release for a simultaneous burn is 0.028 g MOX. If a rate is desired, then 0.008 g/33 s + 0.02 g/99 s = 0.00043 g/s are released for the first 33 s and 0.02 g/99 s = 0.00019 g/s are released for the following 66 s.

Radioactive particles from burning gloves have an AMMD of 21 and geometric standard deviation of 6.4 while those from heating surfaces have an AMMD of 2.5 and geometric standard deviation of 1.3.

A more likely scenario involves sequential burning in which the acetone burns first, followed by the hydraulic fluid and lastly, by the

TABLE 4.7. Properties and Parameters for Nonradioactive Source Term Calculations

Symbol	Properties and Parameters	Kerosene[a]	Rubber Gloves[b]
Wc	Fuel quantity, g	1096[c]	908
A	Surface area, m^2	1.0	1.0
$\dot{q}''_{fc} + \dot{q}''_{fr}$	Total heat flux from flame to fuel surface, kW/m^2	24.5	72.0
$\dot{q}''_{rr}$	Fuel material surface reradiation, kW/m^2	8.0	8.0
L	Heat required to generate a unit mass of vapor, kJ/g or kW-s/g	1.5	2.4
H_t	Net heat of complete combustion, kW-s/g	46-47.9	25.0-27.0
X_a	Combustion efficiency,	0.91	0.41
X_c	Convective fraction of combustion efficiency,	0.57	0.24
Y_{smoke}	Fractional yield of smoke	0.002-0.087	0.15-0.38

(a) Assumes both acetone and hydraulic fluid have combustion characteristics similar to kerosene.
(b) Using combustion properties of polychloroprene (similar to neoprene).
(c) Summation of 385 g (1 pint) of acetone and 711 g (1 quart) of hydraulic fluid gives 1096 g representing fluid (kerosene).

rubber gloves. The burn rate for the fuels are the same as those calculated above, but total burn time and radioactive release is different. Total burn time is

$$385 \text{ g}/(11 \text{ g/s}) + 711 \text{ g}/(11 \text{ g/s}) + 908 \text{ g}/(27.2 \text{ g/s}) = 133 \text{ s} \quad (4.6)$$

Release from heated surfaces is

$$(2.5 \times 10^{-6}/s)(75\ g)(133\ s) = 0.025\ g \tag{4.7}$$

The total release for this scenario is 0.025 g + 0.008 g = 0.033 g MOX. The release rate is 0.025 g/99 s = 0.0002 g/s for the first 99 seconds and

$$0.0002\ g/s + 0.008\ g/33\ s = 0.0004\ g/s \text{ for the following 33 s} \tag{4.8}$$

FIRIN models heat transfer to equipment in the compartment and buildup of pressure and thus will give an estimate of the probability and time of feed hopper overpressurization. If the code is not used, the probability of failure and time of release must be estimated by the analyst.

A more refined estimate of the release from burning gloves can be calculated using an equation from Table 4.4. The equation for polychloroprene with powder contaminant is appropriate for this scenario. The smoke release rate from the burning gloves is needed for the equation and can be calculated using Equation (4.2). The fractional yield of smoke from burning PC is given in Table 4.5, and $\dot{M}_b$ has already been calculated. Thus, smoke rate is

$$0.38 \times 27.2\ g/s = 10.3\ g/s \tag{4.9}$$

and total release of MOX is

$$(0.058)(15\ g)(10.3\ g/s)(33\ s)/(908\ g) = 0.33\ g\ MOX \tag{4.10}$$

This value is more conservative than the 0.008 g release calculated using Table 4.2, but is only applicable to burning PC.

Energy and smoke generation rates may be needed for transport codes. These can be calculated by hand using Equations (4.2), (4.3), and (4.4):

$$\dot{G}_s \text{ (gloves)} = (0.38)(27.2 \text{ g/s}) = 10.3 \text{ g/s} \quad (4.11)$$

$$\text{to } (0.15)(27.2 \text{ g/s}) = 4.1 \text{ g/s}$$

$$\dot{G}_s \text{ (burning liquids)} = (0.087)(11.0 \text{ g/s}) = 1.0 \text{ g/s} \quad (4.12)$$

$$\text{to } (0.002)(11.0 \text{ g/s}) = 0.022 \text{ g/s}$$

Energy generation rates calculated using Equations (4.3) and (4.4) are as follows.

$$\dot{Q}_a \text{ (burning liquids)} = (0.91)(46 \text{ kJ/g})(11.0 \text{ g/s}) = 460 \text{ kW} \quad (4.13)$$

$$\text{to } (0.91)(47.9 \text{ kJ/g})(11.0 \text{ g/s}) = 479 \text{ kW}$$

$$\dot{Q}_a \text{ (gloves)} = (0.41)(25 \text{ kJ/g})(27.2 \text{ g/s}) = 279 \text{ kW} \quad (4.14)$$

$$\text{to } (0.41)(27 \text{ kJ/g})(27.2 \text{ g/s}) = 301 \text{ kW}$$

$$\dot{Q}_c \text{ (gloves)} = (0.24)(25 \text{ kJ/g})(27.2 \text{ g/s}) = 163 \text{ kW} \quad (4.15)$$

$$\text{to } (0.24)(27 \text{ kJ/g})(27.2 \text{ g/s}) = 176.3 \text{ kW}$$

$$\dot{Q}_c \text{ (burning liquids)} = (0.57)(46\text{kJ/g})(11.0 \text{ g/s}) = 288 \text{ kW} \quad (4.16)$$

$$\text{to } (0.57)(47.9 \text{ kJ/g})(11.0 \text{ g/s}) = 300 \text{ kW}$$

These hand calculations of total heat to gases do not consider heat losses to compartment walls, ceiling, floor, and equipment, whereas FIRIN does.

A summary of the results of hand calculations for the simultaneous and sequential burn scenarios is shown in Figure 4.2a and 4.2b. The total smoke and heat generated is the same for both scenarios. Total MOX is higher for the sequential burn scenario than for the simultaneous burn because contaminated surfaces are heated for a longer period of time. A puff release of MOX from overpressurizing the feed

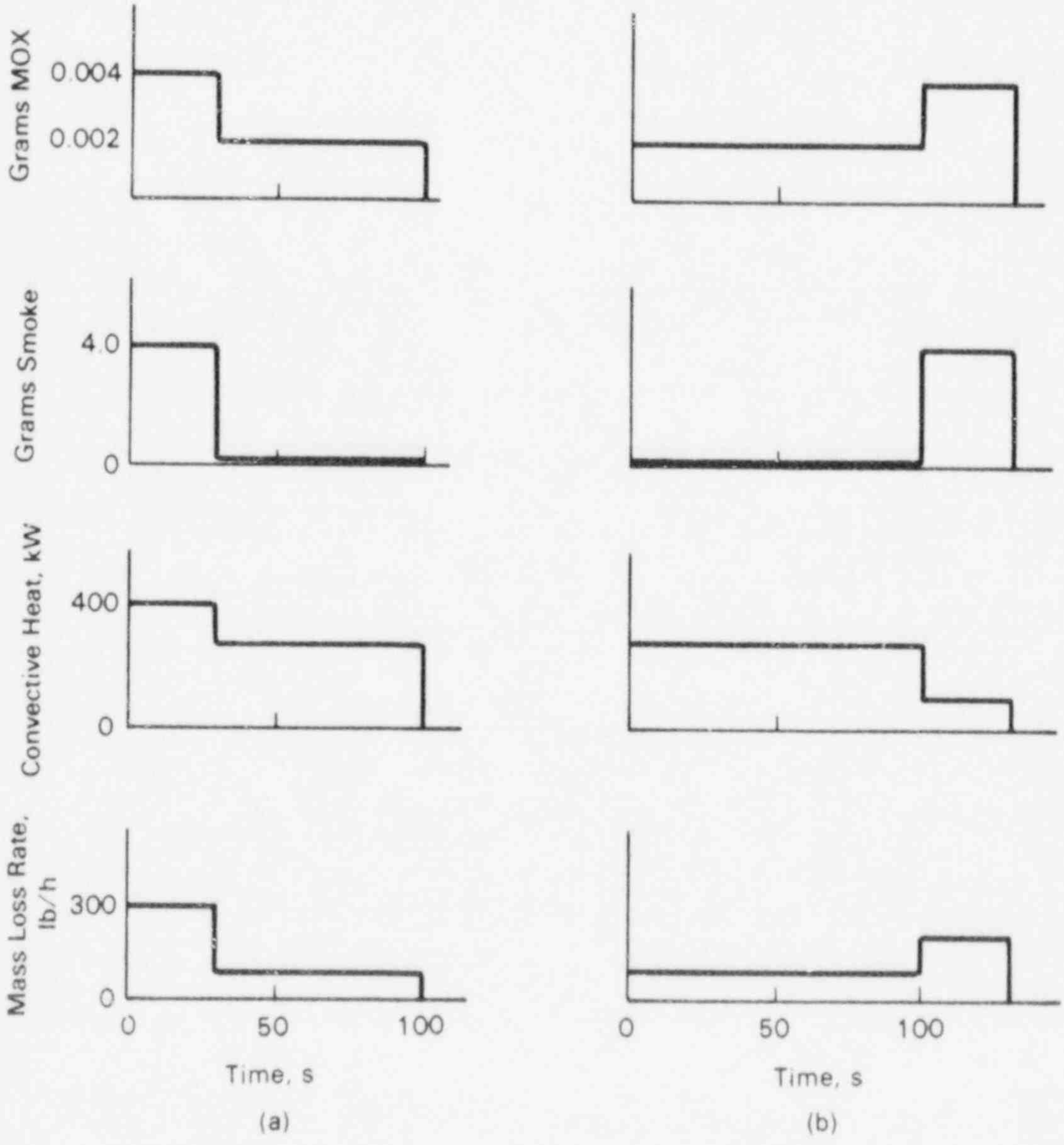

FIGURE 4.2. Results of Hand Calculations from (a) Simultaneous Burn and (b) Sequential Burn

hopper does not appear in this output. For hand calculations, the analyst must decide if and when this release occurs.

- FIRIN Analysis

The FIRIN subroutine can calculate releases from either a simultaneous or sequential burn of combustibles. Both fires are discussed in the following section.

Simultaneous Burning - All of the combustible materials in the slug press enclosure begin to burn at the same time. Fire compartment, combustible material, and radioactive material information is input to FIRIN as illustrated in Table 4.8. Specific information on the format of code input is given in the FIRAC User's Manual.

Sequential Burning - This analysis assumes a sequential burning order, solvent first followed by hydraulic fluid and rubber gloves. The solvent ignites and since it is highly volatile, it is essentially consumed before the hydraulic fluid ignites. The hydraulic fluid burns and heats the adjacent rubber gloves. The rubber gloves ignite just before the hydraulic fluid burns up. Input for this scenario is the same as the previous except for different values of FUEL, AREC, and IBO in the radioactive source term input. Table 4.9 gives these new input values.

This scenario is intended to approximate the growth period of a fire by using the concept of burning order. FIRIN is developed using simple combustion and heat and mass transfer models. Currently, it neglects the complexity and uncertainty of fire spread theories, and avoids contending with large numbers of associated input parameter requirements.

When the three fuels burn together in the simultaneous burn case, each component contributes an external heat flux to the others and thus raises the mass loss rate. Without heat transfer equations there is no way of calculating this heat flux; thus it is neglected in the manual calculations. However, FIRIN takes this effect into consideration. Therefore, $\dot{M}_b$ and $\dot{Q}_a$ are greater for FIRIN than for

TABLE 4.8. Input Parameters for FIRIN Calculation of Simultaneous Burn

Acronym[a]	Value	Comments
Nonradioactive Source Term Input		
TSPEC	500.0 s	
DELT	1.0 s	
MIBO	1	Simultaneous burn
IGNITE	0	Fire growth approximated via burning order concept
IPRINT	10	Printout every 10 s desired
MJE	0	No equipment considerations for heat transfer or contributions to radioactive source term
FUEL (4,1)	908.0 g	Gloves (elastomers)
AREC (4,1)	1.0 m^2	Burning surface area of four gloves
FUEL (7,1)	1096.0 g	Solvent and hydraulic fluid (organic fluids)
AREC (7,1)	1.0 m^2	Burning surface area of organic fluids
LR	41.8 m	
WR	6.7 m	
ZR	8.8 m	
XCEIL	0.457 m	
XWALL	0.305 m	
XFLOOR	0.203 m	
MATERC	1	Concrete
MATERW	1	Concrete
MATERF	1	Concrete
NFP	0	No additional flow paths generated
PI	1.0 atm	
P2	0.990 atm	
TINIT	298 K	
PINIT	0.995 atm	
ZIF	8.5 m	Inlet duct is at ceiling level
ZOF	0.3 m	Outlet duct is at floor level
ZFIRE	0.0 m	Fire is at floor level
EQUIP	0.0	No equipment considerations
FLOW	0.0	No additional flow paths generated
Radioactive Source Term Input		
NRAD (1)	1	Contaminated gloves
NRAD (3)	1	Surface contamination on walls and floor
IFORM	1	Powder on gloves
I	4	Elastomer gloves
JACT	1	MOX identifier
IBO	1	

TABLE 4.8. (contd)

Acronym[a]	Value	Comments
QRAD1	15.0 g	15 g MOX powder on gloves
JACT	2	Still MOX. JACT is given a different value here to compare releases from surface contamination vs that from burning gloves.
QRAD3	75.0 g	75 g MOX surface contamination

(a) Acronym definitions given in Nichels, B. D., and W. S. Gregory. 1986. FIRAC User's Manual: A Computer Code to Simulate Fire Accidents in Nuclear Facilities. NUREG/CR-4561 (LA-10678-M), Los Alamos National Laboratory, Los Alamos, New Mexico.

TABLE 4.9. Input Parameters for FIRIN - Sequential Burn (Slug Press Fire)

Acronym[a]	Value	Comments
Nonradioactive Source Term Inputs (same as Table 4.8 except)		
FUEL (7,1)	385 g	Solvent burns first
AREC (7,1)	1.0 m^2	Surface area of solvent
FUEL (7,2)	711 g	Hydraulic fluid burns second
AREC (7,2)	1.0 m^2	Surface area of hydraulic fluid
FUEL (4,3)	908 g	Gloves burn last
AREC (4,3)	1.0 m^2	Surface area of four gloves
Radioactive Source Term Input (same as Table 4.9 except):		
IBO (for NRAD (1))	3	Gloves are the third material to burn

the manual calculations until the fuel is burned up. FIRIN predicts a quicker burn time (60 s) than the manual calculations for the simultaneous burn. $\dot{G}_s$ for the simultaneous burn is approximately the same for both manual and FIRIN calculations because most of the smoke is given off with the burning gloves.

FIRIN predicts a much lower value of $\dot{Q}_c$ than manual calculations for both cases, even a negative release for much of the fire. This is because FIRIN takes into account heat loss to walls and equipment in the compartment. Initially, a large amount of heat goes into the hot layer. As the hot layer grows, more of it is exposed to the cold wall surface resulting in a loss of heat to the walls at a rate faster than the rate of heat supplied to the hot layer from the fire. This results in a net negative heat rate to the hot layer.

FIRIN enables a user to perform a more comprehensive fire analysis with minimum time and effort. Therefore, it is strongly recommended as an analytical tool for scenarios more complicated than this simple slug press fire.

Solvent Extraction Fire (Fuel Reprocessing). In this section, the general scenario parameters are itemized, then hand calculations and FIRIN are used to calculate the fire source term. Finally, the results are analyzed.

- Scenario Information

One of the solvent extraction columns in a fuel reprocessing plant ruptures while the cell is filled with air. One hundred liters of loaded solvent spills into a diked area at the base of the column. The solvent ignites and burns. The ensuing fire potentially overpressurizes the solvent extraction feed tank.

The fire compartment - is a cell the same size as the canyon in the slug press fire. The cell has a 1.22-m-thick concrete ceiling, and 1.2-m-thick walls and floor lined with 10-gage stainless steel. The solvent extraction feed tank is 2.8 m in diameter and 5.6 m high. It is made of stainless steel and is elevated 3.66 m off the floor. The vessel weighs 2,290 kg when empty and has a failure pressure of 6.8 atmospheres (~100 psi). The ventilation rate is 24.6 m^3/s. Location of inlet and outlet ducts are the same as for the slug press fire.

Combustible material - is 100 ℓ (86,000 g) of solvent. The liquid is held in a diked area 3.5 m x 3.5 m. The solvent is assumed to have some properties similar to kerosene.

Radioactive Materials - at risk during the fire are contaminants in the loaded solvent and in the solvent extraction feed tank. The quantity and form of these materials are given in Table 3.15.

• Hand Calculation

Radioactive Source Term - The appropriate release factor for burning contaminated solvent (from Table 4.2) is 0.3% for U or Pu, 0.77% for nonvolatiles other than U or Pu, and 1.0% for emivolatiles. Therefore, (0.003)(540) = 1.62 g Pu are released. Releases from the other isotopes ar calculated in a similar manner. Results are shown in Table 4.10.

An alternate method of calculating U and Pu release is given in Table 4.4. The equation for predicting the uranium release from burning 30% TBP in kerosene is applicable for this example. The smoke release rate is calculated using Equation (4.2):

$$\dot{G}_s = (0.087)(135) = 11.7 \text{ g/s} \quad (4.17)$$

$$\text{or } (0.002)(135) = 0.27 \text{ g/s}$$

TABLE 4.10. Radioactive Source Terms from Solvent Fire (Fuel Reprocessing)

Solvent Fire	Release: Release Fraction	Release: g/s
Pu	0.003	2.5×10^{-3}
UO_2	0.003	5.2×10^{-3}
Th	0.003	3.0×10^{-2}
Ru	0.01	3.0×10^{-6}
Rh	0.01	9.0×10^{-7}
Zr	0.0077	2.2×10^{-7}
Nb	0.0077	1.2×10^{-8}
Ce	0.0077	2.1×10^{-6}
Cs	0.01	4.2×10^{-6}
Total		3.8×10^{-2}

This rate is then divided by total mass of fuel and total radioactive mass release (using the larger $\dot{G}_s$) is

$$(1.38)[(11.7 \text{ g/s})/86{,}000 \text{ g}](540 \text{ g}) = 1.101 \text{ g Pu} \qquad (4.18)$$

$$(1.38)[(11.7 \text{ g/s})/86{,}000 \text{ g}](1{,}116 \text{ g}) = 0.210 \text{ g } UO_2 \qquad (4.19)$$

These numbers represent 0.02 percent of the total inventory and thus are a less conservative estimate of radioactive release than the release factors (0.3%) given in Table 4.2.

The user must judge whether the feed tank overpressurizes. If the tank is assumed to rupture, see Section 4.2.3.3 on flashing spray release calculations.

Mass Loss Rate, $\dot{M}_b$ - Assuming sufficient oxygen for flaming combustion of the entire fuel inventory, and using combustion properties of kerosene to model the solvent, the mass loss rate per unit area is calculated using Equation (4.1):

$$\dot{M}_b \text{ (solvent)} = (25 - 8.0)/1.5 \text{ g/m}^2 \text{ s} \qquad (4.20)$$

$$= 11 \text{ g/m}^2 \text{ s}$$

The surface area of the pool is 12.3 m^2 giving

$$\dot{M}_b = 11 \times 12.3 = 135.3 \text{ g/s} = 1\text{-}72.9 \text{ lb/h}.$$

Burning time, t_b - The time it takes to burn all the solvent is

$$t_{burn} = 86{,}000 \text{ g}/135.3 \text{ g/s} = 636 \text{ s} \qquad (4.21)$$

Energy Generation Rate, $\dot{Q}_a$ - From Equation (4.3), the energy generation rate is

$$\dot{Q}_a = (0.91)(46)(135,3) \quad (4.22)$$

$$= 5,700 \text{ kW}$$

Energy Rate to Gases, $\dot{Q}_c$ - Energy carried in the combustion gases is calculated with Equation (4.4).

$$\dot{Q}_c = (0.57)(46)(135.3) = 3,500 \text{ kW} \quad (4.23)$$

$$\text{or } (0.57)(47.9)(135.3) = 3,700 \text{ kW}$$

Smoke Combustion Rate, $\dot{G}_s$ - The quantity of smoke given off from the solvent fire can be calculated [using Equation (4.2) from the previous section]:

$$\dot{G}_s = (0.087)(135) = 11.7 \text{ g/s} \quad (4.24)$$

$$\text{or } (0.002)(135) = 0.27 \text{ g/s}$$

- FIRIN Analysis

  Input parameters for FIRIN analysis are given in Table 4.11. Since the solvent is the only fuel in the fire, only one burning order is needed.

- Discussion of Calculational Results

  FIRIN predicts a mass loss rate that is originally slightly higher than that calculated manually, but decreases with decreasing oxygen concentration during the fire. $\dot{Q}_a$ calculated by FIRIN shows the same effect.

TABLE 4.11. Input Parameters for FIRIN - Solvent Extraction Fire (Fuel Reprocessing)

Acronym[(a)]	Value	Comments
Nonradioactive Source Term Input		
SPEC	1000 s	
DELT	1.0 s	
MIBO	1	Only one fuel
IGNITE	0	
IPRINT	10	
MJE	1	
FUEL (7,1)	86,000 g	
REC (7,1)	12.3 m^2	
LR	41.8 m	
WR	6.7 m	
ZR	8.8 m	
XCEIL	1.22 m	
XWALL	1.22 m	
XFLOOR	1.22 m	
MATERC	1	Concrete
MATERW	3	Stainless steel
MATERF	3	Stainless steel
NFP	0	No additional flow paths generated
P1	0.999 atm	
P2	0.989 atm	
TINIT	322 K	
PINIT	0.994 atm	
ZIF	8.5 m	
ZOF	0.3 m	
ZFIRE	0.0 m	Fire at floor level
EQUIP	1.0	SX feed tank
FLOW	0	No additional flow paths generated diameter
WD (3,1)	2.8 m	Vessel is 2.8 m in diameter
HEQ (3,1)	5.6 m	Vessel is 5.6 m high
HTF (3,1)	3.66 m	Vessel is 3.66 m above the floor
MATERE (3,1)	3	Stainless steel vessel
WMASS (3,1)	2290 kg	Weight of empty vessel is 2290 kg
VGAS3 (1)	0.7 m^3	3600-2900 ℓ = 700 ℓ = 0.7 m^3
WH2O3 (1)	2,900,000 g	Assuming ρ = 1 g/cm^3
TE (JE)	322 K	
T13 (JE)	322 K	
WVES (3)	1	
PF3	6.8 atm	
Radioactive Source Term Input		
NRAD (2)	9	Nine major radioactive materials in burning solvent
NRAD (4)	8	Eight major radioactive materials in feed

Input for Burning Contaminated Combustible Liquid

	NRAD (2)								
	1	2	3	4	5	6	7	8	9
IFORM	2	2	2	4	4	3	3	3	4
I	7	7	7	7	7	7	7	7	7
JACT	1	2	3	4	5	6	7	8	9
IBO	1	1	1	1	1	1	1	1	1
QRAD2 (g)	540	1,100	6,400	0.02	0.06	0.18	0.001	0.17	0.27

Input for Pressurized Liquid Release

	NRAD (4)							
	1	2	3	4	5	6	7	8
IVES	1	1	1	1	1	1	1	1
JACT	1	2	3	4	5	6	8	9
QRAD4	990	2,010	11,649	360	110	320	310	490

$\dot{Q}_c$ is much lower for FIRIN than for manual calculations because heat loss to the walls and equipment are considered. FIRIN predicts a negative $\dot{Q}_c$ during much of the fire when heat is absorbed by the walls from the hot layer faster than it is being generated by the fire.

$\dot{G}_s$ depends on mass loss rate and oxygen concentration (burn mode) and thus exhibit the same effects as $\dot{M}_b$, decreasing gradually with the oxygen concentration in the compartment.

FIRIN predicts a higher radioactive release because it considers the effect of air velocity in making radioactive particles airborne during a fire. Since the radioactive release from FIRIN also depends on M_b, the gradual decline in generation rate with time occurs.

4.2.3.2 Secondary Sample Problem

Flashing Sprays. Flashing sprays are a type of pressurized release caused from overheating process equipment. Although flashing sprays may be caused by fires, the method for calculating releases from flashing sprays are presently not incorporated into FIRIN. Therefore, only manual calculations will be shown for this sample problem.

The solvent extraction fire from the previous problem may heat a pipe which has been blocked off and contains some standing liquid or a tank of radioactive material. The pipe or container may then overpressurize and rupture flashing some of the solution into the compartment.

An equation from Table 4.2 is used to calculate the source term from pressurized releases of heated liquids. The appropriate release factor is:

$$\%\ \text{release} = 30\ MF_g^{0.91} \qquad (4.25)$$

where MF_g is the mole fraction of pressurizing gas or vapor. For flashing sprays MF_g is equal to the amount of vapor flashed immediately after release.

Temperature and pressure conditions before and after release are used to determine thermodynamic properties of the solution and thus calculate fraction flashed. An energy balance on the system provides the following equation:

$$H_{L1} M_{L1} = H_{L2} M_{L2} + H_{V2} M_{V2} \tag{4.26}$$

where H_{L1} = enthalpy of the liquid before release
M_{L1} = mass of the liquid before release
H_{L2} = enthalpy of the liquid after release
M_{L2} = liquid mass after release
H_{V2} = vapor enthalpy after release
M_{V2} = vapor mass after release

Since conservation of mass demands that M_{L1} equals $M_{L2} + M_{V2}$, the equation can be rearranged to

$$\frac{M_{V2}}{M_{L1}} = \frac{H_{L1} - H_{L2}}{H_{V2} - H_{L2}} \tag{4.27}$$

The left-hand side of this equation is the fraction of liquid flashed into vapor after release. The denominator in the right-hand side of the equation is the heat of vaporization at release temperature and pressure.

The Chemical Engineers' Handbook (Perry and Chilton 1973) contains data on the partial pressure of nitric acid and water vapor over aqueous solutions of nitric acid. Even for up to 50% nitric acid solutions at temperatures over 100°C, the partial pressure of water vapor is more than ten times greater than that of nitric acid. Therefore, to simplify analysis, the steam tables will be used in this example to provide values of enthalpy for the release of the aqueous plutonium nitrate solution.

Assuming the rupture occurs at 7.8 atm (115 psig), the enthalpy of water at 7.8 atm (170°C) is 717 J/g (309 Btu/lb_m). The enthalpy of water and heat of vaporization at 1 atm (100°C) are 418 J/g (180 Btu/lb_m) and 2251 J/g (970 Btu/lb_m), respectively. The mole fraction of vapor flashed is (717-418)/2251 or 0.13. Thus, the release fraction is

$$30(0.13)^{0.91} = 4.7\% \quad (4.28)$$

Approximately 5% of all the radioactive materials in the pipe or tank are estimated to be released in a puff occurring at the time of rupture. Particles are assumed to have an AMMD of 6.8 and geometric standard deviation of 3.3.

4.3 EXPLOSIONS

"Non-nuclear explosive events fall into four classes that are based upon the types of reactions that generate the energy (physical or chemical) and the rates at which the energy is generated (fast or slow)." (Halverson and Mishima 1986). These classes are:

- fast physical (molten metal dropped into water)
- slow physical (pressurized releases)
- fast chemical (detonations)
- slow chemical (deflagrations).

As mentioned in Halverson and Mishima (1986), the likelihood of fast physical explosions in nuclear facilities is remote, thus this type of explosion is not considered here. Calculational techniques to estimate the direct airborne release of radioactive materials from the other three types of explosions (detonations, deflagrations and slow physical explosions) are examined in the following subsections.

All the calculational techniques relate the energy impacting the material to the mass of material to be lofted. Methods to estimate the energy generated by various events have been covered in Chapters 2 and 3 and those applicable will be covered again here. Considerations in determining the mass of material involved will be discussed. A technique based upon an upper bound (Bounding Equation) on the airborne releases measured from experimental studies is presented that can provide a conservative estimate of the airborne release from situations where adequate information is not available to utilize the other calculational techniques. Next, a method is provided for both hand and code calculations of airborne releases caused by detonations within or contiguous to solids and liquids. Finally, hand calculations are provided for the sudden releases of pressurized powders and liquids and code calculation for the sudden release of powders. Indirect effects such as aerodynamic entrainment of powders, fragmentation of brittle solids by crush-impact, and the free fall spill of powders can also result from many explosive events, and are covered in other sections of this chapter:

- free fall spills of powders and liquids (4.4)
- aerodynamic entrainment of powders (4.5.2.1)
- fragmentation of brittle solids by crush-impact (4.5.2.2).

4.3.1 Scenario Considerations

The energy involved in an explosion and the mass of material at risk are the primary factors influencing the source term from an explosion. For pressurized releases of powders and liquids, these parameters are well defined by the release pressure and size of the container. However, release pressure must be estimated and is dependent on many factors defining container integrity. The type and thickness of construction material, exposure of container to temperature, pressure, humidity, or corrosive materials, and age of container are some of these factors.

In order to calculate the ratio of equivalent mass of explosives (as TNT) to the mass of inert material subdivided (an index of new surface area created) (MR) that determines the airborne release of solids and liquids from detonations and deflagration, both the energy (as an equivalent weight of TNT) and the inert mass fragmented are required. For condense phase explosives, calculation of the TNT equivalency may not be difficult. For known explosives, TNT equivalencies have been calculated and are shown in Chapter 3. For other materials (e.g., flammable/combustible gases, physical explosions), calculating the TNT equivalency is more difficult and may not be possible. The calculated equivalency for some gases that have been involved in vapor cloud explosions are shown in Table 3.5. For other flammable/combustible gases, a "bounding" value could be calculated by comparing the energy from a unit mass of TNT and from the heat of combustion of a stoichiometric mixture of the gas. If the energy from a physical explosion can be estimated, the calculated value can be compared to the energy per mass for TNT and an equivalent TNT mass estimated.

The estimation of the total inert mass fragmented can also be difficult for detonation and deflagrations. For relatively thin depths of inert material, the entire mass of material can be used if it surrounds the explosive charge or the dimensions of the surface are less than the depth of penetration of the shock front into that material. The depth of penetration is measured from the boundaries of the explosive charge if the inert material is pressing against the explosive charge and, therefore, has the same shape as the explosive charge.

For depths of inert material greater than the depth of penetration of the shock front in that material, the total amount of material involved would be the actual material fragmented and cracked, but left in place. (An explosive charge detonating on the ground digs a crater in the ground; it does not suspend all the dirt in all directions.) Since the basis for calculating the fragmentation is the creation of new surface area by fragmentation of the inert material, the total material involved is greater than just the material fragmented into discrete fragments but also includes the material cracked but left in place. Since the cracking of material is difficult if not impossible to determine, ignoring the mass of materials cracked would esult in a finer size distribution for the fragmented material and would be conservative. Furthermore, the mass fraction of the powder or preexisting particle made airborne by detonations and deflagrations are not readily calculated by the model, since no energy is used for the creation of new surfaces. For small particles, the relaxation times of the particle may be sufficiently short to prevent fragmentation or result only in gross fragmentation.

Only the material affected should be considered in estimating the mass of inert material involved. If the solid or liquid containing the radioactive material of concern is held in a container, some or all of the container would be fragmented. If the radioactive material only lies over or under the explosive charge and another inert material (e.g., dirt, steel, concrete) is also contiguous to the explosive charge, the total mass of both materials fragmented should be used in calculating the MR.

Once airborne, the particles would begin to react to natural processes (e.g., gravity, agglomeration) and both the mass concentration and particle size distribution change with time. For particle number concentrations greater than 10 E+6/cm^3, the agglomeration may be significant. The size of fragments assumed airborne by Steindler and Seefeldt (1980) is not explicitly stated but appears to exceed 100 micrometers (GD). If this is the size of the particles initially airborne, gravitational settling could also be significant. The particle diameter used is geometric diameter (GD) and the particle density (in this case the theoretic density of the inert material is acceptable) must be considered to determine the aerodynamic behavior of the airborne material. Thus, a 3-micrometer GD particle of plutonium dioxide is equivalent aerodynamically to a 10-micrometer sphere of density 1.0.

A cautionary note, the correlation is based upon the extrapolation of experimental data with small MRs (20 or less) to large MRs. The validity of the extrapolation has not been demonstrated.

Table 4.12 lists the required input for calculating source term releases from pressurized releases and detonations.

TABLE 4.12. Input Requirements to [illegible] Source Term Release from Exp[illegible]

- Bounding Equation

  mass ratio - energy in impacting material
  - mass of material acted upon

- Detonation

  mass ratio - energy in explosive charge
  - mass of inert material

- Pressurized Releases

  initial velocity
  mass of material at risk
  ceiling height
  mole fraction of pressurizing gas

4.3.2 Calculational Techniques Illustrated

Calculational techniques to estimate the airborne release from direct mechanisms as the result of explosive events are presented. The calculational techniques covered are the use of the Bounding Equation, the airborne release from impact of a detonation on a solid or liquid, and the airborne release from the sudden release of a powder or liquid under pressure.

4.3.2.1 Bounding Equation

For accident postulations where the event scenario does not define the accident generated conditions that lead to material subdivision/deagglomeration and airborne dispersion, a "conservative" estimate of the airborne release from that incident can be used to estimate the radiological impact. An equation has been developed (Halverson and Mishima 1986) that provides a value that bounds the potential airborne release of particulate materials based upon experimental studies of the airborne release of particulate materials from:

- the free-fall spill of powders, slurries, solutions and viscous liquids
- the release of pressurized powders and liquids including the release of solutions pressured with soluble gases (e.g., carbon dioxide) and vapor ("flashing spray")
- the airborne release calculated for the fragmentation and airborne release from detonations in the midst of solids and liquids.

The equation, developed by empirical fit of the values plotted as an Energy Density (ergs/g inert material involved), (see Figure 4.3) was described in Halverson and Mishima (1986) and is

$$\log (\text{wt\% airborne}) = -2.6 + \sqrt{18.8 (\log E/M_o) - (\log E/M_o)^2 - 67.2} \quad (4.29)$$

where E = effective energy source, ergs (= dyne/cm)

M_o = weight of inert material involved, g

Estimation of the Energy Generated by the Event. To apply the Bounding Equation, both the energy impacting the material and the mass of material

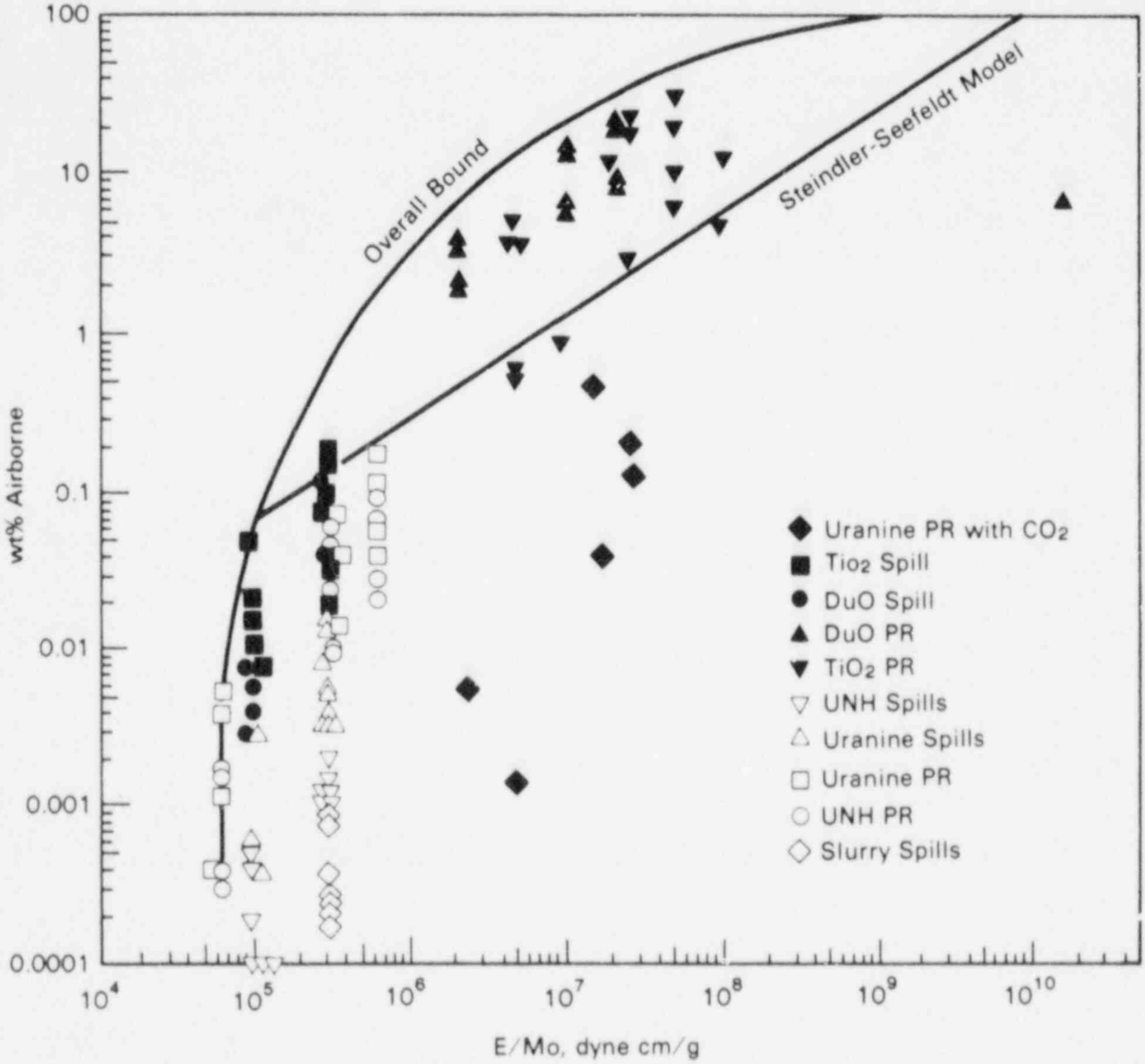

FIGURE 4.3. PNL Experimental Results and Curve Fits

involved are required. The estimation of the energy from chemical explosive events (detonations and deflagrations) has been covered by Chapter 3 and Subsection (4.3.1).

The energy available from the release of a pressurized gas can be bounded by using the calculation for isothermal expansion (Grelecki 1972):

$$E = 1.26\ V\ (P_1/P_o)(T_o/T_1)\ RT\ \ln(P_1/P_2) \qquad (4.30)$$

where E = energy, calories

V = volume of vessel, ft^3

P_1 = pressure of compressed gases, atm

P_2 = final pressure of expanded gases (usually 1 atm), atm

P_o = standard conditions, 1 atm

T_1 = temperature of compressed gases, K

T_o = standard temperature, 273 K

R = Universal Gas Constant, 1.987 cal/g-mole- K

1.26 = conversion factor, ft^3 to g-mole

The method to calculate the energy available from the release of gases dissolved in compressed liquids is shown in Appendix B of Ballinger, Sutter and Hodgson (1987). The method involves the calculation of the Henry's law constant for the pressurizing gases at the temperatures and pressures of concern.

Estimation of the Mass of Material Involved in the Event. The mass of inert material acted upon during an event is the other component required to define the MR. In the case of the release of pressurized materials and free-fall spills, the mass of inert materials involved is all the material contained in the vessel. The amounts of materials involved for fragmentation by detonation or crush-impact are not as easily defined.

For detonations, the materials should be contiguous to or surrounding the detonation to simulate the experimental conditions represented by the Steindler and Seefeldt model (Steindler and Seefeld 30). The material involved is all the material that is fragmented. For relatively thin layers, the penetration of the shock front into the material is sufficient to include the entire depth of the material under or around the charge but, for flat surfaces, not necessarily all the materials at radial distances from the charge are fragmented. For thick layers of materials (feet), the shock front may not penetrate and the inert material involved may represent only a fraction of the material under or around the charge. The depth a shock front will penetrate into some materials from 50 lb TNT equivalency was estimated for a previous study and was found to be:

lead	- 1 ft
steel	- 1 ft
glass	- 1.5 ft
concrete	- 2.5 ft

The penetration would be measured from the edges of the charge so that the penetration pattern would be in the same geometric shape as the charge. Subdivision of powders is not anticipated since the relaxation times and the forces available are generally adequate to anticipate suspension of the particles rather than subdivision. At lower MR_e, there may be some preferential suspension of the finer fractions.

For fragmentation by crush-impact, the area of the material actually impacted by the object would be subjected to crush-impact forces. Again, the depth of penetration of the fragmentation would depend upon the level of force, the tensile strength of the material, if portions of the forces could be absorbed by other materials present (e.g., cladding, containers, the surface upon which the impacted material rests. If the mass of inert material involved can vary, determining the greatest fraction of airborne material for any level of force would be an iterative process.

Estimation of the Volume of Cloud/Plume Generated. The volume of the aerosol released during an event depends upon the gases in which the particles are suspended. For explosive events, the size of the cloud could be estimated from the volume of gases generated by the event. For free-fall spills and fragmentation by crush-impact, the volume of air displaced could be used.

Other Factors That May Affect the Airborne Release Estimates. The mass fraction of the airborne release estimated by the Bounding Equation is for all particles made airborne under the experimental conditions used except for the calculated release from detonations (Steindler and Seefeldt 1980). The size distribution considered to be suspendible for this model is not explicitly stated but the plots of particles airborne for the experimental studies considered indicate that the size assumed to be airborne exceeds 100 micrometers. The airborne release estimated by some of the other techniques discussed in this chapter may limit their estimates to particles in the "respirable" size range (10 micrometers AED and less for the purposes of this study) and estimates by the Bounding Equation may be significantly larger than derived from these techniques at the same energy levels.

Unless the conditions resulting from the event result in a serious loss of structural integrity (a significant breach of the exterior surfaces of the building), the airborne material resulting from these events are released into a space within the facility and, for nuclear grade facilities, a ventilated space. The particles assumed to be airborne by this technique can be very large by aerosol considerations (exceeding 10 micrometers AED) and could be seriously affected by conditions within the ventilated space.

If the time the airborne particles remain in the space (the time between release of the airborne material and the time it is exhausted from the space) is measured in minutes, natural processes can result in some depletion. The flow through the large ventilated spaces is not adequate for turbulent flow and good mixing is not anticipated after release. The terminal settling velocity of a particle 100 micrometers AED is 15.5 m/min (51 ft/min). Agglomeration (coagulation), diffusion and other natural depletion mechanisms can reduce the mass concentration of airborne material exhausted from the space.

4.3.2.2 Fragmentation of Solids and Liquids by Detonations

Detonations release their energy over a very short period of time (microseconds) resulting in extremely narrow shock waves (all the energy impacts objects close to the point of origin over a very short period of time). The impact of the shock front generated can shatter solids and liquids that are contiguous to or that surround the explosive charge. Steindler and Seefeldt (1980) correlated the mass fraction of the material shattered and made airborne from experimental data on metals and solutions. The relationship between the mass of material fragmented and the energy in the explosive charge (expressed as equivalent weight of TNT) is termed the "Mass Ratio" (MR). The initial amount of fragmented material made airborne is equal to

$$2.783\ (MR)^{0.3617}\ \text{g aerosol/g explosive (TNT)} \qquad (4.31)$$

under the assumptions of the diameter and the size distribution of fragments airborne used by Steindler and Seefeldt (1980).

The seven-step procedure presented by Steindler and Seefeldt (1980) is covered in detail in Halverson and Mishima (1986) and is reproduced here:

Step 1 - Estimate the mass ratio.

Step 2 - Estimate the mass median diameter (d_g) for the particle size distribution from Figure 4.4.

Step 3 - Estimate the amount of material initially made airborne using the equation above.

Step 4 - Select the particle size ranges that are of interest in the particular case under consideration. Often, 0 to 3 micrometers, 3 to 10 micrometers, 10 to 100 micrometers and +100 micrometers will provide adequate fractionation. For each particle size range, apply step 5 through 7.

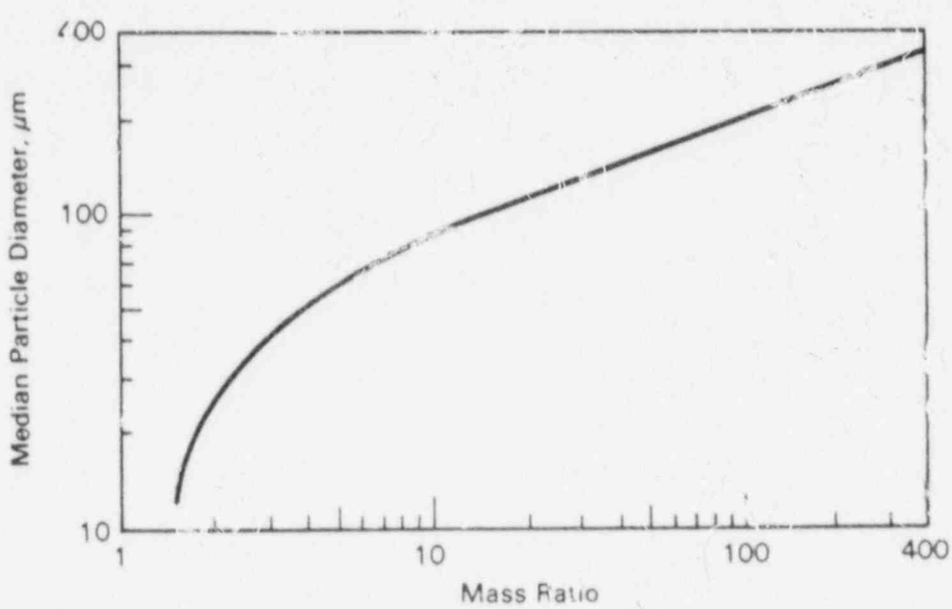

FIGURE 4.4. Extrapolation of Explosive Dispersal Data to High Mass Ratios

Step 5 - Calculate the standard normal deviate (Z):

$$Z = (\ln d - \ln d_g)/\ln \text{geometric standard deviation}, \quad (4.32)$$

[A geometric standard deviation of 2 was assumed by Steindler and Seefeldt (1980) but any value could be assumed.]

Step 6 - Calculate the percent of the aerosol in each size range of interest by subtracting the two endpoint values of the cumulative normal frequency distribution [P(Z)] in Table 4.13.

Step 7 - Multiply the percent of the aerosol in each range by the initial amount made airborne to get the weight initially made airborne in each size range.

The process has been programmed as the computer code, DETIN. The mass and fraction of the fragments made airborne in five particle diameter (GD) ranges, is tabulated for a unit mass of explosives as shown in Appendix C Tabulated Values of Inert Material Initially Made Airborne from Detonations by the DETIN Code. The explanation of the various values used in the table are also found in Appendix C. The file for the code is shown in Appendix D DETIN Computer Code. The DETIN code should be used in the place of hand calculations if the user has a range of conditions to be analyzed.

4.3.2.3 Pressurized Release of Powders (Hand Calculations)

The fraction airborne and size distribution of aerosols produced from pressurized releases of powders has been measured (Sutter 1983). In these experiments, the mass of material at risk, release pressure, and position of material with regard to the pressurized container were varied. Two types of powders (differing greatly in theoretical density) were used. A regression of the data indicates that the release pressure has the greatest influence on fraction airborne. As expected, higher release pressures produced a higher fraction of material to become airborne. Contaminant mass also influenced fraction airborne, but to a lesser extent: as mass of material at risk

TABLE 4.13. Cumulative Probability Distribution (from Abramowitz and Stegun 1965)

Z	P (z)	Z	P (z)	Z	P (z)
0.00	0.50000 00000 00000	1.30	0.90319 95154 14390	2.60	0.99533 88119 76281
0.02	0.50797 83137 16902	1.32	0.90658 24910 06528	2.62	0.99560 35116 51879
0.04	0.51595 34368 52831	1.34	0.90987 73275 35548	2.64	0.99585 46986 38964
0.06	0.52392 21826 54107	1.36	0.91308 50380 52915	2.66	0.99609 29674 25147
0.08	0.53188 13720 13988	1.38	0.91620 66775 84986	2.68	0.99631 38919 90825
0.10	0.53982 78372 77029	1.40	0.91924 33407 66229	2.70	0.99653 30261 96960
0.12	0.54775 84260 20584	1.42	0.92219 61594 73454	2.72	0.99673 59041 84109
0.14	0.55567 00048 05909	1.44	0.92506 63004 65673	2.74	0.99692 80407 81350
0.16	0.56355 94628 91433	1.46	0.92785 49630 34106	2.76	0.99710 99319 23774
0.18	0.57142 37159 00901	1.48	0.93056 33766 66669	2.78	0.99728 20550 77299
0.20	0.57925 97094 39103	1.50	0.93319 27987 31142	2.80	0.99744 48696 69572
0.22	0.58706 44226 48215	1.52	0.93574 45121 81064	2.82	0.99759 88175 25811
0.24	0.59483 48716 97796	1.54	0.93821 98232 88188	2.84	0.99774 43233 08458
0.26	0.60256 81132 01761	1.56	0.94062 00594 05207	2.86	0.99788 17949 59596
0.28	0.61026 12475 55797	1.58	0.94294 65667 62246	2.88	0.99801 16241 45106
0.30	0.61791 14221 88953	1.60	0.94520 07083 00442	2.90	0.99813 41866 99616
0.32	0.62551 58347 23320	1.62	0.94738 38615 45748	2.92	0.99824 98430 71324
0.34	0.63307 17360 36028	1.64	0.94949 74165 25897	2.94	0.99835 89387 65843
0.36	0.64057 64332 17991	1.66	0.54154 27737 33277	2.96	0.99846 18047 88262
0.38	0.64057 64332 17991	1.66	0.54154 27737 33277	2.98	0.99855 87580 82660
0.40	0.65542 17416 10324	1.70	0.95543 45372 41457	3.00	0.99865 01020
0.42	0.66275 72731 5[illegible]51	1.72	0.95728 37792 08671	3.05	0.99885 57932
0.44	0.67003 14463 39407	1.74	0.95907 04910 21193	3.10	0.99903 23968
0.46	0.67724 18897 49653	1.76	0.96079 60967 12518	3.15	0.99918 36477
0.48	0.68439 63034 83778	1.78	0.96246 20196 51483	3.20	0.99931 28621
0.50	0.69146 24612 74013	1.80	0.96406 96808 87074	3.25	0.99942 29750
0.52	0.69846 82124 53034	1.82	0.96562 04975 54110	3.30	0.99951 65759
0.54	0.70540 24837 84302	1.84	0.96711 58813 40836	3.35	0.99959 59422
0.56	0.71226 02811 50973	1.86	0.96855 72370 19248	3.40	0.99966 30707
0.58	0.71904 26911 01436	1.88	0.96994 59610 38800	3.45	0.99971 97067
0.60	0.72574 68822 49927	1.90	0.97128 34401 83998	3.50	0.99976 73709
0.62	0.73237 11065 31017	1.92	0.97257 10502 96163	3.55	0.99980 73844
0.64	0.73891 37003 07139	1.94	0.97381 01550 59548	3.60	0.99984 08914
0.66	0.74537 30853 28664	1.96	0.97500 21048 51780	3.65	0.99986 88798
0.68	0.75174 77694 46430	1.98	0.97614 82356 48592	3.70	0.99989 22003
0.70	0.75803 63477 76927	2.00	0.97724 98680 51821	3.75	0.99991 15827
0.72	0.76423 75022 20749	2.02	0.97830 83062 32353	3.80	0.99992 76520
0.74	0.77035 00028 35210	2.04	0.97932 48371 33930	3.85	0.99994 09411

TABLE 4.13. (contd)

Z	P (z)	Z	P (z)	Z	P (z)
0.76	0.77637 27075 62401	2.06	0.98030 07295 90623	3.90	0.99995 19037
0.78	0.78230 45624 14267	2.08	0.98123 72335 65062	3.95	0.99996 09244
0.80	0.78814 46014 16604	2.10	0.98213 55794 37184	4.00	0.99996 83288
0.82	0.79389 19464 14187	2.12	0.98299 69773 52367	4.05	0.99997 43912
0.84	0.79954 58067 39551	2.14	0.98382 26166 27834	4.10	0.99997 93425
0.86	0.80510 54787 48192	2.16	0.98461 36652 16075	4.15	0.99998 33762
0.88	0.81057 03452 23288	2.18	0.98537 12692 24011	4.20	0.99998 66543
0.90	0.81593 98746 53241	2.20	0.98609 65524 86502	4.25	0.99998 93115
0.92	0.82121 36203 85629	2.22	0.98679 06161 92744	4.30	0.99999 14601
0.94	0.82639 12196 61376	2.24	0.98745 45385 64054	4.35	0.99999 14601
0.96	0.83147 23925 33162	2.26	0.98808 93745 81453	4.40	0.99999 45875
0.98	0.83645 69406 72308	2.28	0.98869 61557 61447	4.45	0.99999 57065
1.00	0.84134 47460 68543	2.30	0.98927 58899 78324	4.50	0.99999 66023
1.02	0.84613 57696 27265	2.32	0.98982 95613 31281	4.55	0.99999 73177
1.04	0.85083 00496 69019	2.34	0.99035 81300 54642	4.60	0.99999 78875
1.06	0.85542 77003 36091	2.36	0.99086 25324 69428	4.65	0.99999 83403
1.08	0.85992 89099 11231	2.38	0.99134 36809 74484	4.70	0.99999 86992
1.10	0.86433 39390 53618	2.40	0.99180 24640 75404	4.75	0.99999 89829
1.12	0.86864 31189 57270	2.42	0.99223 97464 49447	4.80	0.99999 92067
1.14	0.87285 68494 37202	2.44	0.99265 63690 44652	4.85	0.99999 93827
1.16	0.87697 55969 48657	2.46	0.99305 31492 11376	4.90	0.99999 95208
1.18	0.88099 98925 44800	2.48	0.99343 08808 64453	4.95	0.99999 96289
1.20	0.88493 93297 78292	2.50	0.99379 03346 74224	5.00	0.99999 97133
1.22	0.88876 75625 52166	2.52	0.99413 22582 84668		[(-6)3]
1.24	0.89251 23029 25413	2.54	0.99445 73765 56918		
1.26	0.89616 53188 78700	2.56	0.99476 63918 36444		
1.28	0.89972 74320 45558	2.58	0.99505 99842 42230		

increased, fraction airborne tended to decrease. Pressure and mass were combined in the initial velocity term shown in Equation (4.33) (see Equation (4.34). Velocity as a parameter produced a higher correlation with fraction airborne than pressure alone.

The equation is

$$F = 1 \times 10^4 V_o^{1.4} \tag{4.33}$$

where F = mass fraction airborne, and V_0 = initial velocity in m/s. Figure 4.5 shows the data with the regression line drawn through it. The regression coefficient (r^2) value is 62.8% indicating a high degree of scatter.

A powder pressurized release may be assumed instantaneous. An upper bound source term is provided by applying Equation (4.25) and assuming all material generated challenges the filter. A lower bound estimate can be calculated assuming the aerosol generated disperses uniformly throughout the compartment and applying the dilution factor to be described in Section 4.4.2.1. The average size distribution of aerosols from the powder pressurized releases is given in Table 4.14.

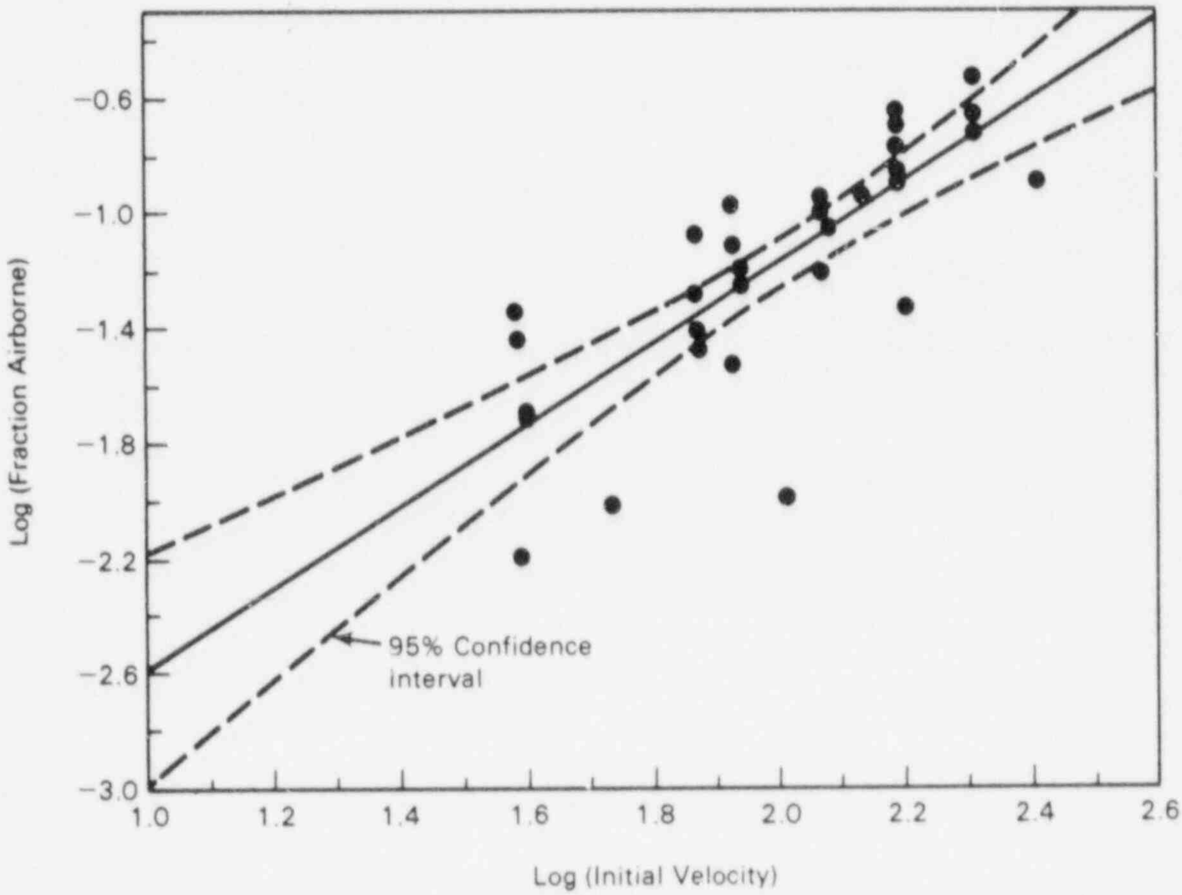

FIGURE 4.5. Fraction Airborne vs Initial Velocity for Powder Pressurized Releases

TABLE 4.14. Average Size Distribution of Powder Pressurized Release Experiments (Sutter 1983)

	AMMD, micron	σ_g
Average	11.2	6
St. Dev.	5.2	3
Range	2.4 to 25.0	2 to 14
95% Conf. Interval	9.6 to 12.8	2 to 14

Computer Code Calculations. The computer model (PREL) for estimating the generation of airborne particles from a pressurized release of powders should be used in place of hand calculations if a rate of particles made airborne is desired. This code is similar to the model for powder spills. In both cases, particles are sheared off during the transport of the bulk material through the air. The energy of release, however, is different for pressurized releases than for spills. Gravitational energy is the driving force in powder spills. For pressurized releases, the energy comes from the pressure differential at rupture. An initial velocity, V_0, is calculated based on the pressure difference, void space in the container, and mass of contents. A listing of PREL is included in Appendix B.

Inputs to the code are the mass of source material, initial velocity, timestep, distance to container barrier, cosine of degree from upward vertical of the direction of failure, and frequency of timesteps printed out. The code calculates the diameter, elevation and velocity of the powder front for each timestep. The drag force on this front is then calculated based on the Reynolds number. The amount airborne during the timestep is assumed proportional to the drag force, with the proportionality factor determined empirically.

Initial velocity can be estimated by

$$V_o = \left(\frac{2P\,v_t}{m}\right)^{1/2} \qquad (4.34)$$

where P = differential pressure at release

v_t = void space in the container (container volume minus volume occupied by powder crystals)

m = total mass in container (includes mass of pressurized gas)

Release pressure depends on the type and thickness of container construction material. Methods of calculating bursting pressures for vessels are given in Halverson and Mishima (1986). Figure 2.1 shows the bursting pressure for various materials and vessel diameters based on the hoop-stress equation detailed in Halverson and Mishima (1986).

The size distribution of aerosols generated by pressurized releases of powders has been measured (Sutter 1983). The average AMMD and σg of reported experiments is 11.2 and 6, respectively. Table 4.14 shows the spread of the data and the 95% confidence interval.

Aerosol generation from pressurized releases takes place during a very small increment of time (less than one second). For small compartments with little mixing, the entire release may be taken directly to the filters with no mixing or dispersion. In a larger room, however, significant dispersion of particles may take place before they are transported to the outlet vents. An exponential dilution factor assuming uniform distribution within the compartments may be used to give a lower bound estimate of release. This dilution factor is described in Section 4.4.2.1.

4.3.2.4 Pressurized Release of Liquids - Hand Calculations

In the release of pressurized liquids, energy of release is provided by gas dissolved in the liquid or vapors generated by heating of a liquid. At rupture, dissolved gas or vapors come out of solution causing bubbles that break up to form aerosols. Table 4.15 is a summary of data collected in experiments at PNL (Sutter 1983, Ballinger, Sutter and Hodgson 1987). The aerosols were collected using high volume impactors located several feet from the source. The measured data was corrected to account for particle settling and evaporation, using the codes described in Section 5.3 of Ballinger et al. (1987). The "Initial Aerosol" portion of Table 4.15 contains the corrected

TABLE 4.15. Liquid Pressurized Release Data

			Impactor Data			Initial Aerosol				
Run	Vol, cc	press., psig	AED, μm	σg	Fract Airb x 10^6	AED, μm	σg	% Mass Settled	Fract Airb x 10^6	Mole Fract Press. gas
1[(a)]	350	500	4	3	590	13.4	3.8	5.2	622	0.00039
2	100	50			44	34.0	6.8	16.6	53	0.000048
3	100	250	2.4	4	447	2.7	12.4	3.8	465	0.00022
4	350	50	1.5	3	4	6.0	5.0	5.0	4	0.00048
6	350	250	4	1.6	65	14.0	2.2	3.9	68	0.00022
7	100	500	4	3	1841	14.9	3.1	4.9	1936	0.00039
8	350	40	2.1	4	12	7.9	3.6	4.5	1.3	0.000048
9	100	250	4	3.6	650	11.9	3.0	6.6	696	0.00022
11		50	2.1	4	51	6.7	4.2	5.0	54	0.000048
12	100	500	4	4	1107	10.6	3.2	7.9	1202	0.00039
13	350	500	4.3	2.4	367	14.0	4.1	5.8	390	0.00039
14	350	250	3.6	3	120	13.2	3.0	5.4	127	0.00022
1[(b)]	350	500	17	4	219	10.0	16.7	29.2	309	0.00039
2	100	50	6	7.5	17	6.6	14.5	16.9	20	0.000048
3	100	250	14	2.7	445	9.8	10.3	23.2	579	0.00022
4	350	50	3	4.8	3	3.1	16.7	11.1	3	0.000048
5	350	250	45	5.9	101	10.8	13.9	27.6	140	0.00022
6	100	500	14	2.5	683	9.1	6.9	21.6	871	0.00039
8	350	500	14	2.9	279	9.9	11.	24.6	370	0.00039
9	100	500	14	2.9	952	9.8	8.3	24.1	1254	0.00039
10	350	250	12	2.9	89	9.3	8.8	23.2	116	0.00022

TABLE 4.15. (contd)

Run	Vol, cc	press., psig	Impactor Data: AED, μm	σg	Fract Airb x 10^6	Initial Aerosol: AED, μm	σg	% Mass Settled	Fract Airb x 10^6	Mole Fract Press. gas
11	100	250	11	4.6	586	9.7	8.6	22.9	760	0.00022
12	350	50	5	5.2	4	5.0	8.4	14.3	5	0.000042
13	100	50	8	4.6	18	7.4	8.4	18.7	22	0.000048
1[(c)]	350	50	1.5	3.8	14	5.1	3.5	3.7	15	0.0023
2	100	500	2.7	5.5	2200	12.3	5.9	6.4	2350	0.02
3	350	250	2.3	5.2	390	9.6	5.6	5.6	413	0.0135
4	100	250	2.1	2.6	5000	6.9	2.6	2.9	5149	0.0121
5	350	500	3.3	11.0	1300	15.5	12.2	8.6	1422	0.0200
6	100	50	1.9	3.3	55	6.6	3.6	3.9	57	0.00265
1[(d)]	350	122	7.7	2.7	22,240	22.0	2.4	10.8	24,930	0.117
2	700	126	5.9	2.6	15,130	19.8	2.4	8.[illegible]	16,540	0.145
3	350	239	6.3	2.7	48,750	20.4	2.5	9.0	53,570	0.179
4	100	124	6.4	3.3	85,070	20.6	3.2	9.9	94,420	0.114
5	350	57	8.4	5.6	8.921	22.6	5.4	11.0	10,024	0.071
6	350	243	6.2	2.7	50,380	20.4	1.9	9.3	55,550	0.203

(a) Uranine pressurized with air
(b) Uranyl nitrate hexahydrate pressurized with air
(c) Uranine pressurized with CO_2
(d) Flashing sprays of uranine.

values which were back calculated using the evaporation/settling correction codes on the measured data. The mole fraction of pressurizing gas was computed using methods described in Appendix B of Ballinger et al. (1987).

An empirical fit of the measured data provides

$$F = 0.30\ (MF_g)^{0.91} \tag{4.35}$$

where F = fraction airborne

MF_g = mole fraction of pressurizing gas

The equation for corrected data differed slightly

$$F = 0.33\ (MF_g)^{0.91} \tag{4.36}$$

Figure 4.6 shows the data with a regression line drawn through it. The correlation coefficient for the line is 82.2%. The AMMD of aerosols produced were larger for the UNH/air releases than for the other experiments. However, no correlation with source volume, pressure, fraction airborne, or mole fraction of pressurizing gas was found. Table 4.16 gives the average AMM and σ_g for both measured data and corrected data for each set of experiments. The user should take into account the type of pressurizing gas, and properties of source material when choosing an AMM and σ_g for the scenario under analysis. If the solution does not match any particular set of experiments, the AMM and σ_g for all data should be used.

Equation (4.35), AMMD and σ_g for measured data should be used in most cases. However, if the user has an evaporation/settling code or wants to account for these and other particle depletion mechanisms separately, Equation (4.36) should be used.

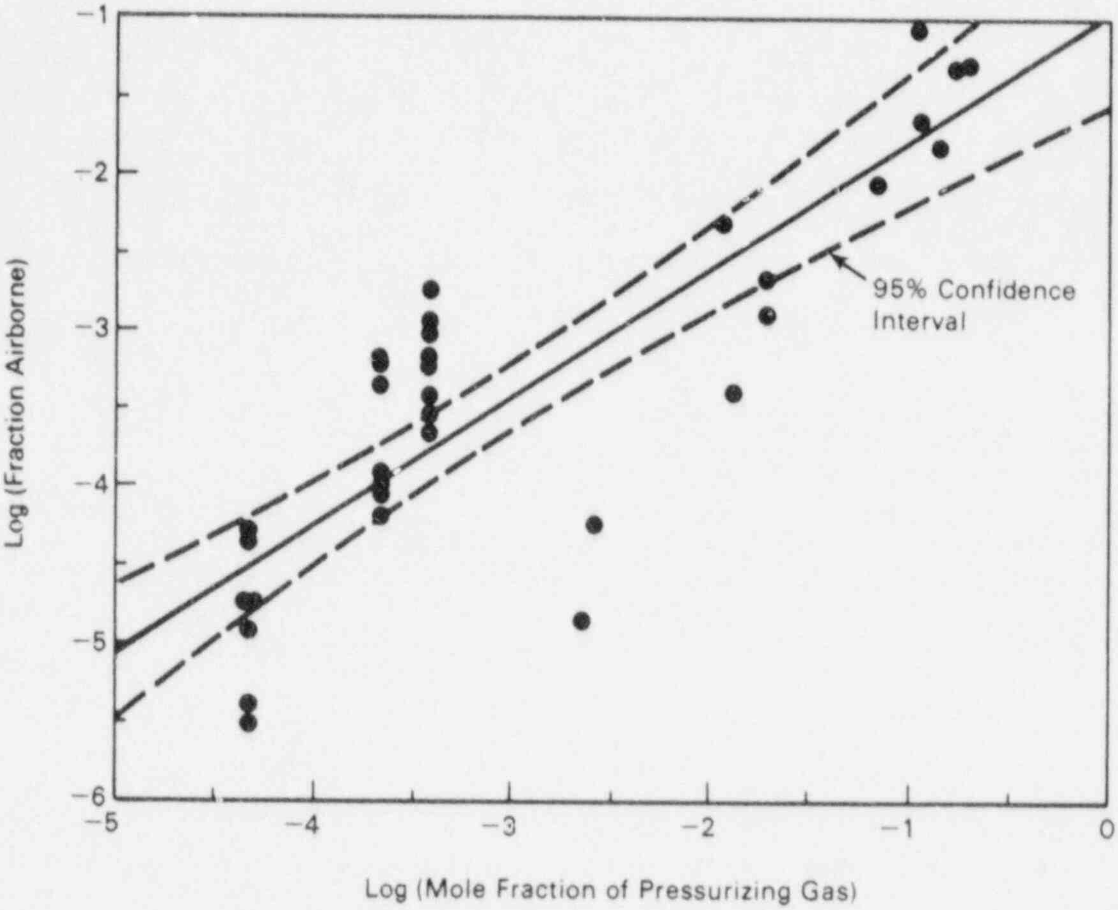

FIGURE 4.6. Fraction Airborne vs Mole Fraction of Pressurizing Gas for Liquid Pressurized Releases

TABLE 4.16. Size Distribution of Aerosols from Liquid Pressurized Releases

	Measured Data		Evaporation/Settling Corrected Data	
	Average AMMD, μm	Average σ_g	Average AMMD, μm	Average σ_g
All Data	7.3	3.9	12.0	6.6
Uranine/Air	3.3	3.2	12.4	4.5
UNH/Air	13.6	4.2	8.4	11.1
Uranine/CO_2	2.3	5.2	9.3	5.6
Flashing Sprays	6.8	3.2	21.0	3.0

4.3.3 Sample Problems

4.3.3.1 Primary Sample Problem - Solvent Explosion in Glove Box Containing Plutonium Dioxide Powder

The source term (fraction and size distribution of radioactive material made airborne) from an explosive event can be estimated by the energy ratio (the energy release in ergs per gram of nonexplosive material at risk). The physical form of the nonexplosive material is also a consideration. The event chosen to illustrate the calculation is the deflagration of a flammable solvent in a glove box containing plutonium dioxide powder.

Solvents may be used in nuclear fuel cycle facilities for cleaning and decontamination. Although the volume of solvent permitted around radioactive materials may be limited and other safety features implemented, the potential exists for this type of event. In the postulated event, a small volume of solvent in a glove box holding plutonium dioxide powder spills, evaporates in a vapor, mixes with the oxygen in the glove box atmosphere, is ignited and deflagrates. The pressure impulse from the deflagration disperses the powder inside the glove box and ruptures the barriers separating the interior from the ambient atmosphere around the glove box (gloves, HEPA filter, etc.).

In this event, the glove box is assumed to be 2.1 m x 1.1 m x 1.1 m. The volume of the box is 2.4 m^3.

If the solvent is acetone (a commonly used flammable solvent), the reaction is

$$C_3H_6O + 4O_2 \text{ ------}\rightarrow 3H_2O + 3\ CO_2$$

The amount of acetone that can react is limited by the moles of oxygen available. The moles of oxygen available in 2.4 m^3 is

$$2.4\ m^3\ (0.21\ O_2/\text{air})\ (44.6\ \text{moles air}/m^3\ \text{air}) = 22.5\ \text{moles oxygen.}$$

The stoichiometric reaction of 22.5 moles of oxygen with acetone vapor indicates that 326 g of acetone could react with the amount of oxygen present.

In most cases, the volume of flammable solvent allowed in glove boxes is much less. Acetone may be limited to 50 mℓ per portable container and 5 portable containers allowed per glove box. If we assume that a single portable container is broken and 50 mℓ of acetone is released, the quantity available from its reaction is:

$$50 \text{ m}\ell \times (0.79 \text{ g/m}\ell) \times (1/58.05 \text{ g-mole/g}) = 0.68 \text{ g-mole} \quad (4.37)$$

The heat of combustion for acetone is 426.8 kcal/g-mole.

Not all the energy available by combustion is released by explosive events. Strehlow (1972) gives a typical fraction of energy released under similar conditions in a deflagration as 10% or less. If we assume 10% of the energy available from combustion is released during the explosive event, the energy available from this event is

$$426.8 \text{ kcal} \times 0.68 \times 0.1 = 29.0 \text{ kcal} \quad (4.38)$$

Converting to dyne-cm (ergs):

$$29.0 \text{ kcal} \times 4.184 \times 10^{10} = 1.21 \times 10^{12} \text{ dyne-cm} \quad (4.39)$$

Plutonium dioxide powder is assumed to be contained in a can 0.15 m (6 in.) diameter and 0.15 m (6 in.) high, positioned on the glove box floor. The point source of the explosion is in the middle of the glove box 0.55 m - 0.15 m = 0.4 m from the top of the can. The fraction of explosive energy reaching the can may be calculated as follows (dissipation of energy with distance is neglected);

$$\text{Can area} = 3.14 \ (0.075 \text{ m})^2 = 0.018 \text{ m}^2 \quad (4.40)$$

$$\text{Surface of sphere} = 12.57\ (0.4\ \text{m})^2 = 2.0\ \text{m}^2 \tag{4.41}$$

$$\text{Energy fraction} = 0.018/2.0 = 0.009 \tag{4.42}$$

This fraction is doubled to account for reflection of the blast wave. Therefore, energy to the can of powder is:

$$(0.009)(2)(1.21 \times 10^{12}\ \text{dyne-cm}) = 2.18 \times 10^{10}\ \text{dyne-cm} \tag{4.43}$$

The amount of nonexplosive material at risk is 2000 g and the energy ratio is

$$2.18 \times 10^{10}\ \text{dyne-cm}/2000\ \text{g} = 1.09 \times 10^{7}\ \text{dyne-cm/g} \tag{4.44}$$

The fractional airborne release of the powder can be estimated from the equation bounding the experimental data generated by the Pacific Northwest Laboratory (Halverson and Mishima 1986):

$$\begin{aligned} \log\ (\text{wt\% airborne}) &= -2.6 + \sqrt{18.8\ (\log E/M_o) - (\text{Log } E/M_o)^2 - 67.2} \quad (4.45) \\ &= \quad .6 + \sqrt{132.3 - 49.5 - 67.2} \\ &= -2.6 + \sqrt{15.6} \\ &= -2.6 + 3.95 \\ &= 1.35 \end{aligned}$$

wt% airborne = 22.4 = 22%

Because the material is a powder, the method of computing size distribution from the fragmentation of the solids (Halverson and Mishima 1986) is not applicable and the size distribution of the original powder is assumed. A "conservative" size distribution for a plutonium dioxide powder is shown in Figure 4.7 (Mishima et al. 1979). Thus, it is estimated that 22% of the powder

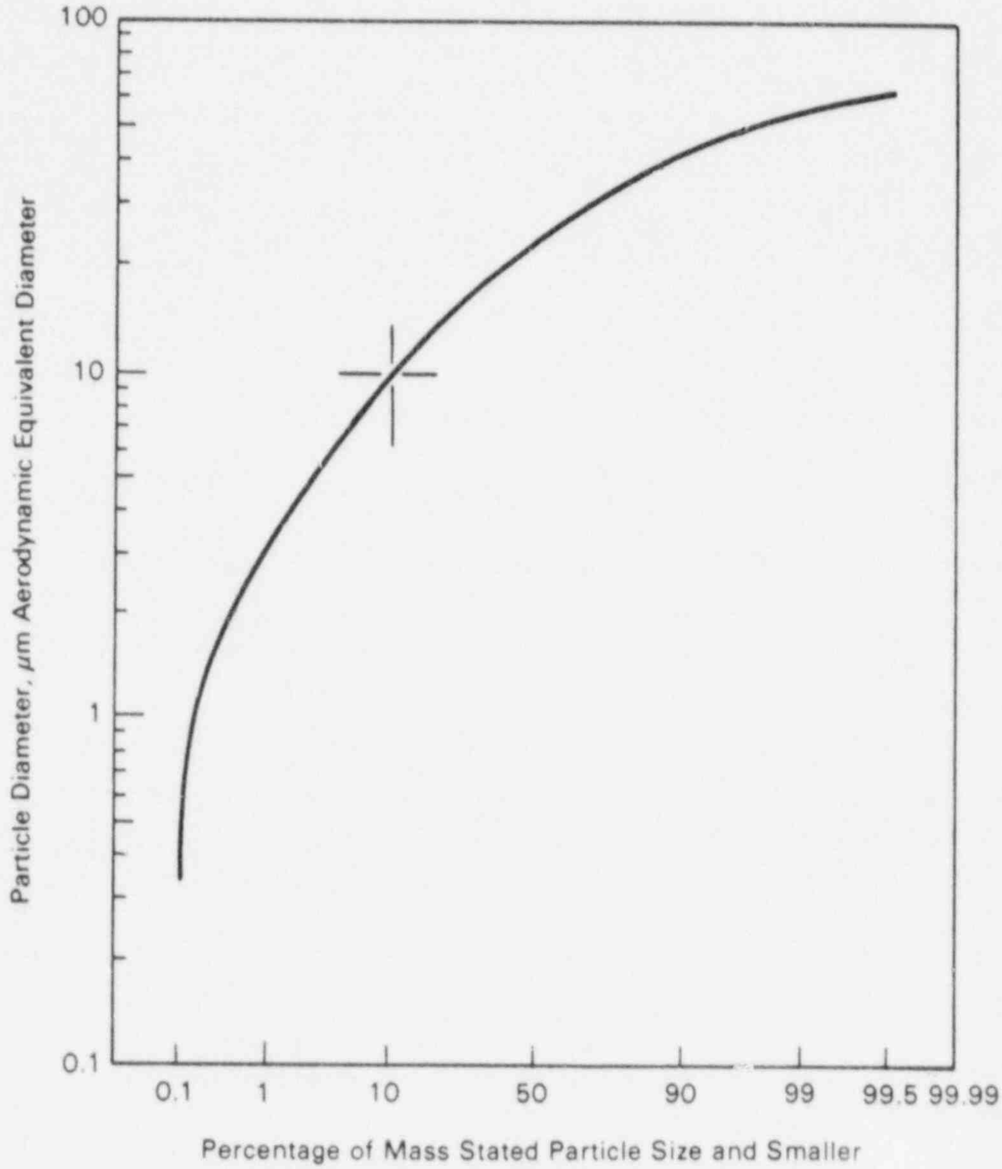

FIGURE 4.7. Nominal PuO_2 Particle Size Distribution

could be made airborne by the deflagration. The fraction of "respirable" particles (10 μm and less Aerodynamic Equivalent Diameter) is 10% and, therefore, the respirable amount is

2000 g (0.22) (0.10) = 44 g "respirable" particles airborne.(4.46)

The heat generated by the reaction is very high (flame temperature could be around 1300°C). This temperature is sufficient to ignite various materials in the enclosure (paper, rubber, etc.). If directed toward a glove, it could burn/melt an opening in the glove compromising the integrity of the enclosure. Upon completion of the reaction, the total heat generated would be distributed throughout the volume of the box.

The fraction of powder airborne in the enclosure that is expelled to the ambient atmosphere around the glove box is a function of the pressurization of its volume. The pressure generated represents both an excess volume of gas in the glove box and the effect of the expansion of the gas by the increased temperature. The fraction of particles expelled is related to the excess pressure. The quantity of excess gas generated by the reaction is small (less than 1%) since less than 1 mole of reactant (acetone) is involved.

Temperature rise in the glove box is calculated as follows:

$$\text{prior to explosion } n = PV/RT \tag{4.47}$$

$$= (1 \text{ atm})(2.4 \times 10^6 \text{ cc})/(82.06 \text{ atm cc/g-mole K})$$

$$(298 \text{ K}) = 98.1 \text{ g-mole}$$

ignoring the slight change in n after the explosion,

$$T_2 - T_1 = q/(n \times C_p) \tag{4.48}$$

$$= 29000 \text{ g-cal}/(98.1 \text{ g-mole} \times 7 \text{ g-cal/g-mole K})$$

$$= 42.2 \text{ K}$$

$$\text{so } T_2 = 298 + 42 = 340 \text{ K and } T_2/T_1 = 340/298 = 1.14$$

Thus, the fraction released from the glove box to the room due to pressurization is 1 - (1/1.14) = 0.124. The initial puff release to the room is

$$(0.124) \times (44) = 5.5 \text{ g "respirable" particles} \tag{4.49}$$

The remaining 38.5 g of respirable particles in the glove box might not enter the room. If no excess pressure is generated by another heat or gas source, the particles will fall out or be transported into the glove box exhaust system. If excess pressure is generated, the expulsion gas via the opening is a function of the pressure drop across the openings (exhaust outlet, hole in a glove, etc.).

4.3.3.2 Secondary Sample Problems

Pressurized Release of Powders - Hand Calculations. A can of plutonium oxide converted from plutonium nitrate is stored in a can which has been taped shut. Due to incomplete conversion of nitrate to oxide, some of the nitrate remains in the can. Decomposition of the nitrate to NO_x gases and an increase in temperature increases the pressure past the failure point of the container. The can ruptures, releasing the built-up gases and some of the powder.

If the volume of the can is 1 ℓ and contains 500 g of powder with a theoretical density of 11 g/cm^3, the void space in the container is 1000 cm^3 - (500 g/11 g/cm^3) = 955 cm^3. The pressurizing gas (decomposition products) fill in the void spaces of the container. If the failure pressure is 15 psig (1.0 x 10^6 dyne/cm^2), the weight of these gases (assuming no increase in temperature) is calculated by scaling the gas density at the release temperature (325 K) by the release pressure divided by standard pressure and multiplying the scaled density by the void space. If the decomposition gas is primarily nitrogen with a density of 0.001 g/cm^3 at 325 K then the equation is

$$0.0011\ \text{g/cm}^3\ \frac{29.7\ \text{psig}}{14.7\ \text{psig}}\ 955\ \text{cm}^3 = 2.1\ \text{g} \qquad (4.50)$$

This weight is negligible compared to the weight of the powder. However, at higher release pressures, and for other pressurizing gases, the weight of the gas may be significant. Total mass of material pressurized in the can is 502 g. The initial velocity of the powder at release is calculated using Equation (4.34).

$$V_o = \left[\frac{2(1.0 \times 10^6 \text{ dyne/cm}^2)(955 \text{ cm}^3)}{502 \text{ g}}\left(\frac{1 \text{ g cm/s}^2}{1 \text{ dyne}}\right)\right]^{0.5} \quad (4.51)$$

$$= 1950 \text{ cm/s} \left(\frac{1 \text{ m}}{100 \text{ cm}}\right) = 1.5 \text{ m/s}$$

Ceiling height (distance to container barrier) is 3 m (10 ft). This scenario may be analyzed using Equation (4.33). For an initial velocity of 19.5 m/s the fraction airborne is

$$F = 1 \times 10^{-4} (19.5 \text{ m/s})^{1.4} = 0.0064 \quad (4.52)$$

Total release is (0.0064)(500 g) = 3.2 g PuO_2 powder.

The size distribution of airborne particles is characterized by an AMMD of 11.2 micron and σ_g of 6. As an upper bound, all 3.2 g are assumed to challenge the filters. As a lower bound, a dilution factor can be applied. See Section 4.4.3.1 for a sample problem in which a dilution factor is calculated.

Pressurized Release of Powders - Code Calculations. The scenario in the preceding sample problems can be analyzed using the PREL computer code. Pertinent input information is powder mass = 500 g, initial powder velocity = 19.5 m/s, release pressure = 15 psig, ceiling height = 3 m, and the release is upward vertical so the cosine of the angle is 1.0 Input to PREL is

EMO	VO	PRES	DELT	XMAX	GSOS	NPRINT
0.500 kg	19.5 m/s	15 psig	0.005 s	3.0 m	1.0	5

The resulting output is shown in Table 4.17. As in the previous problem, the aerosols have an AMMD of 11.2 micron and a σ_g of 6.

4.3.3.3 Pressurized Release of Liquids

Flashing sprays are one type of liquid pressurized release. Subsection 4.2.3.2 is a flashing spray sample problem and uses Equation (4.35) to determine the fraction airborne. If the analyst has access to an evaporation/setting code, or wants to account for partial depletion mechanisms in the

TABLE 4.17. Output from PREL for Sample Problem on Pressurized Release of Powders

MASS (KG) = 0.5000 VO(M/S) = 19.50 PRES (PSIG) = 15.00
DELT(S) = 0.0050 XMAX(M) - 3.00 NPRINT = 5

T(S) = 0.025	X2(M) = 0.48	V2(M/S) = 19.16	MASS AB (G) = 0.109
T(S) = 0.050	X2(M) = 0.96	V2(M/S) = 18.64	MASS AB (G) = 0.273
T(S) = 0.075	X2(M) = 1.42	V2(M/S) = 17.92	MASS AB (G) = 0.482
T(S) = 0.100	X2(M) = 1.86	V2(M/S) = 16.98	MASS AB (G) = 0.702
T(S) = 0.125	X2(M) = 2.27	V2(M/S) = 15.88	MASS AB (G) = 0.895
T(S) = 0.150	X2(M) = 2.66	V2(M/S) = 14.68	MASS AB (G) = 1.034
T(S) = 0.175	X2(M) = 3.01	V2(M/S) = 13.46	MASS AB (G) = 1.110
T(S) = 0.175	X2(M) - 3.01	V2(M/S) = 13.46	MASS AB (G) = 0.000

TOTAL AIRBORNE (G) = 4.60 PERCENT AB = 0.9210

T = time, s
X2 = distance, m
V2 = velocity, m/s
MASSAB = mass airborne, g

compartment separately, Equation (4.36) should be used. For a mole fraction of vapor flashed of 0.13 (see Section 4.2.3.2) the fraction airborne is:

$$F = 0.33\ (0.13)^{0.91} = 0.0515 \qquad (4.53)$$

Thus, a slightly more conservative value than that produced by using Equation (4.26) of 5.2% airborne is used to obtain the source term mass. Table 4.15 lists the AMMD and σ_g from flashing spray releases at the source (before evaporation and settling take place) as 21.0 microns and 3.0, respectively.

4.4 SPILLS

Although spills are generally considered a low energy event compared to the other accidents covered in this document, they may occur through human error or as a side effect of fires, explosions, tornadoes, and equipment failures. Therefore, methods for source term evaluation from spills must be covered to provide a complete range of accident conditions. The mechanisms of release for spills depends on the type of material spilled. Powders behave differently than liquids, and slurries tend to behave more like liquids then powders producing aerosols from free falls spills. This section describes three methods of calculating mass airborne from spills in static air: a computer code for freefall spills of powders, hand calculations for powder spills, and hand calculations for liquid (and slurry) spills. Ballinger et al. (1987) describes these methods in more detail. Sample spill problems are also presented in this section to illustrate use of the calculational methods.

4.4.1 Scenario Considerations

Spill energy is the single most important factor in determining the magnitude of release. Spill height determines the amount of gravitational energy available to break up and rebound particles on impact. Height also influences the amount of time source material is exposed to shear forces during the fall. These forces work to break off particles from a falling stream.

Properties of the source material such as density and viscosity are an indication of the cohesive forces holding the material together. At higher viscosities, the cohesive force is stronger than drag forces acting on the falling mass. Consequently, fewer particles are sheared off and made airborne. Less dense materials have more volume per unit weight, increasing the potential for aerodynamic entrainment by air flowing past and for resistance of air to displacement by the falling particles.

Air (or other gaseous mediums through which source material is falling) has properties which also influence the source term. As density and viscosity of air decreases, less resistance is applied to falling particles. Therefore, fraction airborne decreases with air density and viscosity.

Other factors, such as spill orientation, spill rate, initial material dispersion, properties of the surface on which material is spilled, airflow rate, and projections interrupting the spill may influence the source term. However, these factors, and extreme cases such as continuous spills and spills from extreme heights are not considered in present models since information on these areas is scarce or nonexistent. Table 4.18 lists the required input for calculating source term release from spills.

4.4.2 Calculational Techniques Illustrated

Three methods are presented for calculating the mass airborne and particle sizes of aerosols generated from spills: hand calculations for powder spills, a computer code for free fall spill of powders, and hand calculations for liquid spills.

4.4.2.1 Powder Spills - Hand Calculations

A simple regression of the powder spill data reported in Sutter, Johnston and Mishima (1981) and Ballinger et al. (1987) provide an equation for hand calculating mass release from powder spills. The relationship giving the highest correlation coefficient (r^2) is

$$\log\ (\text{mass airborne}) = -8 + 1.0\ \log\left(\frac{M_o H^2}{\rho_p}\right) \tag{4.64}$$

where mass airborne = grams

M_o = mass spilled, g

H = spill height, cm

ρ_p = powder bulk density, g/cm^3

TABLE 4.18. Input Requirements to Estimate Source Term Release from Spills

	Powder Code	Powder-Hand	Liq-Hand
Spill height	✓	✓	✓
Solution viscosity			✓
Radioactive material density	✓	✓	✓
Spill mass	✓	✓	✓
Air density	✓		✓
Air viscosity	✓		
Spill volume			✓

The correlation coefficient for this equation was 78.0%. Figure 4.8 shows the data with a regression line drawn through it. This equation can be rearranged to

$$\text{Fraction airborne} = 1 \times 10^{-8} \frac{H^2}{\rho_p} \tag{4.55}$$

Therefore, the fraction airborne depends only on the height of the spill and bulk density of the powder. If a range of values is given for the mass spilled, then fraction airborne multiplied by an upper and lower bound of mass spilled gives a range for mass airborne, or fraction airborne can be multiplied by a single estimate of material at risk in a spill.

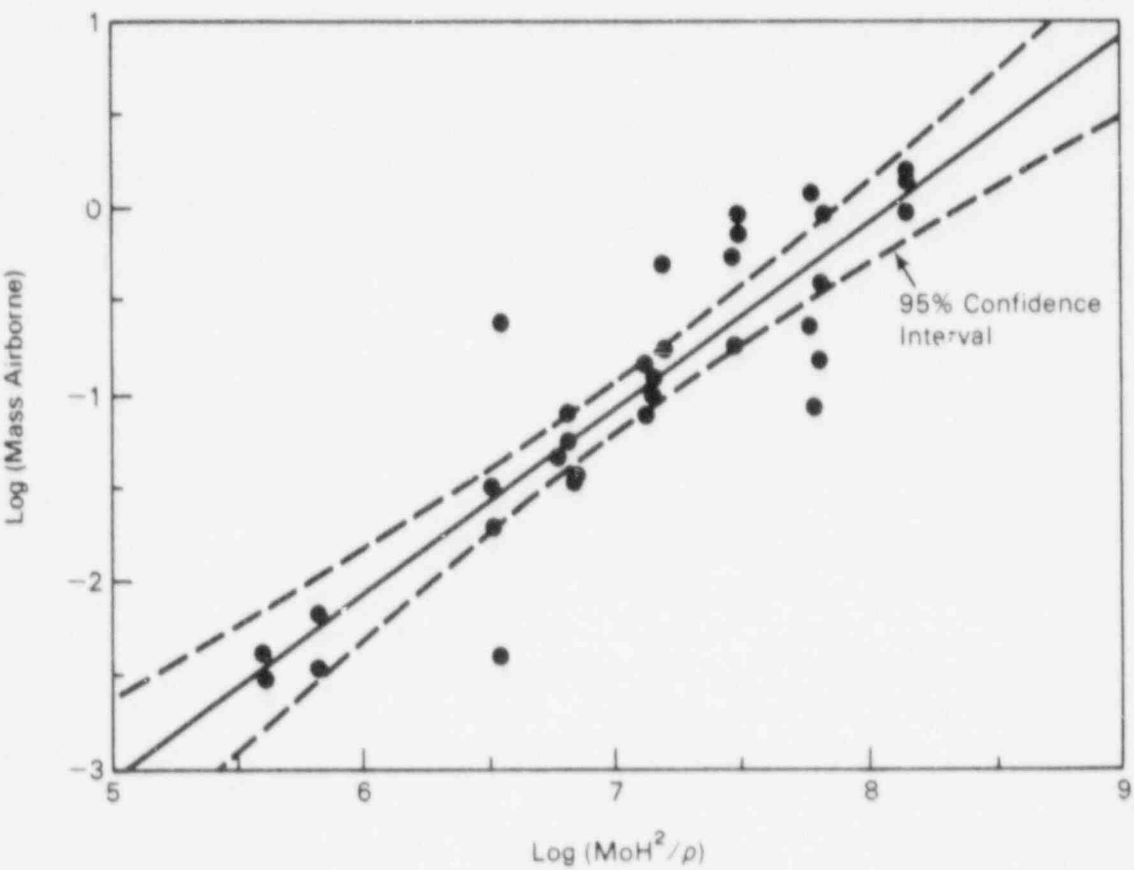

FIGURE 4.8. Mass Airborne vs Spill Parameters for Powder Spills

For hand calculations, the release can be assumed to occur in a puff. In actuality, the release may be spread over a small increment of time (less than one second). A conservative value (upper bound) of mass airborne to the filters from a puff release can be computed using the equation just given. A lower bound can be calculated for larger rooms with high flow rates using the dilution factor shown in the next section. Particle depletion mechanisms applicable to specific scenarios must be evaluated on a case-by-case basis. Particle size calculations are the same as that shown in the following subsection.

Powder Spill - Computer Code Calculations. The code for powder spills should be used in place of hand calculations if a more refined estimate and rate of particles grade airborne is desired. The mechanisms that contribute to the generation of airborne-respirable dust during a powder spill are a shearing off of particles from the main powder mass as it falls, and a breakup and rebounding of particles on impact with the stopping surface. Since the amount airborne from the two mechanisms are difficult to separate and measure experimentally, they have been combined in the present powder spill model code. This code (PSPILL), described in Ballinger et al. (1987) simulates the falling of powders through air. The bulk material is assumed to form a ball that grows at a constant rate as it descends. Diameter and velocity of the powder front is calculated at each timestep specified by the user. Fraction airborne is assumed to be proportional to the drag force on the powder front. The proportionality factor, determined empirically based on experiments performed at PNL (Sutter, Johnston and Mishima 1981) is a function of a combination of two dimensionless numbers, the Reynolds (Re) and Froude (Fr) numbers. This combination Re^2/Fr is also known as the Galileo number.

Inputs to the code are the mass of powder spilled, spill height, powder bulk density, density and viscosity of air (or other gaseous medium through which the powder falls), and timestep. For each timestep, the time, distance fallen, velocity of the powder front, and mass airborne for that timestep are output. At the end of the run, the total and percent mass airborne are output for the entire spill. A listing of the code and description of how to use it are given in Ballinger et al. (1987).

Because the code is based on experiments reported by Sutter, Johnston and Mishima (1981), it can be applied to free fall spills of powder in static air. For small rooms such as the Radioactive Aerosol Release Tank that is 20 m^3, the mass rate of particles made airborne is the rate of particles to the exit vents. However, most accident scenarios will involve larger rooms and significant airflow. In these cases, particles may become dispersed throughout the room and may settle or become attached to surfaces in the compartments through some of the particle depletion mechanisms listed in Table 4.1.

The mass rate of particles to the filters can be bounded by upper and lower estimates. The upper estimate is the mass rate of material generated at the source as predicted by the powder spill code. The lower estimate involves calculating an exponential dilution factor based on room volume and airflow rate and applying it to the computer output. It may be lower still if fresh air mixing is poor. This is often expressed with a mixing factor <1 in the numerator of the exponential. The following equation shows how to calculate the exponential dilution:

$$M = M_0 e^{-ft/v} \qquad (4.56)$$

where M = mass airborne at time t (g)

M_0 = initial mass airborne, g

f = flow rate, m^3/s

t = time, s

v = room volume, m^3

The dilution factor should be applied to the total mass airborne for the entire spill since the spill generally occurs within one second. Section 4.4.3.1 is a sample problem showing the use of this method. Particle depletion mechanisms may also lower the mass airborne. However, these must be evaluated on a case by case basis. To obtain a concentration of airborne particles to the filter, the mass airborne at each timestep can be divided by the volumetric airflow to the filter during that same time. The average mass median diameter (aerodynamic equivalent) can be calculated using an empirical correlation (Ballinger et al. 1987). This equation is

$$\text{AMMD (micron)} = 12.1 - 3.29\ \rho_p + 7540\ F \qquad (4.57)$$

where ρ_p = powder bulk density, g/cm^3
F = fraction airborne

The geometric standard deviation was 3.73 for DUO aerosols and 5.6 for TiO_2 aerosols. The average of both powders gave a σ_g of 4.82; this is the recommended value of σ_g to use for powder spills.

4.4.2.2 Liquid Spills - Hand Calculations

Methods for predicting the amount airborne from liquid spills (including high viscosity liquids and slurries) have been developed by Ballinger et al. (1987). Based on data from PNL experiments (Sutter, Johnston and Mishima 1981, Ballinger and Hodgson 1986), the following equations were derived:

$$F = 2.3 \times 10^{-5}\ \text{Arch}^{0.44} \left(\frac{\rho_{air}}{\rho_{liq}}\right)^{2.37} \text{Fr}^{0.38} \qquad (4.58)$$

for the original measured data

$$F = 6.31 \times 10^{-6}\ \text{Arch}^{0.45} \left(\frac{\rho_{air}}{\rho_{liq}}\right)^{2.2} \text{Fr}^{0.35} \qquad (4.59)$$

for the evaporation/settling corrected data.

where F = fraction airborne, dimensionless
ρ_{air} = air density, g/cm^3
ρ_{liq} = solution density, g/cm^3
Arch = Archimedes Number = $\rho_{liq}{}^2 h^3 g/\mu^2$
h = spill height, cm

g = gravity constant, cm/s^2

μ = solution viscosity, poise

Fr = Froude Number = V^2/gR

V = impact velocity = $\sqrt{2gh}$, cm/s

R = radius of liquid drop = $\left(\frac{3}{4}\pi\,Vol\right)^{1/3}$

Vol = volume of solution, cm^3

If the analyst is evaluating evaporation, settling, and other particle depletion mechanisms for the specific scenario, the second equation should be used. To obtain this equation, the source term data were back calculated using a code developed specifically for this purpose and described in Ballinger et al. (1987). If the user does not wish to evaluate particle depletion on a case by case basis, the first equation can be applied.

As for powder spills, the release is assumed to occur in a puff and can be given an upper estimate using the equations for fraction airborne at the source. The dilution factor, shown in Section 4.4.3.1, can be used to evaluate dispersion of the material throughout the room for large airflows with vigorous mixing. A lower bound is given using the dilution factor.

The size of airborne particles depends on properties of the solution spilled. Table 4.19 gives the AMMD and σ_g for various solutions. Properties of these solutions are also given. Properties of the solution for a given scenario should be compared to Table 4.19. The AMMD and σ_g for the solution most similar to the spilled solution should be used. If an evaporation/settling code is used, the evaporation/settling corrected data in the table should be applied. Otherwise, the original measured data should be used. If properties of the spilled solution are unknown or do not closely match any of the solutions, then the AMMD and σ_g for all data should be used.

For slurry spills, the following equations may be used to estimate the AMMD of source term particles

$$\text{AMMD}, \mu m = 4.0 \times 10^{-15} \frac{We^{3.2}}{Re^{0.25}} \text{ for measured data} \qquad (4.60)$$

TABLE 4.19. Size Distribution of Aerosols Produced by Liquid and Slurry Spills

	ρ, g/cc	μ, cp	Original Measured Data AMMD, micron	σ_g	Evaporation/ Settling Corrected AMMD, micron	σ_g
All data			8.9	5.4	21.5	7.3
UNH	1.6	3.1	20.1	4.5	27.2	6.0
Uranine	0.9	1.5	7.3	2.9	27.1	3.0
Sucrose Solutions	1.0-1.3	1.3-47.1	3.4	8.5	12.5	12.3
Slurries	1.2-1.4[a]	1.3-3.1[a]	3.1	6.7	15.8	10.1

(a) Properties of the carrying solution.

$$\text{AMMD}, \mu m = 2.3 \times 10^{-8} \frac{We^{1.9}}{Re^{0.16}} \text{ for evaporation/settling corrected data} \quad (4.61)$$

where We = Weber number = $\rho_\ell \frac{DV^2}{\gamma}$ and Re = Reynolds number $= \rho_\ell \frac{DV}{\mu}$

ρ_ℓ = liquid density, g/cm^3

D = diameter = $(\frac{6}{\pi} \text{Vol})^{1/3}$

Vol = liquid volume

V = velocity = $\sqrt{2gh}$

g = gravity constant, cm/s^2

h = spill height, cm

γ = liquid surface tension, dyne/cm

μ = solution viscosity, poise

4.4.3 Sample Problems

4.4.3.1 Secondary Sample Problems

Powder Spill - Using Hand Calculations. A 1-kg container of radioactive powder is spilled from a height of 1.5 m. The bulk density of the powder is 1 g/m^3. Without the aid of the computer code PSPILL, the above scenario can be analyzed using Equation (4.55).

$$\text{Fraction airborne} = 1 \times 10^{-8} \frac{H^2}{\rho_p} \quad (4.62)$$

$$= 1 \times 10^{-8} \frac{(1.50\ \text{cm})^2}{(1.0\ \text{g/cm}^3)} = 0.0002$$

$$\text{Mass airborne} = (0.0002)(1000\ \text{g}) = 0.225\ \text{g} \quad (4.63)$$

The hand calculations give a more conservative estimate of mass airborne for this scenario than computer calculations. The release is assumed to occur in one second. The upper bound concentration of radioactive powder released in one second from the "simple" facility is 0.225 g (0.08 m^3) = 2.8 g/m^3.

Equation (4.57) can be used to calculate the AMMD of the airborne particles.

$$\text{AMMD (micron)} = 12.1 - 3.29(1.0) + 7540(2.0E\text{-}4) \quad (4.64)$$
$$= 10.3\ \text{micron}$$

If the powder characteristics are assumed similar to DUO, σg = 3.73. For unknown powder characteristics σg = 4.82.

<u>Powder Spill - Using Computer Code</u>. A 1-kg container of radioactive powder is spilled from a height of 1.5 m. The bulk density of the powder is 1 g/cm^3. The density and viscosity of air (300 K) is 1.18 kg/m^3 and 1.85 x 10^{-5} Pa•s, respectively (Welty, Wicks and Wilson 1976). A timestep of 0.01 seconds is chosen for the code PSPILL and the user desires a printout every five timesteps. Input to PSPILL is

M_o	H	ρ	ρ_a	Ma	Δt	N
1.0,	1.5,	1000.0,	1.18,	1.85E-5,	0.01,	5

Output for this problem is shown in Table 4.20.

TABLE 4.20. Output from Powder Spill Problem

MASS(KG) = 1.00000 H(M) = 1.50 BULKD(KG/M3) = 10000.00
RHO AIR(KG/M3) = 1.1[illegible] VISC AIR(PA*S) = 0.1850E-04 DELT = 0.0100

Time, s	Dist, m	Vel, m/s	Rad AB, mg
0.050	0.015	0.588	0.025
0.100	0.054	1.078	0.165
0.150	0.118	1.567	0.[illegible]20
0.200	0.206	2.056	1.288
0.250	0.318	2.543	2.837
0.300	0.455	3.027	[illegible].787
0.350	0.616	3.505	11.113
0.400	0.801	3.974	20.241
0.450	1.009	4.428	35.112
0.500	1.239	4.860	50.540
0.550	1.[illegible]90	5.273	42.025
0.560	1.543	5.352	10.831

Total Rad AB(MG) = 180.49

Percent airborne at the source is (0.18 g/1000 g) × 100 = 0.018. As an upper bound, the code output is the mass rate of radioactive powder to the filters. For a 28.3 m^3 (1000 ft^3) room with an airflow rate of 10 air changes per hour the volumetric flow rate is 0.08 m^3/s. With this high of a flow rate, however, some mixing would take place. Assuming the particles are well mixed in the compartment, the dilution factor is

$$C = C_o e^{-ft/v} = C_o e^{-\frac{0.08\ t}{28.3}} = C_o e^{-0.0028\ t} \quad (4.65)$$

$$C_o = \frac{0.18\ g}{0.56\ s} \frac{1}{(0.08\ m^3/s)} = 4\ g/m^3 \quad (4.66)$$

The concentration for the first 10 minutes is shown in Figure 4.9. Use of the dilution factor distributes the source term over time considerably for this case.

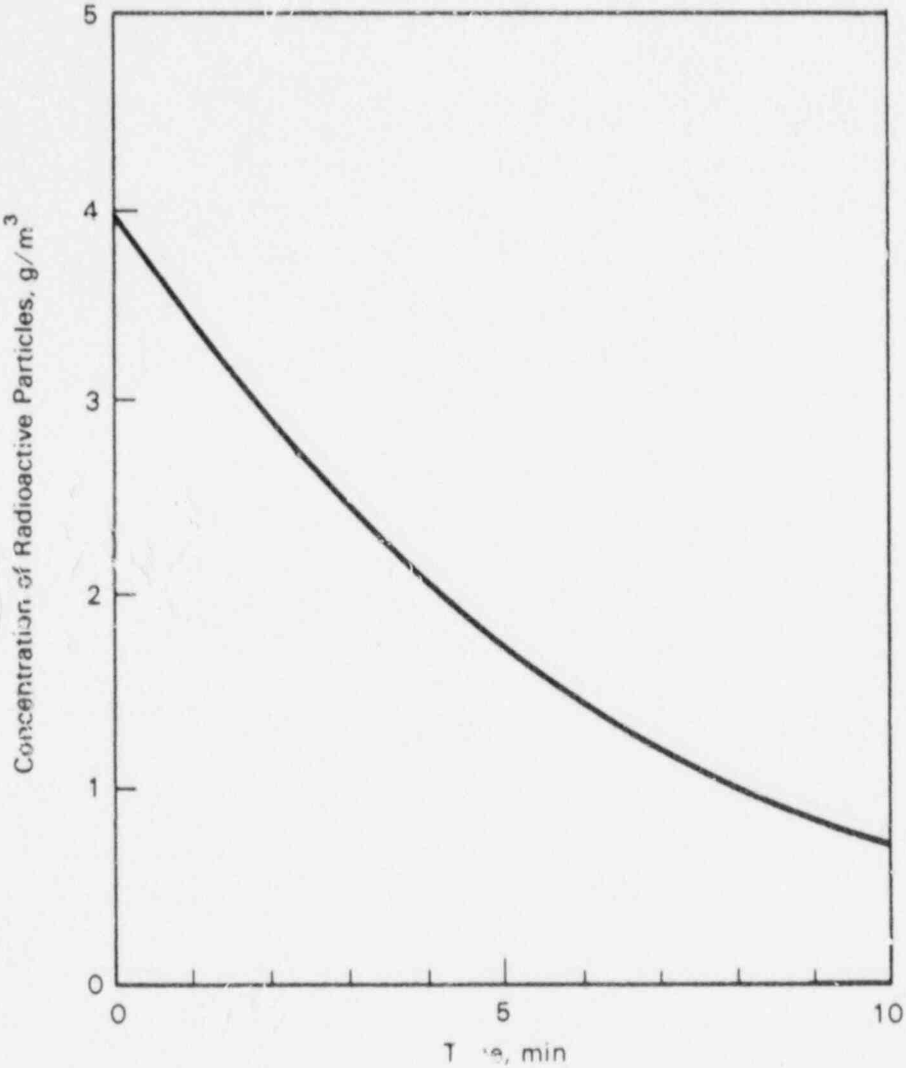

FIGURE 4.9. Concentration of Radioactive Particles to the Outlet Filter from a Powder Spill

Equation (4.37) can be used to calculate the AMMD of the airborne particles.

$$\text{AMMD (micron)} = 12.1 - 3.29(1.0) + 7540(1.8E\text{-}4) \qquad (4.67)$$

$$= 7.5 \text{ micron}$$

If the powder characteristics are assumed similar to DUO, σ_g = 3.73. For unknown powder characteristics σ_g = 4.82.

Liquid Spill. A container holding 5 kg of plutonium nitrate is assumed to fail, spilling the solution 3 m onto the floor. Solution density and viscosity are 1.6 g/cm^3 and 3.1 cp respectively. Therefore, volume of liquid is 5000 g/(1.6 g/cm^3) = 3125 cm^3. Air density is 0.00118 g/cm^3. The Archimedes number is

$$\text{Arch} = \frac{\rho_\ell^2 \, h^3 g}{\mu^2} = \frac{(1.6 \text{ g/cm}^3)^2 (300 \text{ cm})^3 (981 \text{ cm/s}^2)}{0.031 \text{ poise}} \; \frac{1 \text{ poise}}{1 \text{ g/cm s}} \tag{4.68}$$

$$= 2.19 \times 10^{12} \text{ (dimensionless)}$$

The Froude number is

$$\text{Fr} = \frac{V^2}{gR} = \frac{2 \text{ g h}}{g \left(\frac{3}{4} \pi \text{ Vol}\right)^{1/3}} = \frac{2 \; (300 \text{ cm})}{\left(\frac{3}{4} \pi \; 3125 \text{ cm}^3\right)^{1/3}} = 66 \text{ (dimensionless)} \tag{4.69}$$

Without the use of an evaporation/settling code, the fraction airborne is determined by

$$F = 2.3 \times 10^{-5} \text{ Arch}^{0.44} \frac{\rho_{air}}{\rho_{liq}} \text{Fr}^{0.38} \tag{4.70}$$

$$= 2.3 \times 10^{-5} \left(2.19 \times 10^{12}\right)^{0.44} \left(\frac{0.00118 \text{ g/cm}^3}{1.6 \text{ g/cm}^3}\right)^{2.37} (66)^{0.38}$$

$$= 1.15 \times 10^{-6}$$

$$\text{mass airborne} = (1.15 \times 10^{-6})(5000 \text{ g}) = 0.0057 \text{ g} \tag{4.71}$$

The release is assumed to occur in one second. An upper bound release concentration assuming 0.08 m^3/s airflow is

$$\frac{0.0057\ g/s}{0.08\ m^3/s} = 0.07\ g/m^3 \text{ in one second} \tag{4.72}$$

An expotential dilution factor gives a lower bound release. Assuming the particles become well mixed in the same compartment as in the previous two examples, the lower bound release rate is calculated by

$$C = 0.07\ g/m^3\ e^{-0.0028t} \tag{4.73}$$

where t = time, s

If an evaporation/settling code is available and the user wants to take advantage of the specifics of his compartment, then the source term is

$$F = 6.31 \times 10^{-6}\ (2.19 \times 10^{12})^{0.45} \left(\frac{0.00118\ g/cm^3}{1.6\ g/cm^3}\right)^{2.2} (66)^{0.35} \tag{4.74}$$

$$= 1.26 \times 10^{-6}$$

$$\text{mass airborne} = (1.26 \times 10^{-6})(5000\ g) = 0.0063\ g \tag{4.75}$$

Since the material is similar to UNH in density and viscosity, the AMMD and σ_g for the source term without the use of an evaporation/settling code is 20.1 and 5.4, respectively. With use of a code, AMMD and σ_g for the aerosol of the source are predicted to be 27.2 and 6.0, respectively.

4.5 TORNADOES

The potential mechanisms that could result in the airborne release of radioactive materials contained in a nuclear grade facility are bounded by the response of the facility to the tornado. If the tornado induced stresses do not result in the failure of the structure, the quantity of material at risk and the mechanisms that could result in airborne release are limited. Structural analysis can be a valuable technique to define the extent and type of damage. If the structure is compromised, much more (but not necessarily all) of the radioactive materials may be at risk and the types of mechanisms that could impact the materials are more energetic. Many nuclear facilities in areas with significant potential for tornadoes are connected to the National Weather Service tornado watch and have procedures to confine radioactive materials exposed during processing upon receiving a tornado alert.

The estimation of the potential airborne releases from a tornado resulting in damage to the facilities (less than a catastrophic failure of the facility) are covered here. The potential airborne release from a catastrophic failure of the facility is not considered here although most of the mechanisms that could result in airborne release are covered in this chapter.

Two mechanisms for airborne release are covered in detail in this section: aerodynamic entrainment of thick beds of powders and fragmentation of a brittle solid by crush-impact. Independent computer codes have not been developed for these mechanisms and only hand calculations are presented.

4.5.1 Scenario Considerations

Tornadoes can impose high differential static and dynamic pressures upon facilities and openings from the facility. For nuclear grade facilities, the response of some of the ventilation and exhaust systems are covered in Andrae et al. (1985). The principal response that could lead to the airborne release of radioactive materials are high transient flows and unusual differential pressures for various components of the facility. Two openings (air inlet and exhaust) can provide filtered pathways for air into and out of the facility. If the high velocity air or the negative pressure induced in the funnel portion of a tornado impacts either of these openings directly, high transient flow could be induced in the ventilation and exhaust system. The negative pressure is found in the core of the funnel and is oriented in a vertical fashion (Fujita 1978). The high velocity air is found in the vortices of the tornado and is parallel to the surface (Fujita 1978). To be directly impacted, the negative pressure and high velocity air should impact the openings (stack or air intakes) directly and not tangentially.

High transient flows within components of the ventilation and exhaust systems of a facility can result in aerodynamic entrainment of powders from thick beds and the dislocation of particles deposited on flexible surfaces caused by flexing. High transient flows or unusual differential pressures could result in the failure of structural features or equipment within the structure. Mechanisms that could result in the generation of airborne particulate material from such events would be the fragmentation of brittle solids by crush-impact from falling heavy objects and the fracture of brittle containers leading to a free fall spill of their contents. Two mechanisms (aerodynamic entrainment of powders from thick beds and fragmentation of brittle solids due to crush-impact) will be covered below in detail. Information on the other two mechanisms has been provided in previous sections of this chapter.

4.5.2 Calculational Techniques Illustrated

4.5.2.1 Aerodynamic Entrainment of Powders from Thick Beds

The calculational techniques used here are based upon the method for aerodynamic entrainment described by Martin et al. (1983). The required input for calculation techniques is shown in Table 4.21. Gases passing over a surface create a friction velocity as they near the surface. The friction velocity places a stress upon the individual particles in a homogeneous bed and, at a given level, causes particles of a "favored" size to begin to move (roll). As the particles move, they strike other particles of other sizes resulting in movement of the impacted particles. If the particles strike an obstruction, the particle can hop (saltation) and result in movement or suspension of the

TABLE 4.21. Required Input for Calculational Techniques

- Aerodynamic Entrainment of Powders from Thick Beds:

  bulk velocity, U, exceeds threshold friction velocity for suspension of particles as shown in Figure 4.10 (374 cm/s)

- Fragmentation of Brittle Solids by Crush-Impact:

  Effective Energy Density (ED) = Effective Impact Energy (ergs)/volume of material affected (cm^3)

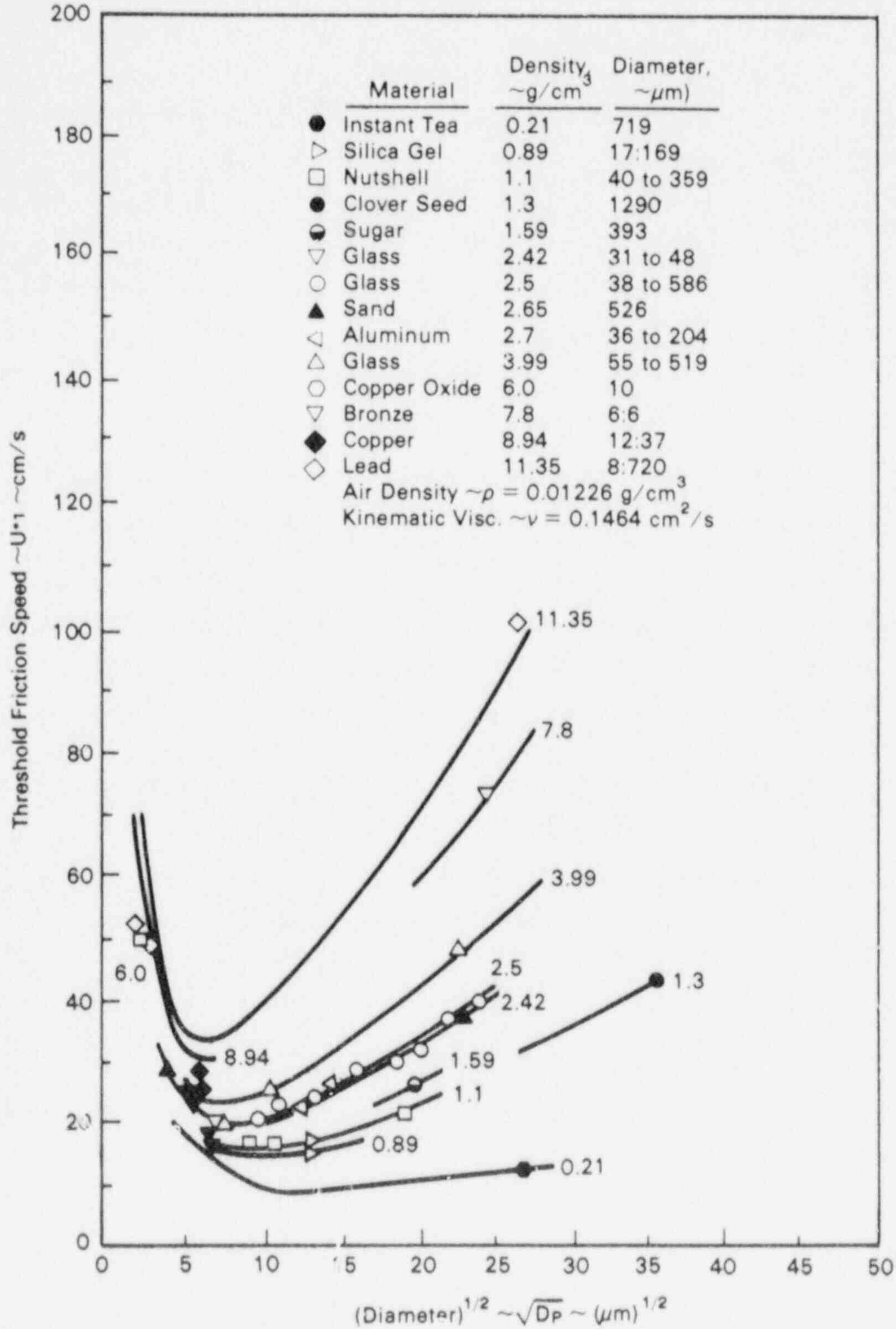

FIGURE 4.10. Particulate Threshold Friction Speed

particles impacted. Larger particles tend to continue to roll (surface creep) while smaller particles become entrained in the ambient airflow upon suspension.

Figure 4.10 is a plot of experimentally measured friction speeds required to initiate movement in a variety of thick beds of materials. The plot correlates the square root of the particle diameter (geometric) versus the threshold friction speed (velocity necessary to initiate movement of particles). For materials with a variety of densities, the threshold friction velocity required to initiate movement has been calculated by Martin et al. (1983) to be 22 cm/s.

Martin et al. (1983) developed a computer code based on these data. The basic equation relating the bulk and friction velocity is:

$$U(y)/U_\star = (1/k) \ln (y/y_0) \qquad (4.76)$$

where $U(y)$ = bulk velocity at some distance y from surface,
$U_\star$ = friction velocity,
k = Von Karmen constant = 0.40,
y_0 = roughness length = R/30, and,
R = average surface roughness height

Assuming a boundary layer thickness, y, of 10 cm and a roughness length, y_0, of 0.0104 cm, then

$$U_\star = U/17.2 \qquad (4.77)$$

The corresponding bulk velocity required to initiate particle movement is 374 cm/s.

The code for material transport calculates a suspension flux. For hand calculations, it is assumed that all the material in the inhalable size range [10 micrometers Aerodynamic Equivalent Diameter (AED) and less] could remain suspended following ejection from the surface and would reach the exhaust ducts.

The material at risk would be powders exposed to the air velocity. Powders in uncapped containers could conservatively be assumed to be exposed although, in reality, their surfaces are only exposed to some component of the air passing over the opening. Powders in shallow trays or on flat surfaces would definitely be at risk. The size of particles that remain suspended is a function of the velocity of the turbulent eddies present. Since the acute radiological concern for particulate materials is internal deposition, the particles that can be transported some distance from their point of emission from the facility and be taken into the respiratory system of humans is the principal concern. These are conservatively estimated to be particles 10 micrometers AED and less and that a fraction of the powder at risk can be used in estimating the airborne release (ICRP 1978).

Other factors that could modify the airborne release by aerodynamic entrainment are:

- aerodynamic entrainment vs time: Martin et al. (1983, pp. 19 & 20) present formulae to calculate the mass release with time. The formulae contain empirical coefficients and the units for various parameters are not stated. Due to the uncertainty in units, it is not recommended that the formulae be used for hand calculations and estimates of particle suspension as a function of time should be performed by the subroutine for material suspension in TORAC. If bulk flow is assumed, the airborne concentration could be estimated by assuming the airborne material is suspended in the volume between the point of origin and the exhaust outlet. The release to the exhaust system is this concentration times the exhaust flow. If the particles generated are well mixed in the total volume of the compartment (turbulent not laminar conditions within the compartment), the release to the exhaust system could be assumed to be exponential and the mass release to the exhaust will decrease with time.

- particle depletion mechanisms in compartments prior to release to exhaust system: standard formulae could be used to calculate the loss of airborne particles during the transit through the facility. Due to conditions, most mechanisms (e.g., gravitational settling, turbulent and Brownian diffusion) do not appear to have a significant effect on airborne particle concentrations during transit through the "simple" compartment under tornado generated conditions. For instance, at a volumetric flow of 4700 cfm, the particles would remain in a 10 ft X 10 ft compartment for less than 2 min assuming no mixing (a reasonable assumption at these low velocities). The settling velocity of a particle 10 micrometers AED is approximately 0.01 ft/s or 0.0002 ft/min. Thus, particles must be approximately 0.004 in. from the floor to settle out during transit through the compartment. Gravitational settling would not be a serious consideration for particles airborne in the "simple" facility at the calculated velocities predicted for tornadoes. If other types of flows or compartment sizes are used, each system should be evaluated to determine if particle depletion mechanisms could have a significant effect upon particle concentration.

- exponential dilution vs bulk flow: as explained above, bulk flow of particles from their point of release to the exhaust outlet appears to be a more reasonable assumption for tornado generated conditions within the "simple" compartment (10 ft X 10 ft X 10 ft) used for these studies. Each system should be evaluated independently and, if warranted, exponential dilution could be assumed if appropriate. If exponential dilution is assumed, a decreasing airborne release to the exhaust as a function of time would be calculated.

4.5.2.2 Fragmentation of Brittle Solids Due to Crush-Impact

The calculational technique used to estimate the fragmentation of brittle solids by crush-impact is that described by Jardine et al. (1982). Various brittle materials (e.g., glass, ceramics, aggregate) were subjected to a range of crush-impact forces. The ratio of actual energy dissapated in brittle fracture to the crush-impact energy applied was approximately 1:2. The empirical fracture-surface energy relationship was nearly constant at 77 J/m^2 (7.7 E+8 ergs) over a 24-fold range of energy densities. At low energy densities (10 J/cm^3 or less), the fraction of fines [less than 10 micrometers

Geometric Diameter (GD)] indicate a relatively uniform response for all materials. Impact tests at higher energy densities (140 J/cm^3) indicate a difference between glasses and ceramics. Aggregates were not tested. The fraction of "fines" generated as a function of Effective Energy Density per unit volume for the two types of material is shown in Figure 4.11.

The crush-impact energy applied can be calculated by:

$$E = mgh \tag{4.78}$$

where E = crush-impact energy, ergs
m = effective mass impacting the object, g
g = gravitational acceleration, 981.5 cm/s^2
h = distance traveled by impacting mass, cm

The Effective Crush-Impact Energy is considered to be 0.5 times the crush-impact energy applied for objects resting on an unyielding surface.

The quantity of material involved will be a part of the scenario postulated. The fraction of material impacted by the falling/flying object will be the material affected. If a surface impacting a brittle solid is of a lesser dimension than the surface impacted, only the volume under the impacting surface should be considered involved.

The fraction of the brittle solid fragmented into "fines" (particle 10 micrometers GD and less) is taken from Figure 4.11 for glasses and ceramic materials. The "fines" fraction is equivalent to the "respirable" fraction for materials with a theoretic density near 1.0 g/cm^3. For materials of other densities, the "respirable" fraction could be determined by assuming a Geometric Standard Deviation and simulating a size distribution based upon AED. The ratio between the "fines" and "respirable" fraction by this method would be used to adjust the fraction of fragments generated for the "respirable" fraction.

It is "conservatively" assumed that all "fines" generated become airborne as a result of the local airflows induced by the impact. The assumption is not unreasonable for fairly large, flat objects because of the pressurization of

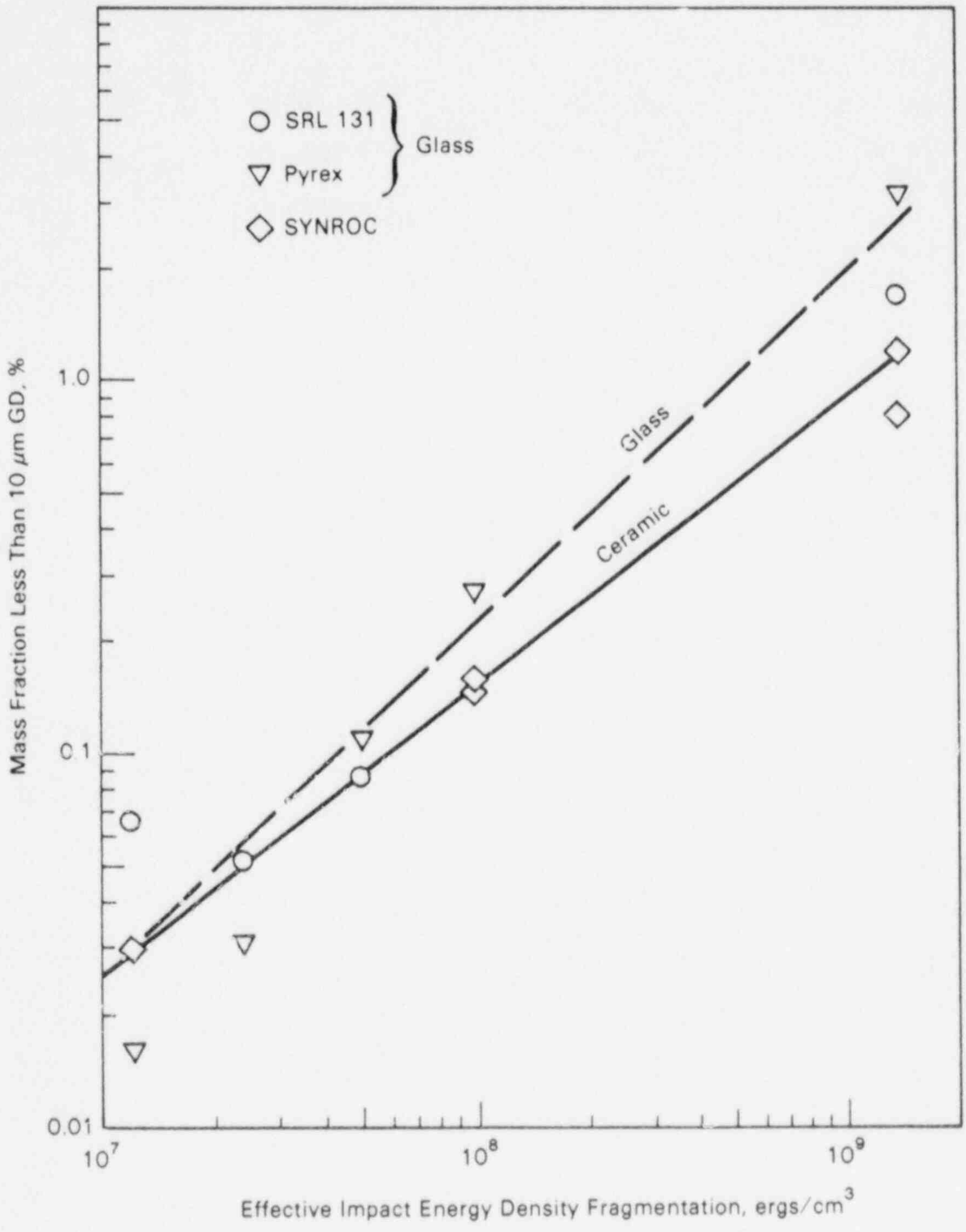

FIGURE 4.11. Effective Impact Energy Density Fragmentation

the air in front of the object. As the impacting object becomes smaller and more streamlined (cuts through the air rather than push the air under it) or the impact energy decreases, the local airflows induced decrease and may not be sufficient to suspend the larger particles generated. However, the tornado itself may induce velocities that could result in the suspension of the "fines."

All particles airborne are assumed to be mixed with the ambient atmosphere around the point of origin. The volume in which the particles airborne are mixed is a function of the local airflows. For very energetic events that induce high airflow, mixing with the entire volume of the compartment is a reasonable assumption. Many events will not generate such airflows and the volume of air in which the particles are dispersed is limited. The volume could be the volume between the point of origin and the exhaust outlet from the compartment.

Other factors that could influence the airborne release by brittle fracture of a solid by crush-impact are:

- Potential variation of strength of materials as a result of age: the tensile strength of materials could deteriorate or increase with age. A generalized formula is given in Jardine et al. (1982) that contains empirical coefficients for impact strength of the material. The other term, the relationship between maximum impact energy and the energy available to create new surface area, was determined in the study. If the impact strength of the material has been experimentally determined (in the units necessary), the new surface area created could be determined. Other data in Jardine et al. (1982) (the size distribution of the fragments) could then be used to determine the fragmentation of the aged or other materials.
- Fragmentation/subdivision mechanisms prior to impact (e.g., thermal cycling, oxidation, others): data indicates that uranium dioxide fuel pellets can be fragmented by other mechanism (e.g., thermal cycling, oxidation) during irradiation (Gilbert, White and Knox 1985; Haberman 1985; Rausch 1984). The size distribution of the fragments for uranium dioxide pellets irradiated to 6000 MWd/MTU is shown in

Figures 4.12 and 4.13. A limited distribution for uranium dioxide fuel pellets irradiated to 30,000 MWd/MTU is shown in Table 4.22. Preexisting particles must be added to the potential airborne release from brittle fracture by crush-impact.

- Other factors that could modify fragmentation: Baker (1977) found variation in the fragments generated by impact from plutonium-238 dioxide pellets as a function of density and prior impact (see Table 4.23). These data could be used to adjust the potential airborne release by brittle fracture caused by crush-impact for this material under these conditions.
- Brittle solids not resting on an unyielding surface: if the solid impacted is not resting upon an unyielding surface, the relationship between maximum impact energy and impact energy available to generate new surface areas determined in Jardine et al. (1982) are not valid. If the scenario includes such situations, assuming the values by use of Jardine et al (1982) data would be "conservative" (tend to overestimate the fragmentation). If values can be determined to adjust the maximum impact energy (determine the energy absorbed by the substrate), the adjusted maximum impact energy applied to the brittle solid could be used.
- Size of brittle solid may limit the distance fragmentation penetrates into a solid: if the impacted object is very deep, the amount of material actually involved may be limited by the depth the fragmentation penetrates into the solid. The data are based upon thin (less than 1 cm deep) solids. Assuming all the material present is involved may not be "conservative" since the fraction of materials in the fines is a function of the energy density. The greatest potential total airborne release can be determined for each situation by iteration (assume various volumes for the impact energy and total volume of solid involved).
- Particle depletion mechanisms in the compartment prior to release to the exhaust system, exponential dilution vs bulk flow: see Section 4.5.2.1.

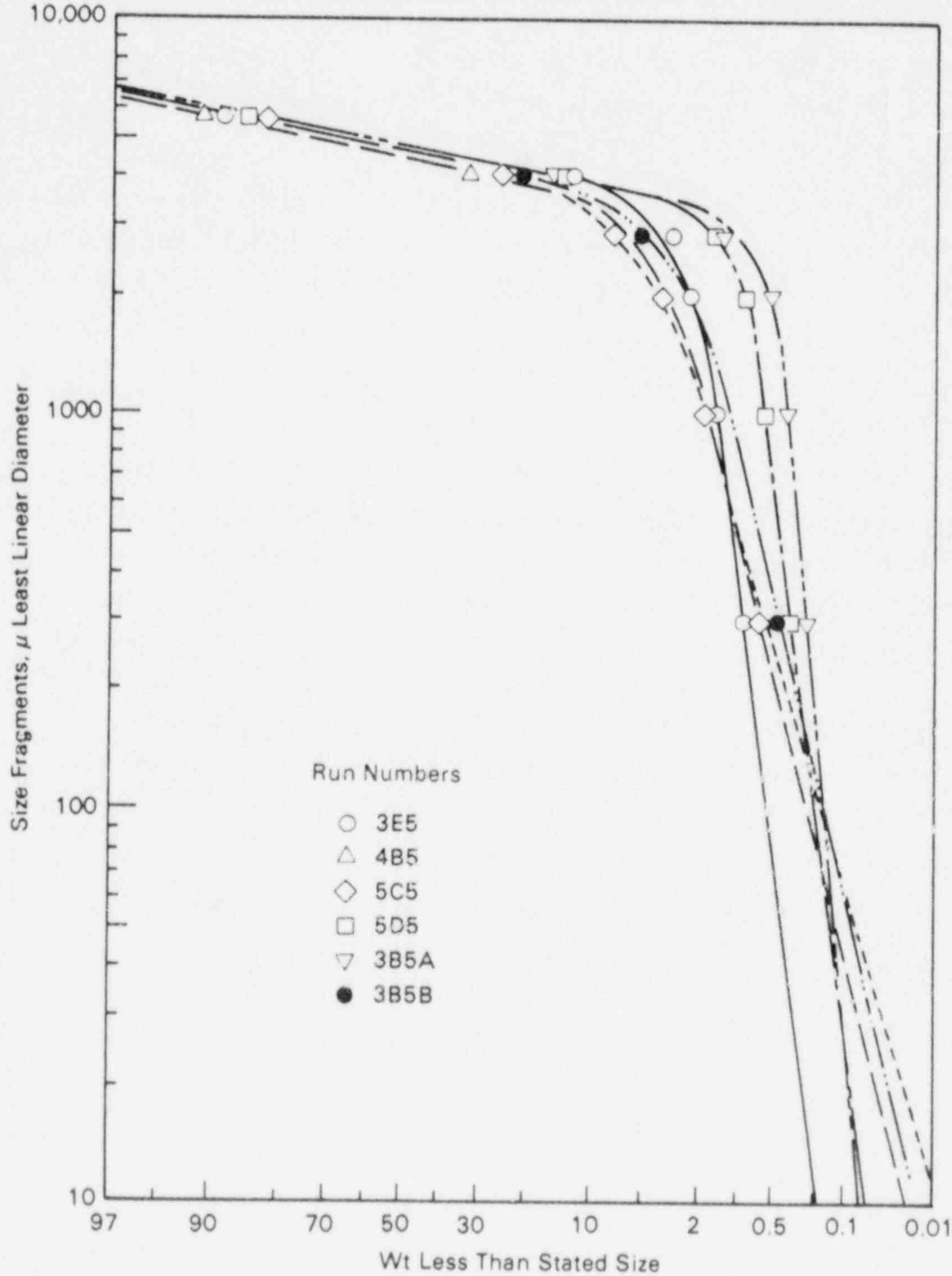

FIGURE 4.12. Size Distribution of Fragments from Fuel Pellets Irradiated to 6000 MWd/MTU

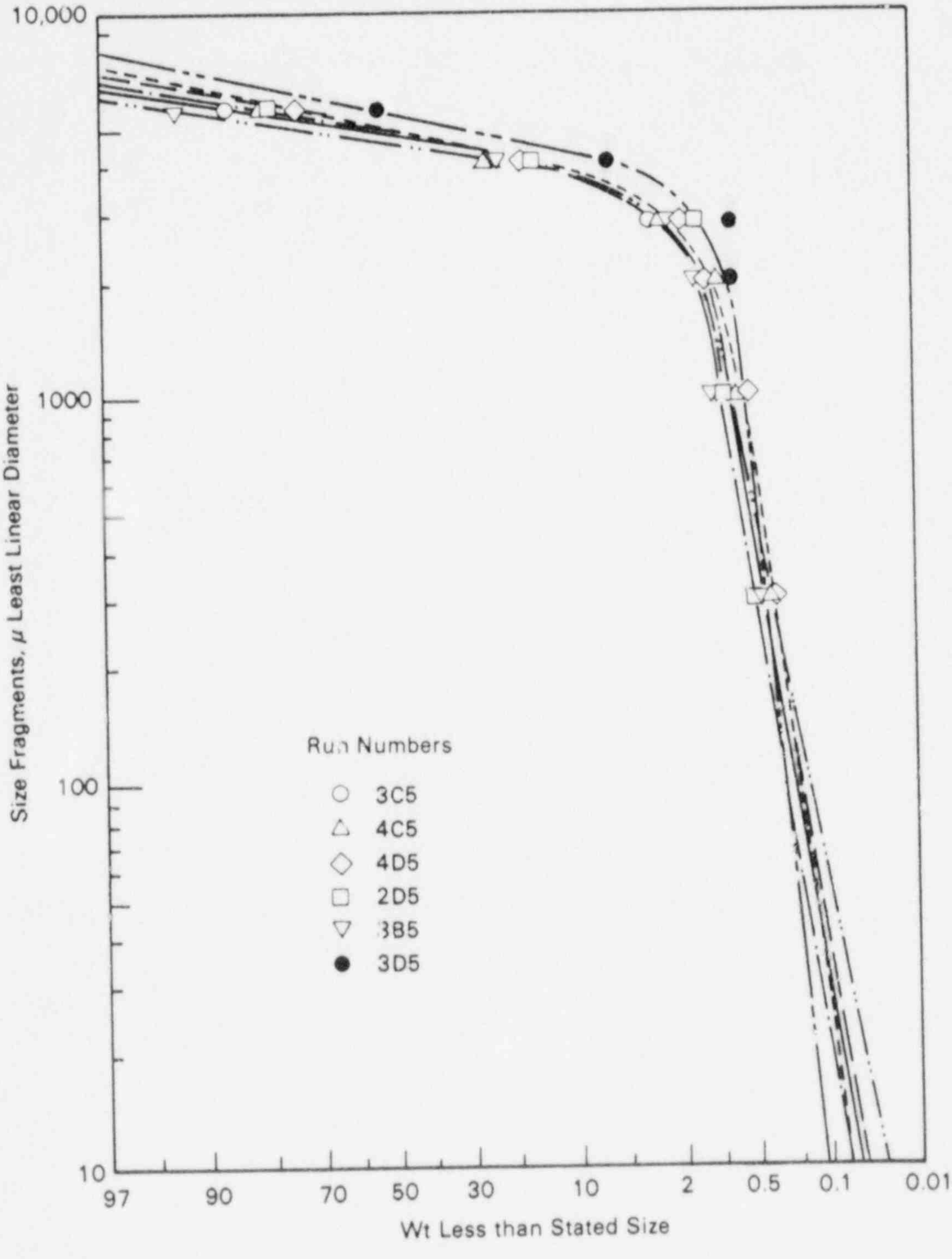

FIGURE 4.13. Size Distribution of Fragments from Fuel Pellets Irradiated 6000 MWd/MTU

TABLE 4.22. Particle Size Distribution for Spent Fuel Specimens

Mesh Size	H. B. Robinson	Point Beach	Shippingport
+14	98.1	89.7	94.1
-14 +20	1.3	5.5	3.4
-20 +40	0.6	4.8	2.5

(Gilbert, White and Knox 1985)

Sieve analysis results for PWR spent fuel fragments from Point Beach Reactor at 29,282 MWd/MTU peak burnup.

Location	Weight Fraction, %			
	Mesh			
	+14	-14 to +20	-20 to +40	-40
Low Gamma Field	91.7	3.02	2.68	2.59
Near Cs Sources	90.59	3.55	2.87	2.98

(White et al. 1984)

TABLE 4.23. Impact Test Series (Baker 1977)

Fuel	Temp, °C	Impact Velocity, m/s	Maximum Diametral Strain, %	Strain, %	Fuel Breakup (Weight Fraction) Under 10 μm
High-density pellet	1300	43.0	5.3	0	0.0008
	760	43.0	3.4	0	0.0025
	1300	65.4	8.4	-3.9	0.0025
	760	62.8	6.1	-1.5	0.0042
	760	86.7	9.1	-4.6	0.0073
Low-density pellet	1300	45.8	12.5	-7.5	0.0029
	760	45.4	11.2	-7.6	0.0042
	1300	73.4	14.5	-12.6	0.0060
	760	71.4	15.1	-12.2	0.0285
Large pellet fragments	1300	49.9	13.2	-12.6	0.0230
	760	50	11.6	-14.7	0.0251
	1300	75.9	14.6	-21.0	0.0718
	760	75.5	15.2	-15.6	0.0649

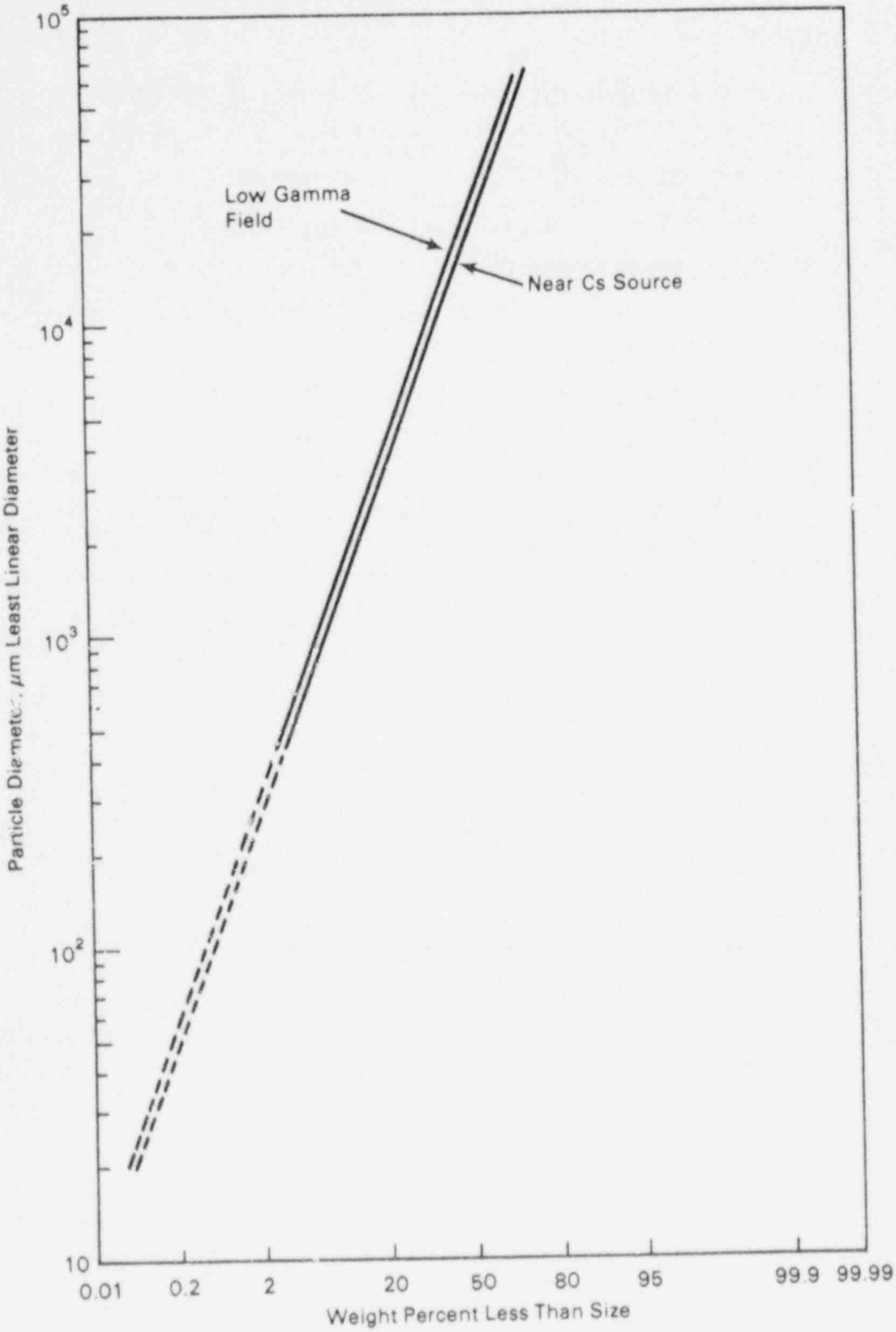

FIGURE 4.14. Sieve Analysis of PWR Spent Fuel Fragments - Point Beach Reactor, 29,282 MWd/MTU (White et al. 1984)

4.5.3 Sample Problems

4.5.3.1 Primary Sample Problem - Impact of Tornado Generated Transient Velocities on an Enclosure Containing Exposed Plutonium Dioxide Powder

It is postulated that a regional design basis tornado passes over the exhaust outlet of a ventilated facility processing plutonium dioxide powder. The principal sources of radioactive materials are an enclosure connected to the ventilation system and, since the facility has been in use for some time, the duct work (approximately 100 ft as shown in the "simple system") connecting the enclosure to the HEPA filters. The powder contamination in the duct is assumed to be present from the movement of powder during the changing of filters on the enclosure and the level of surface contamination is 2500 kg/m^2.

The characteristics of regional design basis tornadoes are covered in Regulatory Guide 1.76, "Design Basis Tornado for Nuclear Power Plants (NRC 1974) based upon a study reported by Markee, Beckerley and Saunders (1974). A most recent compilation of tornadoes in the contiguous United States is found in Ramsdell and Andrews (1986) and the users are directed to these documents for additional information.

It is assumed that the pertinent characteristics of the tornado impacting the facility are: a maximum pressure differential of 50 in. W.G. over 2 seconds with maximum total wind velocity of 200 mph (between Region III and II Design Basis Tornado). It is postulated that the tornado vortex passes directly over the exhaust outlet (stack) resulting in transient, accelerated velocities within the exhaust system and operating areas. The pressure differential through the exhaust systems are assumed to be:

0 s	0 in. W.G.
10 s	0 in. W.G.
12 s	50 in. W.G.
16 s	50 in. W.G.
18 s	0 in. W.G.

If the cross section of an enclosure is 4 ft x 2.5 ft (approximately cross section of a glove box, the smallest enclosure to hold exposed powder), the nominal velocity through the enclosure is estimated at 47 ft/min.

It is postulated that a powder container inside an enclosure is improperly capped and placed in a precarious position during the cessation of operations following a tornado alert. The container topples to the floor and the cap is dislodged upon impact. The powder spills from the container onto the floor and is subjected to the accelerated, transient air flows through the enclosure during the passage of the tornado vortex over the exhaust outlet (stack) of the facility.

Under the condition stated above (2 psi for a 2 ft x 2 ft duct), the induced volumetric flow rate at the enclosure is 4700 cfm. For an enclosure with a cross-sectional area of 2.5 ft x 4 ft (10 ft^2), the calculated bulk velocity through the enclosure is 47 ft/min (238.8 cm/s). The friction velocity at the boundary of a 10 cm laminar layer would be (238.8 cm/s divided by 17.2 =) 13.9 cm/s, which is less than the threshold friction velocity required to induce suspension of materials, 22 cm/s. By strict interpretation of the technique, no particulate material is made airborne under these conditions. For the purposes of some analysis, the fraction of powder suspended would conservatively be estimated to be less than 0.001% for the entire event. (Time release data can not readily be estimated without the use of the Material Transport code in TORAC.)

4.5.3.2 Secondary Sample Problems

Aerodynamic Entrainment of Powders from Thick Beds. At the volumetric flow rate calculated by Andrae et al. (1985) for these conditions, the maximum cross-sectional area where suspension from a thick bed of powders would be induced would be (2.218 E+6 cm^3/s divided by 378 cm/s =) 5.869 cm^2 (6.31 ft^2). The volumetric flow rate required to induce the Threshold Friction Velocity for Particulate Suspension in the enclosure described is (378 cm/s x 9290 cm^2 =) 3.515 m^3/s (7448 cfm). For the cross-sectional area of the "simple" facility room (10 ft x 10 ft or 3.048 m x 3.048 m), a volumetric flow rate of (3.78 m/s x 9.29 m^2 =) 35.1 m^3/s (74400 cfm) is necessary to attain the Threshold Friction Velocity for Particulate Suspension.

If a friction velocity exceeding the Threshold Friction Velocity for Particulate Suspension is calculated for an area where a thick bed of powders could be exposed to those flows, it would be assumed that all the "respirable" [particles 10 micrometers and less Aerodynamic Equivalent (AED) Diameter] fraction in the thick bed of powder would be immediately suspended in the airflow. At the bulk velocity required to achieve the Threshold Friction Velocity for Particulate Suspension (3.78 m/s or 8.3 mph), material suspended in the airflow would be rapidly carried to the exhaust system. For the room in the "simple" facility, the suspended materials could travel the length of the room (10 ft or 3.048 m) in less than one second. Thus, the release could be handled as a "puff" release.

The duration of the airborne release of the "respirable" fraction would be the time the air velocity exceeded the Threshold Friction Velocity for Particulate Suspension. In the problem in Andrae et al. (1985), the duration the velocity exceeded the suspension velocity could be calculated. For most cases where the computer codes are not used, the duration will not be known and the assumption of a minimum time period (e.g., 1 s, a "puff" release) would be "conservative" (maximize the radiological impact to an offsite individual by maximizing the concentration). Such an assumption is not "conservative" if it would result in a significant depletion of material during transit through the facility as a result of high mass or number concentration. In all cases, if the filtration system of the facility is intact, most of the suspended particulate material is removed prior to an offsite release.

An additional factor in the calculated concentration of material is the volume in which the airborne material is suspended. For the purpose of these calculations, it is assumed that the airborne material is suspended in a volume equal to the air passing over the powder to a height of 1 m. Thus, if the powder bed is 1 m wide and the velocity is 3.78 m/s for 1 s, the volume would be 3.78 m^3. If a gram of powder is in the "respirable" fraction, the airborne concentration would be 265 mg/m^3.

Since the airborne material is in transit in the room in the "simple" facility for a short time (less than 1 s), depletion by gravitational settling would be small. The airborne concentration is high and the particles would tend to agglomerate with time, increase in size, and settle out. Inertial effects would be significant for particles of 10 micrometers AED and should be considered in transit through the ventilation system. These effects are considered in Appendix B "Particle Deposition in Sampling Lines" of ANSI N13.1-1969 (ANSI 1969).

Fragmentation of Brittle Solids by Crush-Impact. It is postulated that a concrete roof panel (2 ft wide x 12 ft long x 0.5 ft thick) is displaced during the passage of a tornado over a facility. The panel orients itself end on and falls 18 ft to the floor where it impacts uranium dioxide fuel pellets on the floor of the facility.

The impact energy is

$$E = mgh \tag{4.79}$$

where E - impact energy, ergs
m = mass of object, g
g = gravitational acceleration, 981.5 cm/s^2
h = height, cm

The mass of the object is

$$m = \text{volume} \times \text{density} \tag{4.80}$$

where m = mass, g
volume = 61 cm X 366 cm x 15 cm = 3.4 E+5 cm^3
density = 2.31 g/cm^3 (144 lb/ft^3, Perry and Chilton 1973)

Therefore, m = 3.4 E+5 cm^3 x 2.31 g/cm^3 = 7.8 E+5 g.

The distance traveled by the object before impact is 18 ft (549 cm) and the impact energy is:

$$E = (7.837\text{ E+5 g})(981.5\text{ cm/s}^2)(549\text{ cm}) = 4.22\text{ E+11 ergs} \tag{4.81}$$

The impact area is the cross-sectional area of the concrete roof panel, 60.96 cm X 15.24 cm = 929 cm^2. The maximum number of 0.835 cm diameter X 0.953 m long uranium dioxide fuel pellets in a single layer that would fit in this area is 929 cm^2/0.7958 cm^2 = 1167.4. The volume of 1167.4 pellets is 1167.4 [0.7854 X (0.835 cm)^2 X 0.935 cm] = 1167.4 (0.61 cm^3) = 609.2 cm^3. The effective impact energy for fragmentation is 0.5 X impact energy or 0.5 (4.22 E+11 ergs) = 2.11 E+11 ergs. The Effective Energy Density is

$$E = 2.11 \text{ E+11 ergs}/609.2 \text{ cm}^3 = 3.46 \text{ E+8 ergs/cm}^3 \qquad (4.82)$$

From Figure 4.15, the fraction of the solid fragmented into particles 10 micrometers Geometric Diameter (GD) is approximately 4.6%. The pellets are unirradiated and no preexisting particles are assumed.

If the pellets were irradiated, the preexisting particle in the size range 10 micrometers and less in diameter would also be included. The data on Figure 4.14 is from uranium dioxide fuel pellets irradiated to an exposure level of 33,000 MWd/MTU. The authors attribute the formation of this fraction to be due to thermal cycling during irradiation and cooling. If the clad were failed and the fuel oxidized, an additional source of particles would also have to be considered. The plot indicates that 0.01% could be fragmented in particles 10 micrometers and less by this mechanism. The contribution from this source is probably lost in the uncertainties of the estimation.

The material is uranium dioxide with a theoretic density of 10.96 g/cm^3. The density of the fuel pellets is 96% theoretical (10.6 g/cm^3). The data in Jardine et al. (1982) for SYNROC (a ceramic material) at an energy density of 1.4 E+9 ergs indicate a Mass Median Diameter of 600 micrometers GD with a Geometric Standard Deviation (GSD) of 6.0. This distribution is shown in Figure 4.14 and agrees reasonably well with the derived value of 4.6% for particles 10 micrometers GD. If the conversion from GD to AED [D^2 (GD) X density = d^2 (AED) X density] is applied, then a 10-micrometer AED particle is equal to:

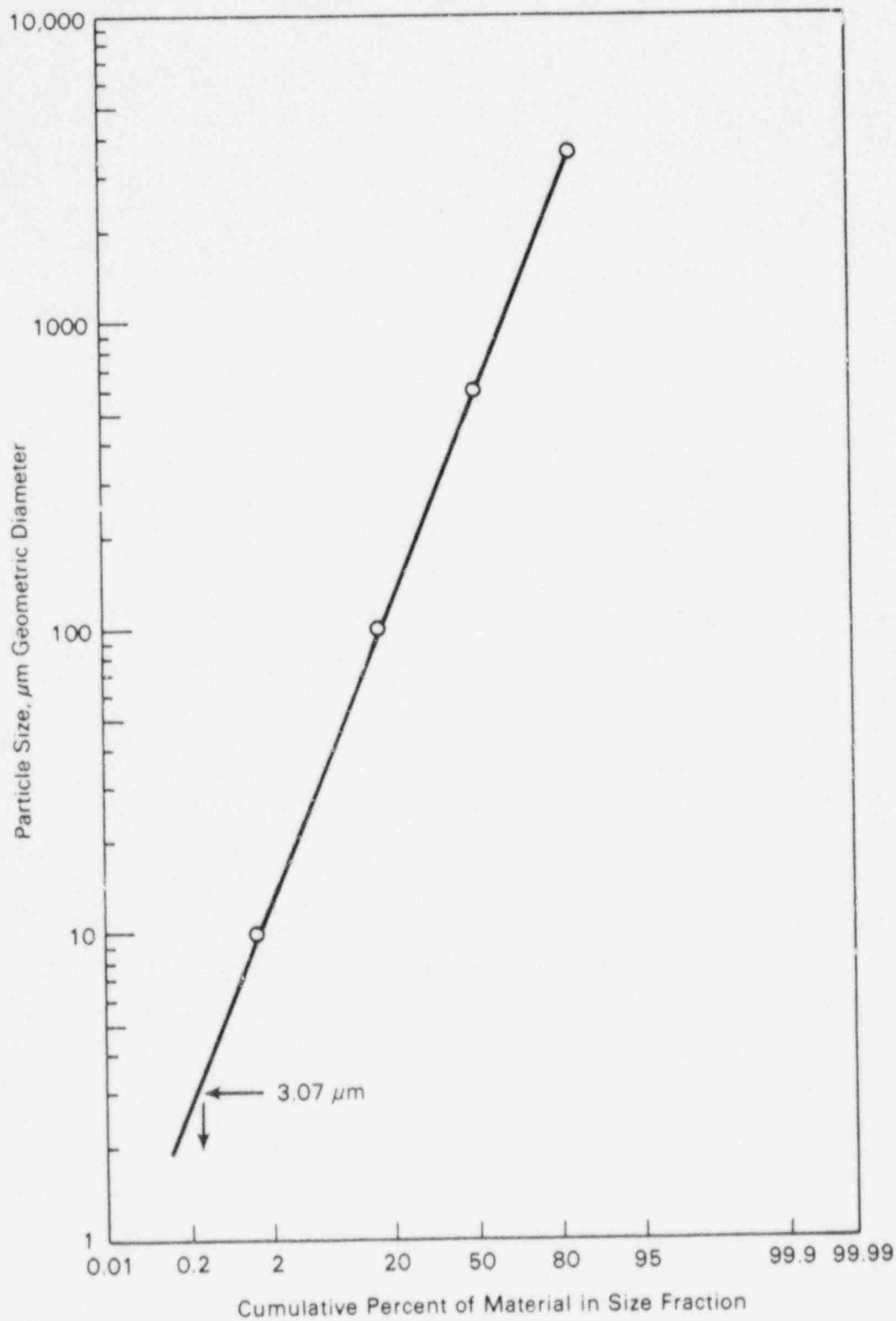

FIGURE 4.15. Size Distribution of Particles Generated by Crush-Impact

$$(10 \text{ micrometers AED})^2 \times 1.0 \text{ g/cm}^3 = \text{GD}^2 \times 10.6 \text{ g/cm}^3 \quad (4.83)$$

$$100 (\text{micrometers AED})^2/10.96 = \text{GD}^2$$

$$\text{AED}^2 = 9.43 (\text{micrometers})^2 \text{ GD}$$

$$\text{D} = 3.07 \text{ micrometers GD}$$

The fraction in the "respirable" size range is estimated to be 0.22% from Figure 4.14 and the mass release to the ventilated space is 0.0022 X 609.2 cm^3 X 10.6 g/cm^3 = 14.2 g.

Since it was postulated that a roof panel is dislodged, an unfiltered pathway from the area where the fragmentation occurs in the facility is available and airborne release could be directly to the environment. If it is assumed that the passage of the tornado vortex over the facility resulted in the dislodgement of the roof panel, the windspeed following the passage of the vortex is the lateral velocity of the tornado (probably less than 50 mph, Fujita 1978). The air is aspirated from the facility by Bernoulli's forces and is competitive with the facility ventilation system if still operable. The conservative assumption would be that all airborne material exits the facility via the unfiltered pathway.

The pathway from the facility is limited and the airborne material drawn slowly from the space. The materials would be moved a considerable distance from its point of origin. For these reasons, the airborne particles would have an adequate time to mix prior to release, and release to the environment would not be immediate. The assumption of a relative uniform distribution of airborne material throughout the entire volume of the space does not appear unreasonable. The release to the environment would be by exponential dilution as shown in Section 4.4.2.

The volumetric flow rate multiplied by the concentration gives the mass release per unit time. The volumetric flow rate can be calculated using the TORAC code described in Chapter 5 for the given conditions or can be assumed for "conservative" estimates.

Particle depletion for larger particles generated by the brittle fracture of solid could be appreciable under the circumstance described. Assuming only the "respirable" fraction becomes airborne diminishes the importance of particle depletion mechanisms for the calculation of airborne release to the environment. In the example used here, the mass airborne release to the ventilated space is 14.2 g. If the space is assumed to be 15 m X 24 m X 5.5 m (50 ft X 80 ft X 18 ft), the volume is 2038.5 m^3 (72,000 ft^3). The uniform mass concentration would be 14.2 g/2040 m^3 = approximately 7 mg/m^3. If a release rate of 1 m^3/s (approximately 2120 cfm) is assumed, the mass release to the environment starts at 7 mg/s and decays to 0.0003 mg in 20325 seconds (338 minutes, 5.66 hours).

4.6 NUCLEAR CRITICALITIES

Nuclear criticalities are the only events considered in this document that generate radioactive materials (fission products). Because of their high specific activity and radiological impact, short half-life fission products that are ordinarily not considered under many accident scenarios are a principal concern for nuclear criticalities. Radioactive materials present in the solutions involved in criticalities can also be airborne. Criticality depends upon amount of fissile material present, concentration, geometry, and moderation. A detailed discussion of the many technical aspects of criticalities can be found in Clayton (1979).

The energy generated by the inadvertent criticality is generally small and evolves over a period of time. As such, the energy is generally not adequate to fail the container or barriers. The material made airborne from a criticality is released into a ventilated space (e.g., enclosure, workplace) and must be transported to the exhaust system. The radioactive materials of principal concern are of short half-life and are gases or vapors. Dispersion/mixing with the air within the ventilated space follows the air. If the air is well mixed, the gases and vapors can be considered well mixed. If the air streams through the ventilated space, the gases and vapors can be thought of as streams within the airflow. Particulate material generated by a criticality will diverge from the fluid flow as a function of aerodynamic particle size, air velocity and turbulence, and particle depletion mechanisms.

If the criticality is well defined, computer codes or published data from inadvertent criticalities that have occurred can be used to estimate the potential airborne release (see Appendix E, letter from G. W. McNair to J. Mishima, "A Review of Criticality Excursion Models", March 26, 1980). For inadvertent criticalities that cannot be well defined or a viable scenario that cannot be postulated for the process and equipment under consideration, calculational techniques for criticalities involving aqueous solutions in various types of processes based upon the U.S. Nuclear Commission (NRC) Regulatory Guides (NRC 1977, 1979a, 1979b) are presented.

4.6.1 Scenario Considerations

Solutions are of principal concern because they have mobility and can be formed into geometrically favorable shapes with inadvertent moderation. Criticality with solids is more readily controlled (the rigidity of the material make inadvertent favorable configurations less of a problem) and moderating materials are generally not allowed in proximity of the fissile material except for planned experiments. Inadvertent criticalities involving solids have generally involved mishaps during planned criticalities (Stratton 1967; IDO 1978). Criticalities with powders are theoretically possible but are not well understood (Clayton et al. 1977). Powders flow and have void spaces, which make assumption of favorable geometries less likely.

Most facilities handling materials with relatively pure, high fissile content have rigorous procedures and checks to prevent inadvertent criticalities. Regulations require facilities and processes used to handle relatively pure fissile materials be designed so that a least two separate events must occur before a condition exists that could result in a criticality.

The products of the criticality are a function of the fissile material (e.g., uranium, plutonium, thorium). The amount of the fission products generated is a function of the total fissions resulting from the criticality. The total fissions depend upon how long the conditions necessary to maintain a critical configuration can exist.

The energy produced by the criticality is dissapated to the atmosphere surrounding the fission material. In the case of solutions of fissile materials, the energy is used to heat the liquids resulting in evaporation of the water, which is part of the moderation. Eventually, the increased concentration and loss of moderation results in the termination of the criticality. For solid systems, displacement of the solid or powder can alter the configuration and result in the termination of the criticality.

Heating of liquids can result in the formation of thin films of heated solution (e.g., liquid creep on the sides of the vessel, wave formation, bubble formation from the discharge of dissolved gases). Breakup of the thin films and entrainment of the droplets in the vapor flux above the heated liquid can result in the airborne release of nonvolatile salts in the solution. Loss of the solvent from the droplets of heated solution can result in the presence of the salt as solid particles in the air. Thus, radioactive materials initially present in the fissile solution can be made airborne by the criticality as well as radioactive materials generated by the criticality.

4.6.2 Calculational Techniques Illustrated

All the calculational techniques to estimate the airborne release of radioactive materials from inadvertent criticalities are for events involving solutions of fissile materials. Three categories of processes are covered - fuel reprocessing plants (uranium fuels with less than 5% ^{235}U enrichment), uranium fuel fabrication plants, and plutonium processing and fuel fabrication plants. The input requirement for the calculational techniques are listed in Table 4.24. Readers are referred to the specific NRC Regulatory Guide for additional information.

TABLE 4.24. Input Requirements to Estimate the Airborne Release from Inadvertent Nuclear Criticalities

- Fuel Reprocessing Plant - vessel volume, concentration of radionuclides in spent fuel solution if other than in Reg. Guide 3.33
- Uranium Fuel Fabrication Plant - other radionuclides in uranium solution (e.g., uranium daughters)
- Plutonium Processing and Fuel Fabrication Plant - composition of fissile solution if criticality postulated in solution.

4.6.2.1 Estimating Airborne Releases from Inadvertent Nuclear Criticalities in a (less than 5% ^{235}U enriched) Uranium Fuel Reprocessing Plant, NRC Regulatory Guide 3.33 (NRC 1977)

Information extracted from NRC Regulatory Guide 3.33 is shown in Table 4.25 and 4.26. The inadvertent nuclear criticality is assumed to occur in a vessel of unfavorable geometry containing a solution of 400 g/ℓ uranium

TABLE 4.25. Assumed Fission Product and Transuranic Nuclide Radioactivity in Spent Fuel Solution Prior to Criticality Incident

3.3% Enriched Fuel Irradiated to 33000 MWd/MTU, cooled 150 days and calculated by ORIGEN code.

Nuclide	Curies/Liter
Tritium	2.9D-1
Strontium-89	4.0E+1
Strontium-90	3.2E+1
Yttrium-90	3.2E+1
Yttrium-91	5.7E+1
Zirconium-95	1.2E+2
Niobium-95	2.2E+2
Ruthenium-103	3.7E+1
Rhodium-103M	3.7E+1
Ruthenium-106	1.7E+2
Rhodium-106	1.7E+2
Iodine-129	1.6E-5
Iodine-131	9.1E-4
Xenon-131m	1.4E-3
Cesium-139	9.0E+1
Cesium-137	4.5E+1
Barium-137M	4.2E+1
Cerium-141	2.4E+1
Cerium-144	3.2E+2
Praseodymium-144	3.2E+2
Promethium-147	1.2E+1
Europium-154	3.3E 0
Plutonium-238	[illegible]E 0
Plutonium-239	1.4E-1
Plutonium-240	2.0E-1
Plutonium-241	4.8E+1
Americium-241	4.8E+1
Curium-242	6.3E 0
Curium-244	1.0E 0

TABLE 4.26. Radioactivity of Important Nuclides Released from the Criticality Accident in Regulatory Guide 3.33 (Ci)

Nuclide	0 to 0.5 h	0.5 to 8 h	Total
Kr-83m	3.7E0	3.3E+1	3.7E+1
Kr-85m	1.6E+1	1.5E+2	1.7E+2
Kr-85	1.5E-4	1.4E-3	1.6E-3
Kr-87	1.0E+2	9.0E+2	1.0E+3
Kr-88	6.5E+1	5.9E+2	6.6E+2
Kr-89	4.1E+3	3.7E+4	4.1E+4
Xe-131m	3.8E-4	3.5e-3	3.9E-3
Xe-133m	5.5E-2	4.9E-1	5.5E-1
Xe-133	1.3E0	1.2E+1	1.3E+1
Xe-135m	1.1E+1	9.9E+1	1.1E+2
Xe-135	1.6E+1	1.5E+2	1.7E+2
Xe-137	3.8E+3	3.5E+4	3.9E+4
Xe-138	1.2E+3	1.0E+4	1.1E+4
I-129	4.2E-11	3.9E-10	4.3E-10
I-131	1.8E-1	1.6E0	1.8E0
I-132	6.7E-1	6.1E0	6.7E0
I-133	3.5E0	3.1E+1	3.5E+1
I-134	4.8E+1	4.8E+2	4.8E+2
I-135	1.2E+1	1.0E+2	1.2E+2

enriched to less than 5% ^{235}U. The solution is also assumed to contain all the fission product and transuranics, except the noble gases, expected to be present in spent fuel at a maximum burnup and minimum cooling for which the plant is designed. The "assumed fission product and transuranic nuclide radioactivity in spent fuel solution prior to criticality event" shown in the guide is for a 3.3% enriched fuel irradiated to 33,000 MWd/MTU (megawatt days per metric ton uranium), cooled 150 days and calculated by ORIGEN code.

The excursion produces an initial burst of 1 E+18 fissions in 0.5 s followed successively at 10-min intervals by 47 bursts of 1.9 E+17 fissions each in 8 h. The excursion is assumed to be terminated by evaporation of 100 ℓ of a solution containing 400 g/ℓ uranium (<5% enriched) and concentrations of associated fission products and transuranic elements corresponding to the sum of those produced in the incident plus those present in irradiated fuel (assuming 100% dissolution) for plant design conditions. However, the noble gas fission products initially present in the fuel are assumed to have been removed prior to the incident. The "radioactivity of important nuclides released from the criticality accident in the guide" is shown.

It is assumed that:

- All noble gas fission products generated by the criticality or present in the solution (the noble gases in the spent fuel solution are assumed removed prior to the event) are released to the ventilated space.
- 25% of all the radioiodine generated by the criticality and present in the spent fuel solution are released to the ventilated space.
- 0.1% of the ruthenium radionuclide resulting from the excursion or initially present in the spent fuel solution prior to the event is released to the ventilated space.
- 0.05% of the salt content of the solution that is evaporated is released to the ventilated space as an aerosol.

Radioactive decay during transit should be taken into account. The reduction in the amount of radioactive material released to the environment through the plant stack may take into account the removal of the airborne materials by the normal operation of the plant engineered safety features (e.g., sorption and filtration systems) on an individual basis.

In order to apply the calculation technique to a specific facility, a vessel with an unfavorable geometry with a volume exceeding 100 ℓ and to which dissolver solution could be transferred via existing piping must be identified. Once the volume of the vessel is identified, the amounts of radioiodine and radioruthenium released to the ventilated space can be estimated assuming the concentrations of nuclides shown in the guide for spent fuel solution. The noble gas fission product are only those generated by the criticality and the aerosol generated is 0.0005 X 100 ℓ X nonvolatile listed in the table for spent fuel solutions except tritium which is completely vaporized as water vapor.

The radionuclides are assumed to be released to a ventilated space operating under normal conditions. The fission products generated at a rate equal to the rate of fissioning. Thus, the initial burst generates 1 E+18/1 E+19 = 0.10 (10%) of the total fission products generated (see Table 4.27). The 47 burst at 10-min intervals each generate 0.90/47 = 0.01915 (1.915%) of the total fission products listed in Table 4.25.

TABLE 4.27. Radioactivity (Ci) and Average Beta and Gamma Energies (MeV/dis) of Important Nuclides Released from Criticality Accident in Regulatory Guide 3.34

Nuclide	Half-life[b,c]	Radioactivity[a]			E_γ[b]	E_β[b]
		0-0.5 h	0.5-8 h	Total		
Kr-83m	1.8 h	2.2E+1	1.4E+2	1.6E+2	2.6E-3	0
Kr-85m	4.5 h	2.1E+1	1.3E+2	1.5E+2	1.6E-1	2.5E-1
Kr-85	10.7 y	2.2E-4	1.4E-3	1.6E-3	2.2E-3	2.5E-1
Kr-87	76.3 m	1.4E+2	8.5E+2	9.9E+2	7.8E-1	1.3E0
Kr-88	2.8 h	9.1E+1	5.6E+2	5.6E+2	2.0E0	3.5E-1
Kr-89	3.2 m	5.9E+3	3.6E+4	4.2E+4	1.6E0	1.3E0
Xe-131m	11.9 d	1.1E-2	7.0E-2	8.2E-2	2.0E-2	1.4E-1
Xe-131m	2.0 d	2.5E-1	1.6E0	1.8E0	4.1E-2	1.9E-2
Xe-133	5.2 d	3.8E0	2.3E+1	2.7E+1	4.6E-2	1.1E-1
Xe-135m	15.6 m	3.1E+2	1.9E+3	2.2E+3	4.3E-2	9.0E-2
Xe-135	9.1 h	5.0E+1	3.1E+2	3.6E+2	2.5E-1	3.7E-1
Xe-137	3.8 m	6.9E+3	4.2E+4	4.2E+4	1.6E-1	1.8E0
Xe-138	14.2 m	1.8E+3	1.1E+4	1.3E+4	1.1E0	6.2E-1
I-131	8.0 d	1.2E0	7.5E0	8.7E0	3.8E-1	1.9E-1
I-132	2.3 h	1.5E+2	9.5E+2	1.1E+3	2.2E0	5.0E-1
I-133	20.8 h	2.2E+1	1.4E+2	1.4E+2	1.6E+2	4.1E-1
I-134	52.6 m	6.3E+2	3.9E+3	4.5E+3	2.6E0	6.1E-1
I-135	6.6 h	6.6E+1	4.0E+2	4.7E+2	1.5E0	3.7E-1

(a) Total curies are based on cumulative yields for fission energy spectrum using the data in Meek and Rider (1974). The assumption of cumulative yield is very conservative; e.g., it does not consider appropriate decay schemes. Calculations regarding individual nuclide yields and decay schemes may be considered on an individual case basis. Data in this table do not include the iodine reduction factor allowed in Section C.2.a of Regulatory Guide 3.34.

(b) Half-lives and average energies are derived using the data in Kocher (1977).

(c) y = year
d = day
h = hour
m = minute.

It could also be assumed that the evaporation rate is equal to the heat generation rate, which is equal to the rate of fissioning. The same factors above could be applied to the 0.05% of the salt content of the 100 ℓ evaporated during the 8-h event.

The fission products listed in Table 4.26 are gases or vapors and would follow the airflow. The airflow in large ventilated spaces under normal conditions is not turbulent, and it is not anticipated that the gases and vapors generated would be mixed with the entire volume of the space. As the airborne material is exhausted from the ventilated space, the uncontaminated air is also extracted and will form a relatively uniform concentration of airborne materials for the entire volume. Thus, for the purposes of estimating the airborne material concentration entering the exhaust, the user may assume that the radioactive materials released are uniformly distributed in the volume from the point of origin to the exhaust outlet.

The particles made airborne could be affected by depletion mechanism if the size is greater than 5 to 10 micrometers AED. The particulate material generated is from the breakup of very thin films and, as such, are small. Furthermore, the liquid is heated and tends to continue to evaporate after the formation of the droplet further decreasing the size. The "conservative" assumption is that all particles airborne are of this size range (depends upon the flow and turbulence in the system but, for most enclosures, is less than 10 micrometers AED) and remain suspended in the flow. Thus, the same assumption as to dilution in the air volume above for gases and vapors could be also applied to particles suspended from the evaporation of the solution.

4.6.2.2 Estimating Airborne Releases from Inadvertent Nuclear Criticalities in a Uranium Fuel Fabrication Plant, NRC Regulatory Guide 3.34 (NRC 1979a)

The pertinent information extracted from NRC Regulatory Guide 3.34 is shown in Table 4.27. The criticality is again assumed to involve a solution of enriched uranium with a concentration of 400 g/ℓ. No preexisting fission product or transuranic other than the uranium is assumed. The fissions and timing of the criticality and the termination are as assumed in NRC Regulatory Guide 3.33 (NRC 1977) above. The "radioactivity (Ci) and average beta and gamma energies (MeV/dis) of important nuclides released from criticality accidents in the guide" are shown. The amounts of some nuclides differ slightly from those listed in NRC Regulatory Guide 3.33 (NRC 1977).

The amounts of the various nuclides released to the ventilated space are

- all the noble gas fission products generated by the criticality
- 25% of the iodine radionuclides generated by the criticality
- 0.05% of the salt content of the solution that is evaporated (400 g/ℓ enriched uranium).

For this case, evaluation of the airborne release to the ventilated space does not require a vessel volume since the only nuclides assumed to be present are those in the uranium solution. (For Reg. Guide 3.33, 25% of all iodine and 1% of all ruthenium present in the spent fuel solution are also postulated to be released.) Equilibrium concentrations of the ^{235}U and ^{238}U daughters could be assumed. The assumptions in Section 4.6.2.1 for calculation of the concentration of gases and vapors released to the ventilated space could be applied here.

4.6.2.3 Estimating Airborne Releases from Inadvertent Nuclear Criticalities in Plutonium Processing and Fuel Fabrication Plant, NRC Regulatory Guide 3.35 (NRC 1979b)

The pertinent information concerning this event extracted from NRC Regulatory Guide 3.35 (NRC 1979b) is shown in Table 4.28. The event sequence is as given for the preceding two events. The scenario does not specify a solution of fissile material involved although the criticality is assumed to be terminated by the evaporation of 100 ℓ of liquid. The "radioactivity (Ci) and average beta and gamma energies (MeV/ dis) of important nuclides released from criticality accident in the guide" is as shown and includes the transuranics in 1 mg of plutonium dioxide with an assumed equilibrium isotopic mixture for recycled plutonium. The other postulated releases to the ventilated space are

- all noble gas fission products generated by the criticality
- 25% of all radioiodine nuclide generated by the criticality
- 0.05% of the salt content of solution evaporated (if applicable).

TABLE 4.28. Radioactivity (Ci) and Average Beta and Gamma Energies (MeV/dis) of Important Nuclides Released from Criticality Accident in Regulatory Guide 3.35

Nuclide	Half-life[b,c]	Radioactivity[a]			E_λ[c]	E_β[c]
		0-0.5 h	0.5-8 h	Total		
Kr-83m	1.8 h	1.5E+1	9.5E+1	1.1E+2	2.6E-3	0
Kr-85m	4.5 h	9.9E0	6.1E+1	7.1E+1	1.6E-1	2.5E-1
Kr-85	10.7 y	1.2E-4	7.2E-4	8.1E-4	2.2E-3	2.5E-1
Kr-87	76.3 m	6.0E+1	3.7E+2	4.3E+2	7.8E+1	1.3E0
Kr-88	2.8 h	3.2E+1	2.0E+2	2.3E+2	2.0E0	3.5E-1
Kr-89	3.2 m	1.8E+3	1.1E+4	1.3E+4	1.6E0	1.3E0
Xe-131m	11.9 d	1.4E-2	8.6E-2	1.0E-1	2.0E-2	1.4E-1
Xe-133m	2.0 d	3.1E-1	1.9E0	2.2E0	4.1E-2	1.9E-1
Xe-133	5.2 d	3.8E0	2.3E+1	2.7E+1	4.6E-2	1.1E-1
Xe-135m	15.6 m	4.6E+2	2.8E+3	3.3E+3	4.3E-1	9.0E-2
Xe-135	9.1 h	5.7E+1	3.5E+2	4.1E+2	2.5E-1	3.7E-1
Xe-137	3.8 m	6.9E+3	4.2E+4	4.9E+4	1.6E-1	1.8E0
Xe-138	14.2 m	1.5E+3	9.5E+3	1.1E+4	1.1E0	6.2E-1
I-131	8.0 d	1.5E0	9.5E0	1.1E+1	3.8E-1	1.9E-1
I-132	2.3 h	1.7E+2	1.0E+3	1.2E+3	2.2E0	5.0E-1
I-133	20.8 h	2.2E+1	1.4E+2	1.6E+2	6.1E-1	4.1E-1
I-134	52.6 m	6.0E+2	3.7E+3	4.3E+3	2.6E0	6.1E-1
I-135	6.6 h	6.3E+1	3.9E+2	4.5E+2	1.5E0	3.7E-1
Pu-233[d]				5.9E-4		
Pu-239				2.7E-5		
Pu-240				5.8E-5		
Pu-241				1.8E-2		
Pu-242				4.3E-7		
Am-241				2.4E-5		

(a) Total curies, except for Pu and Am, are based on cumulative yield for fission energy spectrum using data in Meek and Rider (1974). The assumption of cumulative yield is very conservative; e.g., it does not consider appropriate decay schemes. Calculations regarding individual nuclide yields and decay schemes may be considered on an individual case basis. Data in this table does not include the iodine reduction factor allowed in Section C.2.a of Regulatory Guide 3.35.
(b) y = year, h = hour, d = day, m = minutes.
(c) Half-lives and average energies derived from data in Kocher (1977).
(d) Total radioactivity assumes the isotopic mix to be the equilibrium mix for recycled plutonium and 1 mg of PuO_2 released (Selby 1975).

The guide specifies that 5% of the salt content of the solution involved in the criticality excursion could be made airborne but the values for transuranic radionuclides released is based upon 1 mg of PuO_2 powder. Thus, it appears that the airborne release from criticality excursions involving a powder or liquid could be evaluated by this technique.

The airborne release is into a ventilated space under normal operating conditions for the ventilation system. The factors for use in the calculation of airborne concentrations of the gases and vapors and the particulate materials generated are discussed in Section 4.6.2.1 and can be applied here.

4.6.2.4 Other Codes and Models to Calculate the Release of Radioactive Materials from a Criticality

If a viable scenario can be postulated for the process and facility, a more detailed analysis of the affects of the consequences including equipment, enclosure and structure failure as well as radionuclide release (both fission products generated and reacting materials involved) must be performed. The codes, models and data referenced in the appendix to this chapter can provide a baseline for additional searches of the literature.

4.6.3 Sample Problems

4.6.3.1 Secondary Problem - Inadvertent Criticality in a Fuel Reprocessing Plant

It is postulated that an excursion occurs in a vented vessel of unfavorable geometry containing dissolver solution with a concentration of 400 g/ℓ uranium enriched to less than 5% ^{235}U. The solution is assumed to contain all the transuranic elements and fission products listed in Table 4.25. All the applicable assumptions pertinent to shielding and fissioning rate listed in NRC Regulatory Guide 3.33 (NRC 1977) apply. The fission products generated by the excursion are listed in Table 4.26.

The release from evaporation of the spent fuel solution is dependent upon the radionuclides present in the evaporated spent fuel solution except for the radioiodine and radioruthenium (the fission product gases are assumed removed by prior process operations). The quantity of radioiodine and radioruthenium released depends upon the total amount of these radionuclides present in the spent fuel solution. The total volume involved is a function of the volume of the vessel in which the excursion occurs. The minimum critical spherical volume require to attain a critical configuration for various uranium enrichment levels by type of material is shown in Figure 4.16 taken from Clayton (1979). The shape of liquid in a vessel is not sperical but could achieve a comparable configuration in a cylindrical shape when the height of the solution reached the diameter of the critical sphere. The volume to achieve this configuration in the vessel would depend upon the diameter of the vessel and must exceed 100 ℓ if the assumptions of the Regulatory Guide are used. The radionuclides released from the evaporation of 100 ℓ of spent fuel solution area shown in Table 4.29.

The initial burst of 1 E+18 fissions is assumed to release 10% of the fission product nuclides generated by the excursion and 10% of the materials listed above that evaporate from the spent fuel solution. The initial release is followed at 10-min intervals by 47 burst, which release 1.915% of the fission product nuclides listed for the excursion and listed above for release by evaporation. The materials made airborne are assumed to be diluted in the volume of the ventilated space between the point of origin and the exhaust outlet from that space.

If the room in the "simple" facility is assumed with the point of generation in the center of the room, the dilution volume is one-half the volume of the room or 500 ft^3 (14.16 m^3). The concentrations of the various nuclides from the initial release to the ventilated space are shown in Table 4.30.

^{129}I and ^{131}I are both generated by the criticality and by evaporation of the spent fuel solution. The ^{129}I generated by the evaporation of the spent fuel solution is 7 orders of magnitude greater than that generated by the criticality and should be used for the airborne release estimates. The ^{131}I generated by the criticality is 200 times greater than that generated by evaporation of the spent fuel solution and should be used for the airborne release estimates.

The material released is assumed to be mixed with half the room volume for the "simple" facility. The exhaust flow rate is 1000 cfm or 500 cfm in

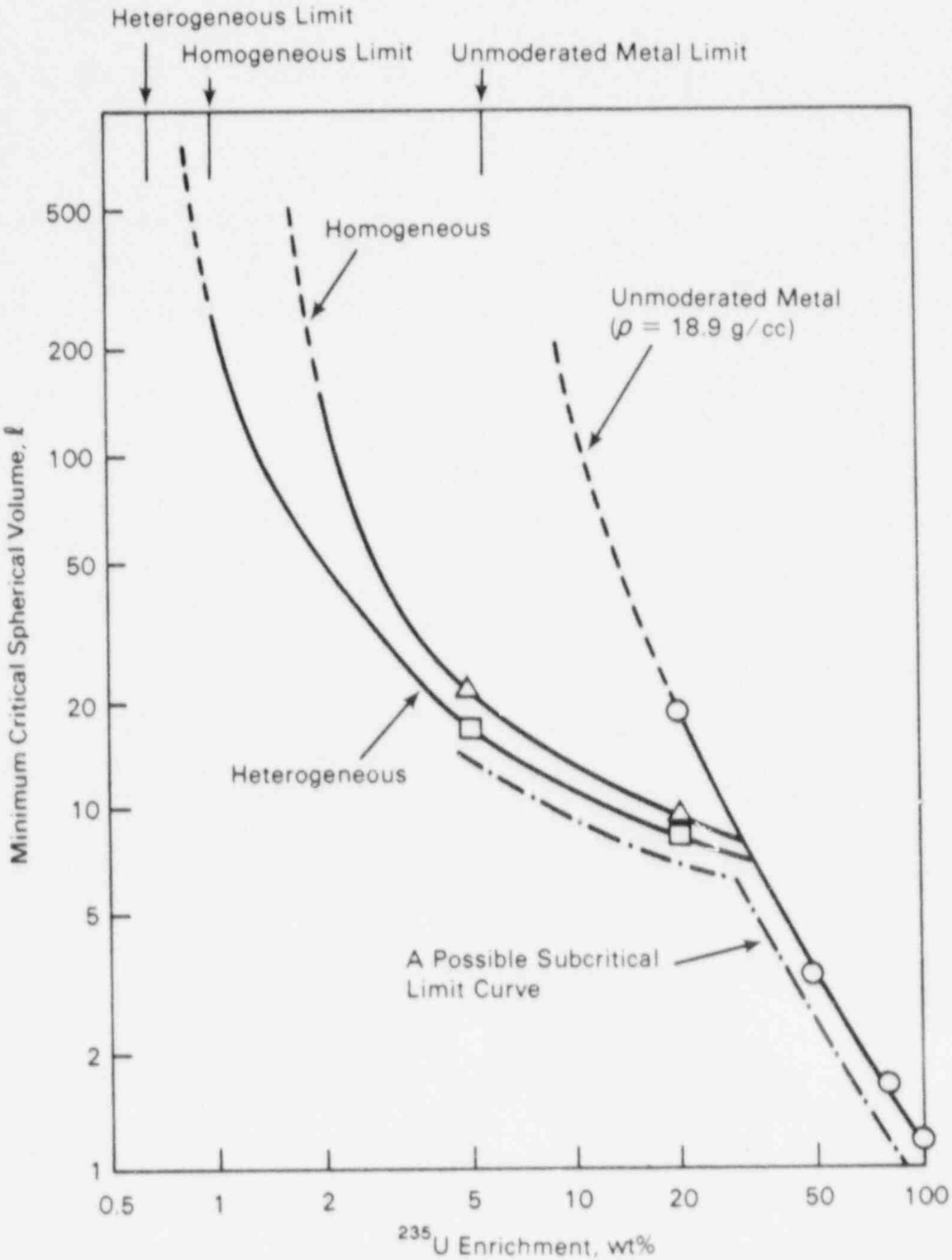

FIGURE 4.16. Minimum Critical Volume vs Uranium Enrichment (Clayton 1979)

TABLE 4.29. Radionuclides Evaporated from 100 ℓ of Spent Fuel Solution During Postulated Criticality Excursion in a Fuel Reprocessing Plant

Tritium:	2.9 E-1 Ci X 1.0 X 100 = 29 Ci
Strontium-89:	4.0 E+1 Ci X 0.0005 X 100 = 2.0 Ci
Strontium-90:	3.2 E+1 Ci X 0.0005 X 100 = 1.6 Ci
Yttrium-90:	3.2 E+1 Ci X 0.0005 X 100 = 1.6 Ci
Yttrium -91:	5.7 E+1 Ci X 0.0005 X 100 = 2.85 Ci
Zirconium-95:	1.2 E+2 Ci X 0.0005 X 100 = 6.0 Ci
Niobium-95:	2.2 E+2 Ci X 0.0005 X 100 = 11.0 Ci
Ruthenium-103:	3.7 E+1 Ci X 0.001 X 100 = 3.7 Ci[a]
Rhodium-103m:	3.7 E+1 Ci X 0.0005 X 100 = 1.85 Ci
Ruthenium-106:	1.7 E+2 Ci X 0.001 X 100 = 17 Ci[a]
Rhodium-106:	1.7 E+2 Ci X 0.0005 X 100 = 8.5 Ci
Iodine-129:	1.6 E-5 Ci X 0.25 X 100 = 0.40 E-5 Ci[a]
Iodine-131:	9.1 E-4 Ci X 0.25 X 100 = 2.3 E-2 Ci[a]
Cesium-139:	9.0 E+1 Ci X 0.0005 X 100 = 4.5 Ci
Cesium-137:	4.5 E+1 Ci X 0.0005 X 100 = 2.25 Ci
Barium-137m:	4.2 E+1 Ci X 0.0005 X 100 = 2.1 Ci
Cerium-141:	2.4 E+1 Ci X 0.0005 X 100 = 1.2 Ci
Cerium 144:	3.2 E+2 Ci X 0.0005 X 100 = 16 Ci
Praseodymium-144:	3.2 E+2 Ci X 0.0005 X 100 = 16 Ci
Promethium-147:	4.2 E+1 Ci X 0.0005 X 100 = 2.1 Ci
Europium-154:	2.3 E 0 Ci X 0.0005 X 100 = 0.115 Ci
Plutonium-238:	1.2 E 0 Ci X 0.0005 X 100 = 0.60 Ci
Plutonium-239:	1.4 E-1 Ci X 0.0005 X 100 = 0.007 Ci
Plutonium-240:	2.0 E-1 Ci X 0.0005 X 100 = 0.01 Ci
Plutonium-241:	4.8 E+1 Ci X 0.0005 X 100 = 2.4 Ci
Americium-241:	8.4 E-2 Ci X 0.0005 X 100 = 0.0042 Ci
Curium-242:	6.3 E 0 Ci X 0.0005 X 100 = 0.315 Ci
Curium-244:	1.0 E 0 Ci X 0.0005 X 100 = 0.05 Ci

(a) Does not include release of 25% of iodine and 0.001% of ruthenium in the remainder of spent fuel solution not evaporated.

0.5 s. Thus, the material is exhausted from the cell as rapidly as it is released and could be viewed as a series of "puff" releases occurring at 10-min intervals.

The air exchange rate for the "simple" facility is higher than commonly found. An exchange rate of 5 to 10 air exchanges per hour are more common. If the air exchange rate were 6 per h, the materials released to the ventilated space could be assumed to be expelled as the next burst occurs and the release would be continuous to the ventilation system. The initial level shown above

TABLE 4.30. Initial Radionuclide Concentrations Released to the Ventilated Space During Postulated Criticality Excursion in a Fuel Reprocessing Plant (0.1 X total curies released during criticality event/volume of ventilated space)

Fission Products from Criticality

Kr-83m:	(0.1 X 37 Ci)/14.16 m^3	= 0.26 Ci/m^3
Kr-85m:	(0.1 X 170 Ci)/14.16 m^3	= 1.2 Ci/m^3
Kr-85:	(0.1 X 0.0016 Ci)/14.16 m^3	= 1.1 E-5 Ci/m^3
Kr-87:	(0.1 X 1000 Ci)/14.16 m^3	= 0.71 Ci/m^3
Kr-88:	(0.1 X 660 Ci)/14.15 m^3	= 4.7 Ci/m^3
Kr-99:	(0.1 X 41,000 Ci)/14.16 m^3	= 290 Ci/m^3
Xe-131m:	(0.1 X 0.0039 Ci)/14.16 m^3	= 2.8 E-5 Ci/m^3
Xe-133m:	(0.1 X 0.55 Ci)/14.16 m^3	= 0.0039 Ci/m^3
Xe-133:	(0.1 X 13 Ci)/14.16 m^3	= 0.092 Ci/m^3
Xe-135m:	(0.1 X 110 Ci)/14.16 m^3	= 0.78 Ci/m^3
Xe-135:	(0.1 X 170 Ci)/14.16 m^3	= 1.2 Ci/m^3
Xe-137:	(0.1 X 39,000 Ci)/14.16 m^3	= 280 Ci/m^3
Xe-138:	(0.1 X 11,000 Ci)/14.16 m^3	= 78 Ci/m^3
I-129:	(0.1 X 4.3 E-10 Ci)/14.16 m^3	= 3.0 E-12 Ci/m^3
I-131:	(0.1 X 1.8 Ci)/14.16 m^3	= 0.013 Ci/m^3
I-132:	(0.1 X 6.7 Ci)/14.16 m^3	= 0.047 Ci/m^3
I-133:	(0.1 X 35 Ci)/14.16 m^3	= 0.25 Ci/m^3
I-134:	(0.1 X 480 Ci)/14.16 m^3	= 3.4 Ci/m^3
I-135:	(0.1 X 120 Ci)/14.16 m^3	= 0.85 Ci/m^3

Salt Evaporated from Spent Fuel Solution

Tritium:	(0.1 X 29 Ci)/14.16 m^3	= 0.20 Ci/m^3
Sr-89:	(0.1 X 2.0 Ci)/14.16 m^3	= 0.014 Ci/m^3
Sr-90:	(0.1 X 1.6 Ci)/14.16 m^3	= 0.011 Ci/m^3
Y-90:	(0.1 X 1.6 Ci)/14.16 m^3	= 0.011 Ci/m^3
Y-91:	(0.1 X 2.85 Ci)/14.16 m^3	= 0.020 Ci/m^3
Zr-95:	(0.1 X 6.0 Ci)/14.16 m^3	= 0.042 Ci/m^3
Nb-95:	(0.1 X 11.0 Ci)/14.16 m^3	= 0.78 Ci/m^3
Ru-103:	(0.1 X 1.85 Ci)/14.16 m^3	= 0.026 Ci/m^3
Rh-103m:	(0.1 X 1.85 Ci)/14.16 m^3	= 0.013 Ci/m^3
Ru-106:	(0.1 X 8.5 Ci)/14.16 m^3	= 0.12 Ci/m^3
Rh-106:	(0.1 X 8.5 Ci)/14.16 m^3	= 0.060 Ci/m^3
I-129:	(0.1 X 1.6 E-3 Ci)/14.16 m^3	= 2.8 E-6 Ci/m^3
I-131:	(0.1 X 0.091 Ci)/14.16 m^3	= 1.6 E-4 Ci/m^3
Cs-139:	(0.1 X 4.5 Ci)/14.16 m^3	= 0.032 Ci/m^3
Cs-137:	(0.1 X 2.25 Ci)/14.16 m^3	= 0.016 Ci/m^3
Ba-137m:	(0.1 X 2.1 Ci)/14.16 m^3	= 0.015 Ci/m^3
Ce-141:	(0.1 X 1.2 Ci)/14.16 m^3	= 0.0085 Ci/m^3
Ce-144:	(0.1 X 16 Ci)/14.16 m^3	= 0.11 Ci/m^3
Pr-144:	(0.1 X 16 Ci)/14.16 m^3	= 0.11 Ci/m^3
Pm-147:	(0.1 X 2.1 Ci)/14.16 m^3	= 0.015 Ci/m^3
Eu-154:	(0.1 X 0.115 Ci)/14.16 m^3	= 8.1 E-4 Ci/m^3
Pu-238:	(0.1 X 0.60 Ci)/14.16 m^3	= 0.0042 Ci/m^3
Pu-239:	(0.1 X 0.007 Ci)/14.16 m^3	= 4.9 E-5 Ci/m^3
Pu-240:	(0.1 X 0.01 Ci)/14.16 m^3	= 7.1 E-5 Ci/m^3
Pu-241:	(0.1 X 2.4 Ci)/14.16 m^3	= 0.017 Ci/m^3
Am-241:	(0.1 X 0.0042 Ci)/14.16 m^3	= 3.0 E-5 Ci/m^3
Cu-242:	(0.1 X 0.315 Ci)/14.16 m^3	= 0.0022 Ci/m^3
Cu-244:	(0.1 X 0.05 Ci)/14.16 m^3	= 3.5 E-4 Ci/m^3

would be carried to the exhaust system for 5 min. After a 5 min delay, a concentration of (1.915%/10%) 19.2% of the initial concentrations would be exhausted to the ventilation system for 5 min. The sequence would be repeated an additional 46 times for a total release period of 8 h.

4.7 EQUIPMENT FAILURES

The equipment failure category covers a broad spectrum of events. In many cases the failure of equipment does not directly lead to a mechanism that results in the airborne release of radioactive materials but initiates or is initiated by the event (e.g., fires, explosions, criticality). In all cases, the concern of this document is analysis of serious events leading to the potential airborne release of significant quantities of radioactive material.

The equipment failure category contains events such as:

- loss of containment from design or material failure--loss of piping, enclosures, vessels holding radioactive materials or shielding them from conditions that could lead to their airborne release
- loss of control systems and devices leading to process malfunction or the airborne release of radioactive material--loss of systems to handle hazardous process materials (e.g., flammable or combustible materials), loss of systems controlling process parameters (e.g., temperature, pressure, depth of cut into cladding, atmosphere around welding) that shield the radioactive or process materials from deleterious conditions
- loss of control of engineered safety features--loss of process off-gas systems, HEPA filtered exhaust systems, barriers
- loss of control of process transport systems--loss of conveyor systems for the transport of process materials within or outside of enclosure, loss of control of vehicles used within facilities to transport radioactive materials from one location to another.

Other equipment failures not covered above may be significant for specific processes or facilities.

4.7.1 Scenario Considerations

All the factors covered in the previous sections of this chapter pertaining to the various mechanisms for airborne release apply here.

4.7.2 Calculational Techniques Illustrated

In many cases, what is termed an "equipment failure" initiates or is the result of events/mechanism covered in the previous sections of this chapter (4.2 Fires, 4.3 Explosions, 4.4 Spills, 4.5 Tornadoes, and 4.6 Nuclear Criticalities). The exceptions are the loss of ventilation blowers and inadvertent operations of dampers that could result in airflows from more contaminated to less contaminated areas of the facility and, if the air inlet is not filtered, to the atmosphere. Other mechanisms may be possible if other processes or if other facility configurations not considered here are utilized. For those situations, the events should be evaluated on a case by case basis. If the events result in the mechanisms covered here, the calculational techniques (or some modified form) may be applicable. If the release mechanism resulting from the event is not covered here, estimates based upon published experimental data for the release mechanism under the conditions postulated or experimental data generated for the specific cases should be used.

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5.0 FUEL CYCLE FACILITIES ACCIDENT CONSEQUENCE ASSESSMENT

5.1 INTRODUCTION

The approach to analyzing the consequences of fuel cycle facility accidents is presented here. Fuel cycle accidents involving fire, explosion, and tornado are investigated using an analytical approach. The proposed analysis method is based on computer codes that model airflow pathways within nuclear facilities, and successful use of these computer codes in a safety analysis depends on the availability of several things.

1. Detailed physical characteristics of the facility to be analyzed. (This type of information is in Chap. 2.)

2. A description of the processes and unit operations in the facility (Chap. 3 provides this type of information.)

3. A defined accident scenario with parameterization of the source term or detailed calculations to develop the source term (Chap. 4 contains information that will aid the analyst in developing the source term.)

Thus, the analyst should become familiar with the material contained in earlier chapters of the handbook before using this chapter. Although we have borrowed heavily from information contained in the user's manuals for the computer codes, the analyst also should obtain copies of them (Andrae et al. 1985, Nichols and Gregory 1986, and Nichols and Gregory 1987).

The techniques and analyses presented here may not always be needed, particularly if the analyst only needs a quick scoping study. By using the information in Chap. 4, the analyst may be able to estimate the magnitude and severity of the accident at its source. If the accident appears to be inconsequential, use of the analytical methods presented in this chapter may not be warranted.

The methods presented here are designed to allow the analyst to predict the effects of the nuclear facility's confinement system on an accidental release within the facility. The analyses can simulate any airflow pathways to the environment--principally the ventilation system. Using these analysis methods, the analyst should be able to estimate the mitigating effects of the confinement system, perform sensitivity studies, evaluate the performance of engineered safeguards, and determine the characteristics of any material released to the environment.

In this chapter, we will discuss analysis strategies, general analysis procedures, modeling concepts, and applicable computer codes. This information will be supplemented with illustrative examples and identification of needed information in other sections of the handbook.

5.2 ANALYSIS STRATEGIES

We believe that there are fundamentally two ways to analyze the consequences of a given accident--Single-Compartment/Single-Duct or a General Analysis. Both approaches use computer codes, but their perspectives are at opposite ends of a spectrum of analyses that may be used. Although both approaches may be used, we believe that the general analysis procedure we recommend will provide consistent and adequate results for a given level of detail and accuracy of input information from the AAH (Chaps. 2--4). In this section, we first will discuss what we have chosen to call "single-compartment/single-duct analysis" and then outline a more general analysis procedure.

5.2.1 Single-Compartment/Single-Duct Analysis

This analysis simplifies the accident simulation by examining the single compartment where the accident takes place. This approach considers the nearest walls and openings to be the fluid-flow, pressure, energy, and mass boundaries. The fluid and material properties during the course of the accident then are assumed to be known. To use this approach, you would take the source term from Chap. 4, add the effective reduction resulting from the compartment wall, and take credit for any filtration in the exhaust duct. Obviously, this procedure greatly simplifies the task of analyzing an entire large airflow network system found in many nuclear facilities.

In fact, this approach could allow the analyst to determine the mitigation or confinement effectiveness of the walls or boundaries nearest to the accident. The computer codes described here could be used for this type of analysis.

Previous investigators have used an approach similar to the single-compartment/single-duct analysis in Fuel Cycle Facility Safety Analysis Reports (SARs). Science Applications Inc. used a single-compartment/single-duct piecemeal summation approach in Vol. IV of their March 1981 report entitled "Adversary Actions in the Nuclear Power Fuel Cycle: Reference Events and Their Consequences" (SAI 1981).

This approach has several disadvantages. It does not include the effect of the rest of the ventilation network system on the reference event. Depending on the accident and the characteristics of the network system, these simplifications may not always be conservative and certainly may not be realistic. Also, we often are concerned with changes in pressure level, flow, or movement of material in other parts of the facility and this type of analysis is not well-suited to determining effects that are removed from the origin of the accident. Therefore, we recommend a more general approach that allows the analyst to use as much detail as needed.

5.2.2 General Analysis

With this approach, the effects of a complete facility ventilation system are included in the analyses. This method does not exclude a quick estimate of accident consequences; it encompasses them. Single-compartment modeling is encompassed as well. The degree, refinement, or extent of the system model is left for the analyst to choose. The analyst can do sensitivity studies or evaluate alternatives by varying the major controlling parameters after a problem is set up, and the calculations are performed rapidly on digital computers. This approach is unique because it uses the network simulation capability inherent in the accident analysis computer codes.

In this method, we first model the entire system (all of the ventilation or other pathways) using an accident analysis computer code. At this stage, the analyst does not need detailed information about a complex accident source.

As source-term data are developed, they can be integrated gradually into the analysis for more refined results. This first step allows the analyst to obtain a quick overview of the entire problem and identifies the zones of major risk, any uncertainties, the feedback mechanisms, and any problems associated with engineered safety systems.

The analyst can do this because a lumped-parameter simulation of the entire ventilation system, including rooms and corridors, is used. Initially, this simulation should use a coarse representation that lumps together many system elements such as rooms, ducts, filters, blowers, and dampers into fewer representative elements. Subsequent analyses can become more detailed as the preliminary computer experiments reveal more detail about the event. This type of simulation is used widely in many fluid/thermal analysis computer codes and will be discussed later.

The general analysis method can be summarized as four steps.

1. Evaluate the overall system response to a parametric accident specification using a coarse network simulation.

2. Simulate and refine the accident zone with or without (preferably with) the results from Step 1 as boundary conditions.

3. Couple the accident zone and system analyses.

4. Refine the analysis temporally and spatially and add safety system details as required.

In some cases, an accident analysis could be finished after Step 1 is performed, for example, if the first level of analysis predicts trivial consequences from the standpoint of internal spread of atmospheric release of radioactive material. This is one of the ways that scoping analyses of less complex situations can use in the general analysis procedure.

In our discussion of the single-compartment/single-duct approach, we indicated that the general analysis procedure would not be precluded. For example, the analyst could skip Step 1 and go directly to Step 2, simulating the accident with a single-compartment/single-duct approach. In fact, the rest of the network system can be taken into account in a rough, approximate way.

5.3 ANALYSIS CODES

A family of analysis computer codes has been designed to provide improved methods of safety analysis to the nuclear industry. There are three codes.

- TORAC: A computer code to analyze tornado-induced gas dynamics and material transport
- EXPAC: A computer code to analyze explosion-induced gas dynamics and material transport
- FIRAC: A computer code to analyze fire-induced gas dynamics, thermal, and material transport

These codes were designed primarily for analyzing nuclear facilities and the primary release pathway--the ventilation system. However, they are applicable to other facilities and can be used to model other airflow pathways within a structure. This family of analysis codes can be extended to model accidents associated with criticality, spills, and equipment failure. Although all three codes are applicable, TORAC is probably the code to use for these situations. No information other than that provided in the user's manual is necessary for input.

The discussion below is only a supplement to the analysis codes' user's manuals. The analyst should obtain the manuals for more detailed information about each code. All of the accident analysis codes can analyze an arbitrary network of interconnected rooms, cells, canyons, or other airflow pathways. The airflow pathways include conventional ventilation system components such as dampers, blowers, ductwork, and filters. The accident simulation requirements are provided for in parametric form, that is, through energy, mass, pressure, or temperature time-histories of the accident. In addition, the user can include a model of the accident zone. For fires, this involves using the FIRIN subroutine of FIRAC; the EXPAC code uses a chamber model to simulate an explosion within a room. The codes can simulate both steady-state and transient events. The capability for basic convective transport of material through the network and for material depletion through gravitational settling and HEPA filter filtration are included, as is entrainment of material in ducts or rooms.

There are two major limitations in these analysis codes.

- The gas dynamics are based strictly on lumped-parameter formulations. The analyst should view predicted values near the accident source with caution. This is particularly true for simulation of an explosion accident.

- The material transport capability is very basic and relies on information found in the literature. For example, material entrainment is based on wind tunnel data. In other areas, the filter plugging model is semi-empirical and needs additional experimental data.

These general limitations should be considered in the analysis procedures that follow. Particular assumptions that we wish to call attention to are

- lumped-parameter formulation;
- gas dynamics decoupled from material transport;
- no material interaction, phase change, or chemical reaction accounted for during transport;
- homogeneous mixture and dynamic equilibrium;
- material deposition by gravitational settling only; and
- material entrainment based on the resuspension factor and other concepts for rooms with semi-empirical rate equations and wind tunnel data for ducts.

A problem can be stopped and restarted in TORAC and EXPAC but not in the FIRAC code. The advantage of this feature is that it allows for a change in the problem. This could be needed if structural limits are reached with an alteration in the flow paths or other characteristics of the system.

The following sections are a general explanation of how one uses the codes and illustrative examples.

5.4 GENERAL ANALYSIS PROCEDURE

In our discussion in Sec. 5.2., we suggested a general analysis procedure that encompasses the single-compartment/single-duct approach. We now will go through the analysis procedure in a general way without referring to a specific accident. That is, the sections that follow are indicative of our suggested analysis process. We will discuss how the AAH user constructs a simulation model, incorporates information from the other AAH chapters, performs sensitivity studies, and alters the simulation with more refined analyses. A single-compartment/single-duct analysis can be done by applying the modeling techniques in the next section and proceeding to the section on accident event zone simulation and refinement.

The computer codes are designed to predict airflows in an arbitrarily connected network system. In a nuclear facility, this could include process cells, canyons, laboratory offices, corridors, and offgas systems, and the ventilation system is an integral part of this network. It is used to move air into, through, and out of the facility. Therefore, the codes must be able to predict flow through a network system that includes such ventilation system components as filters, dampers, ducts, and blowers. These components are connected to the rooms and corridors of the facility to form a complete network for moving air through the structure and maintaining pressure levels in certain areas.

5.4.1 Required Chapter 2 and 3 Information

The first and most critical step is setting up a model of the airflow pathways in a nuclear facility, which requires a comprehensive schematic showing the system components and their interconnections. Drawings, specifications, material lists, safety analysis reports, and existing schematics can be used to develop a system schematic. Figure 5.1 is an excellent example of the type of information needed from Chap. 2 or other sources to construct a network model. A physical inspection of the facility and consultations with the designer(s) before and after the schematic is drawn may be necessary to verify that it is correct. At this stage, the user frequently encounters a lack of data. Although there is no substitute for accurate data, certain assumptions, averaging, or conservative estimates can be used to make the problem tractable.

Chapter 2 provides the analyst with general background information about several nuclear fuel cycle facilities. Fuel manufacturing, fuel separation, fuel recycling, spent fuel storage, and waste solidification plants are discussed. Of particular importance in Chap. 2 are the discussions on airflow parameters and the facility ventilation, filtration, and cleanup systems (Sec. 2.1.3). The analyst should review these sections of the AAH for his specific facility. General information is given about the configuration of the facility and the facility heating, ventilating, and air condition (HVAC) systems. We assume that the analyst is acquainted with the design and layout of nuclear fuel cycle facilities, and these sections of Chap. 2 are only intended to highlight the type of information required. The glovebox ventilation, filtration, and cleanup systems also should be considered and incorporated into the airflow pathways.

Chapter 3 identifies possible accidents that can occur for selected processes. These accidents range from spills to violent hydrogen or red-oil explosions. This information is helpful for prioritizing which possible accidents should be evaluated. The principal information contained in Chap. 3 provides background information for developing the accident scenario and source term for Chap. 4. The quantities of materials at risk and their forms are essential to development of the source term. Therefore, as far as Chap. 5 is concerned, most of the Chap. 3 information is used in Chap. 4.

5.4.2 Coarse Network Model Development

Figures 5.2 and 5.3 show how a simple ventilation system within a facility structure can be transformed into a network schematic. Before proceeding, we will define several terms used to describe network models and then provide examples of models.

Several terms are used to describe the components of a model and are used extensively. They are listed below.

- System. A network of components (branches) joined together at points called nodes.

- Branch. A connecting member between upstream and downstream nodes. A branch contains one component. (Ducts, dampers, filters, and blowers can exist in a branch.)

- Node. A connection point or junction for one or more branches. Volume elements such as rooms, gloveboxes, and plenums are defined as capacitance nodes. The compressibility of the system fluid is taken into account at these capacitance nodes. Boundary points (inlets and exhausts) are defined at nodes. System pressure and material concentration also are defined at nodes.

5.4.2.1 System Modeling Examples

Network systems for airflow through a nuclear facility can be constructed using a building block approach. The building blocks used to construct network systems are shown in Fig. 5.4; these can be arranged to form arbitrary systems (Fig. 5.5). The symbols will be used throughout this chapter. Figure 5.6 is an example showing the correspondence of the building block schematic to a simple network system.

Nodes 1 and 9 in Fig. 5.6 are boundary nodes. A capacitance node, 4, represents the sampling room. In Fig. 5.6, the branches are at the tips of the arrows. The branch numbers are enclosed in parentheses and adjacent to their corresponding branches. Note that Branch 3 is connected on the upstream side by Node 3 and on the downstream side by capacitance Node 4. Duct resistance is shown separately in Branch 2, whereas it is lumped or combined with damper resistance for Branches 4 through 8.

We have illustrated extremely simple network systems thus far. A slightly more complex system is shown in Fig. 5.7, and its corresponding schematic is shown in Fig. 5.8. This system illustrates a room (Node 2, with three connected Branches (1, 2, and 3). Also illustrated, using Branch 5 and Node 5, is the leakage path around the cell access hatch.

Additional network complexity is shown in Fig. 5.9, which is a network [illegible]atic and contains most of the elements common to larger facilities. This [illegible] features the following.

- Natural bypass around rooms
- Recirculation
- Combinations of series and parallel component arrangements
- Rooms (confinement volumes) with multiple inlets and outlets
- Duct friction
- A network consisting of 30 components and 25 nodal points

5.4.3 Accident Simulation

The accident analysis computer codes rely on a parametric form of specification of the accident-induced source term. The computer codes use time-history information that specifies values for parameters such as energy, mass, pressure, temperature, and material. These parameters can be completely arbitrary but must be input to the codes in tabular form or must come from a model within the code. An explosion or a fire can be specified as a function of time by any one of the following four sets of input.

- Pressure and temperature specified
- Mass source and pressure specified
- Mass source and energy source specified
- Mass source and temperature specified

In addition, the material release rate as a function of time and as the material characteristics such as density and particle size must be specified.

5.4.3.1 Chapter 4 Source Terms

The analyst may turn to Chap. 4 and review suggested methods for specifying the parametric form of the accident source term in question. Hand calculations are provided for the fire and explosion accident specifications. However, FIRAC and EXPAC contain source-term models as subroutines to the main transport codes. As explained in Chap. 4, FIRAC contains the fire compartment model FIRIN. If the analyst has more detailed input information about the fire scenario or wishes to obtain more detailed results in the fire compartment itself, the FIRIN option should be used. For simple scoping analyses to evaluate total energy capacity or temperature range, the parametric input specifications should be used. A comparison of these two methods of accident specification is provided in the examples in Sec. 5.6.

The EXPAC computer code contains a source-term model called NORDL (Proctor and Lorent 1974, Wilson 1984). NORDL calculates the gas dynamics associated with a TNT, hydrogen/oxygen gas, acetylene, or red oil explosion. If the origin of the explosion is quite different from those contained in NORDL, the analyst can use a TNT-equivalent approximation for the source term. (See Chap. 3.) This procedure is explained in an example problem in Sec. 5.6. The particulate injection associated with the explosion simulation is not calculated automatically by NORDL. This input requires the analyst to use other explosive material source-term information outlined in Chap. 4.

A specification of pressure vs time at the boundaries is required for the tornado accident. Induced material entrainment can be specified as described above or will be calculated automatically by the TORAC computer code. The tornado accident usually involves specifying some time-history pressure profile at the plant's exhaust and/or inlet.

5.5 ILLUSTRATIVE PROBLEM SYSTEM DESCRIPTION

We have chosen two general systems to use as bases to illustrate example problems. The first is a relatively simple straight-through system consisting of a main cell or room, inlet supply and exhaust blowers, filters, a filter plenum, dampers, and an exhaust stack. This system is shown in Fig. 5.10. We will refer to this as the simple system. The computer model and blower curves are shown in Fig. 5.11. Tables 5.1 and 5.2 contain information for each of the nodes and branches of the computer model. Note that initial pressures, temperatures, and flows are specified. Complete geometric information for volumes, lengths, widths, heights, and cross-sectional area are specified.

The second system we chose to illustrate example problems is much larger and is representative of many fuel cycle facilities. We will refer to it as the representative facility. This system is shown in Fig. 5.12 with a set of steady-state flows and pressures. Multiple blowers, compartments, dampers, and filter systems are included, and the ventilation system network connections are in both parallel and series arrangements. Supply and exhaust blowers are included, and leakage around doors and other areas can be included. In addition, several pressure zones are provided with flow from the least likely contaminated to the more likely contaminated zones.

The user must realize that the simple and representative facilities will only be a basis for many of the illustrative problems. That is, the basic system may be altered by changing room size, changing flow rate, adding glovebox systems, adding more detailed ductwork, or relocating dampers and filters. Therefore, the analyst is cautioned to notice changes in the basic systems from example to example.

5.6 ILLUSTRATIVE EXAMPLES

Chapters 2, 3, and 4 provided information on selected fire, explosion, and tornado sample problems. Chapter 2 provided the analyst with facility descriptions that could affect possible accident scenarios. Chapter 3 outlined the processes that could be involved in possible accidents and discussed the materials at risk, and Chap. 4 outlined specific accident scenarios for fire, explosion, and tornado accidents. The Chap. 4 sample problems use information from Chaps. 2 and 3 to develop the accident scenarios and calculate the accident source terms. Chapter 5 will develop these illustrative sample problems further by incorporating several of them into the FIRAC, EXPAC, and TORAC computer codes to determine the accident consequences. These consequences will include internal physical effects (pressure, flow, and temperature) within the facility in addition to calculating radioactive release at the plants' atmospheric boundaries.

The illustrative examples developed here will be based on the system models outlined in Sec. 5.5 and modified to fit the particular sample problem. Selected accident scenarios and source terms developed in Chap. 4 are used in the examples that follow.

5.6.1 Fire Sample Problem Consequence Assessment

Two sample problems are outlined in Chap. 4 for fires in nuclear facilities. The first involves a fire in the slug press area of a MOX fuel manufacturing facility. The second involves a solvent fire in a fuel reprocessing facility. Both sample problems will be used in the consequence assessment calculations below. In each case, a hand calculation of the source term is used as input to the FIRAC code, and then the same problem is analyzed using the FIRIN option in the FIRAC code.

5.6.1.1 MOX Fire Sample Problem

The MOX fire sample problem will be illustrated by first using the simple system described in Sec. 5.5. For the MOX sample problems, the large room (Node 4) will be replaced by a fire compartment with the following features.

System Description

MOX Fire Compartment

- 6.7 m x 41.8 m x 8.8 m (22.0 ft x 137.1 ft x 28.9 ft)
- 8- to 2-gauge stainless-steel wall covering
- 0.15-m-thick concrete walls (0.5 ft)
- 0.457-m-thick concrete ceilings (1.5 ft)
- 0.203-m-thick concrete floor (0.7 ft)

Table 5.3 describes the node data used in FIRAC to model the MOX facility. Note that Node 11 is only used when the fire compartment model, FIRIN, is used. When the hand calculations are used, Node 4 represents the fire compartment volume. For the hand-calculated source terms, the Node 4 volume is 2465 m^3 (87 034 ft^3).

Table 5.4 shows the branch data for the MOX fuel fabrication facility. This table identifies the type of component for each branch, the steady-state flow rate, the branch flow cross-sectional areas, the duct lengths, the duct heat transfer locations, the blower curve, and the filter type identification. This information is used for both the hand and the FIRIN calculations.

The flow rate through the system is 4.248 m^3/s (9000 ft^3/min) with airflow entering at the ceiling with the outlet located at the floor. The blower curves have been modified to deliver 4.248 m^3/s (9000 ft^3/min) rather than the 0.4720 m^3/s (1000 ft^3/min) specified in the base-case simple system. The digital data for the two blowers are shown in Table 5.5.

MOX Sample Problem Source Terms

The source terms for the sample problem fires are discussed in Chap. 4, Secs. 4.2.3.1 and 4.2.3.2. The first sample problem to be considered will be the MOX fire that occurs in the slug press. We will assume that all of the combustibles burn simultaneously.

Hand-Calculated Source Terms. To illustrate this fire scenario we will first consider the hand-calculated source-term input for the FIRAC transport code and then the source-term input for FIRAC using the FIRIN fire compartment model. Figure 4.2 is a listing of the hand-calculated source terms; these are used to construct mass, energy, and particulate time functions for FIRAC. These time functions are listed below in Table 5.6. The FIRAC input and results using the hand-calculated source terms are discussed below along with results from the FIRIN source-term calculation.

FIRIN-Calculated Source Terms. Table 4.8 contains the input parameters for the FIRIN model used in FIRAC and involves parameters that are used for a simultaneous burn scenario. Using the input values from Table 4.8 does not require construction of the time functions that were used for the hand-calculated source terms. As noted above, the results from these calculations are discussed below in comparison with the results from the hand calculations.

FIRAC Input Summary. In Table 5.7, we list the input parameters for the FIRAC code for both the hand calculations and the FIRIN calculations. These tables and the node, branch, and source-term listings will generate the input listing shown in Tables 5.8 and 5.9.

MOX Fire Sample Problem Results. Discussion of the MOX fire sample problem results will include both the hand-calculated source term and the FIRIN results. In addition, we compare the results of the two calculations. Our ultimate objectives are to calculate the physical effects of the fire scenario and to estimate the radioactive release from the facility.

Figure 5.13 is a plot of pressures for Nodes 1--4 in the simple system from the hand-calculated source term. (See Figs. 5.10 and 5.11 for the system schematic.) The Node 4 pressure is the average pressure in the large canyon, resulting in a peak pressure of approximately 0.336 kPa (1.35 in. of water). This peak pressure contrasts with that calculated with FIRIN as shown in Fig. 5.14. The peak pressure is 0.685 kPa (2.75 in. of water) compared with 0.336 kPa (1.35 in. of water), but the most striking contrast is the large time variations. In the FIRAC run with FIRIN, the change at approximately 50 s to 60 s corresponds roughly to the time when the rubber gloves have quit burning. Another significant change occurs at approximately 350 s. Although not printed out, this is the time when the smoke layer descends to the floor.

The next significant results involve the volumetric flow rates. Figure 5.15 shows the volumetric inlet flows for the hand-calculated source term, and the FIRIN-calculated values are shown in Fig. 5.16. Again, the results are quite different. Noting that Branches 1, 2, and 3 are the inlet to the canyon and Branch 4 is the outlet, we see that the initial fire-induced pressure in the canyon causes a reduction of inlet airflow for a short time, and the inlet airflow is reversed. This can be significant because there is no filter on the canyon inlet and a release of radioactivity is possible. Figure 5.16 indicates a peak reverse flow of 0.472 m^3/s (1000 ft^3/min) for this scenario. Branch 4 (the canyon exhaust) increases in both Figs. 5.15 and 5.16.

Figures 5.17 and 5.18 show the temperatures for the air inlet to the canyon, the average temperature, and the hot-layer temperature for the hand-calculated and FIRIN results, respectively. The hand-calculated source-term peak temperature is approximately 24°C (75°F), whereas the FIRAC/FIRIN peak temperature is 116°C (240°F). In addition, Fig. 5.18 shows reverse flow temperatures between 27°C (80°F) and 60°C (140°F) for the first 50 s of the fire. Figure 5.19 shows that when the smoke layer or hot layer descends to the floor, the exhaust temperature rises 11°C (20°F) to 27°C (80°F). None of these temperatures pose a threat to the exhaust HEPA filter.

Determining the radioactive release from the facility resulting from the MOX fire is the ultimate goal of these calculations. The next set of figures concerning material movement illustrate the consequences of the MOX fire accident.

Figures 5.20 through 5.25 illustrate the results using the hand-calculated source-term input. The smoke production is shown in Figs. 5.20--5.22. The smoke flow rate, the mass through the branches or on a filter, and the deposition are shown on the respective plots. Approximately 0.08 kg (0.176 lbm) of smoke passes through Branch 8, which is the blower. That is, 0.08 kg (0.176 lbm) of smoke is released from the facility in 500 s. The radioactive component from the hand-calculated source term is shown first in Fig. 5.23 for the flow rate out of the canyon. A peak flow rate of 4.5×10^{-8} kg/s (9.9×10^{-8} lbm/s) is shown. Fig. 5.24 shows that of the 1.5×10^{-5} kg (3.3×10^{-5} lbm) that comes out of the canyon, approximately 0.5×10^{-5} kg (1.1×10^{-5} lbm) is deposited on the filter (Branch 6). The analyst should note that the filter is 99.5% efficient and that we have not modeled filter plugging in this analysis. Therefore, the amount of radioactive particulate released from the facility for 500 s is 2.5×10^{-8} kg (5.5×10^{-8} lbm). The particulate difference between the amount passing through Branch 4 and that on the filter at Branch 6 has been deposited on the duct walls and floor of Branch 5 because of gravitational settling. The analyst should note that the problem needs to run longer than 500 s to obtain the total particulate mass expelled from the facility.

The FIRAC/FIRIN calculations for particulate flow yield results that are quite different from the hand-calculated source-term results discussed above. These results are shown in Figs. 5.25 through 5.30. The smoke and radioactive particulate flow rate are shown in Figs. 5.25 and 5.26. They are similar in form, showing an initial flow from 0--50 s and then a much larger flow at 350 s. The initial flow of both smoke and radioactive particulate is associated with the flow reversal discussed above. The flow that starts at 350 s is when the smoke or hot layer has descended to the floor, where tha canyon exhaust is located.

Figures 5.27 and 5.28 show the particulate mass that is located on the filters or has passed through the inlet or exhaust at 500 s. Branch 2 (the canyon inlet) shows that 0.25 x 10^{-2} kg (5.51 x 10^{-3} lbm) and 0.075 x 10^{-5} kg (1.653 x 10^{-6} lbm) smoke and radioactive particulate, respectively, were expelled out of the inlet of the canyon. At 500 s 5.75 x 10^{-2} kg (1.27 x 10^{-1} lbm) and 1.475 x 10^{-5} kg (3.252 x 10^{-5} lbm) of smoke and radioactive particulate have been expelled through the canyon exhaust. The mass of radioactive particulate on the exhaust filter (Branch 6) is shown in Fig. 5.28 to be 0.5 x 10^{-5} kg (1.1 x 10^{-5} lbm). This amount is in complete agreement with that found earlier for the hand-calculated source-term results. Figures 5.29 and 5.30 show the mass deposition of the smoke and radioactive particulate on the duct walls of the canyon exhaust.

5.6.1.2 Solvent Extraction Fire Sample Problem

Description

The solvent extraction fire sample problem first will use the simple system described in Sec. 5.5. The modifications to and details of this system are described below. The large room or cell (Node 4) of the simple system will be modified to incorporate features of the solvent fire compartment.

Solvent Fire Compartment

- 6.7 m x 41.8 m x 8.8 m (22.0 ft x 137.1 ft x 28.9 ft)
- Walls and floor lined with 10-gauge stainless steel
- 1.2-m-thick concrete walls (3.9 ft)
- 1.2-m-thick concrete ceiling (3.9 ft)
- 1.2-m-thick concrete floor (3.9 ft)

The flow rate through the system is 24.5 m^3/s (52 000 ft^3/min) with the airflow inlet at the ceiling and the outlet at the floor. The blower curves for the simple system have been modified to deliver 24.5 m^3/s (52 000 ft^3/min) rather than the specified 0.472 m^3/s (1000 ft^3/min). The digital data for the two blowers are shown in Table 5.10.

Table 5.11 describes the node data used in FIRAC to model the solvent extraction facility. Note that Node 11 is only used when calculations are made with the FIRIN compartment model. Both Node 4 and Node 11 are in the fire compartment. Node 4 is connected to the inlet, and Node 11 is connected to the coutlet. For the hand-calculated source-term case, only Node 4 represents the fire compartment or canyon, and it is equal to 2464.5 m^3 (87 034 ft^3).

The branch data for the solvent extraction facility are listed in Table 5.12. This table identifies the type of component for each branch, the steady-state flow rate, the branch flow cross-section area, the duct lengths, the duct heat-transfer locations, the blower curve identification, and the filter type identification. These data are used in both types of source-term calculations--hand-calculated source terms and FIRIN-calculated source terms.

Solvent Extraction Sample Problem Source Terms

The accident scenario is described in Sec. 4.2.3.1 and occurs when an extraction column ruptures and spills 100 L of solvent into a diked area at the base of the column. The solvent ignites and burns. The fire that results may overpressurize the solvent extraction feed tank. In this section we will develop the fire source terms for FIRAC using both hand calculations and FIRIN.

Hand-Calculated Source Terms. The time functions to be used as input to FIRAC are listed in Table 5.13 and are taken from Sec. 4.2.3.1. In the hand-calculated source-term sample problem, we do not assume that the feed tank overpressurizes and ruptures.

The FIRAC input and results from the hand-calculated source terms are discussed below along with the results from the FIRIN source-term calculation. The use of a fire compartment model to develop the solvent extraction fire source term and its input for the FIRAC code follows.

FIRIN-Calculated Source Terms. Table 4.11 contains the input parameters for the FIRIN model in FIRAC. As noted above, the results of this FIRAC calculation and a comparison with the hand-calculated source-term model are discussed in the following section.

FIRAC Input Summary. Table 5.14 contains a listing of the input parameters for the FIRAC code for both the hand-calculated source terms and the FIRIN calculations. Table 5.14 with Tables 5.10--5.13 will generate the FIRAC code input listings shown in Tables 5.15 and 5.16.

Solvent Extraction Fire Sample Problem Results. Our discussion of the solvent extraction fire sample problem results will include both the hand-calculated source terms and the FIRIN fire chamber model results. We also compare the results of the two calculations.

Figure 5.31 is a plot of pressures vs time for Nodes 1--4 in the simple system from the hand-calculated source term. Node 4 is the average pressure in the large canyon, resulting in a peak pressure of approximately 1.30 in. of water. The pressure decreases to 0.311 kPa (1.25 in. of water) at 636 s, at which time the pressure drops to 0.249 kPa (1.0 in. of water). The pressure drops correspond to when the energy time function input is reduced. In contrast, the peak pressure in the fire chamber (Nodes 4 and 11) calculated with the FIRAC code using FIRIN for the fire chamber model is shown in Fig. 5.32. Sharp pressure spikes rise to 0.473 kPa (1.90 in. of water) at 7.0 s and to 0.349 kPa (1.40 in. of water) at 30 s. This second pressure rise coincides with the time that the fire chamber model hot-layer temperature reaches its maximum value of 293°C (560°F). Also, the radioactive particulate release rate (discussed below) increases sharply at this time, indicating the pressurized release of aerosol from the vessel in the fire chamber. The pressure drops to about 0.237 kPa (0.95 in. of water) at 30 s and then rises to 0.274 kPa (1.10 in. of water) at 70 s. It remains nearly constant for the remainder of the calculation.

The volumetric flows in the branches immediately downstream of the fire chamber are shown in Fig. 5.33 for the hand-calculated source term case and in

Fig. 5.34 for the FIRIN source-term calculation. Again, the time history of the FIRAC/FIRIN-calculated volumetric flow shows significantly more detail than the hand calculation. However, after about 70 s, the predicted flows are steady. The hand calculation shows about a 5% greater flow rate than the FIRAC/FIRIN prediction.

The fire chamber (Node 4) temperature time history reflects the energy input profile for the hand-calculated source term case. As shown in Fig. 5.35, the temperature steadily increases from ambient at time zero to 171°C (340°F) at the energy cut-off time of 636 s. Figure 5.36 shows the FIRAC/FIRIN calculation. The temperature profile for Node 4, which corresponds to the fire chamber hot layer, shows a quick temperature rise from ambient at time zero to 288°C (550°F) at 30 s. The temperature drops to 154°C (310°F) by a time of 150 s and remains at this value until the end of the calculation. In Fig. 5.37 the temperature profile for the fire chamber cold-layer is shown in Node 11. The cold-layer maximum temperature is 182°C (360°F) at about 70 s, which is the time the hot layer descends into the Node 11 region.

The greatest difference in the two calculations is in the particulate release predictions. The FIRAC hand-calculated source-term case predicts a maximum radioactive particulate flow rate in Node 4 of about 4.0×10^{-5} kg/s (8.8×10^{-5} lbm/s) by a time of about 300 s, as shown in Fig. 5.38. Similarly, as shown in Fig 5.39, the maximum smoke flow rate of 2.8×10^{-4} kg/s (6.2×10^{-4} lbm/s) is reached at about the same time. The FIRIN source-term calculation compared much larger values of smoke particulate flow rates and somewhat smaller values of radioactive particulate flow rate. Significantly more detail is shown in these time histories as well. The smoke flow rate, shown in Fig. 5.40, reaches its maximum value of 1.4×10^{-2} kg/s (3.1×10^{-2} lbm/s) at about 400 s. The radioactive particulate flow rate in the fire chamber is shown in Fig. 5.41. At a time of 30 s, the flow rate peaked at 1.8×10^{-5} kg/s (4.0×10^{-5} lbm/s) and has dropped back to slightly less than 1.0×10^{-5} kg/s (2.2×10^{-5} lbm/s) by 50 s. By a time of 100 s, the flow rate has become steady at about 1.1×10^{-5} kg/s (2.4×10^{-5} lbm/s). The time of the initial spike corresponds to the secondary pressure spike shown in Fig. 5.32. This is the time when the pressurized vessel ruptures and the radioactive liquid aerosol is being released into the fire chamber.

The FIRAC/FIRIN calculation predicts that a small amount of radioactive material reaches the atmosphere. Figure 5.42 shows the plot of particulate mass through Branch 2, which is upstream of the fire chamber. This plot indicates that about 6.0×10^{-5} kg (1.3×10^{-4} lbm) of material flowed through this branch to the atmosphere. This flow of material out the inlet occurs early in the calculation. In Fig. 5.34 the flow in Branches 1 and 2 is negative for a few seconds almost immediately after the fire is ignited in the fire chamber. In Fig. 5.41 the particulate flow rate through Branch 2 is plotted as a function of time. Here the negative spike indicates the time during which the radioactive particles were transported to the atmosphere.

5.6.1.3 Fire Sample Problem in Representative Facility

To illustrate how the accident analysis codes can be applied to a more complex facility, we have chosen to model a fire in the representative facility discussed in Sec. 5.5. However, the fire scenario analyzed in this problem is different from the primary sample problems developed in Chaps. 2, 3, and 4. The other accidents (explosion and tornado) will not be illustrated using the representative facility.

System Description

For this scenario, the fire is assumed to occur in the compartment represented by internal boundary Nodes 9, 21, and 22. Three internal boundary nodes were required because the compartment has three flow connections: two inflow (Branches 16 and 17) and one outflow (Branch 14). The inlet and outlet branches (ducts) to the fire compartment have been positioned so that the general ventilation flow direction in the room is downward. Most compartment ventilation ducts in fuel cycle facilities are configured this way to help settle contaminated airborne particulates, which reduces the risk of contamination throughout the facility. A closeup of the fire compartment noding is shown in Fig. 5.43.

The fire compartment is assumed to be 12 m (39 ft) long, 12 m (39 ft) wide, and 6 m (20 ft) high. The centerline elevation (measured from the floor) of the two inlet ventilations is 5.71 m (18.74 ft), and the centerline elevation of the outlet ventilation is 0.9 m (3.0 ft). Also, the fire compartment assumed to have a concrete floor, ceiling, and walls. The ceiling and floor are assumed to be 0.3 m (1.0 ft) thick, and the walls are assumed to be 0.2 m (0.5 ft) thick.

When the system is operating under steady-state conditions, the fire compartment has a pressure of -0.075 kPa (-0.30 in. w.g.) at a temperature of 21°C (70°F). The two inlet ventilators (Branches 16 and 17) supply 1.736 m^3/s (3679 ft^3/min) and 0.137 m^3/s (290 ft^3/min) of air to the compartment. The outlet ventilator exhausts 1.873 m^3/s (3969 ft^3/min) under steady-state conditions. The fire compartment/overall system steady state was achieved by selecting an initial system pressure distribution and using resistance coefficients. The fire compartment exhaust filter (Branch 17) is assumed to be 99.95% efficient and has a plugging factor of 20.1 kg (44.3 lbm). A large filter plugging factor was selected to show the effect of the filter plugging model on the calculated results.

The facility model features 37 branches, 22 nodes [17 capacitance (room) nodes, 2 standard boundary nodes, and 3 internal boundary nodes], 2 blowers, and 9 filters. A complete listing of the input deck for this problem showing the assumed blower curves, initial system pressure distribution, fire compartment input specifications, and so on is presented in Table 5.17.

Fire Accident Scenario

This fire sample problem illustrates the use of the FIRIN sequential burning option. Two fuels (kerosene and polystyrene) will be burned sequentially in the calculation. The fire compartment is assumed to contain 1.4 kg (3.0 lbm) of uncontaminated kerosene. The container of kerosene has an exposed surface (burn) area of 0.5 m^2 (5.0 ft^2). In addition to the kerosene, the compartment contains 13.6 kg (10.0 lbm) of contaminated polystyrene. The polystyrene is assumed to have an exposed surface area of 0.7 m^2 (7.0 ft^2) and is contaminated with 0.10 kg (0.22 lbm) of mixed oxide powder.

Because in the scenario we assumed that the two combustibles at risk within the fire compartment will burn sequentially, the maximum number of burning orders (input parameter MIBO) is 2. The kerosene was selected to initiate the accident sequence and has a burning order (IBO) of 1. After all the kerosene has been consumed, the polystyrene (burning order IBO = 2) will ignite to continue the fire-induced transient. When using the sequential burning option, the combustible input information must be entered according to the burning order. For this problem, the amount (mass) of kerosene preceded the input value for the amount of polystyrene. The same format is used for the input of the respective fuel burn areas.

The radioactive source-term input for the release rates resulting from the burning of the contaminated polystyrene requires that NRAD(1) = 1. This input value for NRAD(1) indicates the radioactive release of particulates will be estimated in the contaminated combustible solid release subroutine. The assumption that the contamination is in the form of a powder requires input parameter IFORM be assigned a value of 1. The combustibles material identifier (I) has been selected to be 2--polystyrene is fuel type (combustibles identifier) 2. The burning order (IBO) of the polystyrene is 2, and the total mass of powder contaminate (QRAD 1) is 0.10 kg (0.22 lbm).

Sample Problem Results

System Response. The sequence of events for the Sample Problem 2 calculation is given in Table 5.18. The kerosene ignition initiates the accident sequence 2 s into the simulation. The fire compartment (represented by Nodes 9, 21, and 22 in the system model) rapidly pressurizes from its steady-state operating value of -0.075 kPa (-0.300 in. w.g.) to approximately 0.125 kPa (0.5 in. w.g.) because of the rapid volumetric expansion of the gases within the compartment caused by the fire. Figure 5.44 shows the fire compartment pressure response for the entire transient. As a result of the pressure increase in the compartment, a reduction in flow at the intakes (Branches 16 and 17) and an increase in flow at the compartment exhaust (Branch 14) is calculated by FIRAC. Volumetric and mass flow rate results for the fire compartment are presented in Figs. 5.45 and 5.46, respectively.

Between 2 and 200 s, the hot layer gradually expands and descends toward the outflow ventilator (Fig. 5.47). As the outflow ventilator begins to exhaust the hot combustion products/gases composing the hot layer, the fire compartment begins to depressurize. The volumetric and mass flows at the intakes to the compartment are enhanced by the depressurization. The compartment exhaust flow rate decreases because of the depressurization and the presence of the hot (less dense) combustion gases at the outflow ventilator. The temperature history for the fire compartment is shown in Fig. 5.48.

The system is perturbed again as the kerosene fire terminates and the contaminated polystyrene ignites through the sequential burning option. This transition occurs between ~250 and ~275 s as shown in Figs. 5.49 and 5.50. The ignition of the polystyrene repressurizes the fire compartment to approximately 0.249 kPa (1.0 in. w.g.). The flow rates to the compartment are affected by the repressurization: enhanced exhaust flow (Branch 14) and reduced intake flow (Branches 16 and 17). As the polystyrene burns, the compartment remains pressurized at approximately 0.224 kPa (0.9 in. w.g.) and becomes more concentrated with smoke particulates. Burning polystyrene releases a significantly larger amount of smoke then does burning kerosene as shown in Fig. 5.51. The introduction of smoke at a faster rate within the compartment begins to deplete the amount of oxygen available to the fire (Fig. 5.52) as a result of filter plugging. The polystyrene continues to burn until ~806 s. At this time, all the combustible materials within the fire compartment have been consumed, and the system begins to recover to a new steady-state operating condition.

Material Transport. The combination of the smoke release rate of the burning polystyrene material and a fire compartment exhaust filter plugging factor of 20.1 kg (44.3 lbm) significantly influences the system response to the fire. The system flow to and from the fire compartment is reduced gradually (after 300 s) as the compartment exhaust filter (Branch 14, filter No. 2) plugs with the smoke particulate. As the filter plugs, the polystyrene burns at a constant burning rate, thereby maintaining a constant fire compartment pressure. Even though the intake flows to the compartment are being reduced, a sufficient oxygen concentration level (>15%) is available to sustain a constant fuel burning rate (Fig. 5.52). Figures 5.53 and 5.54 present the smoke mass flow rate and mass accumulation on the compartment exhaust filter and at several locations near the exit to the facility. The smoke particulate release rates indicate an increasing accumulation rate in Branch 14. After ~300 s, the flow rate in Branch 14 decreases with time (Fig. 5.45); however, the smoke concentration in the hot layer (Fig. 5.51) steadily increases. The net result is the mass flow rate profile in Fig. 5.46.

The release mechanism for radioactive material is the burning of a contaminated combustible solid (polystyrene). Because the burning order (IBO) for the polystyrene is 2 and the kerosene was assumed to be uncontaminated, radioactive material is not transported through the system until the polystyrene has been ignited. The radioactive particulate mass flow rate and mass accumulations for the 20-μm particle size distribution are presented in Figs. 5.55 and 5.56. The radioactive particulate results are similar to the smoke particulate results and can be explained similarly.

Following the termination of the fire (~806 s), the smoke and radioactive particulate flow rates begin to decrease as the particulate concentrations in the hot layer decrease and as the compartment exhaust flow decreases. The system gradually will establish new steady-state operating conditions based on the consequences of the fire. By ~1000 s, more than 0.55 kg (1.21 lbm) of smoke particulate has been deposited on the fire compartment exhaust filter. To the system, the particulate mass on the filter represents an increase in resistance for Branch 14. The system will readjust and establish new steady-state conditions based on the increase in flow path resistance for Branch 14.

Summary. The representative facility fire sample problem illustrated how FIRAC can be applied to a more complex facility. The implementation of the FIRIN sequential burning option, the influence of the filter plugging factor option, the release of radioactive material by burning a contaminated combustible solid, the three internal boundary nodes representing the fire compartment, and the transport of 11 radioactive particle sizes and smoke particulate also were demonstrated. The fire sample problem shows how complicated the interpretation of the calculated results can become when several user options are enabled. For this sample problem, the filter plugging factor proved to be an important input variable. The system's response to the fire would have been different if the filter plugging option had not been used. If the user plans to make a best-estimate calculation, input variables and code options that significantly influence the results should be recognized and used with consideration.

5.6.2 Explosion Sample Problem Consequence Assessment

The explosion sample problem scenario is described in Chap. 4, and involves an explosion in a glovebox containing PuO_2 and acetone. The consequence assessment calculations using the EXPAC computer code are outlined below. The general description of the glovebox arrangement in the simple system is given first and is followed by each variation, which includes the problem description, the geometry tables, the EXPAC input file, the selected graphic results, and a discussion of results.

System Description

A sketch of the ventilation system is shown in Fig. 5.57. This is the "simple" system described in Sec. 5.5 with a glovebox line added to the large room or cell. The model for this system is shown in Fig. 5.58. This system now contains three filters, three blowers, and four dampers. The initial starting flow rates are nominally 0.472 m^3/s (1000 ft^3/min) through the main flow system with 0.024 m^3/s (50 ft^3/min) pulled through the glovebox line. As described in the Chap. 4 sample problem, th glovebox has dimensions (L x W x H) of 6.9 ft x 3.1 ft x 3.1 ft (2.1 m x 1.1 m x 1.1 m). The glovebox piping is a rectangular 0.152-m by 0.152-m (6-in. by 6-in.) duct. The detailed node and branch data are given in Tables 5.19 and 5.20.

Sample Source Terms

The facility description developed above allows the EXPAC model shown in Fig. 5.57 to be developed. After the geometric information is obtained, attention should be turned toward development of the source term. In Chap. 4, the energy and mass associated with the acetone explosion are given as 29.0 kg-cal and 50 ml, respectively.

Conversion into units for EXPAC input yields

$$E_T = \text{energy} = (29 \text{ kg-cal})(\frac{1000 \text{ g}}{\text{kg}})(\frac{1 \text{ Btu}}{252 \text{ g or cal}}) = 115.08 \text{ Btu and} \qquad (5.1)$$

$$M_T = \text{Mass} = (50 \text{ ml})(1 \frac{\text{cm}^3}{\text{ml}})(0.792 \frac{\text{g}}{\text{cm}^3}) = 39.6 \text{ g} = 0.08716 \text{ lb}. \qquad (5.2)$$

These two values can be used to develop the energy and mass injection associated with the explosion. The shape of the mass and energy injections will be assumed to resemble the .angular shape in Fig. 5.59.

The above procedure to determine the injection rates (M_s and E_s) are described in the EXPAC manual. First, the characteristic time for the explosion to fill the glovebox is

$$t = F \times \frac{L}{C} \quad , \qquad (5.3)$$

where

F = factor ranging between 4 and 8,
L = characteristic glovebox dimension (ft), and
C = sound speed (ft/s).

Using F = 6, L = 0.94 m (3.1 ft), and C = 354.2 m/s (1162 ft/s), we obtain for the time

$$t = 6 \times \frac{0.94}{354.2} = 0.016 \text{ s} \quad \text{or}$$

(5.4)

$$t = 6 \times \frac{3.1}{1162} = 0.016 \text{ s} \quad .$$

The area under the curve (Fig. 5.59) represents either the total mass (M_T) or the total energy (E_T). To calculate the mass and energy injection rates, M_s and E_s, we have

$$\dot{M} = M_T \times \frac{2}{T} = 3.96 \times 10^{-2} \times \frac{2}{0.016} = 4.95 \text{ kg/s or}$$

$$\dot{M} = M_T \times \frac{2}{T} = 0.087 \times \frac{2}{0.016} = 10.875 \text{ lb/s and} \tag{5.5}$$

$$\dot{E} = E_T \times \frac{2}{T} = 121.4 \times \frac{2}{0.016} = 15{,}178 \text{ kJ/s or}$$

$$\dot{E} = E_T \times \frac{2}{T} = 115.08 \times \frac{2}{0.016} = 14{,}385 \text{ Btu/s} \quad . \tag{5.6}$$

Having obtained the energy and mass injection source terms, we will determine the particulate quantity, size, and injection rate. From Chap. 4, the source-term calculation for the PuO_2 in the glovebox is 44 g (0.10 lbm) of respirable particles airborne. The quantity of acetone in the form of a spray also may be estimated. From Chap. 4, the 50 ml of acetone is spilled, evaporates, and mixes with the glovebox air. The equation assumes 91% of the 50 mL evaporates and is available for combustion, which leaves 9% as a spray source. This quantity is calculated as (0.09)(50 mL) = 4.5 ml = 4.5 cm^3 (0.15 2 oz). Assuming the density of acetone at 20°C = 0.792 g/cm^3 (49.4 lbm/ft^3), the mass is (4.5 cm^3)(0.792 g/cm^3) = 3.56 g (7.85×10^{-3} lbm). Thus, the total mass suspended is 44.g + 3.56 g = 47.56 g (0.105 lbm). We also assume that both the acetone and PuO_2 are suspended instantaneously.

The size distribution is more difficult to estimate. Sutter (1982) discusses the size distribution of liquids resulting from sprays and reports that the size distribution depends greatly on the type of liquid, amount of liquid, and the method of creating the spray. In the absence of more specific information we have assumed two size distributions (25 μm and 30 μm) for two 1.8 g (3.97×10^{-3} lbm) quantities of acetone.

We now turn to the estimate of size distribution for the PuO_2. From Chap. 4, Fig. 4.4, we choose sizes of 12 μm, 16 μm, and 20 μm. The EXPAC computer code uses mass fraction quantities for input. The equation used for this calculation is

$$\text{Mass fraction} = Y_i = \frac{m_i}{\Sigma m_i + m_g} \quad , \qquad (5.7)$$

where

m_i = mass of particulate material i,
Σm_i = total mass of particles, and
m_g = total gas mass.

The results of these calculations are summarized in Table 5.21 below.

The mass fract on quantities from Table 5.21 along with the material densities are used as input to the EXPAC code. The input location was for the glovebox, which was located at Node 12 as shown in Fig. 5.58.

Input Summary

The EXPAC input parameters are listed in Table 5.22. This table and Tables 5.19--5.21 provide all the information necessary to prepare the input listing shown in Table 5.23.

Glovebox Explosion Sample Problem Results

The EXPAC code provides complete graphic plots of pressure, temperature, and particulate mass fraction at all the nodal points in the problem. In addition, plots of branch volumetric flow rates, mass flow rates, differential pressures, particulate flow rates, and particulate mass passing through a branch are provided. In this sample problem we are particularly concerned about the magnitude of the explosive conditions created in the glovebox line. Therefore, our discussion of the results concentrates on these nodes (11, 12, 13, 14, and 15) and branches (11, 12, 13, 14, and 15).

One of the first results that the analyst would like to know concerns the peak pressures, particularly in the glovebox. From Fig. 5.60 we see that Node 12 (the glovebox) has a peak pressure of 18.6 kPa (2.7 psig). This result assumes that the windows or gloves are not breached. However, this pressure is probably sufficient to breach both the windows and the gloves. If this is the case, the analyst needs to restart the problem with flow paths directly from the glovebox into the room. We have chosen not to do this in this sample problem, and therefore, we assume that the structural integrity is preserved. Other pressures of interest are the pressures near the glovebox filters. From Fig. 5.61 we see that the peak pressure in front of the exhaust glovebox filter is approximately 5.86 kPa (0.85 psig), and the differential pressure is 5.98 kPa (24 in. of water) from Fig. 5.62. The differential pressure across the inlet filter is approximately 8.72 kPa (35 in. of water) (Fig. 5.63). These pressures are not high enough to cause structural damage.

Temperatures associated with explosions can pose a potential threat to the glovebox windows, the gloves, and the HEPA filters on the glovebox inlet and exhaust. Figure 5.64 shows that the peak temperature in the glovebox is 816°C (1500°F) at 0.02 s, and it levels off to 677°C (1250°F) at 1 s after the explosion. These temperatures are well above that needed to burn the glovebox windows, gloves, and filters. However, we again assume no breach in the glovebox or filters takes place. If the analyst wishes to model this, a restart problem can be done adding a flow path.

Flow rates, particularly flow direction, are also extremely important to the analyst. Because the cell (Node 4) does not have HEPA filters on the air inlet line, it is necessary to determine if the explosion causes any flow reversal through the inlet. This can be determined from the volumetric flow plots for Branches 1, 2, and 3 shown in Fig. 5.65. Note that the flow, although significantly reduced [0.472 m^3/s (1000 ft^3/min) down to 2.4 x 10^{-2} m^3/s (50 ft^3/min)], does not become negative. Therefore, there is no danger of release through the air inlet. This is true even though the explosion generates 4.2 m^3/s (9000 ft^3/min) back into the large room (Node 4) from the glovebox inlet (Branch 10). The capacitance of the room is large enough to accept this sudden influx of air. The room (cell) exhaust flow rates are only mildly perturbed (Fig. 5.66). However, this may not be the case if we were to assume a breach in the glovebox.

The results of most value to the analyst concern transport and possible release of particulate because the explosion. This is shown in the particulate mass flow rates, particulate mass passing through a branch, and particulate concentration at the nodes.

Separate particulate plots for each of the particulate sizes are available from the EXPAC analysis. In this analysis, we have three sizes of PuO_2 (12 μm, 16 μm, and 20 μm) and two sizes of acetone 25 μm and 30 μm. These plots are shown in Figs. 5.67 to 5.76 for particulate flow rate in selected branches. Notice in Fig. 5.67 that there is no particulate flow rate through the inlet (Branch 1), but there is release of up to 4.7×10^{-8} kg/s (1.04×10^{-7} lbm/s) of PuO_2 (12 μm) through the facility at Branch 9. Figure 5.68 shows that there is significant particulate backflow through the glovebox inlet (Branch 11). The pattern for particulate flow in Branch 9 is the same for all of the particulate sizes with the 12-, 16-, and 20-μm PuO_2 releases equaling 4.7×10^{-8} kg/s (1.04×10^{-7} lbm/s), 9.4×10^{-8} kg/s (2.07×10^{-7} lbm/s), and 4.7×10^{-8} kg/s (1.04×10^{-7} lbm/s), respectively, at 1 s. The large amount for 16-μm PuO_2 reflects the higher quantity 16-μm PuO_2 suspended from the explosion. The acetone particulate flow rates are 7.6×10^{-9} kg/s (1.68×10^{-8} lbm/s) for both the 25- and 30-μm particles.

The particulate mass plots are similar to the particulate flow rates in that the same pattern exists for all particulate sizes. Therefore, we will only illustrate this effect using the 12-μm PuO_2 plot. Figure 5.77 shows that at 1 s 2.54×10^{-8} kg (5.60×10^{-8} lbm) have passed out of the facility through Branch 9. Figure 5.78 shows that 6.6×10^{-4} kg has been deposited on the inlet filter to the glovebox (Branch 11), and 2.5×10^{-5} kg (1.46×10^{-3} lbm) has been deposited on the glovebox outlet filter. When we sum all of the particulate PuO_2 sizes for mass release we obtain 1×10^{-7} kg (2.2×10^{-7} lbm).

Figure 5.79 shows the relative concentration of 12-μm PuO_2 at selected nodes. Again, we have chosen to illustrate only the 12-μm size PuO_2. In Fig. 5.79 we see that the concentration at Node 11 (downstream of the filter) and Node 4 (the large cell) is extremely small in comparison to other locations downstream of the glovebox. We see that the concentration (at 1 s) at Node 12 is 3.86×10^{-3} kg/m^3 (2.41×10^{-4} lbm/ft^3) and the concentration at Node 13 (just before the glovebox outlet filter) is 1.4×10^{-3} kg/m^3 (8.74×10^{-5} lbm/ft^3). The difference in these two concentrations reflects the deposition that has taken place in the 30.5 m (100-ft-long) duct downstream of the glovebox.

5.6.3 Tornado Sample Problem

The following problem illustrates the use of the TORAC computer code to simulate material movement, deposition, entrainment, and filter plugging because of tornado depressurization at a facility's ventilation inlet or exhaust. The depressurization can cause higher than normal flow velocities, flow reversals, and abnormal operating pressures within the nuclear plant. The problem discussed below evolved from scenarios postulated and described in Chap. 4. The simple facility described in Sec. 5.5 will be used to extend the effects described in Chap. 4, Sec. 4.5.3.1.

Tornado Depressurization in a Simple System

As noted in Chap. 4, Sec. 4.5.3.1, the simple system is struck by a tornado that imposes a pressure drop of 12.5 kPa (50 in. of water) at the facility exhaust. The pressure time history, assuming a depressurization rate of 6.23 kPa (25 in. of water) per second, is given in Table 5.24. Note that the length of the depressurization is assumed to be 6 s.

As noted in Chap. 4, Sec. 4.5.3.1, a radioactive contaminant, PuO_2, with a particle size of 20 μm and density of 2500 kg/m^3 (156 lbm/ft^3), has been deposited in the ductwork that exits from the large cell (Node 4). The filter is assumed to have an efficiency of 80% and a plugging factor of 30 kg (13.6 lbm).

It is not likely that the deposited PuO_2 will entrain (see Fig. 62 of the TORAC users manual). A threshold friction speed of V_{*t} = 40 cm/s (1.31 ft/s) is needed to entrain a 20-μm, 2500-kg/m^3 (156 lbm/ft^3) particle.

We can calculate the flow rate needed in the ductwork to entrain the PuO_2 by using the following equation that relates bulk velocity to friction speed.

$$\frac{V(y)}{V^*} = (\frac{1}{K}) \ln (\frac{Y}{Y_o}) \quad , \tag{5.8}$$

where

Y = distance from surface (10 cm),
k = Von Karman constant (0.4),
Yo = roughness length (0.0104 cm),
V(y) = air velocity in branch, and
V_* = friction speed.

Thus, $V(y) = 17.2\ V_*$ (5.9)

If V_* = 40 cm/s (1.31 ft/s), then V(y) = 686.9 cm/s (22.5 ft/s) with a 0.372 m^2 (4-ft^2) cross-section area, and the volumetric flow can be calculated as 2.55 m^3/s (5408 ft^3/min).

The analyst now needs to set up TORAC to see if this flow rate can be achieved with the specified tornado scenario. The TORAC code incorporates the equations used above not only to calculate the flows but also to calculate the amount of material entrained and deposited.

Input Summary

Table 5.25 presents a summary of the input parameters necessary to run the TORAC computer code. The data descriptions are taken directly from the TORAC user's manual, and the values tabulated are those necessary to run the sample problem. These input values then are organized into the TORAC input file shown in Table 5.26.

Tornado Sample Problem Results

TORAC generates output in the form of both tabular and graphic data. Here we choose to illustrate the use of some of the tabular data. These data are particularly useful when we are interested in determining minimum, maximum, or extreme values for the problem. In Table 5.27 we have reproduced a table that is part of the TORAC output. It is a summary of the extreme values for the sample problem.

Above we calculated the flow necessary to entrain particulate material. This was determined to be 2.55 m^3/s (5408 ft^3/min). From Table 5.27 we find that the maximum flow was 2.59 m^3/s (5488 ft^3/min) in Branch 6. Because this flow is greater than the threshold flow, we can expect a small amount of entrainment to occur. The flows in selected locations are displayed in Fig. 5.80.

The particulate concentration, particulate flow rate, and particulate mass are shown on Figs. 5.81--5.83. Figure 5.81 indicates that a maximum concentration of 1.6×10^{-5} kg/m^3 (9.99×10^{-7} lbm/ft^3) occurs in Branch 5 at approximately 14 s. Figure 5.82 also shows that the largest particulate flow rate is in Branch 5. The maximum quantity of particulate also is in Branch 5 with 1.1×10^{-4} kg (2.43×10^{-4} lbm) at 30 s.

Another table in the TORAC output shows the material accumulation of the facility filters. For this sample problem, 0.0187% has been deposited on the filter.

5.7 GENERAL GUIDANCE INFORMATION

In the following sections, we present general guidance information helpful in determining appropriate filter coefficients, filter plugging factors, resistance coefficients, and initial conditions.

5.7.1 HEPA Filter Laminar and Turbulent Coefficients

The filter model used in all of the accident analysis codes is

$$\Delta\rho = K_L \mu \frac{Q}{A^{3/2}} + K_T \rho \frac{Q^2}{2A^2} , \qquad (5.10)$$

where

$\Delta\rho$ = pressure drop,
μ = viscosity,
ρ = fluid density,
Q = volume flow rate,
A = frontal area,
K_L = laminar coefficient, and
K_T = turbulent coefficient.

The coefficients K_L and K_T are dimensionless and are porous-medium dependent. The two coefficients have been investigated experimentally for several filter types. Three types of filters were evaluated by measuring pressure drop vs flow rate and then fitting Eq. (5.10) to the data (Tang et al., 1984). The coefficients in Table 5.28 were obtained based on this limited amount of data.

5.7.2 Filter Plugging Coefficients

For most HEPA filtering applications, certainly under normal operating conditions, filter plugging is not a concern. However, when a heavily particulate-laden airstream impinges on a HEPA filter, filter plugging is serious because pressure drop across the filter changes drastically. This condition could result from tornado- or explosion-induced flows. However, fires, with the large amount of smoke associated with the accident, present the worst condition for plugging a HEPA filter. Because fires pose the most serious threat for filter plugging, we concentrate our effort on the effects of smoke particulate. To model the effect of particulate impingement on the filter, we must obtain a relationship between particulate mass on the filter and pressure drop across the filter. One possible relationship could be expressed by

$$\frac{\Delta\rho}{(\Delta\rho)_0} = f(M_a) \quad . \tag{5.11}$$

where

$\Delta\rho$ = pressure drop across the filter,
$\Delta\rho_0$ = pressure drop across a clean filter, and
M_ρ = particulate mass on the filter.

We assume that the functional form, $f(M_\rho)$, is the following

$$f(M_\rho) = 1 + \alpha M_\rho + \beta M_\rho^2 \tag{5.12}$$

where

α = linear plugging coefficient with, and units of M_ρ^{-1} and

β = second order plugging coefficient with units of M_ρ^{-2} .

If α and β are equal to zero, Eq. (5.12) reduces to the conventional pressure drop across a clean filter.

The filter plugging coefficients, a and β, must be determined experimentally. Limited studies have been performed at Los Alamos National Laboratory to gain some insight into the relative magnitude of these coefficients for smoke aerosols (Fenton et al., 1983, Gunaji 1984). These coefficients depend on a given combustion condition (fuel type, s burning rate, and oxygen concentration). The Los Alamos studies examined two materials [polystyrene (PS) and polymethylmethacrylate (PMMA)], two burning rates, and two oxygen concentrations. The results of the plugging coefficient tests are given in Table 5.29.

FIRAC, EXPAC, and TORAC do not use the complete quadratic relationship of $1 + \alpha M_\rho + \beta M_\rho^2$. Only a linear relationship of $1 + \alpha M_\rho$ currently is in the accident analysis codes.

5.7.3 Resistance Coefficients

Fluid flow in pipes or ducts is discussed in every textbook on elementary fluid mechanics (Gerhart 1985). In these books it is shown that the pressure loss for flow through a straight duct is related to the flow by the following energy relationship:

$$\Delta\rho = RQ^2 \quad , \tag{5.13}$$

where

$\Delta\rho$ = pressure drop,
Q = volumetric flow, and
R = empirical resistance coefficient.

Equation (1) can be arranged as

$$Q = \left(\frac{1}{R}\right)^{1/2} \Delta\rho^{1/2} . \tag{5.14}$$

or

$$Q = \beta\Delta\rho^{1/2} . \tag{5.15}$$

This arrangement is the basis used for the equation in the TORAC computer code.

In other words, the resistance coefficient β is used in the iteration loop where the calculations are made. However, output may very well be in the form used in Eq. (1) for R.

In the EXPAC and FIRAC computer codes, the resistance coefficient is formulated in what appears to be a different way. However, this resistance coefficient is related to the R and β coefficients discussed above. The form of the resistance coefficient found in development of the EXPAC and FIRAC computer code gas dynamics is as follows.

$$\Delta p = K \left(\frac{\rho U^2}{2}\right) \tag{5.16}$$

where

U = duct velocity

ρ = fluid density, and

K = dimensionless resistance coefficient.

Because these different forms of the fluid flow resistance coefficient can be found in the three computer codes, we wish to show the relationship of R, β, and K.

Using Eq. (5.16) and $U = \frac{Q}{A}$, we see that

$$\Delta p = \frac{\rho K}{2} \left(\frac{Q}{A}\right)^2 \tag{5.17}$$

or

$$\Delta p = \frac{\rho K}{2A^2} Q^2 \quad ; \tag{5.18}$$

therefore,

$$R = \frac{\rho K}{2A^2} \tag{5.19}$$

or

$$K = \frac{2A^2}{\rho} R \quad . \tag{5.20}$$

Having discussed the various forms of the resistance coefficient, it is necessary to point out how the coefficients are used in each code.

TORAC

In the TORAC computer code, the resistance coefficient in the form of R is used throughout the code. If the user does not specify the resistance coefficient but does specify the initial pressures or pressure differentials and the initial flow, the resistance coefficient will be calculated from a rearrangement of Eq. (5.13):

$$R = \frac{\Delta p}{Q^2} \quad . \tag{5.21}$$

If the user has K, the formulation in Eq. (5.19) can be used to calculate R. When the pressure is specified in inches of water, the flow is specified in cubic feet per minute, and A is the cross-section area in square feet, the following relationship can be used to calculate R:

$$R = (8.299 \times 10^{-7})\ \rho K/A^2 \quad . \tag{5.22}$$

Values of K can be found in many fluid mechanics textbooks or handbooks. K is nondimensional and can be used in TORAC to include all pressure losses in a length of duct. That is, the duct friction, entrance and exit losses, the effect of bends, and so on can be combined to yield an effective K.

The following relationship is used, for duct friction.

$$K = f\left(\frac{L}{D}\right) \quad , \tag{5.23}$$

where

f = Darcy or Moody friction factor,

L = length of duct, and

D = hydraulic diameter = $\frac{4\text{ (flow area of cross-section)}}{\text{perimeter of cross-section}}$.

The value of f for fully developed turbulent flow is a function

$$f = F(\text{cross-section}, \frac{UD}{\nu}, \frac{\varepsilon}{D}) \quad , \tag{5.24}$$

where

ν = kinematic viscosity

ε = equivalent surface roughness.

For circular ducts and turbulent flow, the value of f can be computed from

$$f = [1.14 - 2\log(\frac{\varepsilon}{D} + \frac{21.25}{(\frac{uD}{\nu})^{0.9}})]^{-2} \quad . \tag{5.25}$$

For noncircular ducts, Eq. (5.25) is used with the diameter D of the circular duct replaced by an equivalent diameter D_e, where

$$D_e = \frac{64}{k} D \quad , \tag{5.26}$$

where

k = laminar flow friction coefficient,

$= f\left(\frac{uD}{\nu}\right) = 56.91$ for a square duct,

$$= f\left(\frac{uD}{\nu}\right) = \frac{64}{\frac{2}{3} + \frac{11}{24}\frac{b}{a}\left(2-\frac{b}{a}\right)} \text{ for a rectangular duct,}$$

a,b = sides of the rectangle,

D = diameter for a circular duct,

a = side of a square duct, and

$a = \frac{2ab}{a+b}$, for a rectangular duct.

The roughness coefficient ε for common materials found in ventilation areas is listed in Table 5.30.

In addition to calculating K for duct friction, other losses have to be accounted for, and they also have corresponding values for K. Some of the K values for entrance and exit loss are shown in Fig. 5.84 along with an equation showing how an effective K is computed. Table 5.31 gives other approximate values for K that may be encountered.

The internal calculation and iteration routine in TORAC is based upon the resistance coefficient, β. β is calculated from the user-specified R as shown in Eq. (5.15) or from the internal calculation of pressure drop divided by flow squared. The resistance is reconverted back to the R form for the TORAC output.

EXPAC and FIRAC

The EXPAC and FIRAC codes treat the resistance to fluid flow differently than TORAC. In the discussion above we showed that the coefficient β was used in the internal iteration loop of TORAC. In the iteration loop of EXPAC and FIRAC, an effective resistance coefficient, K_{eff}, is used. The formulation for K_{eff} is

$$K_{eff} = \left(\frac{f_i \ell_i}{2D_i} + K_i\right)\left(\frac{A}{A_i}\right)^2 + \left(\frac{f\ell}{D} + K\right) + \left(\frac{f_i \ell_i}{2D_i} + K_i\right)\left(\frac{A}{A_i}\right)^2 , \qquad (5.27)$$

where A, A_i, A_j, ℓ, ℓ_i, and ℓ_j are identified in Fig. 5.85.

We have included a form (Fig. 5.86) that the analyst may find useful in calculating the K_{eff} for each branch. In both codes, the input requires a forward or reverse resistance coefficient. In other words, in one flow direction, the resistance may be an exit loss; however, if the flow reverses, the loss may be an entrance loss. Therefore, K_{eff} has to be computed for both directions.

When the analyst has determined K_{eff}, these values can be used to compute a resistance coefficient R, as defined in Eq. (5.19). This dimensional coefficient can be calculated in units appropriate for the EXPAC and FIRAC codes by the equation

$$R = \frac{K_{eff} \; P}{2A^2 R' \; T} , \qquad (5.28)$$

where K_{eff} is the nondimensional resistance factor, P is the ambient pressure, A is the flow area of the duct, R' is the gas constant, and T is the ambient temperature. A value for R' that will allow you to input temperature in °R, area in ft^2, and ambient pressure in psia is

$$R' = 2.2264 \times 10^5 \; \frac{ft^2 \; psia}{min^2 \; in. \; w.g. \; °R} . \qquad (5.29)$$

If you prefer to input the ambient pressure in units of in. w.g., with all other units the same as above, the value of R' is

$$R' = 6.6163 \times 10^6 \frac{ft^2 \text{ in. w.g.}}{min^2 \text{ in. w.g. } ^\circ R} \quad . \tag{5.30}$$

Using either of these values for R'_{air} with the ambient pressure in the corresponding units gives resistance coefficients, R, with the units of in. w.g./$(ft^3/min)^2$, which are the units needed for the FIRAC and EXPAC codes.

5.7.4 Initial Conditions

The accident analysis codes require specification of the initial or normal operating conditions of the facility being analyzed. In most cases, the design flow rates and pressure distribution are available from the architect/engineer or facility design drawings. These specifications are sufficient to provide the initial conditions for the computer codes. Using these values, the codes automatically calculate the corresponding resistance. However, it is not always necessary to have initial pressures or flows to use as input to the computer codes.

If the analyst is able to determine the flow resistance coefficients for a system along with an arbitrary initial pressure distribution, this is sufficient to initialize the problem. This is the basic feature of the flow network codes. That is, given a resistance distribution he can calculate the corresponding pressures and flows. This is because all of the equations are written in terms of fluid resistance, pressure, and density. The pressure and density terms are iterated until convergence is achieved or the momentum and energy conservation equations are satisfied.

The accident analysis codes cannot accept unlimited amounts of energy input at time zero into a capacitance node (room). The tabulated data in Table 5.32 indicate that the room volume has virtually no effect on the magnitude of the initial energy injection rate. The prescribed volumetric flow rate does have a small effect. In contrast to this somewhat restrictive initial condition, if the analyst allows the code to reach a steady-state balance and then injects the energy, the magnitude of energy injection rate is not restricted. For example, in a test system, up to 1 000 000 kW (947.8 Btu/s) of energy was injected into a room of 2.8 x 10^{-2} m^3 (1.0 ft^3) with a volumetric flow of 0.47 m^3/s (1000 ft^3/min). In this case, the energy rate was ramped up from zero to the maximum in five time steps over a period of 1.0 s.

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TABLE 5.1. Node Data for the Simple System

Node	Pressure (in. w.g.)	Temperature (°F)	Volume (ft^3)	L (ft)	W (ft)	H (ft)
1	0.00	60	--	--	--	--
2	-0.69	60	20	5	2	2
3	1.10	60	20	5	2	2
4	1.00	60	1000	10	10	10
5	0.90	60	200	50	2	2
6	0.80	60	200	50	2	2
7	-0.20	60	20	5	2	2
8	-0.30	60	20	5	2	2
9	0.40	60	20	5	2	2
10	0.00	60	20	5	2	2

TABLE 5.2. Branch Data for the Simple System

Branch	Component Type	Flow (ft^3/min)	Cross-Section Area (ft^2)	L (ft)	Curve Number
1	Valve	1000	4	0	--
2	Blower	1000	4	0	1
3	Valve	1000	4	0	--
4	Duct	1000	4	50	--
5	Duct	1000	4	50	--
6	Filter	1000	4	0	1
7	Valve	1000	4	0	--
8	Blower	1000	4	0	2
9	Valve	1000	4	0	--

TABLE 5.3. FIRAC Node Data for the MOX Facility

Node	Fire Node	Pressure (in. w.g.)	Temperature (°F)	Volume (ft^3)	Flow Area (ft^2)	Elevation (ft)
1		0.0	60	N/A	N/A	0.0
2		-0.5	60	180.0	36.0	0.0
3		1.1	60	180.0	36.0	0.0
4	**	1.0	60	N/A	N/A	0.0
5		0.9	60	2000.0	36.0	0.0
6		0.8	60	2000.0	36.0	0.0
7		-0.2	60	180.0	36.0	0.0
8		-0.3	60	180.0	36.0	0.0
9		0.4	60	180.0	36.0	0.0
10		0.0	60	N/A	N/A	0.0
11	**	1.0	60	N/A	N/A	0.0

TABLE 5.4. FIRAC Branch Data for the MOX Facility

Branch	Component Type	Flow ft^3/min)	Cross-Section Area (ft^2)	L (ft)	Curve Number	Heat Transfer
1	Valve	9000	36.0	0.0	N/A	No
2	Blower	9000	36.0	0.0	1	No
3	Valve	9000	36.0	0.0	N/A	No
4	Duct	9000	36.0	50.0	N/A	Yes
5	Duct	9000	36.0	50.0	N/A	Yes
6	Filter	9000	36.0	0.0	1	No
7	Valve	9000	36.0	0.0	N/A	No
8	Blower	9000	36.0	0.0	3	No
9	Valve	9000	36.0	0.0	N/A	No

TABLE 5.5. MOX Facility Blower Data

Blower 1		Blower 3	
Pressure (in. w.g.)	Flow (ft^3/min)	Pressure (in. w.g.)	Flow (ft^3/min)
2.7	-1000	2.3	-1000
1.9	0	1.6	0
1.8	8000	1.5	7700
1.6	10000	1.3	9400
0.8	13000	0.8	11000
0.0	14000	0.0	12000

TABLE 5.6. Mass, Energy, Smoke, and Radioactive Material Time Functions

Time (s)	Mass Injection Rate (lb/h)	Mass Injection Temp (°F)	Energy (kW)	Smoke (g/s)	Radioactive Particulate (g/s)
0.0	0.0	0.0	0.0	0.0	0.0
2.0	0.0	0.0	0.0	0.0	0.0
2.1	303.1	1045.0	410.6	4.107	4.3×10^{-4}
33.0	303.1	1045.0	410.6	4.107	4.3×10^{-4}
34.0	87.2	1045.0	300.3	0.022	1.9×10^{-4}
100.0	87.2	1045.0	300.3	0.022	$1.9 \times 10-^{4}$
101.0	0.0	0.0	0.0	0.0	0.0
1000.0	0.0	0.0	0.0	0.0	0.0

TABLE 5.7. Input Parameters for the Hand-Calculated and FIRIN Source Terms for the MOX Facility Fire

Acronym	Hand-Calculated Value	FIRIN Value	Comments
1. Run Control Card Input:			
RUNT	ST	ST	
TINIT	0.0	0.0	
DTI	5.0	5.0	
TOT	500.0	500.0	
NSPOUT	0.0	0.0	
SOUT(1)	0.0	0.0	
SOUT(2)	0.0	0.0	
SOUT(3)	0.0	0.0	
SOUT(4)	0.0	0.0	
SOUT(5)	0.0	0.0	
2. Print/Plot Control Input:			
LUNITS			Blank
PLTOPT			Blank
NPFRMS	3	3	
NQFRMS	3	3	
NMFRMS	3	3	
NTFRMS	3	3	
NAFRMS	0	0	
NSPECC	2	2	Particulate
species			
KNDSPC	1 2	1 2	2 cards
NFLXFR	1 1	1 1	
NPMOFR	1 1	1 1	
NWMAFR	1 1	1 1	
NSRCFR	1 1	1 1	
NSINFR	0 0	0 0	
NYFRMS	0 0	0 0	
3. Plot Frame Card Input:			
NCRVS			
NCID			

TABLE 5.7. Input Parameters for the Hand-Calculated and FIRIN Source Terms for the MOX Facility Fire (cont)

Acronym	Hand-Calculated Value	FIRIN Value	Comments
NCID			See input listing
NCID			
NCID			
XSCL			
4. Run Control II Card Input:			
MAXIT	Default	Default	
CONVRG	Default	Default	
IDEP	1	1	
IENT	1	1	
PINP	P	P	
TINP	T	T	
IAINP	Default	Default	
IGINP	Default	Default	
IFIRIN	1	0	
NGSPECE			
NSPECES	2	2	
INC			Blank
IAINP	Default	Default	
IGINP	Default	Default	
IFIRIN	1	0	
NGSPECE			
NSPECES	2	2	
INC			Blank
5. Boundary Control Card Input:			
NPFN	0	0	
NBNODS	2	4	
PZERO	Default	Default	
TAMB	Default	Default	
NTFN	1	0	
NEFN	1	0	
NMFN	1	0	

TABLE 5.7. Input Parameters for the Hand-Calculated and FIRIN Source Terms for the MOX Facility Fire (cont)

Acronym	Hand-Calculated Value		FIRIN Value				Comments
NCFN	2		0				
NGFN	Default		Default				
6. Geometry and Component Control Card Input:							
NBRCH	9		9				
NNODES	10		11				
NROOMS	8		7				
NBLFNS	3		3				
NFILRS	1		1				
NCDAMP	Default		Default				
7. Branch Description Input:			See Table 5.4				
8. Particulate Species Data:			See Table 5.6				
9. Gaseous Species Data:			None				
10. Boundary Node Data:							
IBNNR	1	10	1	4	10	11	2 cards for hand-
ITYPBN	Default	Default	Default	1	Default	1	calculated value
PB	Default	Default	Default	1.0	Default	1.0	and 4 cards for
JBPFN	Default	Default	Default	Default	Default	Default	FIRIN value
TBI	Default	Default	Default	Default	Default	Default	
IBTFN	Default	Default	Default	Default	Default		
ELEV	Default	Default	Default	Default	Default		
11. Time Function Data Control:							
IFN							
NP	Table 5.6		None				
ITEM							
12. Time Function Definition:	See Table 5.6		None				
13. Room Data:							See Table 5.3
14. Control Damper:							
CTLNODE							
DAMPNUM							
TYPE	None		None				
PMIN							
PMAX							

TABLE 5.7. Input Parameters for the Hand-Calculated and FIRIN Source Terms for the MOX Facility Fire (cont)

	Acronym	Hand-Calculated Value		FIRIN Value		Comments
	THETA					
	DTHETA					
	TDELAY					
15.	Blower Curve Control:					See Table 5.5
	JB					
	NPBC					
16.	Blower Curve Data:					See Table 5.5
17.	Filter Data:					
	NFE	1		1		
	FEF	0.995		0.995		
	ALFI	0		0		
	AKL	2830000		2830000		
	AKT	10.5		10.5		
18.	Pressure Input:					See Table 5.3
19.	Temperature Input:					See Table 5.3
20.	Scenario Control Specifications (FIRIN Input)					See Table 4.7
21.	Time Step Card Input:					
	DTMAX	1.0	1.0	1.0	0.005	
	2 Cards					
	TEND	2.0	500.0	2.0	500.00	
	EDINT	1.0	50.0	1.0	50.0	
	GRFINT	Default	Default	Default	Default	

TABLE 5.8. Input Listing for the FIRAC Computer Code Using Hand-Calculated Values for the MOX Facility

```
 1$* CANMOXH
 2$ SIMPLE SYSTEM W/ MOX FUEL FIRE HAND CALC
 3$* RUN CONTROL 1
 4$    ST  0.0    5.        500.
 5$* PRINT/PLOT CONTROL
 6$          3     3     3     3     0     2
 7$    1     1     1     1     1
 8$    2     1     1     1     1
 9$* PLOT FRAME DESCRIPTION CARDS
10$    4     1     2     3     4
11$    3     5     6     7
12$    3     8     9    10
13$    4     1     2     3     4
14$    4     5     6     7     8
15$    1     9
16$    4     1     2     3     4
17$    4     5     6     7     8
18$    1     9
19$    4     1     2     3     4
20$    3     5     6     7
21$    3     8     9    10
22$    4     2     4     6     8
23$    4     2     4     6     8
24$    4     2     4     6     8
25$    4     2     4     6     8
26$    4     2     4     6     8
27$    4     2     4     6     8
28$    4     2     4     6     8
29$    4     2     4     6     8
30$* RUN CONTROL 2
31$                      1     1     P     T                   1              2
32$* BOUNDARY AND INTERNAL CONTROL
33$    0     2                                 1     1     1     2
34$* GEOMERTY AND COMPONENT CONTROL
35$    9    10           8     3     1
36$* BRANCH DATA
37$    1     1     2   9000.00       36.0       0.00V          0.00            0       0.
38$ 0.000E+00 0.000E+00    0
39$    2     2     3   9000.00       36.0       0.00B          0.00            1       0.
40$ 0.000E+00 0.000E+00    0
41$    3     3     4   9000.00       36.0       0.00V          0.00            0       0.
42$ 0.000E+00 0.000E+00    0
43$    4     4     5   9000.00       36.0      50.00D          0.00            0       0.
44$ 0.000E+00 0.000E+00    0                                   2.00      100.          1
45$      6.8    1200.        1     .25     .76     .76   331.5   172.9   .6671     60.
46$    5     5     6   9000.00       36.0      50.00D          0.00            0       0.
47$ 0.000E+00 0.000E+00    0                                   2.00      100.          1
48$      6.8    1200.        1     .25     .76     .76   331.5   172.9   .6671     60.
49$    6     6     7   9000.00       36.0       0.00F          0.00            0       0.
50$ 0.000E+00 0.000E+00          1
51$    7     7     8   9000.00       36.0       0.00V          0.00            0       0.
52$ 0.000E+00 0.000E+00    0

            10        20        30        40        50        60        70        80
   12345678901234567890123456789012345678901234567890123456789012345678901234567890
53$    8     8     9   9000.00       36.0       0.00B          0.00            2       0.
54$ 0.000E+00 0.000E+00    0
55$    9     9    10   9000.00       36.0       0.00V          0.00            0       0.
56$ 0.000E+00 0.000E+00    0
57$* PARTICULATE SPECIES DATA
58$          1  SMOKE          1.        1.
59$          2  TOT PRT        50.       2.5
60$* BOUNDARY DATA
61$    1
```

TABLE 5.8. Input Listing for the FIRAC Computer Code Using Hand-Calculated Values for the MOX Facility (cont)

```
   10
* TEMPERATURE TIME FUNCTION FOR MASS INJECTION
   1    2
      0.0      1100.     1000.0     1100.
* ENERGY TIME FUNCTION FOR SIMULTANEOUS BURN MOX FIRE
   1    8
      0.0        0.0        2.0        0.0        2.1      410.6
      33.      410.6        34.      300.3       100.      300.3
      101.       0.0      1000.        0.0
* MASS INJECTION TIME FUNCTION
   1    8    1
      0.0        0.0        2.0        0.0        2.1      303.1
      33.      303.1        34.       87.2       100.       87.2
      101.       0.0      1000.        0.0
* PARTICULATE SPECIES TIME FUNCTION -SMOKE-  & -RAD PART-
   1    8
      0.0        0.0        2.0        0.0        2.1      4.107
      33.      4.107        34.       .022       100.       .022
      101.       0.0      1000.        0.0
   2    8
      0.0        0.0        2.0        0.0        2.1     .00043
      33.     .00043        34.     .00019       100.     .00019
      101.       0.0      1000.        0.0
* ROOM DATA
   2     180.0    0    0    0    0      0.00      0.00
     36.0
   3     180.0    0    0    0    0      0.00      0.00
     36.0
   4   87469.8    1    1
     638.         2
        1         1
        2         2
   5   2000.00    0    0    0    0      0.00      0.00
     36.0
   6   2000.00    0    0    0    0      0.00      0.00
     36.0
   7     180.0    0    0    0    0      0.00      0.00
     36.0
   8     180.0    0    0    0    0      0.00      0.00
     36.0
   9     180.0    0    0    0    0      0.00      0.00
     36.0
* BLOWER CURVE
```

TABLE 5.8. Input Listing for the FIRAC Computer Code Using Hand-Calculated Values for the MOX Facility (cont)

```
               10        20        30        40        50        60        70        80
      12345678901234567890123456789012345678901234567890123456789012345678901234567890
105$     1    6
106$    -1000.0        2.70      0.00      1.90    8000.0      1.80
107$    10000.0        1.60   13000.0      0.80   24000.0      0.00
108$     2    6
109$    -2000.0        1.40      0.00      1.00    7000.0      0.90
110$    10000.0        0.70   14000.0      0.40   16000.0      0.00
111$     3    6
112$    -1000.0        2.30      0.00      1.60    7700.0      1.50
113$     9400.0        1.30   11000.0      0.80   12000.0      0.00
114$*  FILTER DATA
115$          1        .995       0.0 2830000.0     10.50
116$* PRESSURE INPUT (W.G.)
117$ 0.00000000E+00-0.50000000E+00 0.11000000E+01 0.10000000E+01 0.90000000E+00
118$ 0.80000000E+00-0.20000000E+00-0.30000000E+00 0.40000000E+00 0.00000000E+00
119$* TEMPERATURE INPUT (DEG. F)
120$ 0.60000000E+02 0.60000000E+02 0.60000000E+02 0.60000000E+02 0.60000000E+02
121$ 0.60000000E+02 0.60000000E+02 0.60000000E+02 0.60000000E+02 0.60000000E+02
122$* TIME STEP CARD

123$                   1.0         2.         1.
124$                   1.00      500.        50.
```

TABLE 5.9. Input Listing for the FIRAC Computer Code Using FIRIN Values for the MOX Facility

```
*CANMOX
SIMULTANEOUS FIRE W/ MOX AND EXHAUST AT FLOOR
* RUN CONTROL 1
  ST  0.0   5.        500.
* PRINT/PLOT CONTROL
         3    3    3    3    0    2
    1    1    1    1    1
    2    1    1    1    1
* PLOT FRAME DESCRIPTION CARDS
    4    1    2    3    4
    4   11    5    6    7
    3    8    9   10
    4    1    2    3    4
    4    5    6    7    8
    1    9
    4    1    2    3    4
    4    5    6    7    8
    1    9
    4    1    2    3    4
    4   11    5    6    7
    3    8    9   10
    4    2    4    6    8
    4    2    4    6    8
    4    2    4    6    8
    4    2    4    6    8
    4    2    4    6    8
    4    2    4    6    8
    4    2    4    6    8
    4    2    4    6    8
* RUN CONTROL 2
                   1    1    P    T                        0              2
* BOUNDARY AND INTERNAL CONTROL
    0    4                             0    0    0
* GEOMERTY AND COMPONENT CONTROL
    9   11         7    3    1
* BRANCH DATA
    1    1    2  9000.00      36.0       0.00V          0.00           0       0.
 0.000E+00 0.000E+00    0
    2    2    3  9000.00      36.0       0.00B          0.00           1       0.
 0.000E+00 0.000E+00    0
    3    3    4  9000.00      36.0       0.00V          0.00           0       0.
 0.000E+00 0.000E+00    0
    4   11    5  9000.00      36.0      50.00D          0.00           0       0.
 0.000E+00 0.000E+00    0                               2.00     100.          1
      6.8   1200.      1     .25      .76      .76   331.5   172.9   .6671    60.
    5    5    6  9000.00      36.0      50.00D          0.00           0       0.
 0.000E+00 0.000E+00    0                               2.00     100.          1
      6.8   1200.      1     .25      .76      .76   331.5   172.9   .6671    60.
    6    6    7  9000.00      36.0       0.00F          0.00           0       0.
 0.000E+00 0.000E+00         1
    7    7    8  9000.00      36.0       0.00V          0.00           0       0.
 0.000E+00 0.000E+00    0
    8    8    9  9000.00      36.0       0.00B          0.00           0       0.
 0.000E+00 0.000E+00    0
    9    9   10  9000.00      36.0       0.00V          0.00           0       0.
 0.000E+00 0.000E+00    0
* PARTICULATE SPECIES DATA
         1  SMOKE            1.         1.
         2  TOT PRT         50.         2.5
* BOUNDARY DATA
    1
    4 1          1.
   10
   11 1          1.
```

TABLE 5.9. Input Listing for the FIRAC Computer Code Using FIRIN Values for the MOX Facility (cont)

```
* ROOM DATA
    2      180.0     0     0     0     0        0.00        0.00
      36.0
    3      180.0     0     0     0     0        0.00        0.00
      36.0
    5    2000.00     0     0     0     0        0.00        0.00
      36.0
    6    2000.00     0     0     0     0        0.00        0.00
      36.0
    7      180.0     0     0     0     0        0.00        0.00
      36.0
    8      180.0     0     0     0     0        0.00        0.00
      36.0
    9      180.0     0     0     0     0        0.00        0.00
      36.0
* BLOWER CURVE
    1    6
  -1000.0        2.70        0.00        1.90     8000.0        1.80
  10000.0        1.60     13000.0        0.80    14000.0        0.00
    2    6
  -2000.0        1.40        0.00        1.00     7000.0        0.90
  10000.0        0.70     14000.0        0.40    16000.0        0.00
    3    6
  -1000.0        2.30        0.00        1.60     7700.0        1.50
   9400.0        1.30     11000.0        0.80    12000.0        0.00
* FILTER DATA
         1        .995        0.0 2830000.0       10.50
* PRESSURE INPUT (W.G.)
0.00000000E+00-0.50000000E+00 0.11000000E+01 0.10000000E+01 0.90000000E+00
0.80000000E+00-0.20000000E+00-0.30000000E+00 0.40000000E+00 0.00000000E+00
         1.
* TEMPERATURE INPUT (DEG. F)
0.60000000E+02 0.60000000E+02 0.60000000E+02 0.60000000E+02 0.60000000E+02
0.60000000E+02 0.60000000E+02 0.60000000E+02 0.60000000E+02 0.60000000E+02
          60.
* SCENARIO CONTROL SPECIFICATION CARD
      500.         200           1

* INITIAL CONDITIONS / FLOW SPECIFICATION CARDS
      60.         1.0
         3           4        27.9         2.0
         4          11         1.0         2.0
* FUEL MASS AND SURFACE AREA CARDS
                                 2                          2.416
                            10.764                         10.764
* FIRE COMPARTMENT GEOMETERY
    137.1         22.         29.          1.5           1.         .67         0.0
* FIRE COMPARTMENT MATERIALS
         1           1           1
* RADIOACTIVE SOURCE IDENTIFIER CARD
         1                       1
         1           4           1           1
      .033
         2        .165
* TIME STEP CARD
                  1.0          2.           1.
                  .005        500.          50.
```

TABLE 5.10. Solvent Extraction Facility Blower Data

Blower 2		Blower 3	
Pressure (in. w.g.)	Flow (ft^3/min)	Pressure (in. w.g.)	Flow (ft^3/min)
1.4	-10 000	2.3	-10 000
0.8	0	1.6	0
0.7	77 000	1.5	77 000
0.6	100 000	1.3	94 000
0.4	110 000	0.8	110 000
0.0	120 000	0.0	120 000

TABLE 5.11. FIRAC Node Data for the Solvent Extraction Facility

Node	Fire Node	Pressure (in. w.g.)	Temperature (°F)	Volume (ft^3)	Flow Area (ft^2)	Elevation (ft)
1		0.0	60	N/A	N/A	0.0
2		-0.1567	60	2000	200	0.0
3		1.4	60	2000	200	0.0
4	**	1.0	60	N/A	N/A	0.0
5		0.9	60	10 000	200	0.0
6		0.8	60	10 000	200	0.0
7		-0.2	60	2000	200	0.0
8		-0.3	60	2000	200	0.0
9		0.4	60	2000	200	0.0
10		0.0	60	N/A	N/A	0.0
11	**	1.0	60	N/A	N/A	0.0

TABLE 5.12. Solvent Extraction Facility Branch Data for the FIRAC Code

Branch	Component Type	Flow (ft^3/min)	Cross-Section Area (ft^2)	L (ft)	Curve Number	Heat Transfer
1	Valve	52 000	200	0	N/A	No
2	Blower	52 000	200	0	3	No
3	Valve	52 000	200	0	N/A	No
4	Duct	52 000	200	50.0	N/A	Yes
5	Duct	52 000	200	50.0	N/A	Yes
6	Filter	52 000	200	0	1	No
7	Valve	52 000	200	0	N/A	No
8	Blower	52 000	200	0	2	No
9	Valve	52 000	200	0	N/A	No

TABLE 5.13. Hand-Calculated Solvent Extraction Fire Source Terms for FIRAC

Time	Mass Injection Rate (lb/h)	Mass Injection Temp. (°F)	Energy (kW)	Smoke (g/s)	Radioactive Particulate (g/s)
0.0	0.0	0.0	0.0	0.00	0.0
3.0	1072.9	1000.0	3700.0	0.27	3.8×10^{-2}
50.0	1072.9	1000.0	3700.0	0.27	3.8×10^{-2}
100.0	1072.9	1000.0	3700.0	0.27	3.8×10^{-2}
300.0	1072.9	1000.0	3700.0	0.27	3.8×10^{-2}
636.0	1072.9	1000.0	3700.0	0.27	3.8×10^{-2}
636.1	0.0	0.0	0.0	0.00	0.0
1000.0	0.0	0.0	0.0	0.00	0.0

TABLE 5.14. Input Parameters for the Hand-Calculated and FIRIN Source Terms for the Solvent Extraction Fire

Acronym	Hand-Calculated Value	FIRIN Value	Comments
1. Run Control Card Input:			
RUNT	ST	ST	
TINIT	0.0	0.0	
DTI	5.0	5.0	
TOT	1000.0	500.0	
NSPOUT	Default	Default	
SOUT(1)	Default	Default	
SOUT(2)	Default	Default	
SOUT(3)	Default	Default	
SOUT(4)	Default	Default	
SOUT(5)	Default	Default	
2. Print/Plot Control Input:			
LUNITS	Default	Default	
PLTOPT	Default	Default	
NPFRMS	3	3	
NQFRMS	3	3	
NMFRMS	3	3	
NTFRMS	3	3	
NAFRMS	0	0	
NSPECC	2	2	
KNDSPC	1 2	1 2	Particulate species
NFLXFR	1 2	1 1	
NPMOFR	1 1	1 1	2 cards
NWMAFR	1 1	1 1	
NSRCFR	1 1	1 1	
NSINFR	Default	Default	
NYFRMS	Default	Default	
3. Plot Frame Card Input:			
NCRVS			
NCID			

TABLE 5.14. Input Parameters for the Hand-Calculated and FIRIN Source Terms for the Solvent Extraction Fire (cont)

Acronym	Hand-Calculated Value	FIRIN Value	Comments
NCID			
NCID			See input listing
NCID			
XSCL			
4. Run Control II Card Input:			
MAXIT	Default	Default	
CONVRG	0.001	Default	
IDEP	1	1	
IENT	1	1	
PINP	P	P	
TINP	T	T	
IAINP	Default	Default	
IGINP	Default	Default	
IFIRIN	1	Default	
NGSPECE	Default	Default	
NSPECES	2	2	
INC			Blank
5. Boundary Control Card Input:			
NPFN	Default	Default	
NBNODS	2	4	
PZERO	Default	Default	
TAMB	Default	Default	
NTFN	1	Default	
NEFN	1	Default	
NMFN	1	Default	
NCFN	2	Default	
NGFN	Default	Default	
6. Geometry and Component Control Card Input:			
NBRCH	9	9	
NNODES	10	11	
NROOMS	8	7	
NBLFNS	3	3	

TABLE 5.14. Input Parameters for the Hand-Calculated and FIRIN Source Terms for the Solvent Extraction Fire (cont)

Acronym	Hand-Calculated Value		FIRIN Value				Comments
NFILRS	1		1				
NCDAMP	Default		Default				
7. Branch Descn Input:							See Table 5.10
8. Particulate Species Data:							See Table 5.11
9. Gaseous Species Data:							None
10. Boundary Node Data:							
IBNNR	1	10	1	4	10	11	2 cards for hand-calculated values and 4 cards for FIRIN values
ITYPBN	Default	Default	1	Default	1		
PB default		Default	1.0	Default	1.0		
JBPFN	Default	Default	Default	Default	Default		
TBI default		Default	Default	Default	Default		
IBTFN	Default	Default	Default	Default	Default		
ELEV	Default	Default	Default	Default	Default		
11. Time Function Data Control:							
IFN							
NP							
ITEM							
12. Time Function Definition: Table 5.13							None
13. Room Data:							See Table 5.11
14. Control Damper:							
CTLNODE							
DAMPNUM							
TYPE							
PMIN							None
PMAX							
THETA							
DTHETA							
TDELAY							
15. Blower Curve Control:							See Table 5.8
JB							
NPBC							

TABLE 5.14. Input Parameters for the Hand-Calculated and FIRIN Source Terms for the Solvent Extraction Fire (cont)

	Acronym	Hand-Calculated Value	FIRIN Value	Comments	
16.	Blower Curve Data:			See Table 5.10	
17.	Filter Data:				
	NFE	1	1		
	FEF	0.995	0.995		
	ALFI	0.0	0.0		
	AKL	2830000.	2830000.		
	AKT	10.5	10.5		
18.	Pressure Input:			See Table 5.11	
19.	Temperature Input:			See Table 5.11	
20.	Scenario Control Specifications (FIRIN Input)			See Table 4.11	
21.	Time Step Card Input:				
	DTMAX	0.01	0.01	0.1	0.01
	TEND	345.	1000.	2.0	500
					2 cards
	EDINT	50.	50.	1.0	50.0
	GRFINT	Default	Default	Default	Default

TABLE 5.15. Input Listing for FIRAC Using FIRIN Source Terms for the Solvent Extraction Fire

```
 1$* CANSOL
 2$SOLVENT FIRE FROM AAH
 3$* RUN CONTROL 1
 4$    ST  0.0   5.        500.
 5$* PRINT/PLOT CONTROL
 6$          3     3     3     3     0     2
 7$    1     1     1     1     1
 8$    2     1     1     1     1
 9$* PLOT FRAME DESCRIPTION CARDS
10$    4     1     2     3     4
11$    4    11     5     6     7
12$    3     8     9    10
13$    4     1     2     3     4
14$    4     5     6     7     8
15$    1     9
16$    4     1     2     3     4
17$    4     5     6     7     8
18$    '     9
19$    4     1     2     3     4
20$    4    11     5     6     7
21$    3     8     9    10
22$    4     2     4     6     8
23$    4     2     4     6     8
24$    4     2     4     6     8
25$    4     2     4     6     8
26$    4     2     4     6     8
27$    4     2     4     6     8
28$    4     2     4     6     8
29$    4     2     4     6     8
30$* RUN CONTROL 2
31$                1     1     P     T                   0                   2
32$* BOUNDARY AND INTERNAL CONTROL
33$    0     4                             0     0     0
34$* GEOMERTY AND COMPONENT CONTROL
35$    9    11           7     3     1
36$* BRANCH DATA
37$    1     1     2   52000.0     200.0       0.00V          0.00             0         0.
38$ 0.000E+00 0.000E+00    0
39$    2     2     3   52000.0     200.0       0.00B          0.00             3         0.
40$ 0.000E+00 0.000E+00    0
41$    3     3     4   52000.0     200.0       0.00V          0.00             0         0.
42$ 0.000E+00 0.000E+00    0
43$    4    11     5   52000.0     200.0      50.00D          0.00             0         0.
44$ 0.000E+00 0.000E+00    0                                  2.00      100.             1
45$    15.96    3000.      1       .25       .76       .76    331.5    172.9    .6671      60.
46$    5     5     6   52000.0     200.0      50.00D          0.00             0         0.
47$ 0.000E+00 0.000E+00    0                                  2.00      100.             1
48$    15.96    3000.      1       .25       .76       .76    331.5    172.9    .6671      60.
49$    6     6     7   52000.0     200.0       0.00F          0.00             0         0.
50$ 0.000E+00 0.000E+00          1
51$    7     7     8   52000.0     200.0       0.00V          0.00             0         0.
52$ 0.000E+00 0.000E+00    0

            10        20        30        40        50        60        70        80
   12345678901234567890123456789012345678901234567890123456789012345678901234567890
53$    8     8     9   52000.0     200.0       0.00B          0.00             2         0.
54$ 0.000E+00 0.000E+00    0
55$    9     9    10   52000.0     200.0       0.00V          0.00             0         0.
56$ 0.000E+00 0.000E+00    0
57$* PARTICULATE SPECIES DATA
58$          1  SMOKE           1.         1.
59$          2  TOT PRT        50.         2.5
60$* BOUNDARY DATA
61$    1
```

TABLE 5.15. Input Listing for FIRAC Using FIRIN Source Terms for the Solvent Extraction Fire (cont)

```
62$     4 1          1.0
63$    10
64$    11 1          1.0
65$* ROOM DATA
66$    2    2000.0     0     0     0     0      0.00       0.00
67$      200.0
68$    3    2000.0     0     0     0     0      0.00       0.00
69$      200.0
70$    5  10000.00     0     0     0     0      0.00       0.00
71$      200.0
72$    6  10000.00     0     0     0     0      0.00       0.00
73$      200.0
74$    7    2000.0     0     0     0     0      0.00       0.00
75$      200.0
76$    8    2000.0     0     0     0     0      0.00       0.00
77$      200.0
78$    9    2000.0     0     0     0     0      0.00       0.00
79$      200.0
80$* BLOWER CURVE
81$    1    6
82$   -1000.0       2.70      0.00       1.90    8000.0       1.80
83$   10000.0       1.60   13000.0       0.80   14000.0       0.00
84$    2    6
85$  -50000.0       1.40      0.00       0.80   77000.0       0.70
86$  100000.0       0.60  110000.0       0.40  120000.0       0.00
87$    3    9
88$  -500000.       9.2   -120000.      4.60   -97000.       3.50
89$   -77000.       1.70      0.00       1.60    77000.       1.50
90$    94000.       1.30   110000.       0.80   120000.       0.00
91$* FILTER DATA
92$         1       995       0.0 2830000.0      10.50
93$* PRESSURE INPUT (W.G.)
94$ 0.00000000E+00-0.15670000E+00 0.14000000E+01 0.10000000E+01 0.90000000E+00
95$ 0.80000000E+00-0.20000000E+00-0.30000000E+00 0.40000000E+00 0.00000000E+00
96$           1.
97$* TEMPERATURE INPUT (DEG. F)
98$ 0.60000000E+02 0.60000000E+02 0.60000000E+02 0.60000000E+02 0.60000000E+02
99$ 0.60000000E+02 0.60000000E+02 0.60000000E+02 0.60000000E+02 0.60000000E+02
100$           60.
101$* SCENARIO CONTROL SPECIFICATION CARD
102$       1000.         200          1
103$                                            1.0           1
104$* INITIAL CONDITIONS / FLOW SPECIFICATION CARDS

         10        20        30        40        50        60        70        80
12345678901234567890123456789012345678901234567890123456789012345678901234567890
105$      120.2       1.0
106$          3         4      21.0     15.96
107$          4        11       8.0     15.96
108$* FUEL MASS AND SURFACE AREA CARDS
109$                                                      189.596
110$                                                      132.397
111$* FIRE COMPARTMENT GEOMETRY
112$      137.1       22.       29.        4.0     29.53     29.53        0.0
113$* FIRE COMPARTMENT MATERIALS
114$          1         3         3
115$* EQUIPMENT VESSEL CARDS
116$                              1
117$                          9.186
118$                        18.3225
119$                          12.00
120$                              3
121$                         5048.5
122$
```

TABLE 5.15. Input Listing for FIRAC Using FIRIN Source Terms for the Solvent Extraction Fire (cont)

```
123$
124$
125$   24.72
126$ 6393.34
127$
128$
129$
130$   120.2
131$
132$
133$   120.2
134$
135$
136$   99.96
137$* RADIOACTIVE SOURCE IDENTIFIER CARD
138$                   9                                       8
139$         2         7         1         1
140$      1.19
141$         2         7         2         1
142$     2.425
143$         2         7         3         1
144$      14.1
145$         4         7         4         1
146$   .000044
147$         4         7         5         1
148$   .000132
149$         3         7         6         1
150$   .000396
151$         3         7         7         1
152$  .0000022
153$         3         7         8         1
154$   .000374
155$         4         7         9         1
156$   .000595
            10        20        30        40        50        60        70        80
    12345678901234567890123456789012345678901234567890123456789012345678901234567890
157$         1         1      2.18
158$         1         2      4.43
159$         1         3     25.78
160$         1         4    .79366
161$         1         5     .2425
162$         1         6     .7055
163$         1         8     .6834
164$         1         9     1.080
165$* TIME STEP CARD
166$                 0.1        2.        1.
167$                .010      500.       50.
```

TABLE 5.16. Input Listing for FIRAC Using Hand-Calculated Source Terms for the Solvent Extraction Fire

```
 1$* CANSOLH
 2$SOLVENT FIRE FROM AAH
 3$* RUN CONTROL 1
 4$   ST  0.0    5.      1000.
 5$* PRINT/PLOT CONTROL
 6$          3    3    3    3    0    2
 7$    1     1    1    1    1
 8$    2     1    1    1    1
 9$* PLOT FRAME DESCRIPTION CARDS
10$    4     1    2    3    4
11$    3     5    6    7
12$    3     8    9   10
13$    4     1    2    3    4
14$    4     5    6    7    8
15$    1     9
16$    4     1    2    3    4
17$    4     5    6    7    8
18$    1     9
19$    4     1    2    3    4
20$    3     5    6    7
21$    3     8    9   10
22$    4     2    4    6    8
23$    4     2    4    6    8
24$    4     2    4    6    8
25$    4     2    4    6    8
26$    4     2    4    6    8
27$    4     2    4    6    8
28$    4     2    4    6    8
29$    4     2    4    6    8
30$* RUN CONTROL 2
31$          0.001    1    1    P    T                   1              2
32$* BOUNDARY AND INTERNAL CONTROL
33$    0     2                       1    1    1    2
34$* GEOMERTY AND COMPONENT CONTROL
35$    9    10          8    3    1
36$* BRANCH DATA
37$     1    1    2  52000.00      200.0      0.00V          0.00          0      0.
38$ 0.000E+00 0.000E+00    0
39$     2    2    3  52000.00      200.0      0.00B          0.00          3      0.
40$ 0.000E+00 0.000E+00    0
41$     3    3    4  52000.00      200.0      0.00V          0.00          0      0.
42$ 0.000E+00 0.000E+00    0
43$     4    4    5  52000.00      200.0     50.00D          0.00          0      0.
44$ 0.000E+00 0.000E+00    0                                2.00                 1
45$    15.96   3000.       1     .25     .76      .76   331.5   172.9   .6671   60.0
46$     5    5    6  52000.00      200.0     50.00D          0.00          0      0.
47$ 0.000E+00 0.000E+00    0                                2.00                 1
48$    15.96   3000.       1     .25     .76      .76   331.5   172.9   .6671   60.0
49$     6    6    7  52000.00      200.0      0.00F          0.00          0      0.
50$ 0.000E+00 0.000E+00              1
51$     7    7    8  52000.00      200.0      0.00V          0.00          0      0.
52$ 0.000E+00 0.000E+00    0

            10        20        30        40        50        60        70        80
   12345678901234567890123456789012345678901234567890123456789012345678901234567890
53$     8    8    9  52000.00      200.0      0.00B          0.00          2      0.
54$ 0.000E+00 0.000E+00    0
55$     9    9   10  52000.00      200.0      0.00V          0.00          0      0.
56$ 0.000E+00 0.000E+00    0
57$* PARTICULATE SPECIES DATA
58$          1  SMOKE          1.         1.
59$          2  TOT PRT       50.         2.5
60$* BOUNDARY DATA
61$     1
```

TABLE 5.16. Input Listing for FIRAC Using Hand-Calculated Source Terms for the Solvent Extraction Fire (cont)

```
62$    10
63$* TEMPERATURE TIME FUNCTION FOR MASS INJECTION
64$     1    5
65$        0.0        0.0        3.0    1000.0      636.0     1000.0
66$      636.1        0.0     1000.0       0.0
67$*  ENERGY TIME FUNCTION
68$     1    5
69$        0.0        0.0        3.0    3700.0      636.0     3700.0
70$      636.1        0.0     1000.0       0.0
71$*  MASS INJECTION TIME FUNCTION
72$     1    5    1
73$        0.0        0.0        3.0    1072.9      636.0     1072.9
74$      636.1        0.0     1000.0       0.0
75$*   PARTICULATE SPECIES TIME FUNCTION: 1) SMOKE; 2) RAD PART
76$     1    5
77$        0.0        0.0        3.0      0.27      636.0       0.27
78$      636.1        0.0     1000.C       0.0
79$     2    5
80$        0.0        0.0        3.0     0.038      636.0      0.038
81$      636.1        0.0     1000.0       0.0
82$* ROOM DATA
83$     2    2000.0     0    0    0    0       0.00       0.00
84$      200.0
85$     3    2000.0     0    0    0    0       0.00       0.00
86$      200.0
87$     4   87469.8     1    1
88$        638.       2
89$          1        1
90$          2        2
91$     5  10000.00     0    0    0    0       0.Q0       0.00
92$      200.0
93$     6  10000.00     0    0    0    0       0.00       0.00
94$      200.0
95$     7    2000.0     0    0    0    0       0.00       0.00
96$      200.0
97$     8    2000.0     0    0    0    0       0.00       0.00
98$      200.0
99$     9    2000.0     0    0    0    0       0.00       0.00
100$     200.0
101$* BLOWER CURVE
102$    1    6
103$   -1000.0        2.70       0.00       1.90    8000.0       1.80
104$   10000.0        1.60    13000.0       0.80   14000.0       0.00

        10        20        30        40        50        60        70        80
12345678901234567890123456789012345678901234567890123456789012345678901234567890
105$    2    6
106$  -50000.0        1.40       0.00       0.80   77000.0       0.70
107$  100000.0        0.60   110000.0       0.40  120000.0       0.00
108$    3    9
109$  -500000.         9.2   -120000.       4.60   -97000.       3.50
110$   -77000.        1.70       0.00       1.60    77000.       1.50
111$    94000.        1.30    110000.       0.80   120000.       0.00
112$* FILTER DATA
113$         1        .995        0.0 2830000.0      10.50
114$* PRESSURE INPUT (W.G.)
115$ 0.00000000E+00-0.15670000E+00 0.14000000E+01 0.10000000E+01 0.90000000E+00
116$ 0.80000000E+00-0.20000000E+00-0.30000000E+00 0.40000000E+00 0.00000000E+00
117$* TEMPERATURE INPUT (DEG. F)
118$ 0.60000000E+02 0.60000000E+02 0.60000000E+02 0.60000000E+02 0.60000000E+02
119$ 0.60000000E+02 0.60000000E+02 0.60000000E+02 0.60000000E+02 0.60000000E+02
120$* TIME STEP CARD
121$                 0.01       345.        50.
122$                 0.01      1000.        50.
```

TABLE 5.17. Input Deck Listing for the Representative Facility Sample Problem

```
      SAMPLE PROBLEM 2
 #  RUN CONTROL I
    ST    0.    1.       999.
 #                PRINT / PLOT CONTROL CARD
   ALL     1     1     1     1          5
     1     1     1
     2     1     1
    11     1     1
    12     1     1
    13     1     1
 #  FRAME DESCRIPTION CARDS
     4     9    15    21    22
     3    14    16    17
     3    14    16    17
     4     9    15    21    22
     4    14    34    35    36
     4    14    34    35    36
     4    14    34    35    36
     4    14    34    35    36
     4    14    34    35    36
     4    14    34    35    36
     4    14    34    35    36
     4    14    34    35    36
     4    14    34    35    36
     4    14    34    35    36
 #                RUN CONTROL CARD 2                          "IFIRIN"
                                     P    T                      0           0   13
 #  BOUNDARY CONTROL                (P, T, E, M)
          5                         70.
 #  GEOMETRY AND COMPONENT CONTROL
   37   22          17     2     3
 #  BRANCHES
      1     1     2   17600.00     12.000     10.000V
 0.          0.                                              3.464
      2     2     3   17600.00     12.000      0.000F
 C.          0.                    1                         3.464
      3     3     4   17600.00     12.000      0.000B
 0.          0.                                              3.464            1
      4     4     5   17600.00     12.000     15.000V
 0.          0.                                              3.464
      5     5     6    7710.00      5.000     10.000V
 0.          0.                                              2.236
      6     7    15     578.00       .380      0.000F
 0.          0.                    1                          .6164
      7     6     7     413.00       .290     20.000V
 0.          0.                                               .5385
      8     6    11      50.00       .290      1.000V
 0.          0.                                               .5385
      9    11     7     143.00       .100      1.000V
 0.          0.                                               .3162
     10     8    15     433.00       .290      0.000F
          0.  0.                   1                          .5385
     11     6    11      50.00       .290      1.000V
 0.          0.                                               .5385
     12     6     8     290.00       .200     20.000V
          0.  0.                                              .4472
     13    11     8     143.00       .100      1.000V
 0.          0.                                               .3162
     14    21    15    3766.00      2.500      0.000F
 2.600E-04  0.                     2                         1.581
     15     6    11     100.00      0.100      1.000V
 0.          0.                                               .3162
     16     6     9    3480.00      2.300     20.000V
```

TABLE 5.17. Input Deck Listing for the Representative Facility Sample Problem (cont)

```
2.875E-08 O.                                                   1.517
  17    11    22      286.00       .190     1.000V
O.            O.                                               .4359
  18    10    15     2000.00      2.300     0.000F
O.            O.                 1                             1.517
  19     6    11      100.00      0.100     1.000V
O.            O.                                               .3162
  20     6    10     1714.00      2.100    20.000V
O.            O.                                               1.449
  21    11    10      286.00       .190     1.000V
O.            O.                                               .4359
  22     5    11      930.00       .620    10.000V
O.            O.                                               .7874
  23     5    20     7260.00      4.800    20.000V
O.            O.                                               2.191
  24     5    12     1700.00      1.100    20.000V
O.            O.                                               1.049
  25    12    15     1700.00      1.100     0.000F
O.            O.                 1                             1.049
  26    13    15     3746.00      2.400     0.000F
O.            O.                 1                             1.549
  27    11    13      286.00       .190     1.000V
O.            O.                                               .4359
  28    20    13     3460.00      2.300    20.000V
O.            O.                                               1.517
  29    20    11      100.00       .070     1.000V
O.            O.                                               .2646
  30    14    15     3886.00      2.500     0.000F
O.            O.                 1                             1.581
  31    20    11      100.00       .070     1.000V
O.            O.                                               .2646
  32    20    14     3600.00      2.400    20.000V
O.            O.                                               1.549
  33    11    14      286.00       .190     1.000V
O.            O.                                               .4359
  34    15    16    17600.00     12.000    10.000V
O.            O.                                               3.464
  35    16    17    17600.00     12.000     0.000F
O.            O.                 3                             3.464
  36    17    18    17600.00     12.000          B                        2
O.            O.                                               3.464
  37    18    19    17600.00     12.000    10.000V
                                                               3.464
#          PARTICULATE SPECIE DATA CARDS
           1   SMOKE            1.        1.
           2   TOTRAD P        20.        1.
           3   RAD P  .1         .1       1.
           4   RAD P  .2         .2       1.
           5   RAD P  .4         .4       1.
           6   RAD P  .6         .6       1.
           7   RAD P  .8         .8       1.
           8   RAD P  1.        1.        1.
           9   RADP  1.5        1.5       1.
          10   RADP  1.9        1.9       1.
          11   RAD P 8.         8.        1.
          12   RADP  15.       15.        1.
          13   RADP  20.       20.        1.
#   BOUNDARY DATA
     1 O                       70.
     9 1      -0.3             70.
    19 O                       70.
    21 1                       70.
    22 1                       70.
#   ROOM DATA                  (E, M, P, T)
```

TABLE 5.17. Input Deck Listing for the Representative Facility Sample Problem (cont)

```
  2     500.00
 120.000
  3     500.00
 120.000
  4     500.00
 120.000
  5     500.00
 120.000
  6     500.00
  50.000
  7    3600.00
  180.00
  8    4440.00
  222.00
 10   87400.00
  4370.0
 11   10200.00
  510.00
 12  117300.00
  5865.0
 13   20000.00
  1000.0
 14   20000.00
  1000.0
 15     500.00
 120.000
 16     500.00
 120.000
 17     500.00
 120.000
 18     500.00
 120.000
 20     500.00
  50.00
#  BLOWER CURVES
  1    6
 -5600.00      13.80       0.00      9.80  12000.00      9.70
 17600.00       8.15   25200.00      4.00  30800.00      0.00
  2    6
 -7700.00      18.10       0.00     12.10   8000.00     12.00
 17600.00      11.10   26700.00      6.00  34400.00      0.00
#  FILTER DATA
        1     .9995        0.
        2     .9995       20.
        3     .9995        0.
#  PRESSURES
        0.0000        -5.1500        -7.1500        1.0000         .5000
        0.0000        -.3000         -.3000         -.3000         -.3000
        -.1500        -.1500         -.3000         -.3000        -1.3480
       -7.6000       -10.6000         .5000         0.0000         0.0000
        0.0000         0.0000
#    TEMPERATURES
          70.0          70.0          70.0          70.0          70.0
          70.0          70.0          70.0          70.0          70.0
          70.0          70.0          70.0          70.0          70.0
          70.0          70.0          70.0          70.0          70.0
          70.0          70.0
#          FIRE SCENARIO CONTROL SPECIFICATIONS          "IFLOW3"
   1100.         100          2
      0          0.0          0         0.0          0          1
#          FIRE COMPARTMENT INITIAL CONDITIONS AND NODING
    70.0    -0.30
      16          9        18.74       1.517
      14         21        3.000       1.581
```

TABLE 5.17. Input Deck Listing for the Representative Facility Sample Problem (cont)

```
      17          22        18.74       .4359
#         FUEL TYPE, MASS ,AND BURN AREA
    0.0      0.0      0.0      0.0      0.0      0.0     3.00     0.0      0.0
    0.0     30.0      0.0      0.0      0.0      0.0     0.0      0.0      0.0
    0.0      0.0      0.0      0.0      0.0      0.0     5.0      0.0      0.0
    0.0      7.0      0.0      0.0      0.0      0.0     0.0      0.0      0.0
#          FIRE COMPARTMENT DIMENSIONS AND MATERIALS
     39.0       39.0       20.0      1.000      0.500      1.000      1.500
      1          1          1
      RADIOACTIVE SOURCE TERM INPUT (POLYSTYRENE)
      1          0          0          0          0          0          0
      1          2          1          2
    .2205
#          TIME STEP CARDS
                .001      3.001       0.5
                .01      10.01        1.0
                .05     999.05       50.
```

Table 5.18. Transient Event Sequence for the Representative Facility Fire

Event	Time (s)
Kerosene ignites	2
Hot layer descends to centerline elevation of inflow boundaries	12
Hot layer descends to centerline elevation of outflow boundary	190
Contaminated polystyrene ignites	265
Transport of radioactive material initiated	265
Fire compartment exhaust filter begins to plug	325
Maximum system temperature 88°C (190°F) attained	806
Fire terminated	806
End of calculation	1000

Table 5.19. Node Data for Sample Explosion Problem

Node	Pressure (in. w.g.)	Temperature (°F)	Volume (ft^3)	L (ft)	W (ft)	H (ft)
1	0.00	60	--	--	--	--
2	-0.69	60	20	5	2	2
3	1.10	60	20	5	2	2
4	1.00	60	1000	10	10	10
5	0.90	60	200	50	2	2
6	0.80	60	200	50	2	2
7	-0.20	60	20	5	2	2
8	-0.30	60	20	5	2	2
9	0.40	60	20	5	2	2
10	0.00	60	--	--	--	--
11	0.90	60	1.25	50	0.50	0.5
12	0.90	60	89.70	6.9	3.10	3.1
13	0.80	60	12.50	50	0.50	0.5
14	0.70	60	12.50	50	0.50	0.5
15	-0.30	60	1.25	5	0.50	0.5

Table 5.20. Branch Data for Sample Explosion Problems

Branch	Component Type	Flow (ft^3/min)	Cross-Section Area (ft^2)	L (ft)	Curve Number
1	Valve	1000	4	0	--
2	Blower	1000	4	0	1
3	Valve	1000	4	0	--
4	Duct	1000	4	50	--
5	Duct	1000	4	50	--
6	Filter	1000	4	0	--
7	Valve	1000	4	0	--
8	Blower	1000	4	0	2
9	Valve	1000	4	0	--
10	Duct	50	0.25	0.08	--
11	Duct filter	50	0.25	0	--
12	Duct	50	0.25	50	--
13	Duct	50	0.25	50	--
14	Filter	50	0.25	0	--
15	Blower	50	0.25	15	3

TABLE 5.21. Material Source-Term Information for Input to EXPAC

Particle	Size	Density (kg/m^3)	m_i (g)	Y_i	Input Location
PuO_2	12 μm	0.25×10^4	11.0	3.54×10^{-3}	Node 12
PuO_2	16 μm	0.25×10^4	22.0	7.08×10^{-3}	Node 12
PuO_2	20 μm	0.25×10^4	11.0	3.54×10^{-3}	Node 12
Acetone	25 μm	0.792×10^3	1.8	5.73×10^{-4}	Node 12
Acetone	30 μm	0.792×10^3	1.8	5.73×10^{-4}	Node 12

TABLE 5.22. EXPAC Input Values for the Glovebox Sample Problem

Acronym	Value
RUN CONTROL CARD I	
RUNT	ST
TINIT	0
DTI	0.001
TOT	1.0
NSPOUT	0
SOUT1	0
SOUT2	0
ZOOM	0
IPART	1
INTERA	0
IMAT	1
PRINT/PLOT CONTROL CARD	
LUNITS	Default
PLTOPT	All
NPFRMS	4
NQFRMS	5
NMFRMS	5
NTFRMS	4
NDFRMS	5
NSFRMS	10
NAFRMS	10
NYFRMS	5
NDFRMS	5
PLOT FRAME CARD	See input listing
NCRVS(K)	
NCID(1)	
NCID(2)	
NCID(3)	
NCID(4)	
XSCL(K)	
RUN CONTROL CARD II	
MAXIT	500
CONVRG	0.0001
RBETA	0.0
PINP	P
TINP	T
NPART	5
BOUNDARY AND INTERNAL CONTROL CARD	
NBNODS	2
PZERO	Default
TAMB	Default
NPFN	Default
NTFN	Default
NEFN	1

TABLE 5.22. EXPAC Input Values for the Glovebox Sample Problem (cont)

Acronym	Value
NMFN	1
NCFN	Default
GEOMETRY AND COMPONENT CONTROL CARD	
NBRCH	15
NNODES	15
NBLWRS	3
NROOMS	13
NBLFNS	3
NFILRS	3
BRANCH DESCRIPTION DATA CARDS	
(Card 1)	
ib	
INDU	
INDD	
Q	
FA	See input listing
XL	
ICPTYP	
CCPTYP	
DIFP	
IBCN	
D5	
(Card 2)	
FZ	
RZ	
NFE	
BOUNDARY NODE DATA CARD	
IBNNR(I)	1
PB(I)	Default
IBPFN(I)	Default
TB(I)	Default
IBTFN(I)	10
TIME FUNCTION CONTROL CARD	
IFN	1
INP	3
IMT	Default
APART(I)	Default
TIME FUNCTION DATA CARD	
T(I, IFN)	See input listing
FT(I, IFN)	
T(I+1, IFN)	
FT(I+1, IPN)	
T(I+2, IFN)	
FT(I+2, IFN)	

TABLE 5.22. EXPAC Input Values for the Glovebox Sample Problem (cont)

Acronym	Value
ROOM DATA CARDS	
(Card 1)	See Table 4.19
I1	
VOL(I1)	
NOE(I1)	
NOM(I1)	
NOP(I1)	
NOT(I1)	
REDOT(I1)	
RMDOT(I1)	
(Card 2)	
RFA(I1)	
NOC(I1)	
RCDOT(I1)	
XW	
XH	
XLX	
EXPLOSION CHAMBER CARD	
NEXOPT	Default
NEXRM	
WLB	
NTYPE	
MULTIPLE PARTICLE DATA CARDS	
(Card 1)	
pname	
(Card 2)	
IDPART(I)	
DIAM(I)	
RHOM(I)	
(Card 3)	
YS(I, J)	See Table 5.21
YS(I, J+1)	
YS(I, J+2)	
YS(I, J+3)	
(Card 4)	
NRSO(I, K)	
NRSI(I, K)	
NDSO(I, K)	
NDSI(I, K)	
TMASS(I, K)	
BLOWER CURVE CONTROL CARD	
J	
NP	

TABLE 5.22. EXPAC Input Values for the Glovebox Sample Problem (cont)

Acronym	Value
BLOWER CURVE DATA CARD	
XB(I, J)	See simple system description
FXB(I, J)	See input listing
XB(I+1, J)	
FXB(I+1, J)	
XB(I+2, J)	
FXB(I+3, J)	
FILTER-MODEL CONTROL CARD	
K	Same for all three filters
JP	1
AKT(K)	12
AKL(K)	0.283×10^7
FILTER-MODEL DATA CARDS	
FEF(J, K)	See input listing
ALFL(K)	
PRESSURE INPUT CARD	
P(I)	See input listing
P(I+1)	
P(I+2)	
P(I+3)	
P(I+4)	
TEMPERATURE INPUT CARD	
T(I)	See input listing
T(I+1)	
T(I+2)	
T(I+3)	
T(I+4)	

TABLE 5.23. Input Listing for the EXPAC Computer Code TNT Explosion Glovebox Problem

```
*
PNL glove box problem modified
*
* RUN CONTROL 1
  st   0.00000   0.00100   1.00000   0   0.00000   0.00000   0   1   0   1
* PRINT/PLOT CONTROL
 all    4    5    5    4    5    10    10    5    5
* PLOT FRAME DESCRIPTION
    4    2    3    4    5       0.00
    4    6    7    8    9       0.00
    3   11   12   13    0       0.00
    2   14   15    0    0       0.00
    3    1    2    3    0       0.00
    3    4    5    6    0       0.00
    3    7    8    9    0       0.00
    3   10   11   12    0       0.00
    3   13   14   15    0       0.00
    3    1    2    3    0       0.00
    3    4    5    6    0       0.00
    3    7    8    9    0       0.00
    3   10   11   12    0       0.00
    3   13   14   15    0       0.00
    4    2    3    4    5       0.00
    4    6    7    8    9       0.00
    3   11   12   13    0       0.00
    2   14   15    0    0       0.00
    3    1    2    3    0       0.00
    3    4    5    6    0       0.00
    3    7    8    9    0       0.00
    3   10   11   12    0       0.00
    3   13   14   15    0       0.00
    1    3    1    6    9    0       0.00
    1    2   11   14    0    0       0.00
    2    3    1    6    9    0       0.00
    2    2   11   14    0    0       0.00
    3    3    1    6    9    0       0.00
    3    2   11   14    0    0       0.00
    4    3    1    6    9    0       0.00
    4    2   11   14    0    0       0.00
    5    3    1    6    9    0       0.00
    5    2   11   14    0    0       0.00
    1    3    1    6    9    0       0.00
    1    2   11   14    0    0       0.00
    2    3    1    6    9    0       0.00
    2    2   11   14    0    0       0.00
    3    3    1    6    9    0       0.00
    3    2   11   14    0    0       0.00
    4    3    1    6    9    0       0.00
    4    2   11   14    0    0       0.00
    5    3    1    6    9    0       0.00
    5    2   11   14    0    0       0.00
    1    4    4   11   12   13       0.00
    2    4    4   11   12   13       0.00
    3    4    4   11   12   13       0.00
    4    4    4   11   12   13       0.00
    5    4    4   11   12   13       0.00
    1    4    4   11   12   13       0.00
    2    4    4   11   12   13       0.00
    3    4    4   11   12   13       0.00
    4    4    4   11   12   13       0.00
    5    4    4   11   12   13       0.00
* RUN CONTROL 2
  500    0.0001      0.    p    t    5
* BOUNDARY AND INTERNAL CONTROL
    2    14.70    60.00    0    0    1    1    0
* GEOMETRY AND COMPONENT CONTROL
   15   15    3   13    3    3
* BRANCH DATA
    1    1    2   1000.00      4.00     0.00v        0.00        0    0.
 0.000e+00 0.000e+00    0
    2    2    3   1000.00      4.00     0.00b        0.00        1    0.
 0.000e+00 0.000e+00    0
    3    3    4   1000.00      4.00     0.00v        0.00        0    0.
 0.000e+00 0.000e+00    0
    4    4    5   1000.00      4.00    50.00d        0.00        0    0.
 0.000e+00 0.000e+00    0
    5    5    6   1000.00      4.00    50.00d        0.00        0    0.
 0.000e+00 0.000e+00    0
    6    6    7   1000.00      4.00     0.00f        0.00        0    0.
 0.000e+00 0.000e+00    1
```

TABLE 5.23. Input Listing for the EXPAC Computer Code TNT Explosion Glovebox Problem (cont)

```
   7    7    8   1000.00       4.00      0.00v          0.00           0      0.
 0.000e+00 0.000e+00     0
   8    8    9   1000.00       4.00      0.00b          0.00           2      0.
 0.000e+00 0.000e+00     0
   9    9   10   1000.00       4.00      0.00v          0.00           0      0.
 0.000e+00 0.000e+00     0
  10    4   11     50.00       0.25      0.08a          0.00           0      0.
 0.000e+00 0.000e+00     0
  11   11   12     50.00       0.25      0.00f          0.00           0      0.
 0.000e+00 0.000e+00     3
  12   12   13     50.00       0.25     50.00a          0.00           0      0.
 0.000e+00 0.000e+00     0
  13   13   14     50.00       0.25     50.00a          0.00           0      0.
 0.000e+00 0.000e+00     0
  14   14   15     50.00       0.25      0.00f          0.00           0      0.
 0.000e+00 0.000e+00     2
  15   15    9     50.00       0.25     15.00b          0.00           3      0.
 0.000e+00 0.000e+00     0
* BOUNDARY DATA
    1      0.00    0      0.00    0
   10      0.00    0      0.00    0
* ENERGY-TIME FUNCTION (BTU/S)
    1    3
0.0000e+000.0000e+000.8000e-020.1438e+050.1600e-010.0000e+00
* MASS-TIME FUNCTION (lbm/S)
    1    3
0.0000e+000.0000e+000.8000e-020.1090e+020.1600e-010.0000e+00
* ROOM DATA
    2     20.00    0     0    0     0       0.00       0.00
      4.00     0      0.00       2.00       2.00       5.00
    3     20.00    0     0    0     0       0.00       0.00
      4.00     0      0.00       2.00       2.00       5.00
    4   1000.00    0     0    0     0       0.00       0.00
    100.00     0      0.00      10.00      10.00      10.00
    5    200.00    0     0    0     0       0.00       0.00
      4.00     0      0.00       2.00       2.00      50.00
    6    200.00    0     0    0     0       0.00       0.00
      4.00     0      0.00       2.00       2.00      50.00
    7     20.00    0     0    0     0       0.00       0.00
      4.00     0      0.00       2.00       2.00       5.00
    8     20.00    0     0    0     0       0.00       0.00
      4.00     0      0.00       2.00       2.00       5.00
    9     20.00    0     0    0     0       0.00       0.00
      4.00     0      0.00       2.00       2.00       5.00
   11      1.25    0     0    0     0       0.00       0.00
      0.25     0      0.00       0.50       0.50       5.00
   12     89.70    1     1    0     0       0.00       0.00
     12.96     0      0.00       3.61       3.61       6.89
   13     12.50    0     0    0     0       0.00       0.00
      0.25     0      0.00       0.50       0.50      50.00
   14     12.50    0     0    0     0       0.00       0.00
      0.25     0      0.00       0.50       0.50      50.00
   15      1.25    0     0    0     0       0.00       0.00
      0.25     0      0.00       0.50       0.50       5.00
* EXCHAM DATA
    0   00       0.00    0
* Multiple particle size data
PuO2 12
          1    0.12e-04    0.25e+04
          0.00e+00         0.00e+00         0.00e+00         0.00e+00
          0.00e+00         0.00e+00         0.00e+00         0.00e+00
          0.00e+00         0.00e+00         0.00e+00         3.54e-03
          0.00e+00         0.00e+00         0.00e+00
    0     0     0     0 0.000e+00
    0     0     0     0 0.000e+00
    0     0     0     0 0.000e+00
    0     0     0     0 0.000e+00
    0     0     0     0 0.000e+00
    0     0     0     0 0.000e+00
    0     0     0     0 0.000e+00
    0     0     0     0 0.000e+00
    0     0     0     0 0.000e+00
    0     0     0     0 0.000e+00
    0     0     0     0 0.000e+00
    0     0     0     0 0.000e+00
    0     0     0     0 0.000e+00
PuO2 16
          2    0.16e-04    0.25e+04
          0.00e+00         0.00e+00         0.00e+00         0.00e+00
          0.00e+00         0.00e+00         0.00e+00         0.00e+00
```

TABLE 5.23. Input Listing for the EXPAC Computer Code TNT Explosion Glovebox Problem (cont)

```
          0.00e+00        0.00e+00        0.00e+00        7.08e-03
          0.00e+00        0.00e+00        0.00e+00
     0    0    0    0 0.000e+00
     0    0    0    0 0.000e+00
     0    0    0    0 0.000e+00
     0    0    0    0 0.000e+00
     0    0    0    0 0.000e+00
     0    0    0    0 0.000e+00
     0    0    0    0 0.000e+00
     0    0    0    0 0.000e+00
     0    0    0    0 0.000e+00
     0    0    0    0 0.000e+00
     0    0    0    0 0.000e+00
     0    0    0    0 0.000e+00
     0    0    0    0 0.000e+00
PuO2 20
          3    0.20e-04   0.25e+04
          0.00e+00        0.00e+00        0.00e+00        0.00e+00
          0.00e+00        0.00e+00        0.00e+00        0.00e+00
          0.00e+00        0.00e+00        0.00e+00        3.54e-03
          0.00e+00        0.00e+00        0.00e+00
     0    0    0    0 0.000e+00
     0    0    0    0 0.000e+00
     0    0    0    0 0.000e+00
     0    0    0    0 0.000e+00
     0    0    0    0 0.000e+00
     0    0    0    0 0.000e+00
     0    0    0    0 0.000e+00
     0    0    0    0 0.000e+00
     0    0    0    0 0.000e+00
     0    0    0    0 0.000e+00
     0    0    0    0 0.000e+00
     0    0    0    0 0.000e+00
     0    0    0    0 0.000e+00
Acetone 25
          4    0.25e-04   0.79e+03
          0.00e+00        0.00e+00        0.00e+00        0.00e+00
          0.00e+00        0.00e+00        0.00e+00        0.00e+00
          0.00e+00        0.00e+00        0.00e+00        5.73e-04
          0.00e+00        0.00e+00        0.00e+00
     0    0    0    0 0.000e+00
     0    0    0    0 0.000e+00
     0    0    0    0 0.000e+00
     0    0    0    0 0.000e+00
     0    0    0    0 0.000e+00
     0    0    0    0 0.000e+00
     0    0    0    0 0.000e+00
     0    0    0    0 0.000e+00
     0    0    0    0 0.000e+00
     0    0    0    0 0.000e+00
     0    0    0    0 0.000e+00
     0    0    0    0 0.000e+00
     0    0    0    0 0.000e+00
Acetone 30
          5    0.30e-04   0.79e+03
          0.00e+00        0.00e+00        0.00e+00        0.00e+00
          0.00e+00        0.00e+00        0.00e+00        0.00e+00
          0.00e+00        0.00e+00        0.00e+00        5.73e-04
          0.00e+00        0.00e+00        0.00e+00
     0    0    0    0 0.000e+00
     0    0    0    0 0.000e+00
     0    0    0    0 0.000e+00
     0    0    0    0 0.000e+00
     0    0    0    0 0.000e+00
     0    0    0    0 0.000e+00
     0    0    0    0 0.000e+00
     0    0    0    0 0.000e+00
     0    0    0    0 0.000e+00
     0    0    0    0 0.000e+00
     0    0    0    0 0.000e+00
     0    0    0    0 0.000e+00
     0    0    0    0 0.000e+00
* BLOWER CURVE
     1    6
  -100.00      3.20      0.00      2.40    800.00      2.30
  1000.00      2.10   1300.00      1.30   1400.00      0.00
     2    6
  -200.00      1.40      0.00      1.00    700.00      0.90
  1000.00      0.70   1400.00      0.40   1600.00      0.00
     3    6
```

TABLE 5.23. Input Listing for the EXPAC Computer Code TNT Explosion Glovebox Problem (cont)

```
   -100.00      2.30      0.00      1.60    770.00      1.50
    940.00      1.30   1100.00      0.80   1200.00      0.00
 * FILTER MODEL DATA
     1    1        12. 0.283e+07
  0.99500000e+00
  0.00000000e+00
     2    1        12. 0.283e+07
  0.99500000e+00
  0.00000000e+00
     3    1        12. 0.283e+07
  0.99500000e+00
  0.00000000e+00
 * PRESSURE INPUT (W.G.)
  0.00000000e+00 0.21000000e+00 0.21000000e+01 0.20000000e+01 0.19000000e+01
  0.18000000e+01 0.80000000e+00-0.35000000e+00 0.40000000e+00 0.00000000e+00
  0.19000000e+01 0.90000000e+00 0.80000000e+00 0.70000000e+00-0.15000000e+00
 * TEMPERATURE INPUT (deg. F)
  0.60000000e+02 0.60000000e+02 0.60000000e+02 0.60000000e+02 0.60000000e+02
  0.60000000e+02 0.60000000e+02 0.60000000e+02 0.60000000e+02 0.60000000e+02
  0.60000000e+02 0.60000000e+02 0.60000000e+02 0.60000000e+02 0.60000000e+02
```

TABLE 5.24. Tornado Depressurization Time History

Time (s)	ΔP (in. of water)
0	0
10	0
12	-50
16	-50
18	0

TABLE 5.25. Input Parameters for the Tornado Sample Problem

Data Description		Value
1.	Run Control Card I	
	a. SS - steady state only ST - steady state plus transient RS - restart problem TP - restart after transient SP - restart after steady-state RP - restart after restart	ST
	b. Problem start time (s)	0
	c. Transient time step size	0.01
	d. Total problem time (s)	30.0
	e. Number of special outputs	Default
	f. Flag for material transport	1
	g. Flag for calculated source and sink option	1
2.	Print/Plot Control Card	
	a. Units for output lists and plots	Default
	b. List at every output time	Default
	c. Number of pressure plot frames	Default
	d. Number of flow plot frames	1
	e. Number of pressure differential frames	0
	f. Number of material concentration frames	1
	g. Number of material flow plot frames	1
	h. Number of material accumulation on filter or amount through branches plot frames	1
3.	Plot Frames Description	See input file
4.	Run Control Card II	
	a. Maximum iterations per time step	500
	b. Convergence criterion	Default
	c. Relaxation parameter	Default
	d. Pressure input option	P
	e. Flag for blower failure option	1
	f. Flag for changing blower curve	1
5.	Boundary Control Card	
	a. Total number of pressure-time functions for all boundary nodes	1
	b. Total number of boundary nodes	2
	c. Value for atmospheric pressure	Default
	d. Value for atmospheric temperature	Default
	e. Number of resistance functions	1
	f. Flag for control damper option	1
	g. Number of material functions	1

TABLE 5.25. Input Parameters for the Tornado Sample Problem (cont)

Data Description	Value	
6. Geometry and Component Control Card		
a. Number of branches	9	
b. Number of nodes	10	
c. Number of rooms	3	
d. Total number of blower characteristic functions	3	
e. Number of filter models	1	
7. Branch Data		
a. Branch number		
b. Upstream node number		
c. Downstream node number		
d. Initial estimate of flow	See Table 5.2	
e. Hydraulic duct radius		
f. Duct lenght		
g. Component type		
h. Branch pressure differential		
i. Resistance coefficient		
j. Blower curve identification number		
k. Filter model indentification number		
8. Data Description	2 cards	
a. Boundary node number	1	10
b. Initial value of node pressure	Default	Default
c. Identification of node time function	Default	1
9. Control Damper Control		
a. Total number of control dampers	1	
10. Control Damper Data		
a. Branch number	0	
b. Resistance function I.D. number	1	
c. Initial value of resistance	4.0×10^{-7}	
11. Blower Change Control		
a. Total number of blowers involved	1	
12. Blower Change Data Card		
a. Branch number	Default	
b. New blower function I.D. number	3	
c. Time that change occurs	50.	
13. Pressure Function Control Card		
a. Pressure function I.D. number	1	
b. Number of data points	5	
14. Pressure Function Data Card		
a. Value of time(s) at first data point	See Table 5.1	
b. Value of pressure		

TABLE 5.25. Input Parameters for the Tornado Sample Problem (cont)

Data Description	Value
15. Material Function Control Card	
a. Function I.D. number	1
b. Number of points	6
c. Total amount of material	0.35
16. Material Function Data Card	
a. Value of time(s) at first point	See input listing
b. Value of material generation	
17. Resistance Function Control Card	
a. Resistance Function Control Card	1
b. Number of points	4
18. Resistance Function Data	
a. Value of time(s) at first point	
b. Value of resistance at first point	See input listing
19. Blower On/Off Data Control Card	
a. Total number of blowers involved	1
20. Blower On/Off Data Card	
a. Blower branch number	
b. "Off" time(s)	
c. Value of branch resistance in blower-off time(s)	See input listing
d. "On" time(s)	
21. Room Data Card	
a. Node number for room	
b. Room width	
c. Room height	See Table 5.1
d. Room length	
e. Material generation identification number	
22. Blower Curve Control Card	
a. Blower curve number identifier	
b. Number of points defining this blower curve	See input listing
23. Blower Curve Data Card	
a. Flow (cfm) for the first point	
b. Blower head (in w.g.) for first pt	See input listing
.	
.	
.	

TABLE 5.25. Input Parameters for the Tornado Sample Problem (cont)

Data Description	Value
24. Filter Model Control Card	
a. Filter-model identification number	1
b. Number of species	1
c. Turbulent Coefficient	Default
d. Laminar Coefficient	Default
25. Filter Model Data Cards	
a. Filter efficiency	0.8
b. Filter plugging factor (kg^{-1})	30.0
26. Pressure Input Card	
a. Pressure (in w.g.) at the first node	See Table 5.1
.	
.	
.	
27. Calculated Source and Sink	
a. Material density (kg/m^3)	2500
b. Material diameter (m)	2.0×10^{-5}
c. Room entrainment flag	
d. Room deposition flag	
e. Duct entrainment flag	See input listing
f. Duct deposition flag	
g. Material mass available for entrainment (kg)	

TABLE 5.26. Input Listing for the TORAC Computer Code Sample Problem

```
*
EXAMPLE PROBLEMS (E.G. ENTRAINMENT)
*
* RUN CONTROL 1
   ST  0.0  .01 030.                                                        1    0    1
* PRINT/PLOT CONTROL                           PLOT OPTION NO. 4
          0    1    0    1    1    1               "     "    "  4
* FRAME DESCRIPTIONS                               "     "    "  4
    4    2    4    5    8                          "     "    "  4
    4    4    5    6    7                          "     "    "  4
    4    4    5    6    7                          "     "    "  4
    4    4    5    6    7                          "     "    "  4
* RUN CONTROL 2
 500                               P    1    1
* BOUNDARY CONTROL
    1    2                              1    1    1
* GEOMETRY AND COMPONENT CONTROL
    9   10              3    3    1
* BRANCH DATA
    1    1    2 1000.                         V
    2    2    3 1000.                         B                   1
    3    3    4 1000.                         V
    4    4    5 1000.                         V
    5    5    6 1000.                         V
    6    6    7 1000.                         F                     1
    7    7    8 1000.                         V
    8    8    9 1000.                         B                   2
    9    9   10 1000.                         V
* BOUNDARY DATA
    1                   0
   10                   1
* CONTROL DAMPER INSTRUCTIONS
    1
    0    1   4.000E-07  9
* BLOWER CURVE CHANGE INSTRUCTIONS
    1
    0    3  50.    2
* TORNADO PRESSURE FUNCTION
    1    5
0.0          0.0          10.          0.0          12.          -50.
16.          -50.         18.          0.0
* PARTICULATE FUNCTION
    1    6 0.35
0.0          0.0          10.          0.0          12.          0.1
14.          0.1          16           0.0          60.          00
* CONTROL DAMPER FUNCTION
    1    4
0.0                    4.000E-07  80.           4.000E-07  100.          1.000E-06
150.                   1.000E-06
* BLOWER TURNED OFF/ON INSTRUCTIONS
    1
    0  50.          1.000E-09 150.          2
* ROOM DATA
    4  10.          10.          10.          0
    5  2.           2.           50.
    6  2.           2.           50.
* BLOWER CURVES
    1    6
-100.        2.7          0.0          1.9          800.         1.8
1000.        1.6          1300.        0.8          1400.        0.0
    2    6
-200.        1.4          0.0          1.0          700.         0.9
1000.        0.7          1400.        0.4          1600.        0.0
    3    6
```

TABLE 5.26. Input Listing for the TORAC Computer Code Sample Problem (cont)

```
65$-100.        2.3        0.0        1.6        770.        1.5
66$ 940.        1.3        1100.      0.8        1200.       0.0
67$* FILTER MODEL DATA
68$     1     1
69$    .8
70$   30.0
71$* PRESSURES
72$      0.0              -0.5              +1.1              1.0              0.9
73$      0.8              -0.2              -0.3              0.4              0.0
74$* CALC. SOURCE/SINK COEFFICIENTS
75$   2500.       2.0E-05
76$     0     0     0     0    0.0
77$     0     0     1     0    1.0
78$     0     0     0     0    0.0
```

TABLE 5.27. Summary of Extreme Values for the Tornado Sample Problem

1. Maximum pressure of 0.274 kPa (1.101 in. w.g.) occurs at Node 3 at a time of 30 s.
2. Minimum pressure of 12.5 kPa (-50 in. w.g.) occurs at Node 10 at a time of 16 s.
3. Maximum flow of 2.6 m^3s (5488 ft^3/min) occurs in Branch 8 at a time of 18 s.
4. Minimum flow of 0.77 m^3/s (1623 ft^3/min) occurs in Branch 8 at a time of 18 s.
5. Filter in Branch 6 has the largest pressure differential of 1.37 kPa (5.49 in. w.g.) at a time of 12 s.
6. Filter in Branch 6 has the largest flow of 2.6 m^3/s (5488 ft^3/min) at a time of 12 s.
7. Damper in Branch 9 has the largest pressure differential of 0.30 kPa (1.21 in. w.g.) at a time of 12 s.
8. Room number 1 has the highest positive pressure of 0.25 kPa (1.0 in. w.g.) at a time of 30 s.
9. Room number 3 has the lowest negative pressure of 8.2 kPa (-33.1 in. w.g.) at a time of 16 s.

Table 5.28. Filter Coefficients[a]

Filter Maker	Nominal Design Flow Rate (ft^3/min)	K_L	K_T
American Air	500	7.298×10^6	10.50
American Air	1000	2.83×10^6	12.25
Flanders	1800	3.310×10^6	18.91
LUWA	1800	1.456×10^6	11.11

[a]The data outlined here are presented in more detail in a Los Alamos National Laboratory report.[7]

Table 5.29. Filter Plugging Coefficients

Fuel	Combustion Condition	$\alpha(1/kg)$	$\beta(1/kg^2)$
PS	High O_2	20.7	0.735×10^{-2}
PS	Low O_2	4.8	0.277×10^{-4}
PMMA	Underventilated	47.7	-0.308×10^{-1}
PMMA	overventilated	64.1	-0.573×10^{-1}

TABLE 5.30. Roughness Coefficients

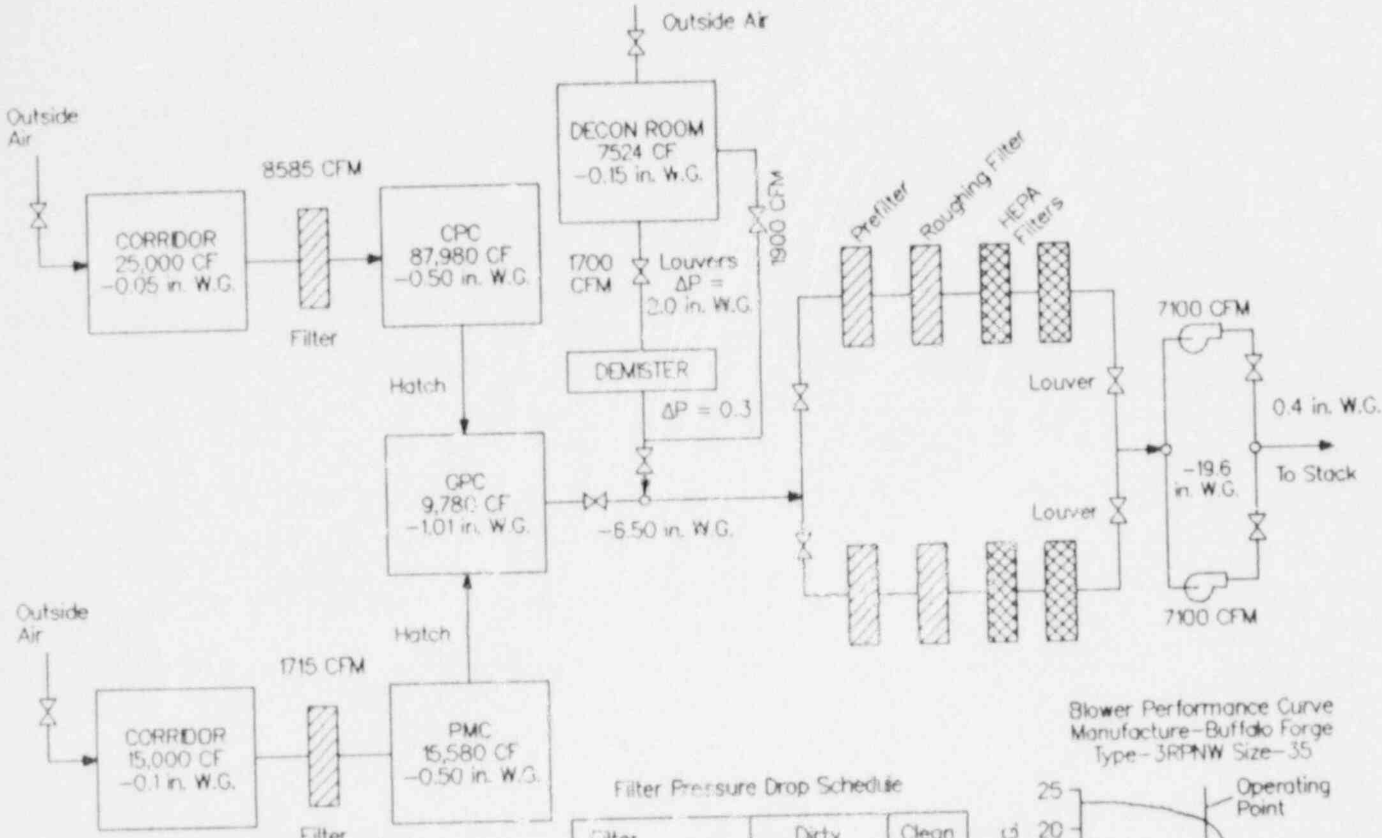
Material	ε (in.)	M
Sheet Metal	0.004 - 0.0008	1.016×10^{-4} - 2.032×10^{-5}
Concrete		
- Smooth	0.007 - 0.001	1.778×10^{-4} - 2.50×10^{-5}
- Rough	0.1 - 0.03	2.540×10^{-3} - 7.620×10^{-4}
- Unusually Rough	0.35 - 0.1	8.890×10^{-3} - 2.50×10^{-3}
Wood		
- New	0.004 - 0.001	1.016×10^{-4} - 2.50×10^{-5}
Glass or Plastic	0.0004 - 0.00006	1.016×10^{-5} - 1.524×10^{-6}
Rubber	0.003 - 0.00025	7.620×10^{-5} - 6.350×10^{-6}
Ceramic	0.06	1.524×10^{-3}

TABLE 5.31. Coefficient K for Certain Duct Configurations

Configuration	K
Sudden expansion	$(1 - \frac{A_1}{A_2})^2$, where A_1 is smaller
Sudden contraction	$0.42 [1 - (\frac{D_2}{D_1})^2]$
Cone contraction	
30°	0.02
45°	0.04
60°	0.07
bends 90°	0.2 - 0.04

Table 5.32. Maximum Initial Energy Injection Rate

Room Volume		Flow		Maximum Energy Rate	
m^3	ft^3	m^3/s	ft^3/min	KW	Btu/s
28.3	1000	0.0472	100.0	1.60	1.5
28.3	1000	0.472	1000.0	2.00	1.9
28.3	1000	4.72	10000.0	2.10	2.0
283.0	10 000	0.0472	100.0	1.65	1.6
283.0	10 000	0.472	1000.0	2.30	2.2
283.0	10 000	4.72	10000.0	2.10	2.0
2832.0	100 000	0.0472	100.0	1.65	1.6
2832.0	100 000	0.472	1000.0	2.30	2.2
2832.0	100 000	4.72	10000.0	2.10	2.0



Filter Pressure Drop Schedule

Filter	Dirty	Clean
Prefilter	0.15 in. W.G.	0.1
Roughing Filter	2.0	0.2
1st Bank HEPA's	8.5	1.3
2nd bank HEPA's	1.3	1.3

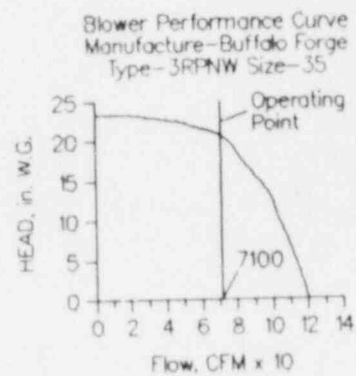


FIGURE 5.1. Flow Schematic and Modeling Information Necessary for Coarse Network Model Development

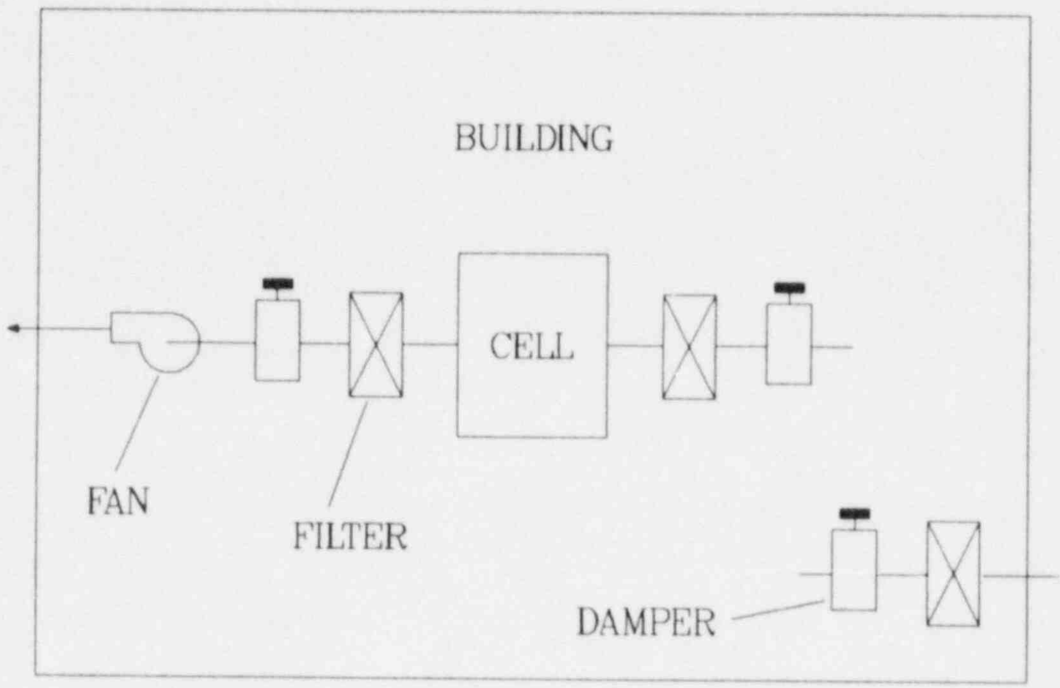


FIGURE 5.2. Facility with Ventilation System

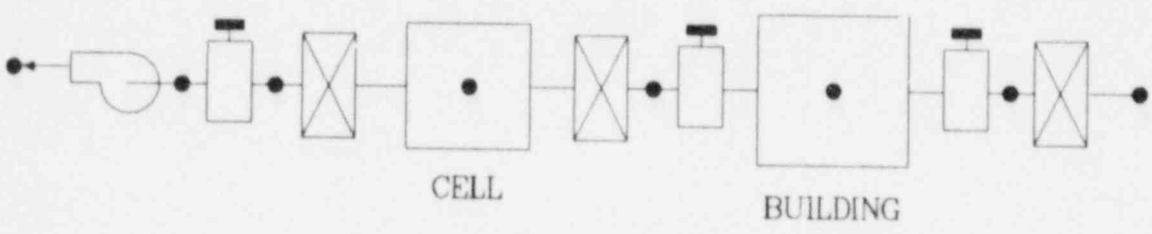


FIGURE 5.3. Schematic for Ventilation Network

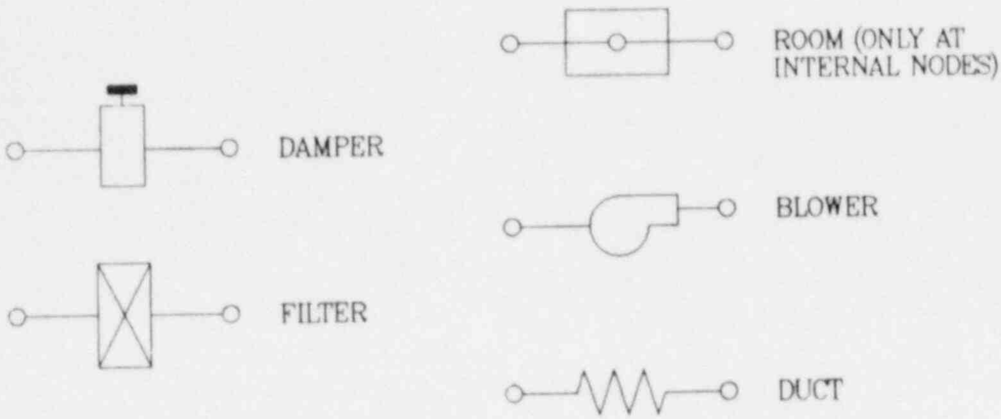


FIGURE 5.4. Network System Building Blocks

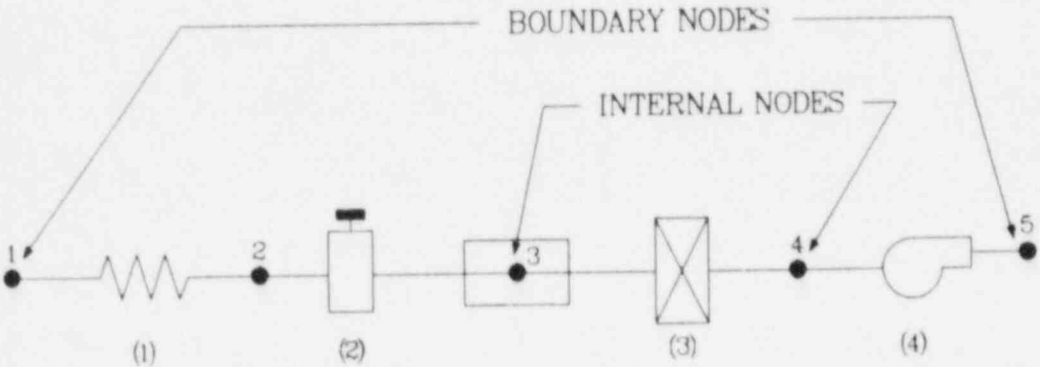


FIGURE 5.5. Connection of Building Blocks

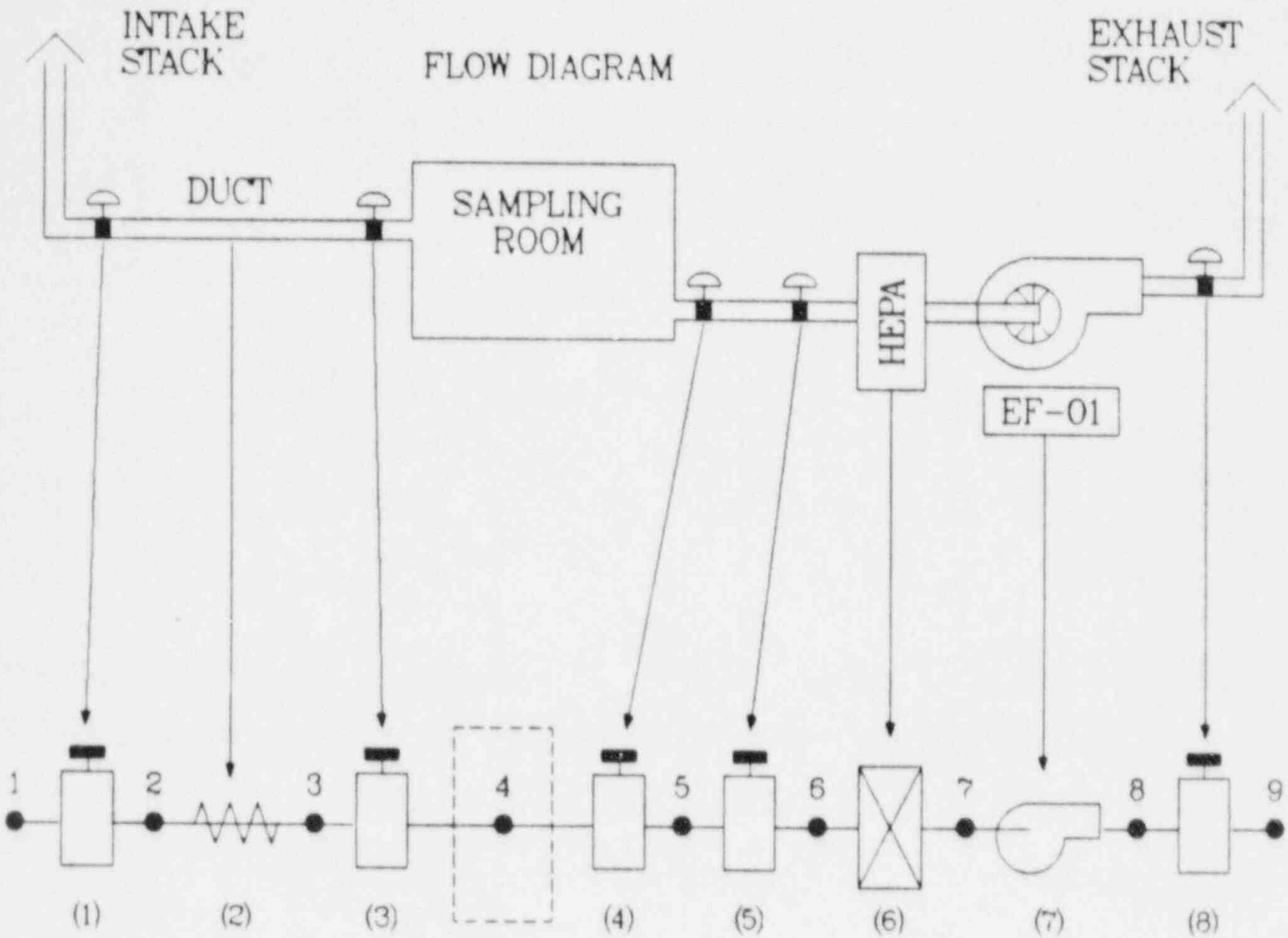


FIGURE 5.6. Lumped Modeling of a Simple System

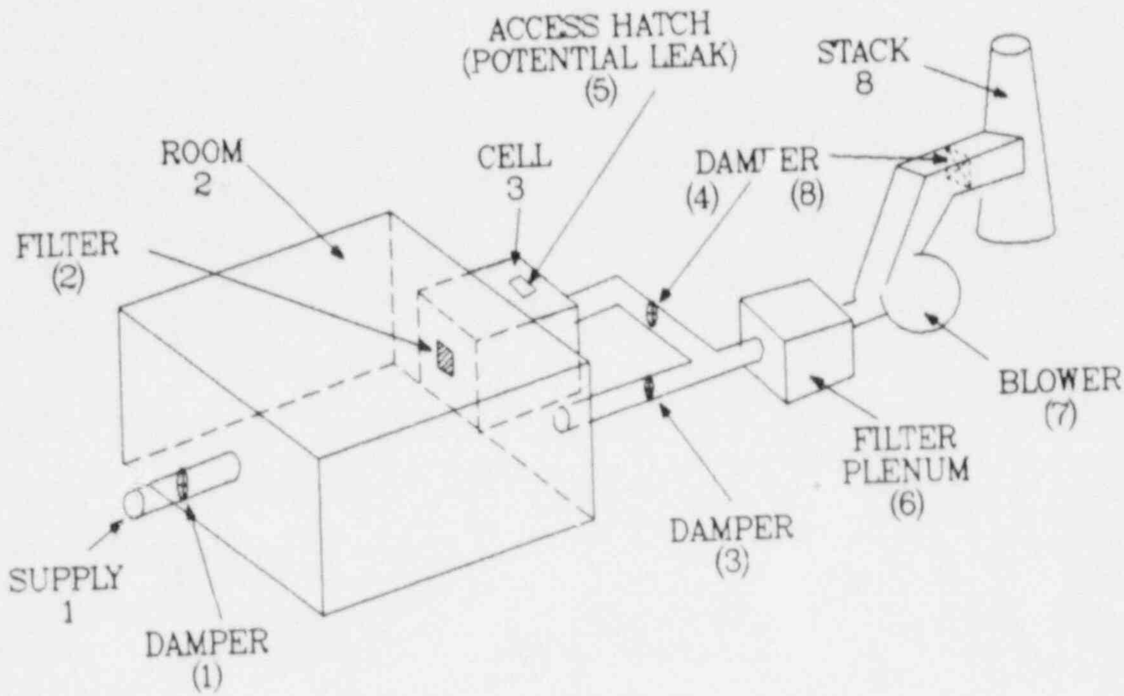


FIGURE 5.7. Simple Flow Network

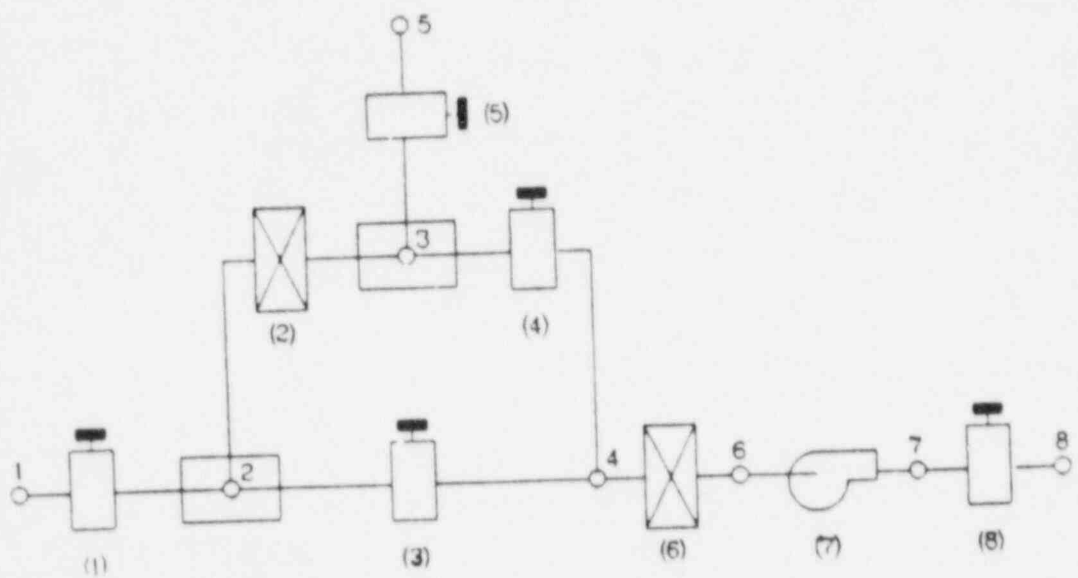


FIGURE 5.8. Network Model

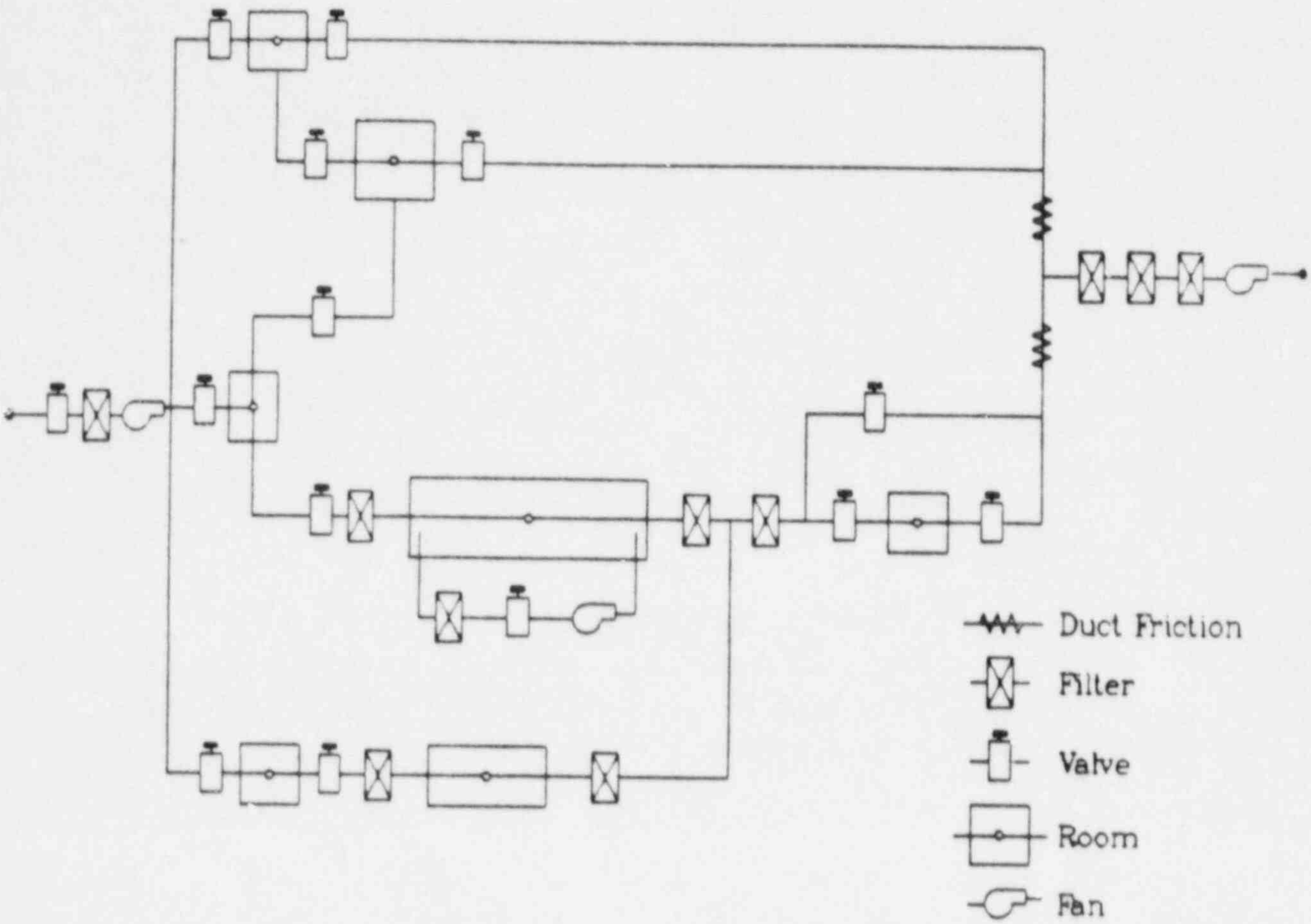


FIGURE 5.9. Sample Network Model

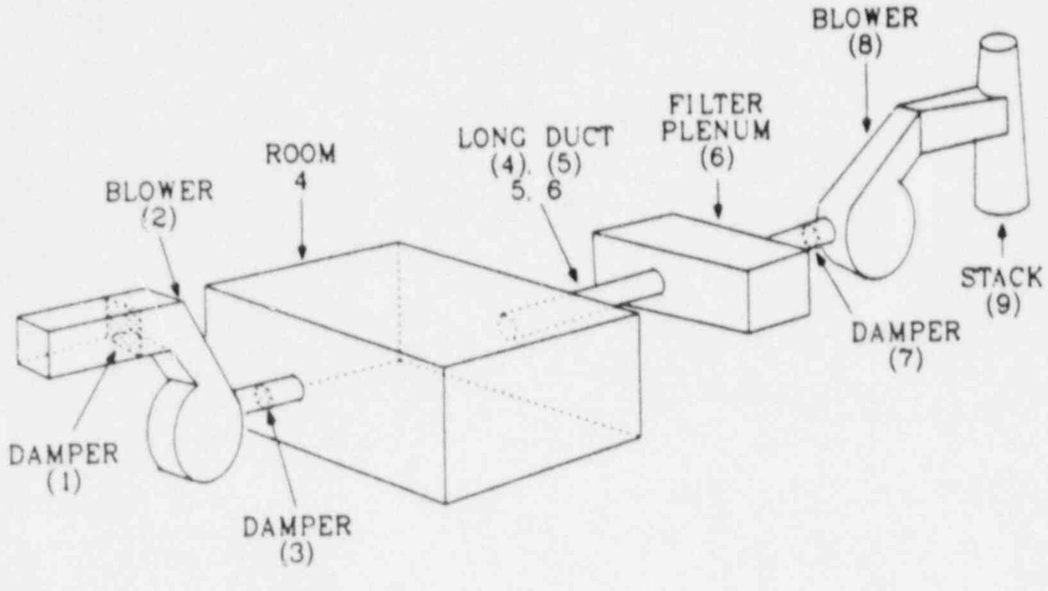


FIGURE 5.10. Simple System for Sample Problems

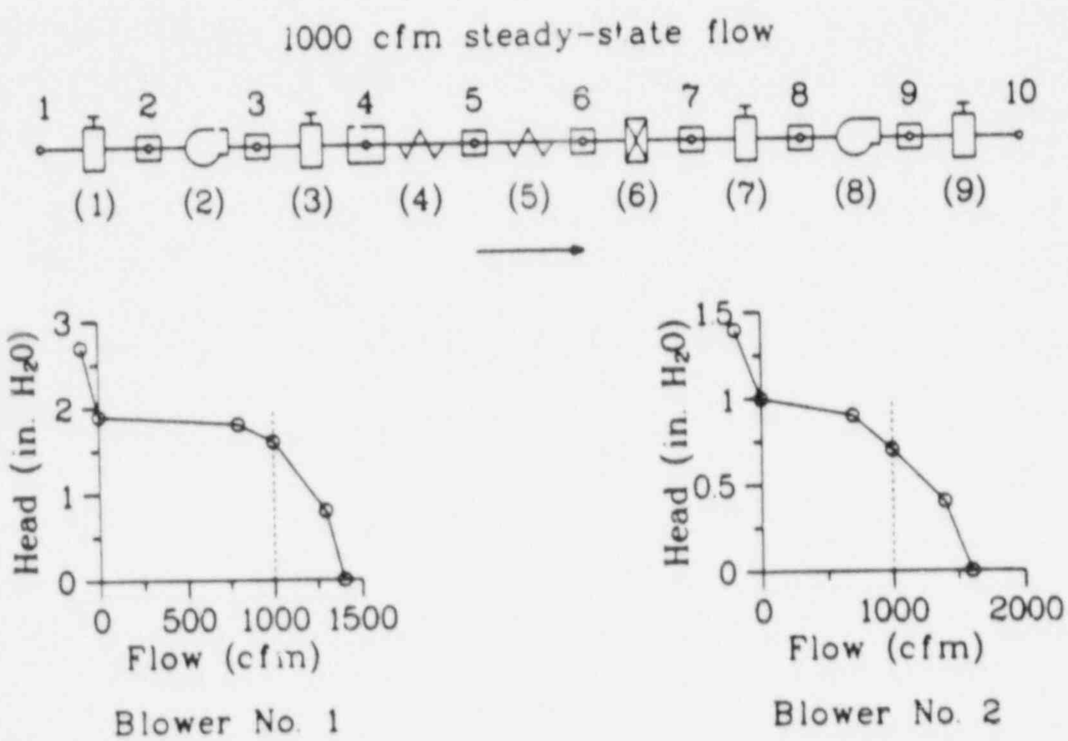


FIGURE 5.11. Model of the Simple System and Blower Curves

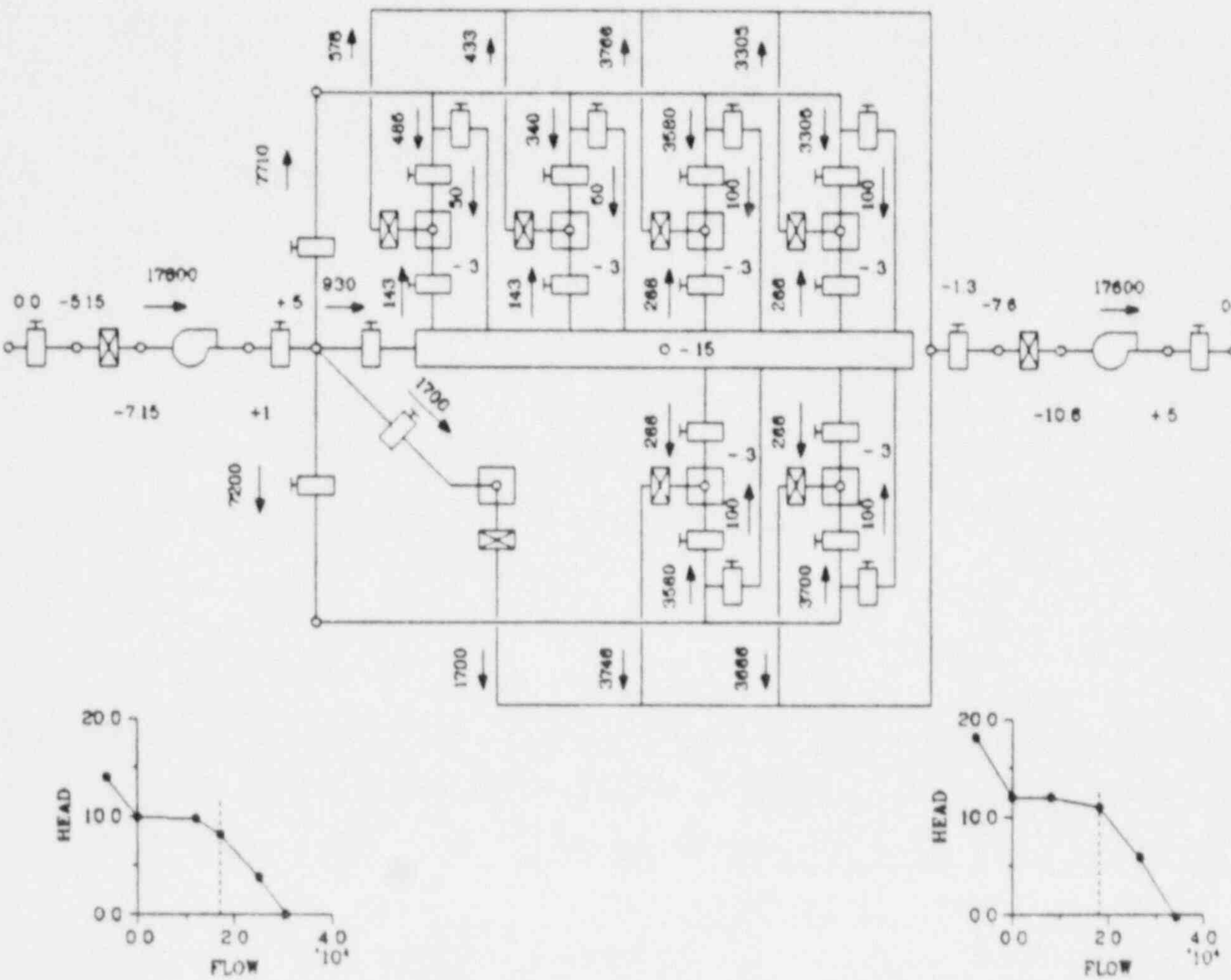


FIGURE 5.12. Data for Steady-State Condition for Representative Facility Ventilation System

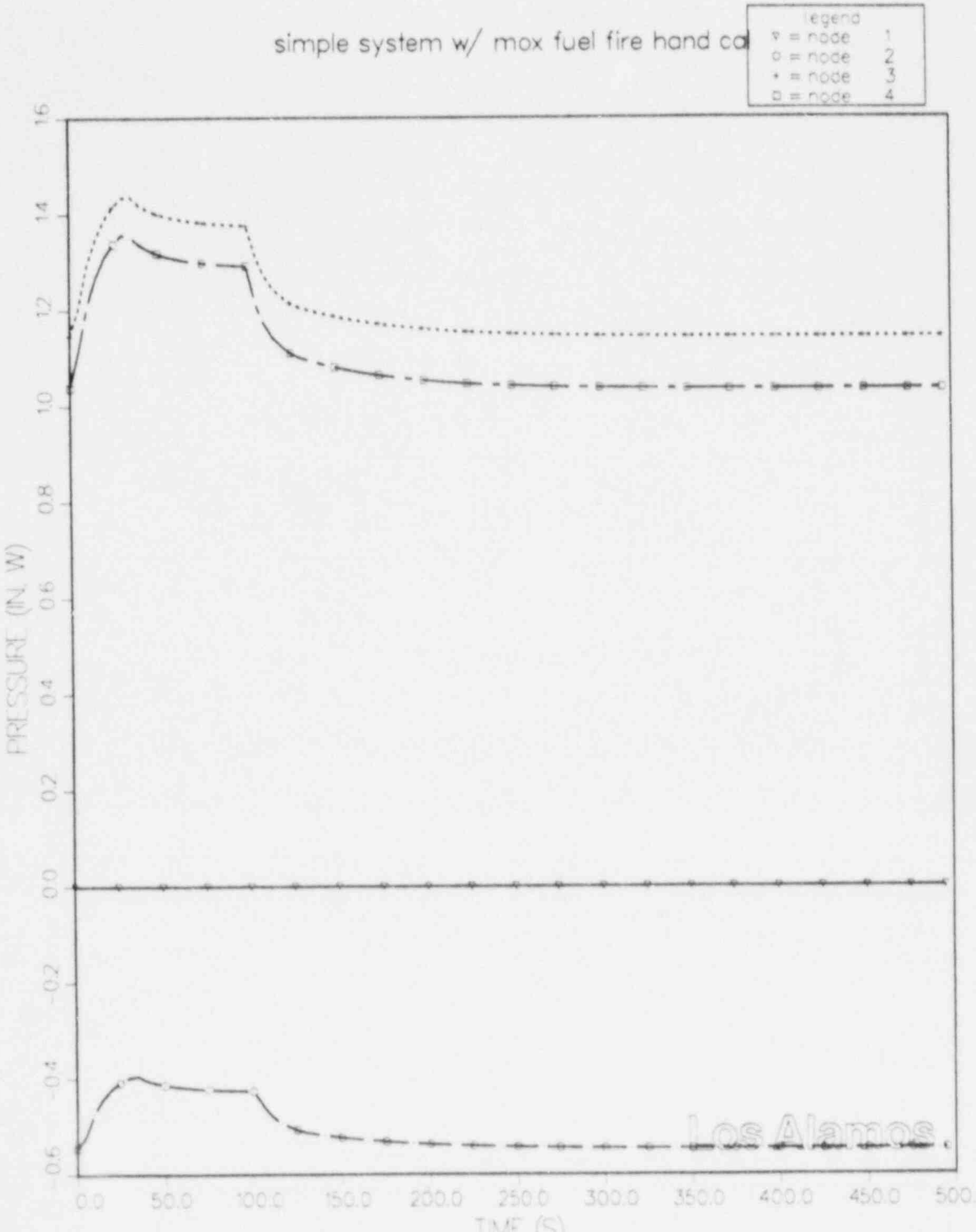


FIGURE 5.13. Pressure Time History for the Hand-Calculated Source Term for the MOX Fuel Fire for Nodes 1, 2, 3, and 4

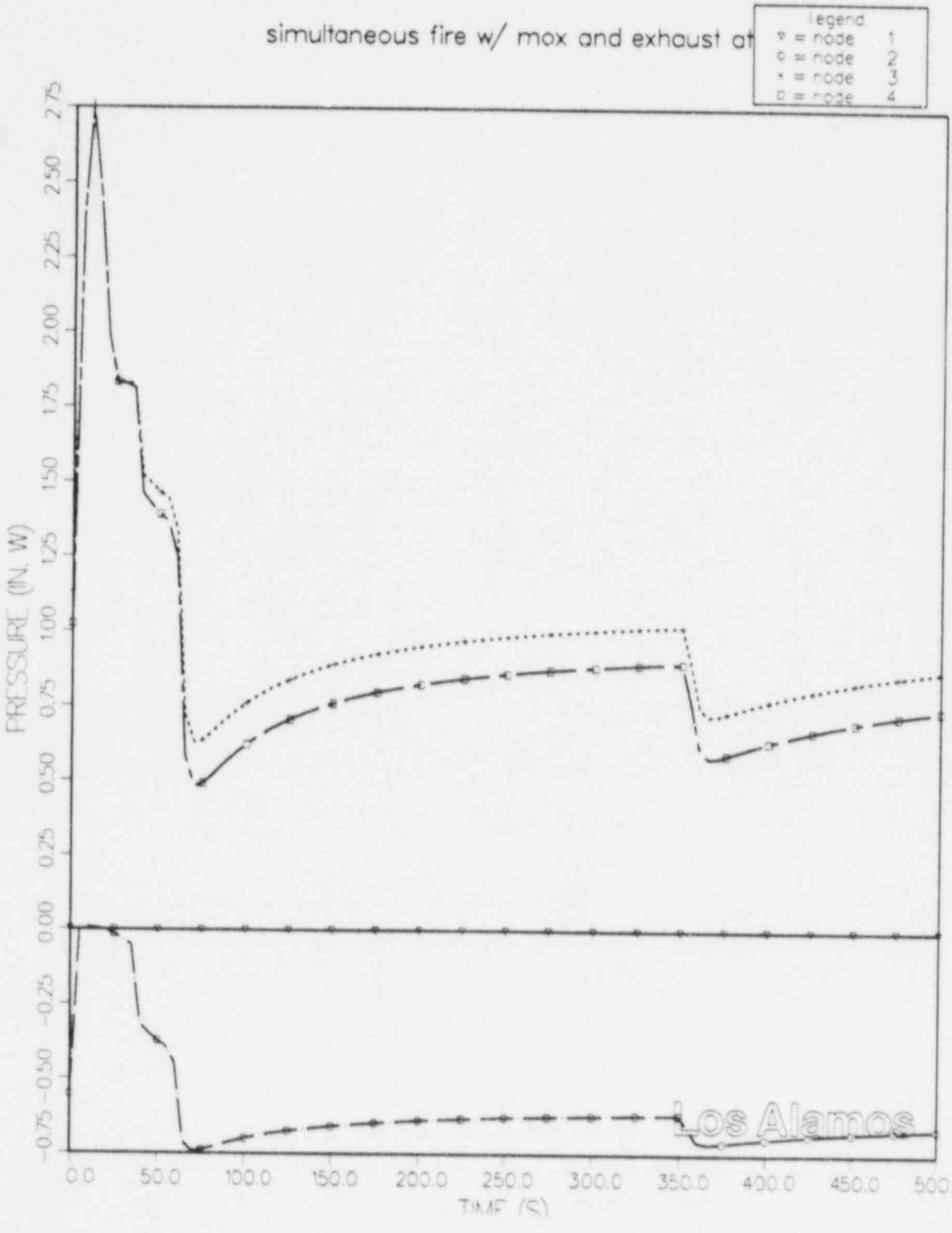


FIGURE 5.14. Pressure Time History for the FIRIN Source-Term Calculation of the MOX Fuel Fire for Nodes 1, 2, 3, and 4

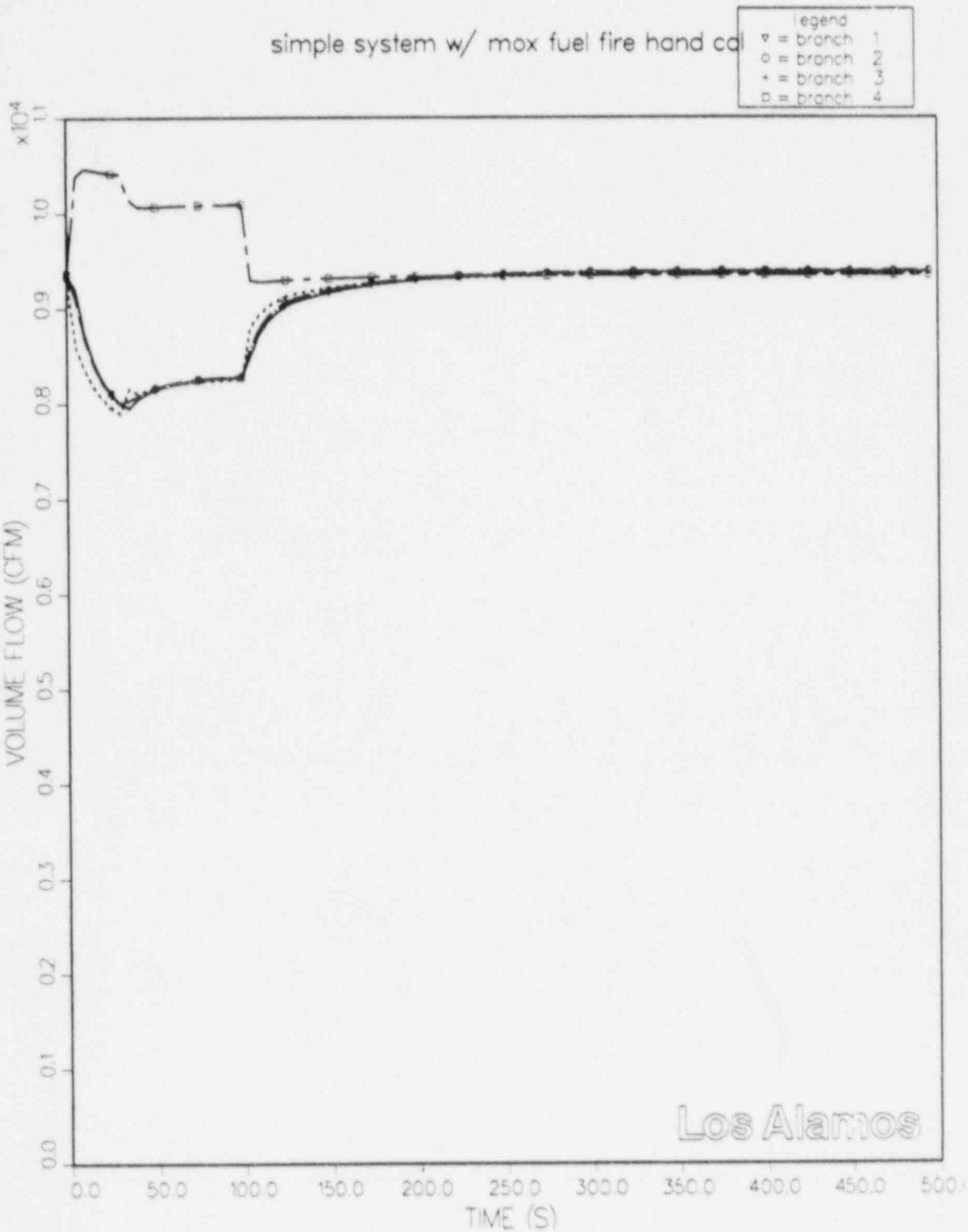


FIGURE 5.15. Volumetric Flow Time History for the Hand Calculated Source Term for the MOX Fuel Fire for Branches 1, 2, 3, and 4

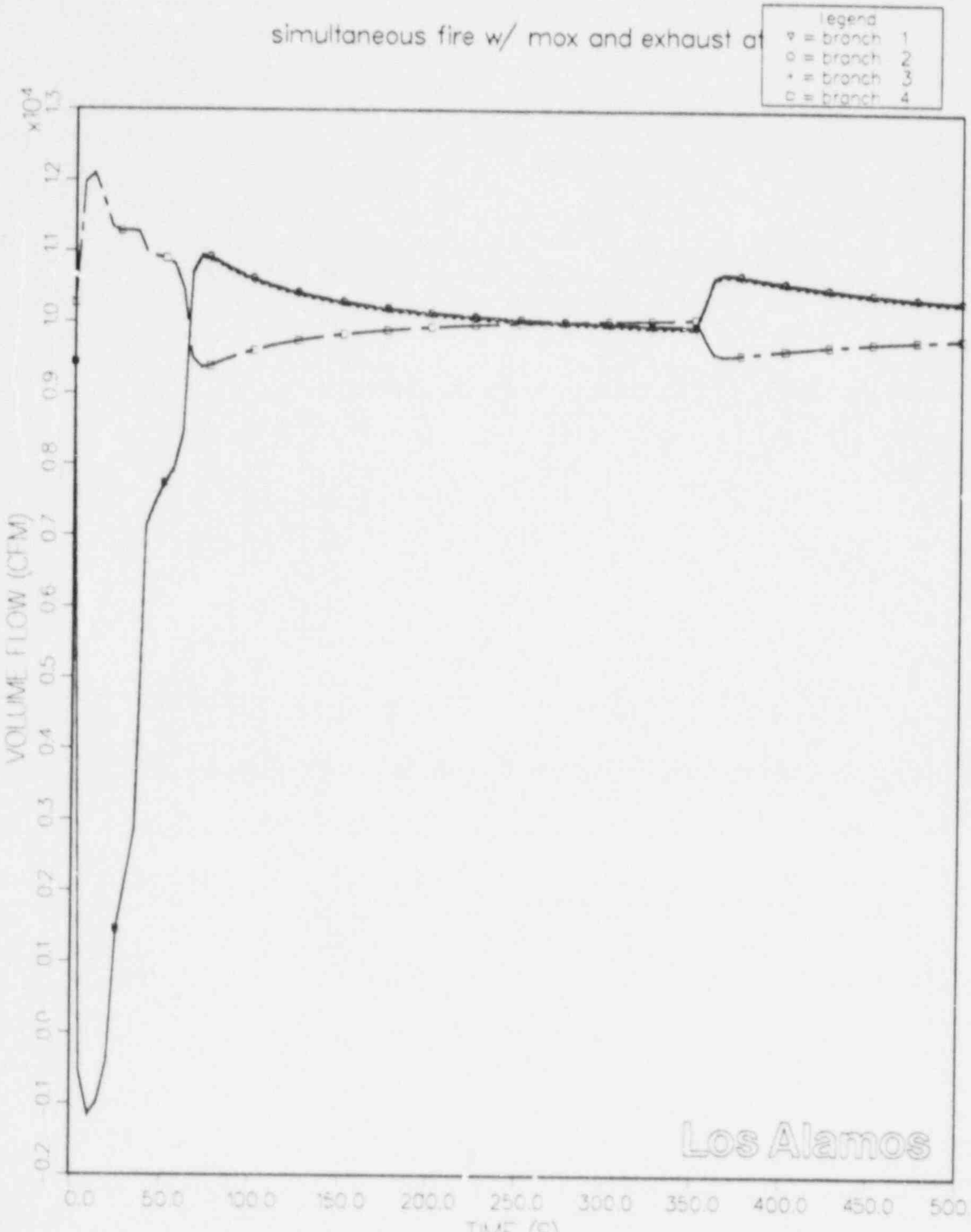


FIGURE 5.16. Volumetric Flow Time Histories for the FIRIN Source-Term Calculation of the MOX Fuel Fire for Branches 1, 2, 3, and 4

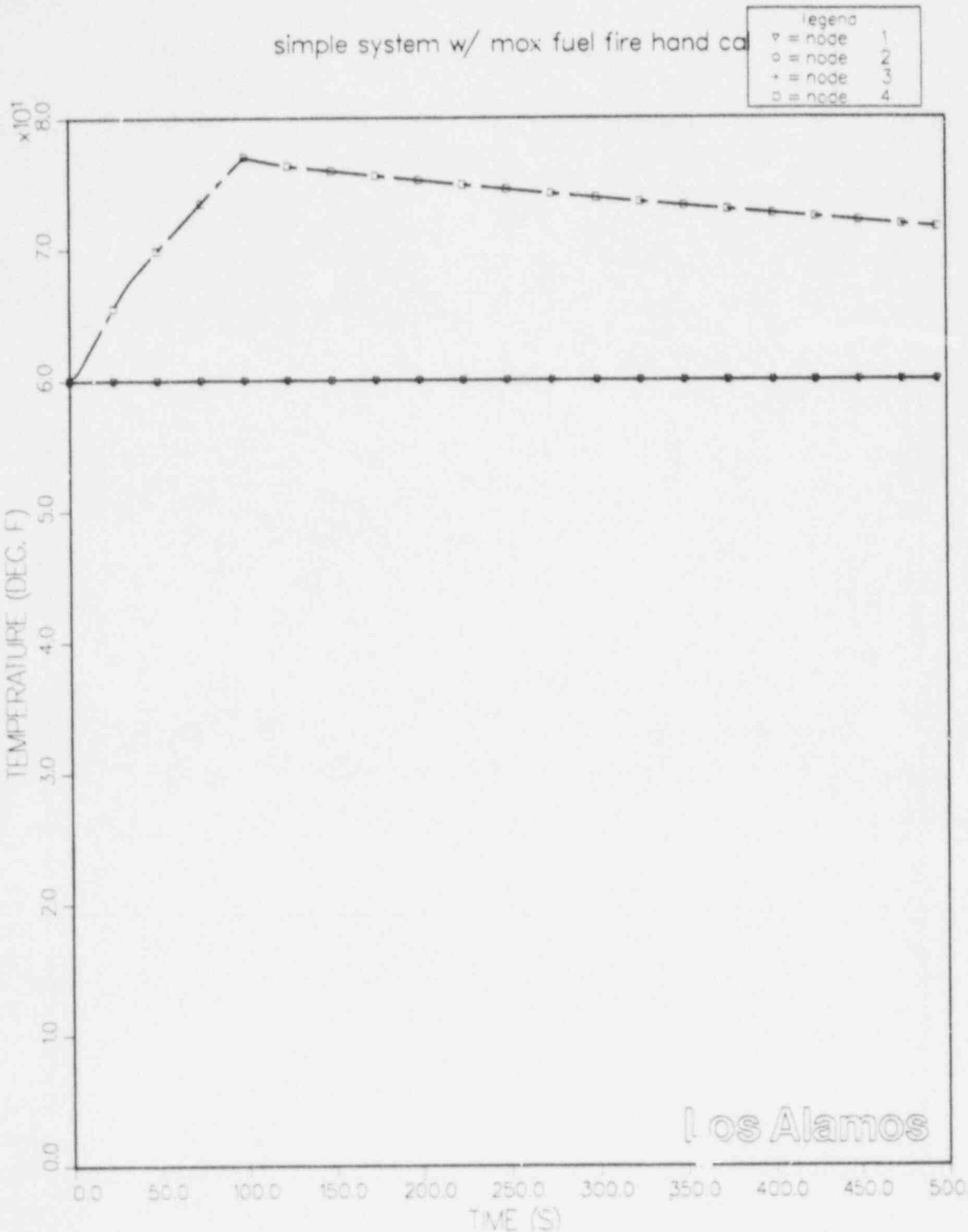


FIGURE 5.17. Temperature Time Histories for the Hand-Calculated Source Term for the MOX Fuel Fire for Nodes 1, 2, 3, and 4

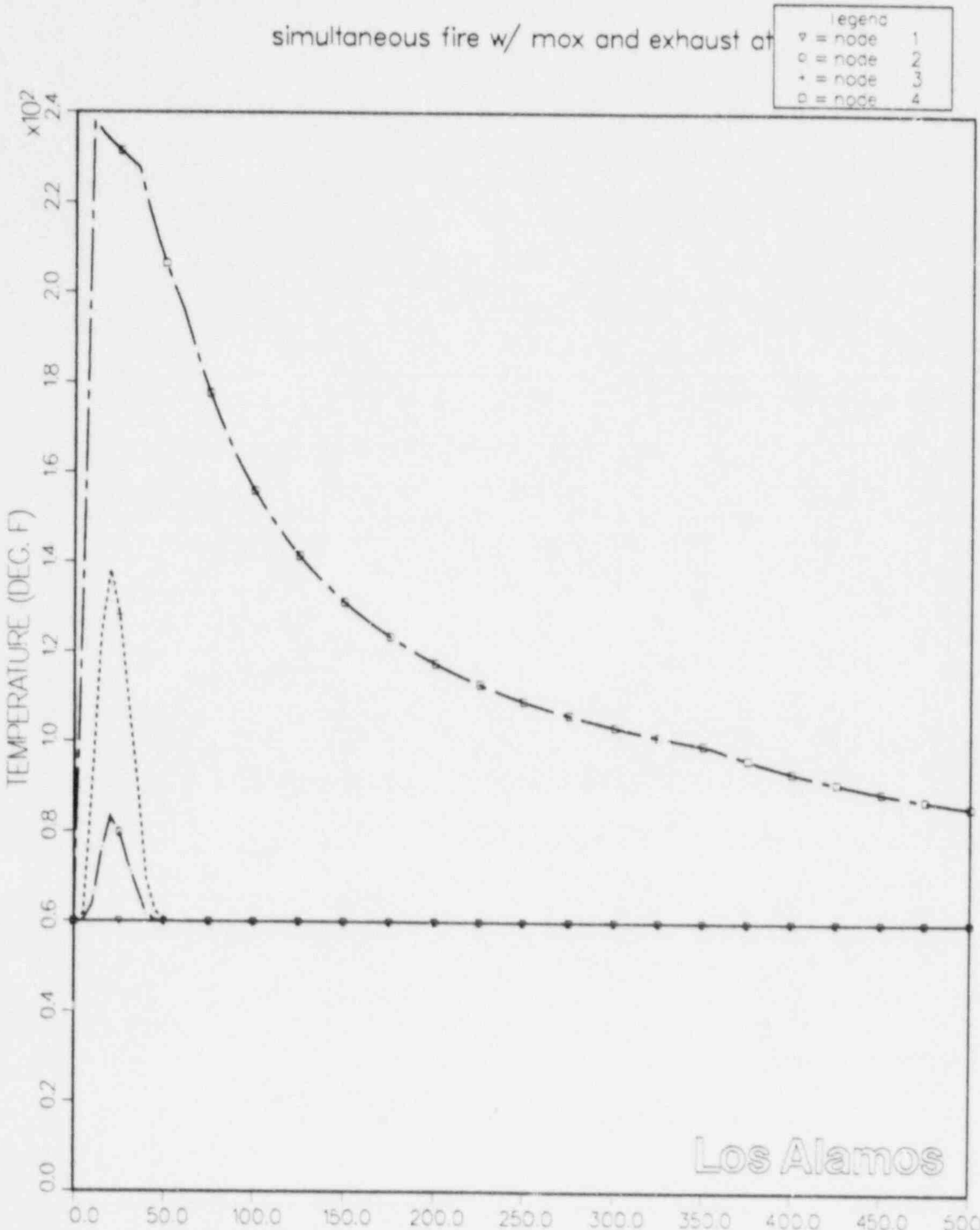


FIGURE 5.18. Temperature Time Histories for the FIRIN Source-Term Calculation of the MOX Fuel Fire for Nodes 1, 2, 3, and 4

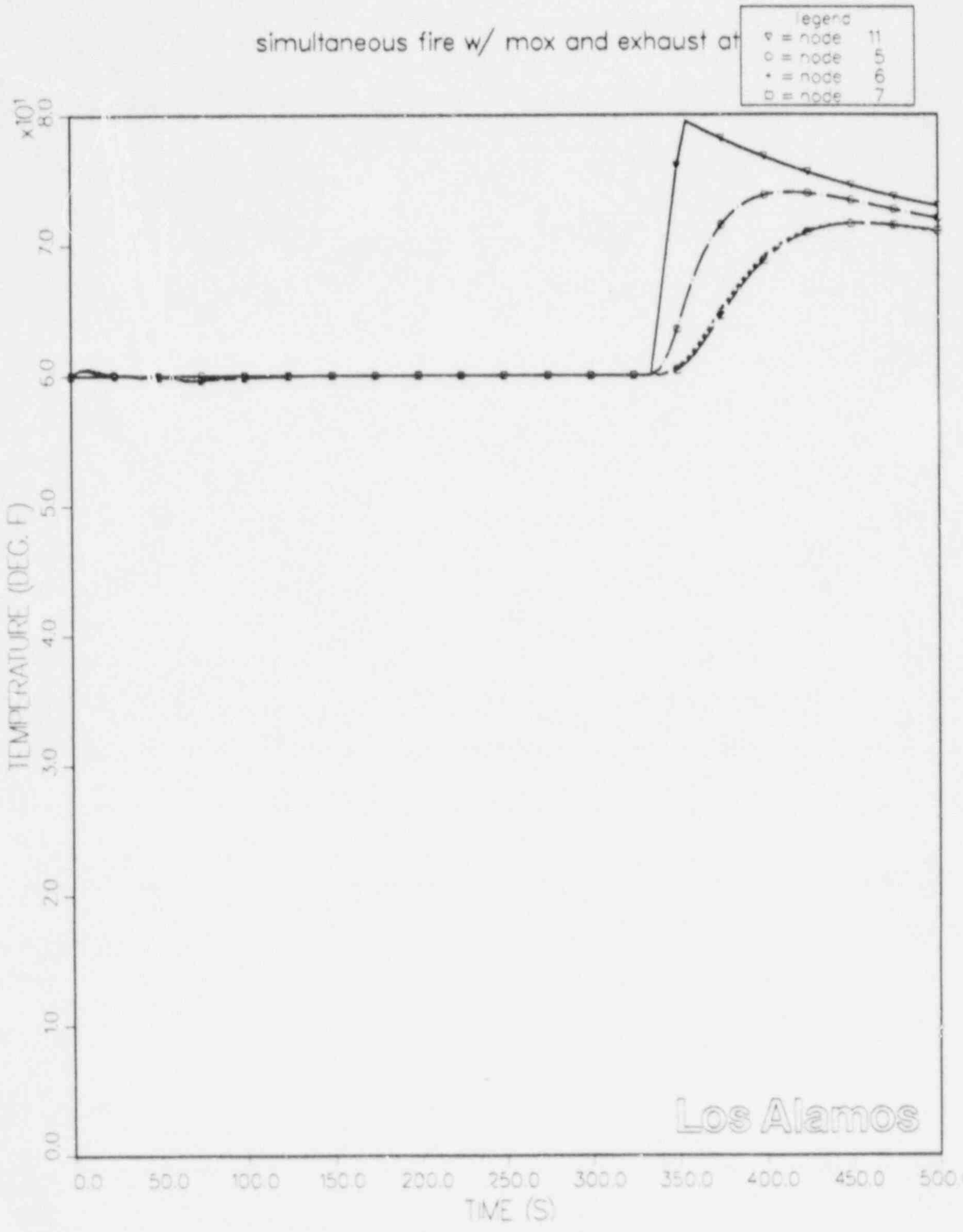


FIGURE 5.19. Temperature Time Histories for the FIRIN Source-Term Calculation of the MOX Fuel Fire for Nodes 5, 6, 7, and 11

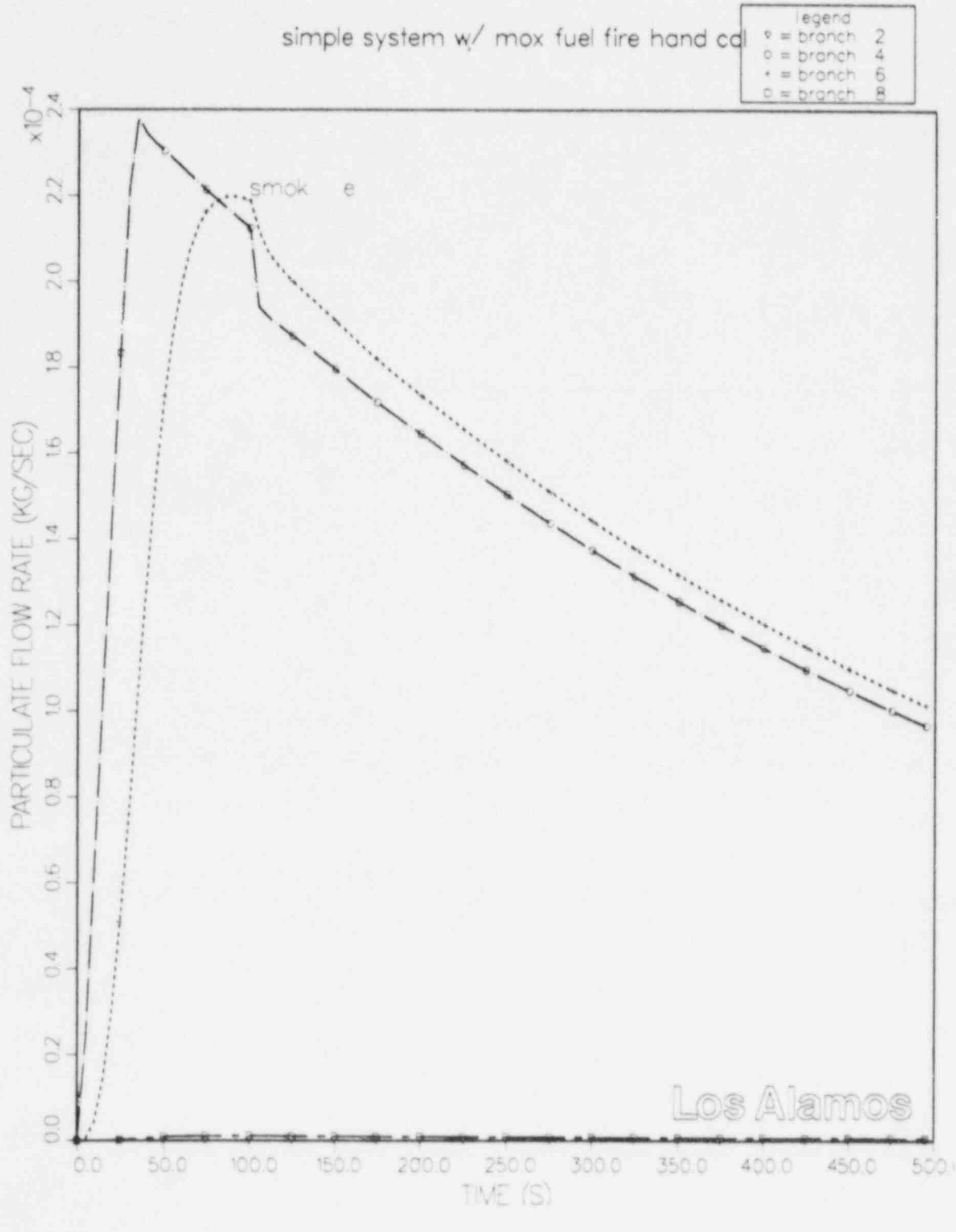


FIGURE 5.20. Smoke Mass Flow Rate Time Histories for the Hand-Calculated Source Term for the MOX Fuel Fire for Branches 2, 4, 6, and 8

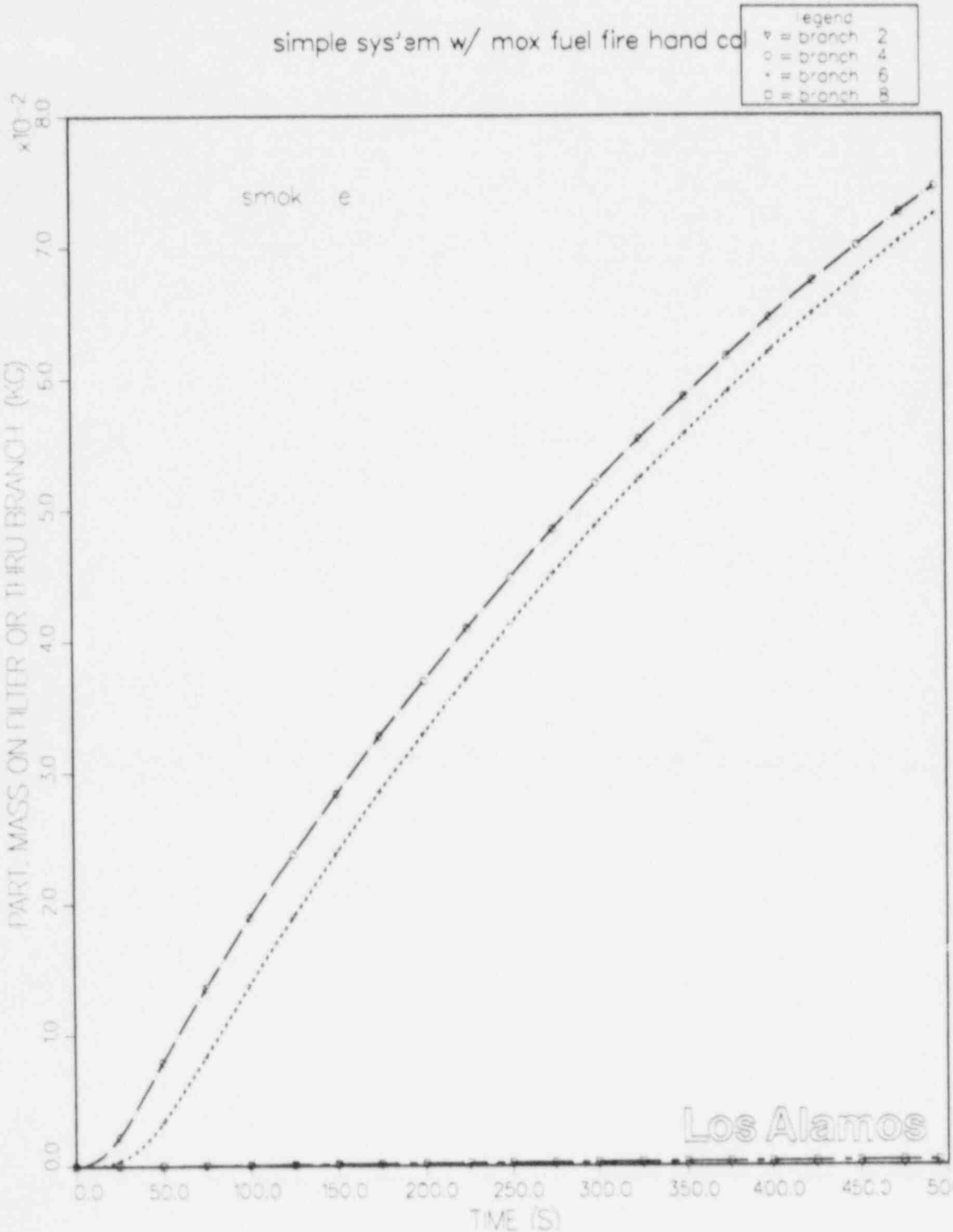


FIGURE 5.21. Total Mass of Smoke Accumulated on a Filter or That Flowed Through a Branch as a Function of Time for the Hand-Calculated Source Term for the MOX Fuel Fire for Branches 2, 4, 6, and 8

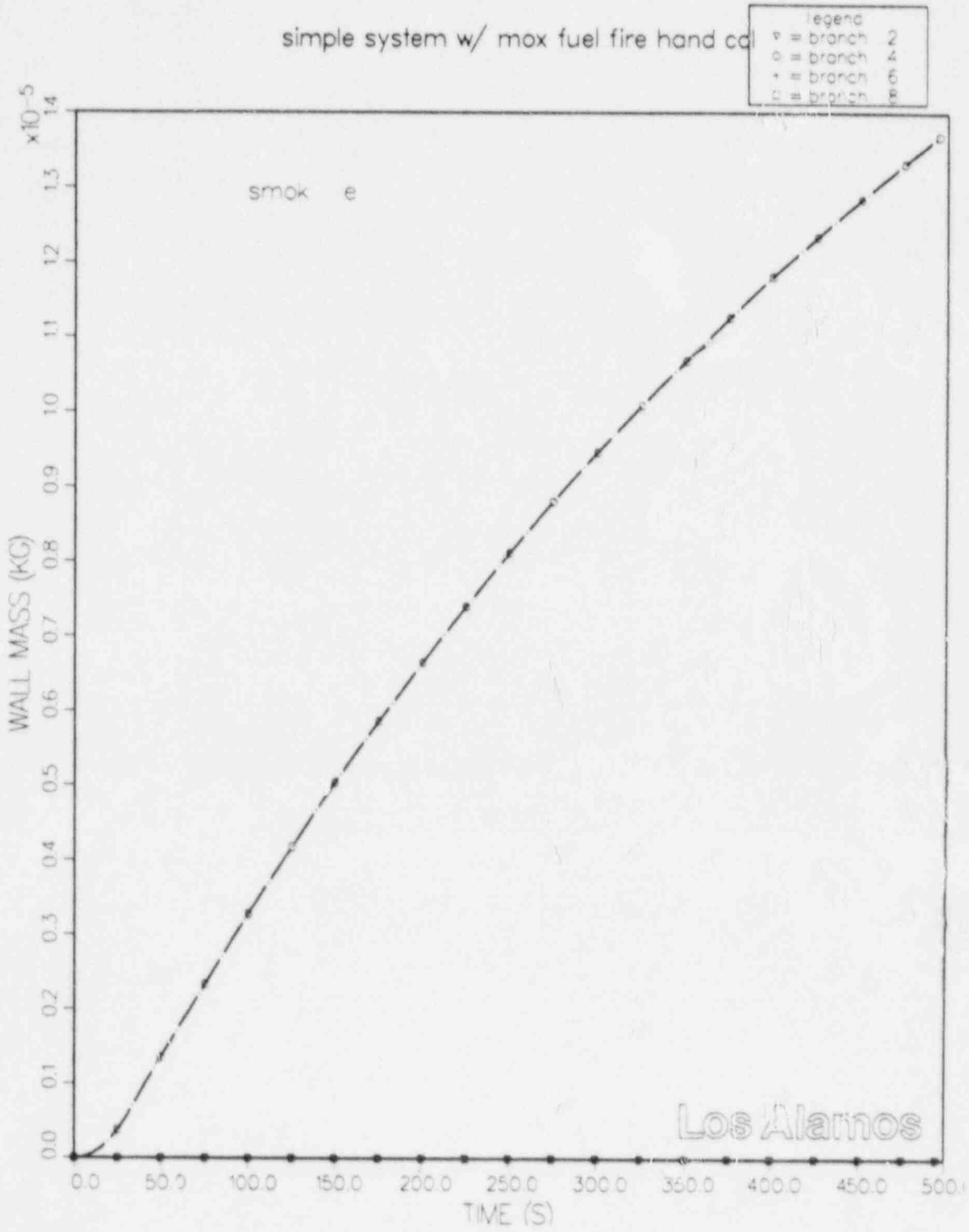


FIGURE 5.22. Mass of Smoke Deposited as a Function of Time for the Hand-Calcuated Source Term fo: the MOX Fuel Fire for Branches 2, 4, 6, and 8

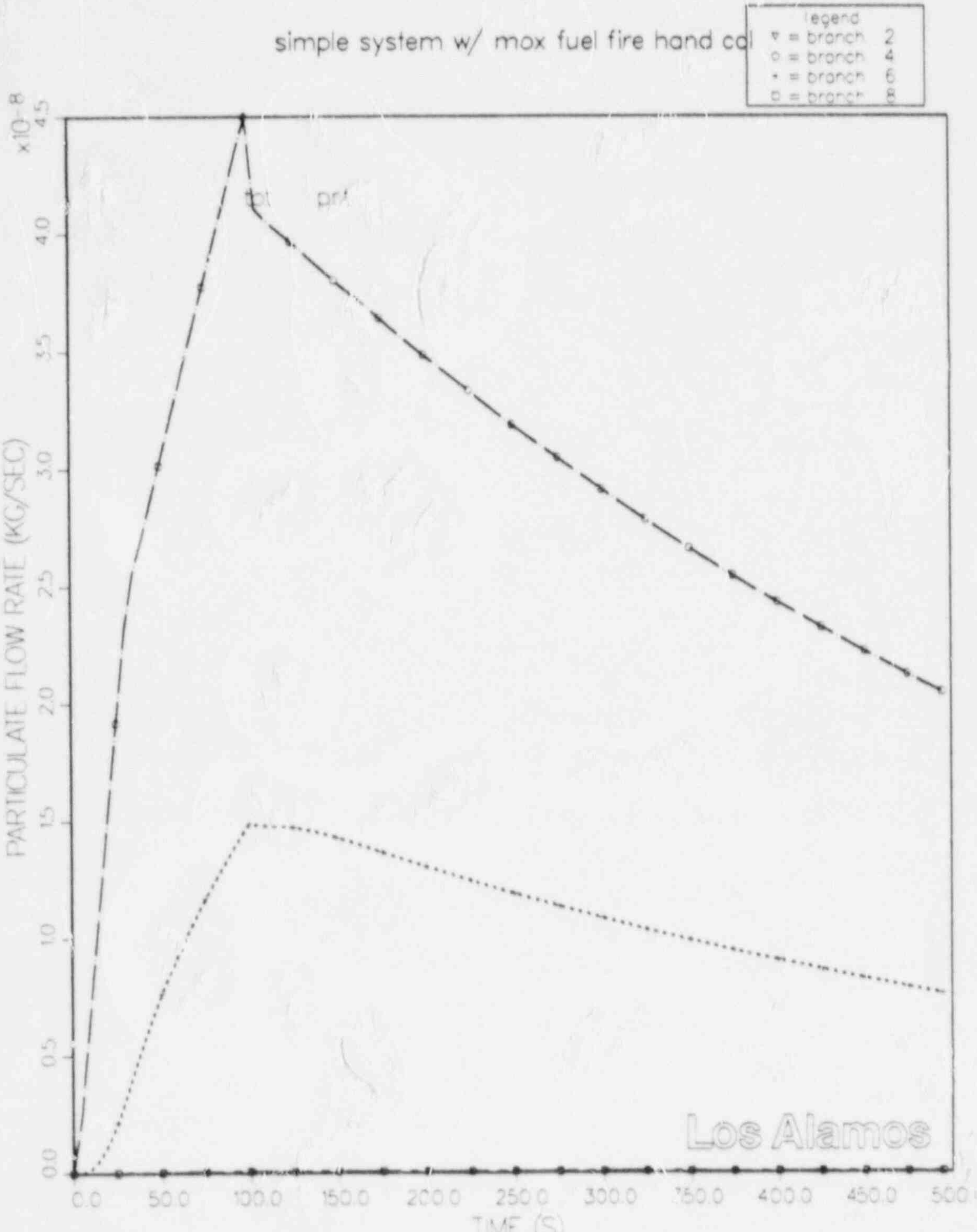


FIGURE 5.23. Total Radioactive Particulate Flow Rate Time Histories for the Hand-Calculated Source Term for the MOX Fuel Fire for Branches 2, 4, 6, and 8

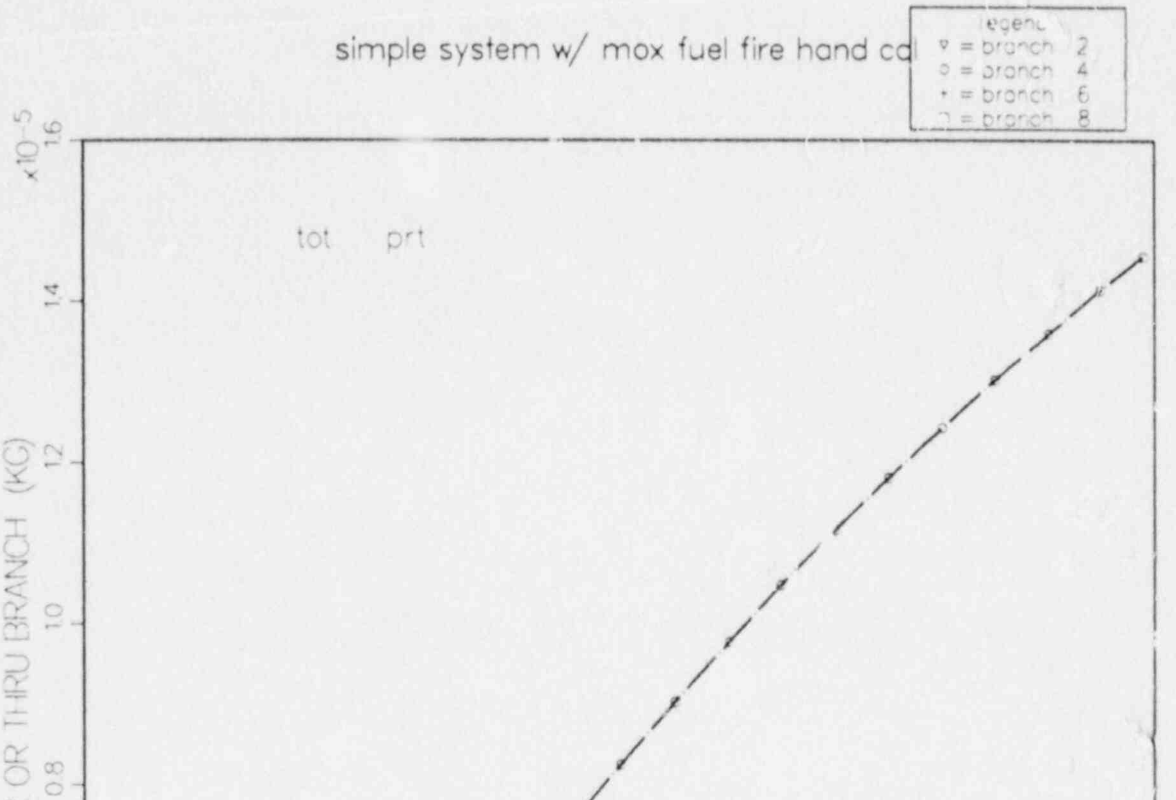


FIGURE 5.24. Total Mass of Radioactive Particulate Material Accumulated on a Filter or That Flowed Through a Branch as a Function of Time for the Hand-Calculated Source Term for the MOX Fuel Fire for Branches 2, 4, 6, and 8

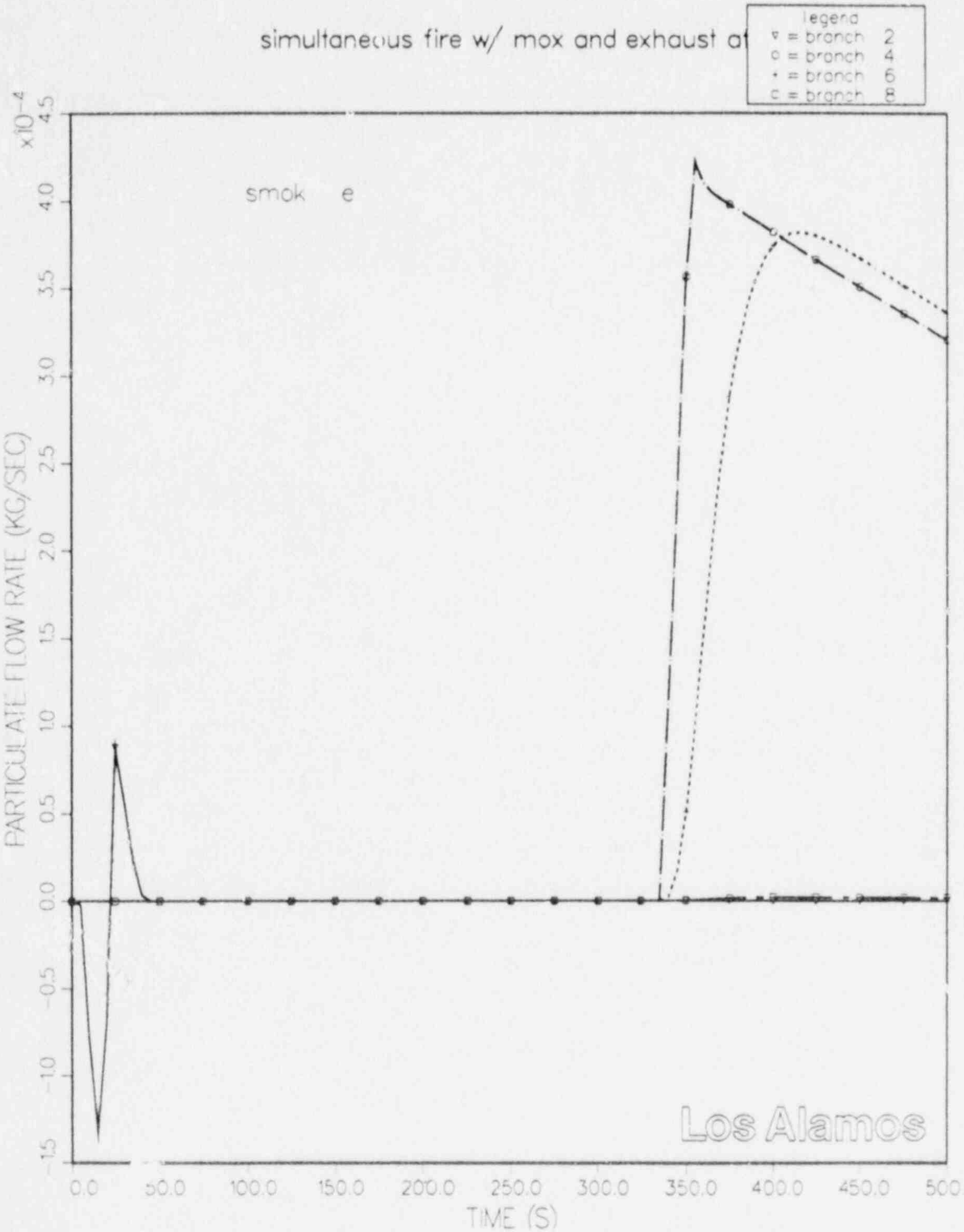


FIGURE 5.25. Smoke Flow Rate Time Histories for the FIRIN Source-Term Calculation of the MOX Fuel Fire for Branches 2, 4, 6, and 8

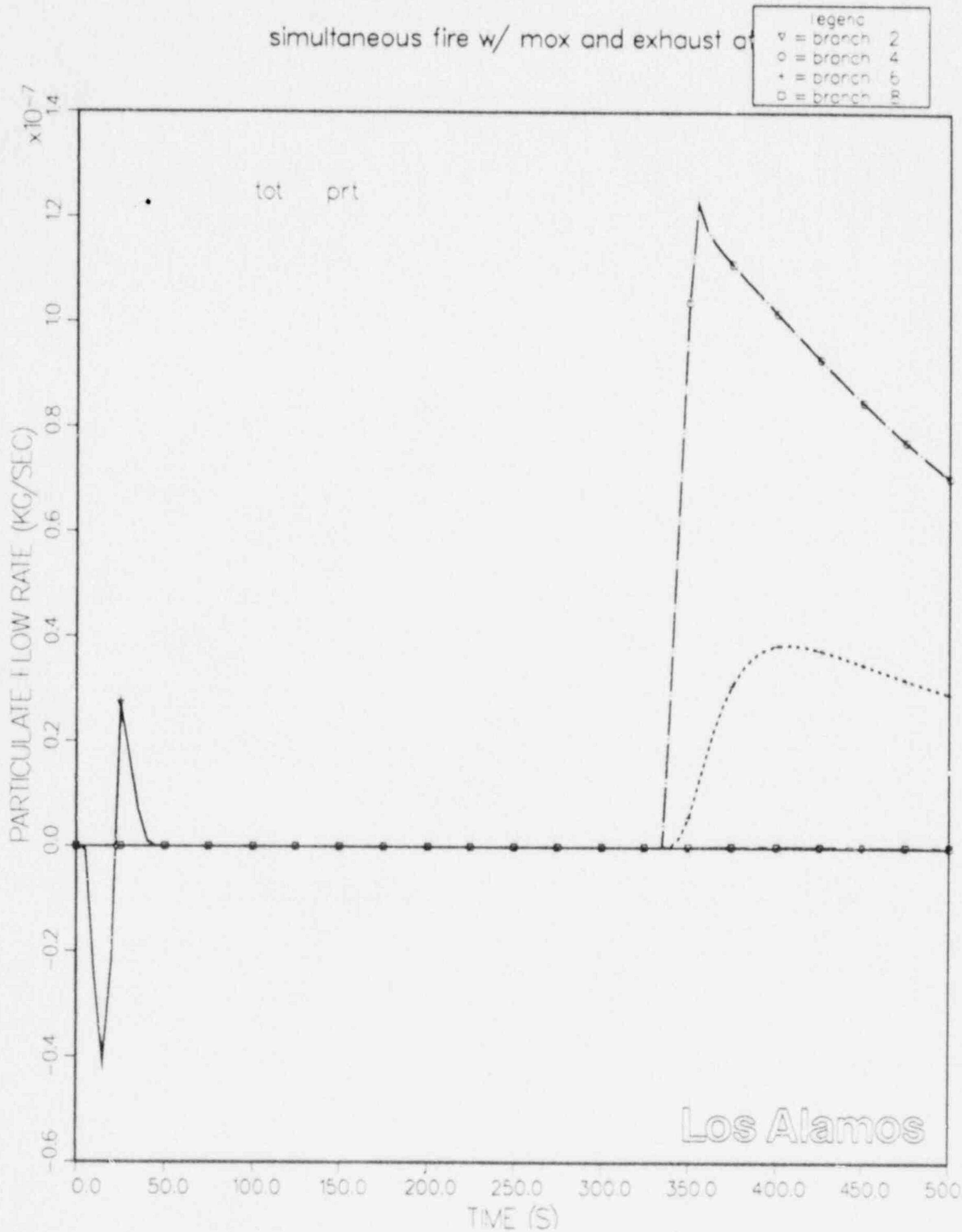


FIGURE 5.26. Total Radioactive Particulate Flow Rate Time Histories for the FIRIN Source-Term Calculation of the MOX Fuel Fire for Branches 2, 4, 6, and 8

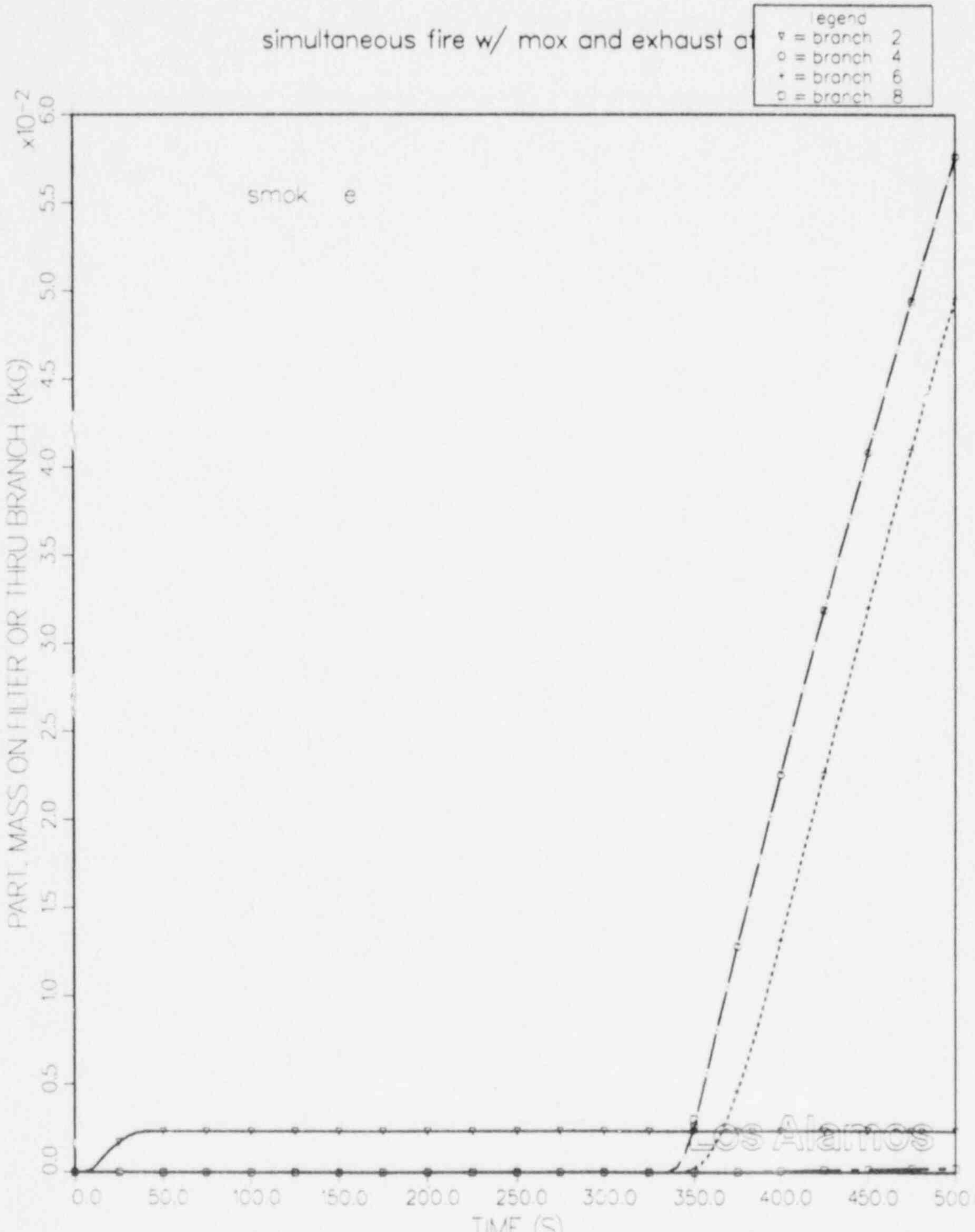


FIGURE 5.27. Total Mass of Smoke Accumulated on a Filter or That Flowed Through a Branch as a Function of Time for the FIRIN Source-Term Calculation of the MOX Fuel Fire for Branches 2, 4, 6, and 8

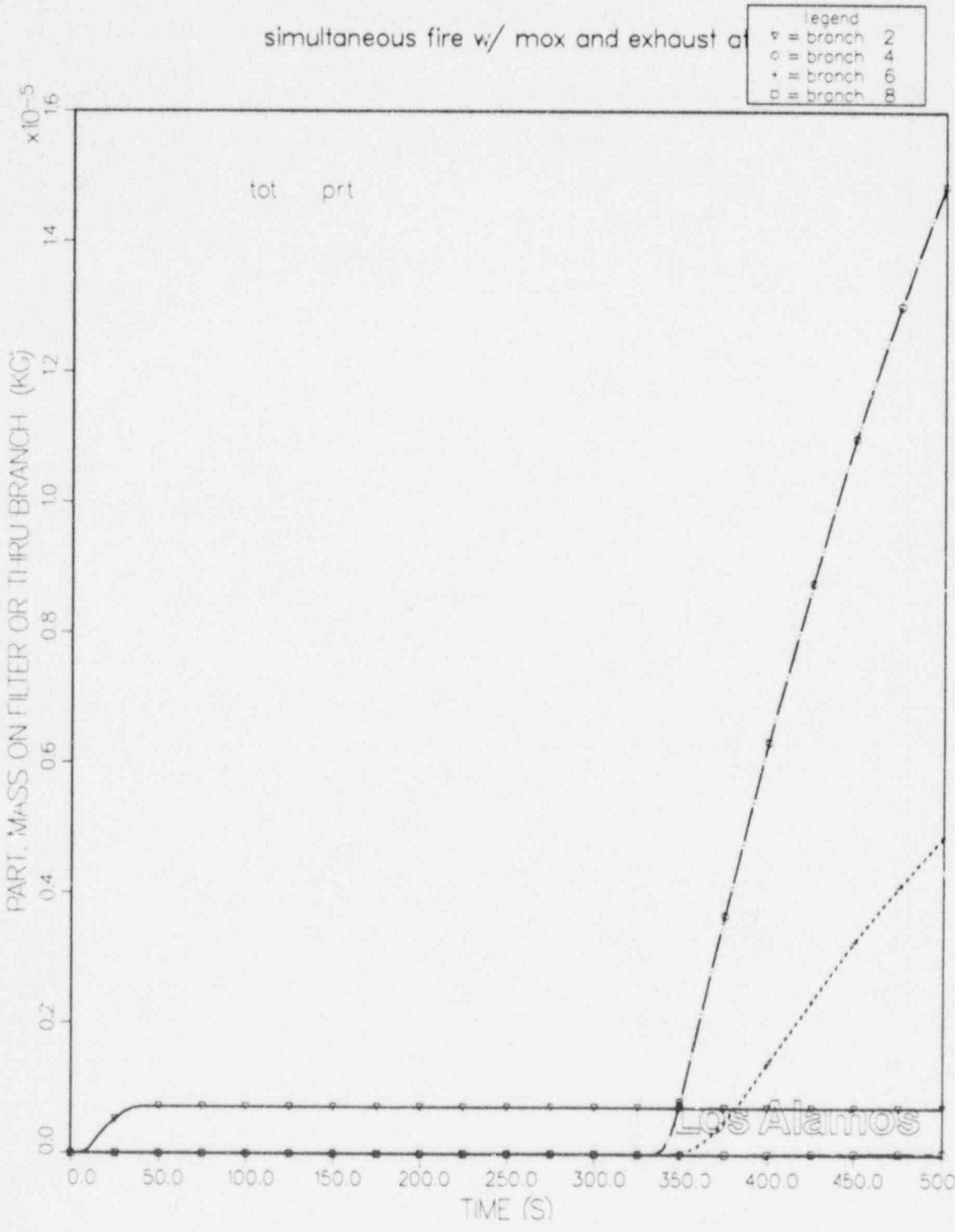


FIGURE 5.28. Total Radioactive Particulate Mass Accumulated on a Filter or Flowed Through a Branch as a Function of Time for the FIRIN Source-Term Calculation of the MOX Fuel Fire for Branches 2, 4, 6, and 8

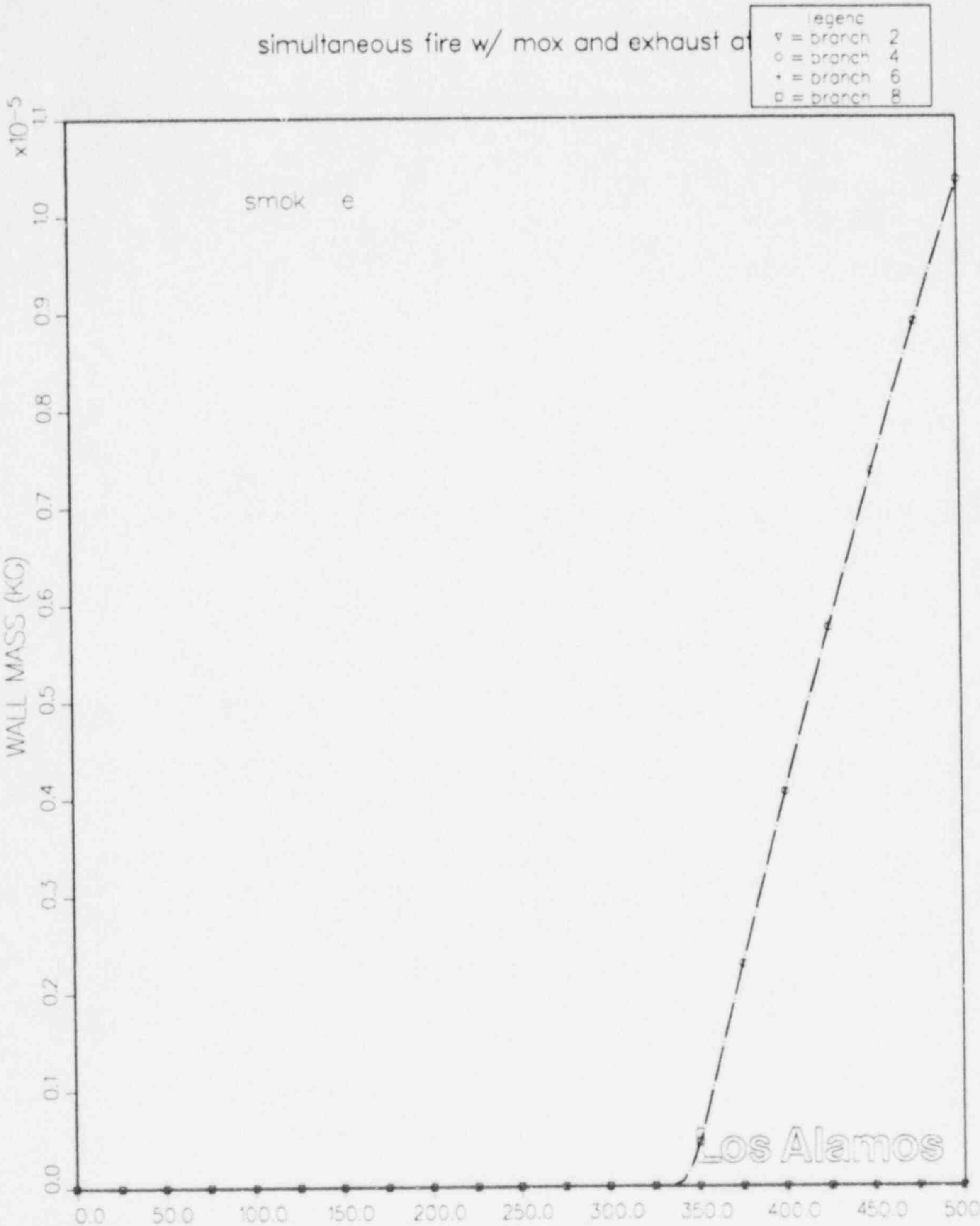


FIGURE 5.29. Mass of Smoke Deposited as a Function of Time for the FIRIN Source-Term Calculation of the MOX Fuel Fire for Branches 2, 4, 6, and 8

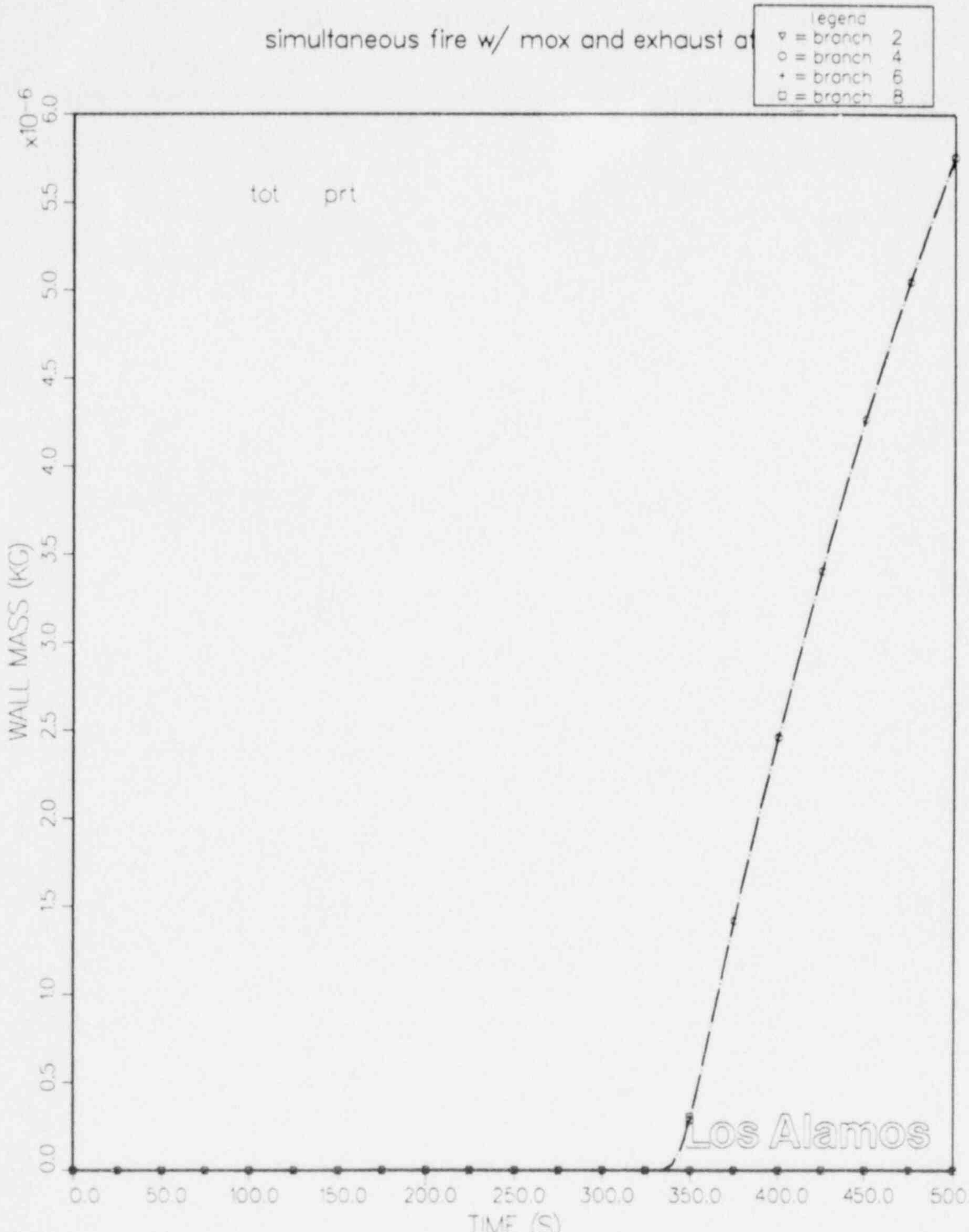


FIGURE 5.30. Mass of Ratioactive Particulate Material Deposited as a Function of Time for the FIRIN Source-Term Calculation of the MOX Fuel Fire for Branches 2, 4, 6, and 8

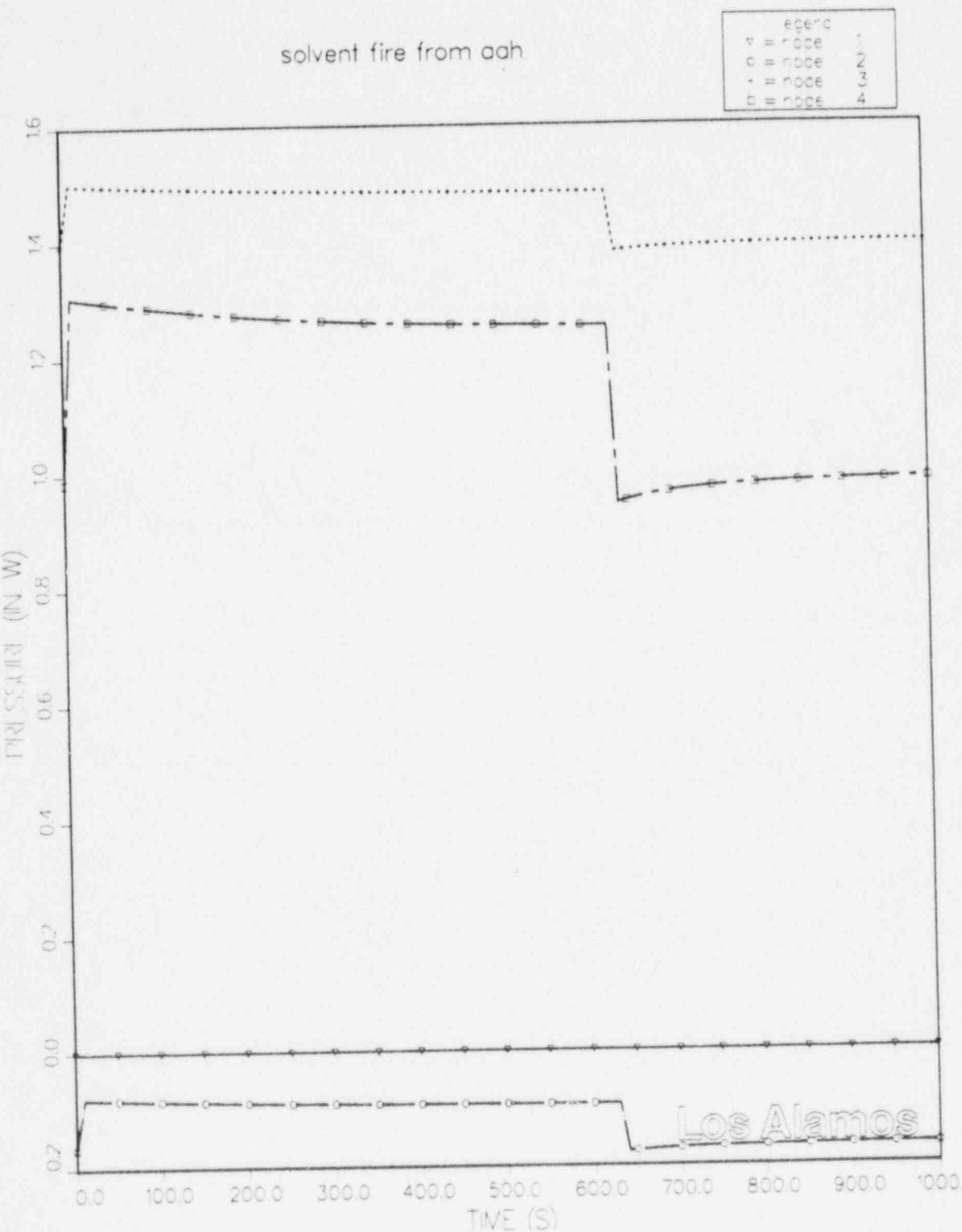


FIGURE 5.31. Pressure Time Histories for the Hand-Calculated Source Term for the Solvent Extraction Fire for Nodes 1, 2, 3, and 4

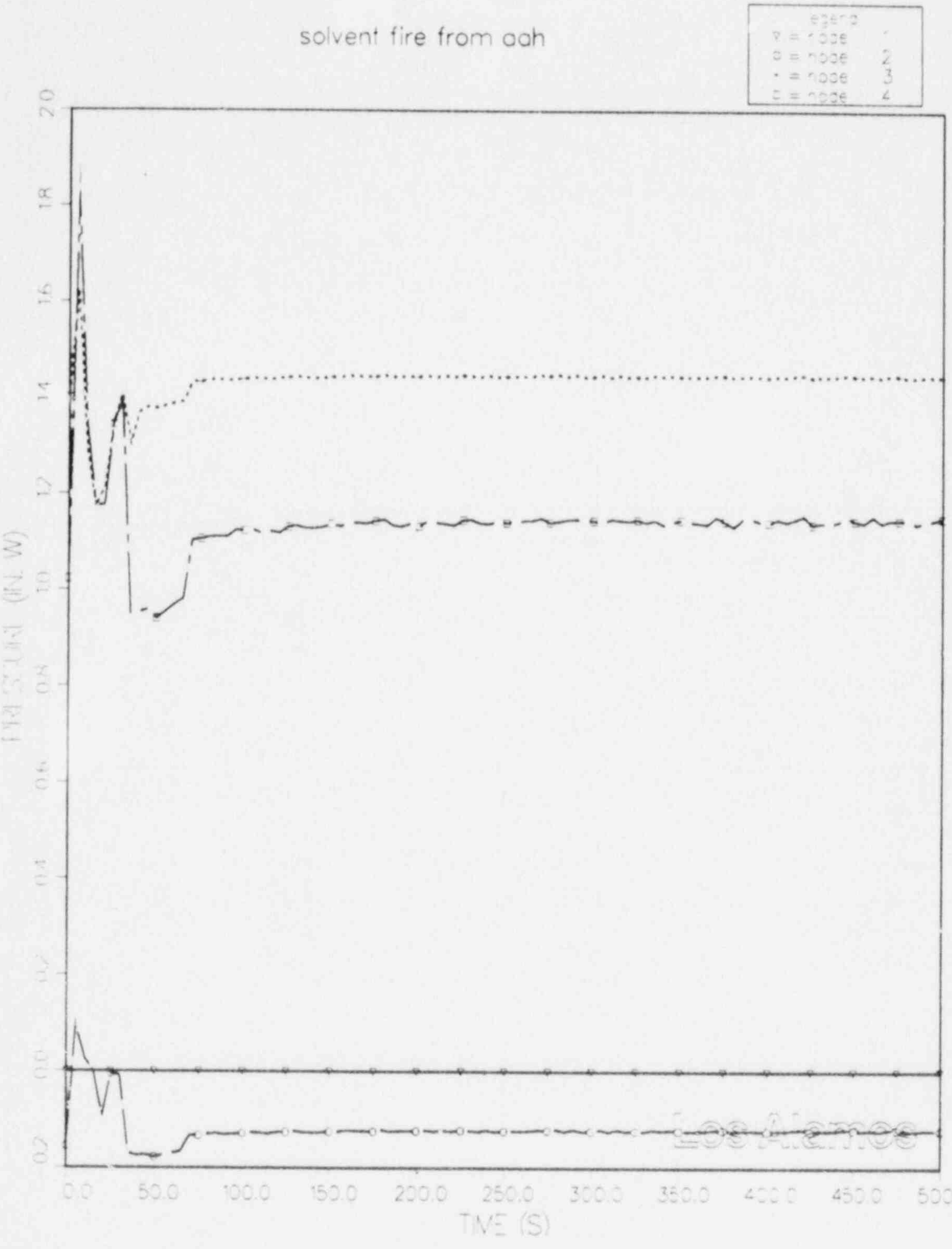


FIGURE 5.32. Pressure Time Histories for the FIRIN Source-Term Calculation of the Solvent Extraction Fire for Nodes 1, 2, 3, and 4

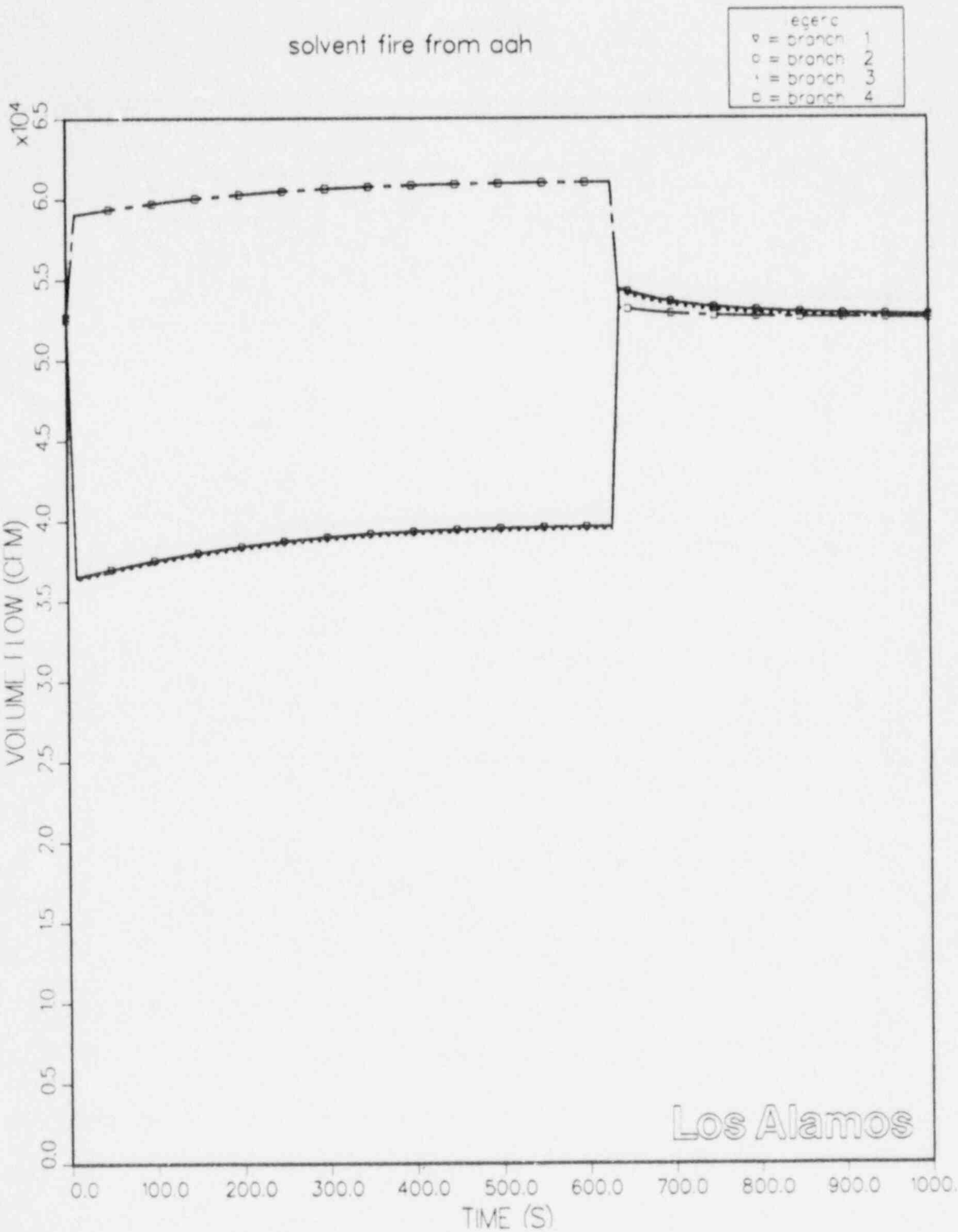


FIGURE 5.33. Volumetric Flow Rate Time Histories for the Hand Calculated Source Term for the Solvent Extraction Fire for Branches 1, 2, 3, and 4

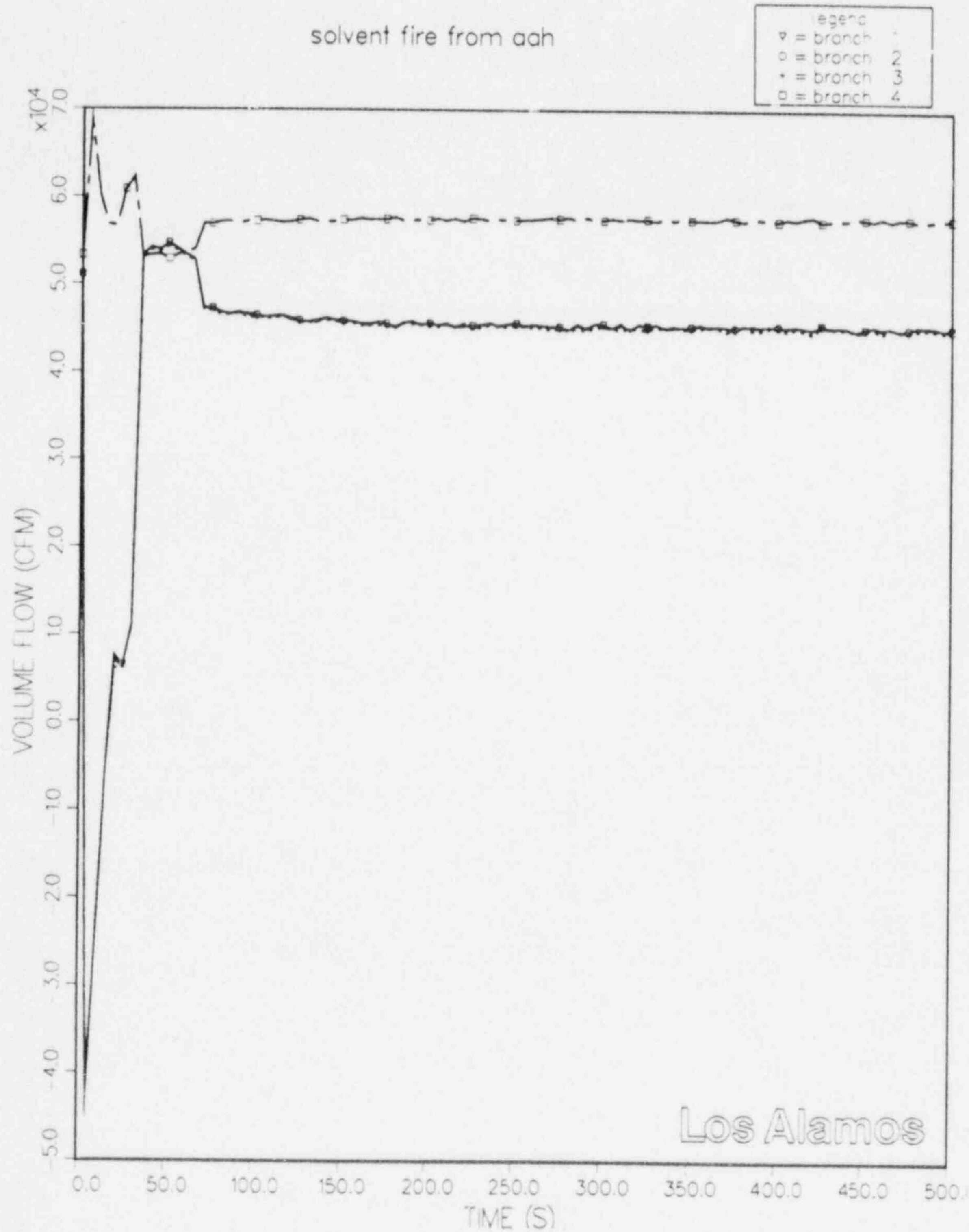


FIGURE 5.34. Volumetric Flow Rate Time Histories for the FIRIN Source-Term Calculation of the Solvent Extraction Fire for Branches 1, 2, 3, and 4

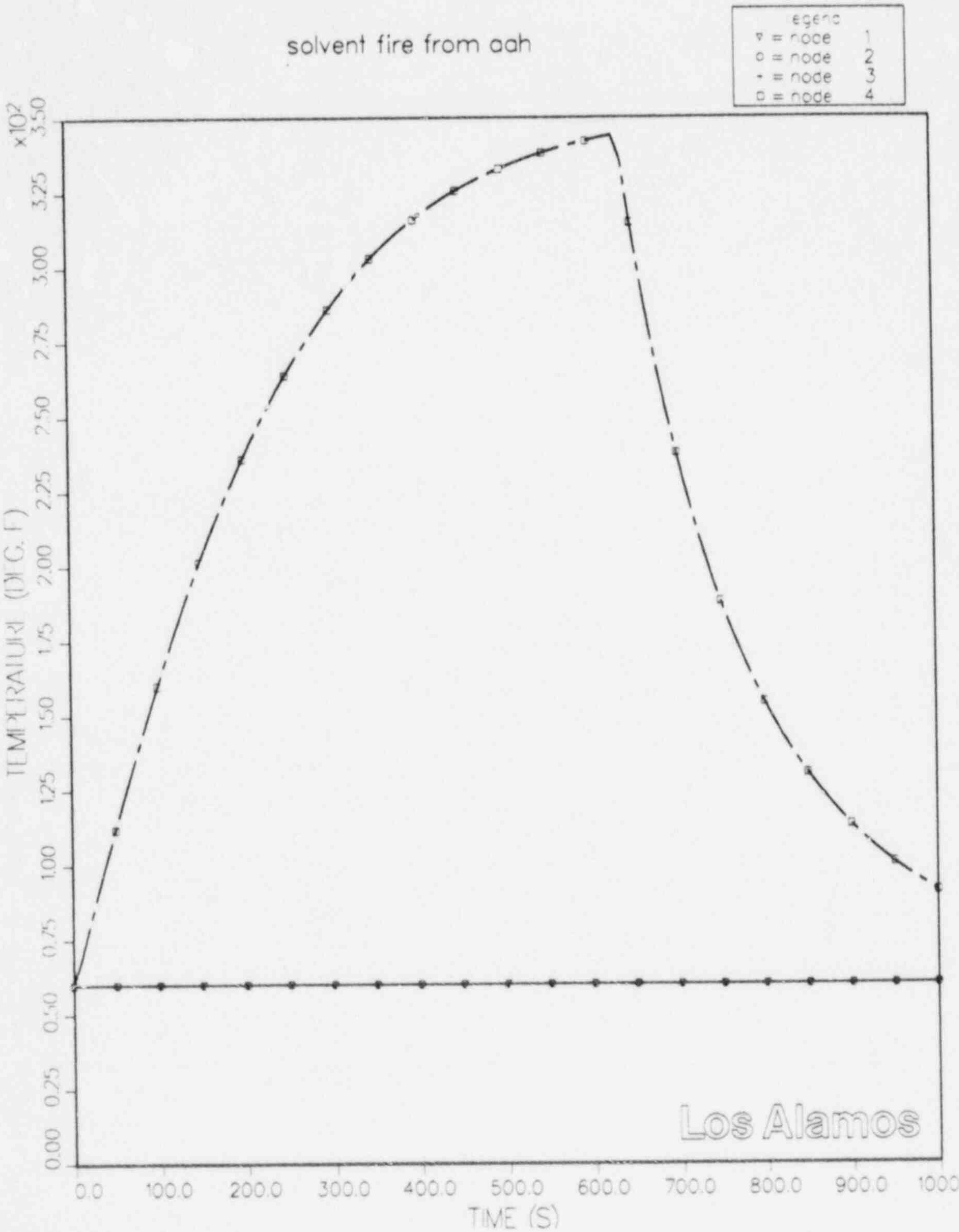


FIGURE 5.35. Temperature Time Histories for the Hand-Calculated Source Term for the Solvent Extraction Fire for Nodes 1, 2, 3, and 4

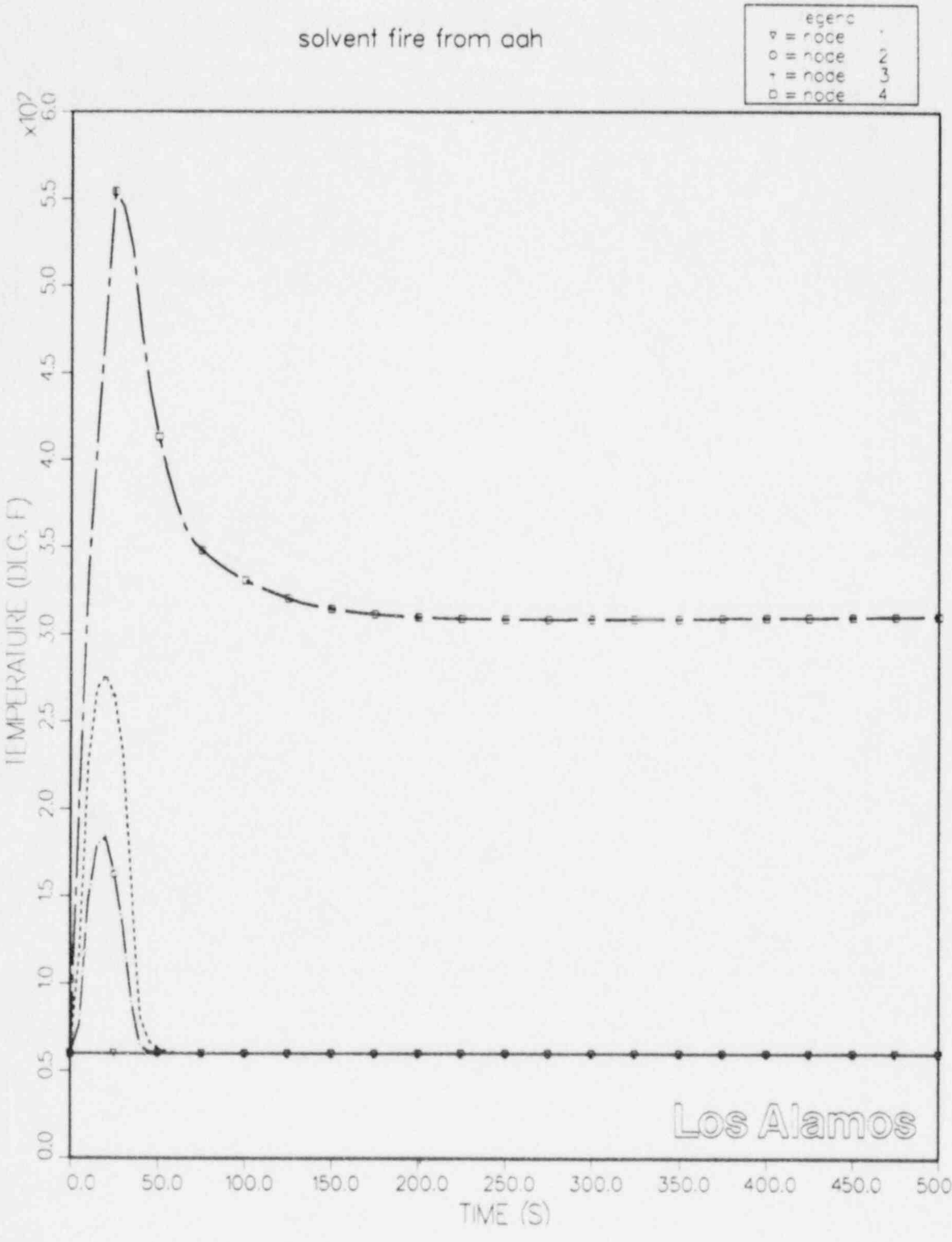


FIGURE 5.36. Temperature Time Histories for the FIRIN Source-Term Calculation of the Solvent Extraction Fire for Nodes 1, 2, 3, and 4

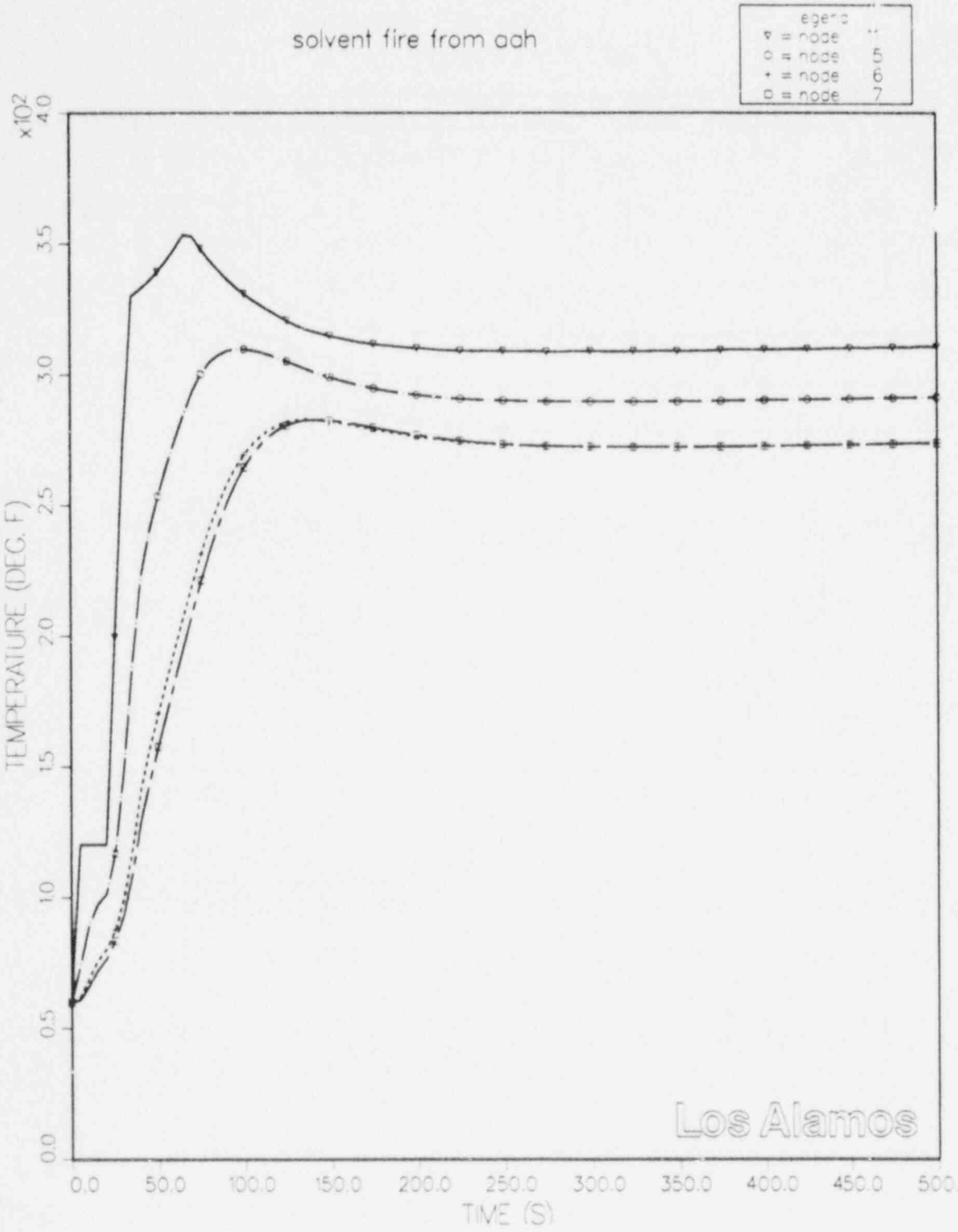


FIGURE 5.37. Temperature Time Histories for the FIRIN Source-Term Calculation of the Solvent Extraction Fire for Nodes 5, 6, 7, and 11

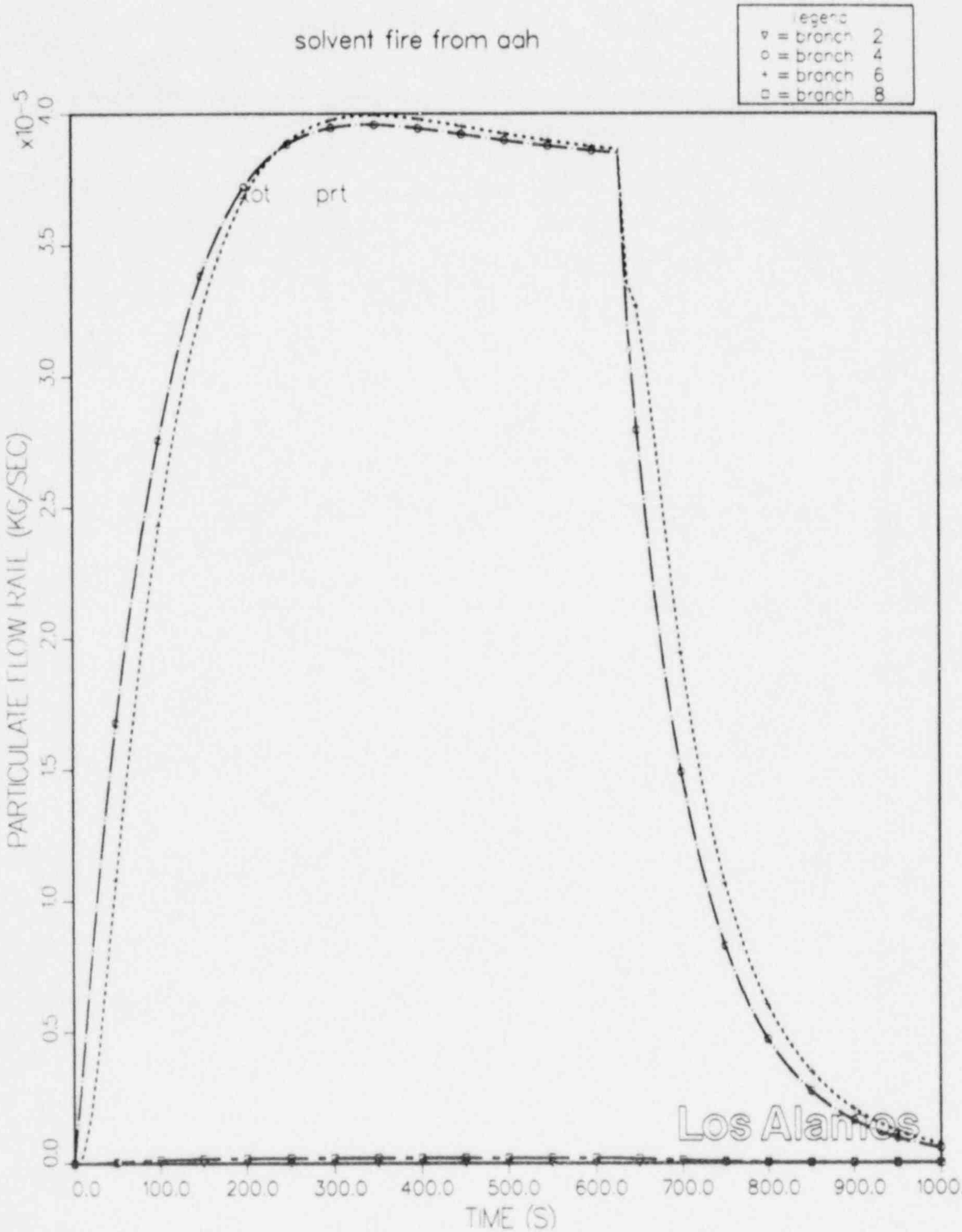


FIGURE 5.38. Total Radioactive Particulate Flow Rate Time Histories for the Hand Calculated Source Term for the Solvent Extraction Fire for Branches 2, 4, 6, and 8

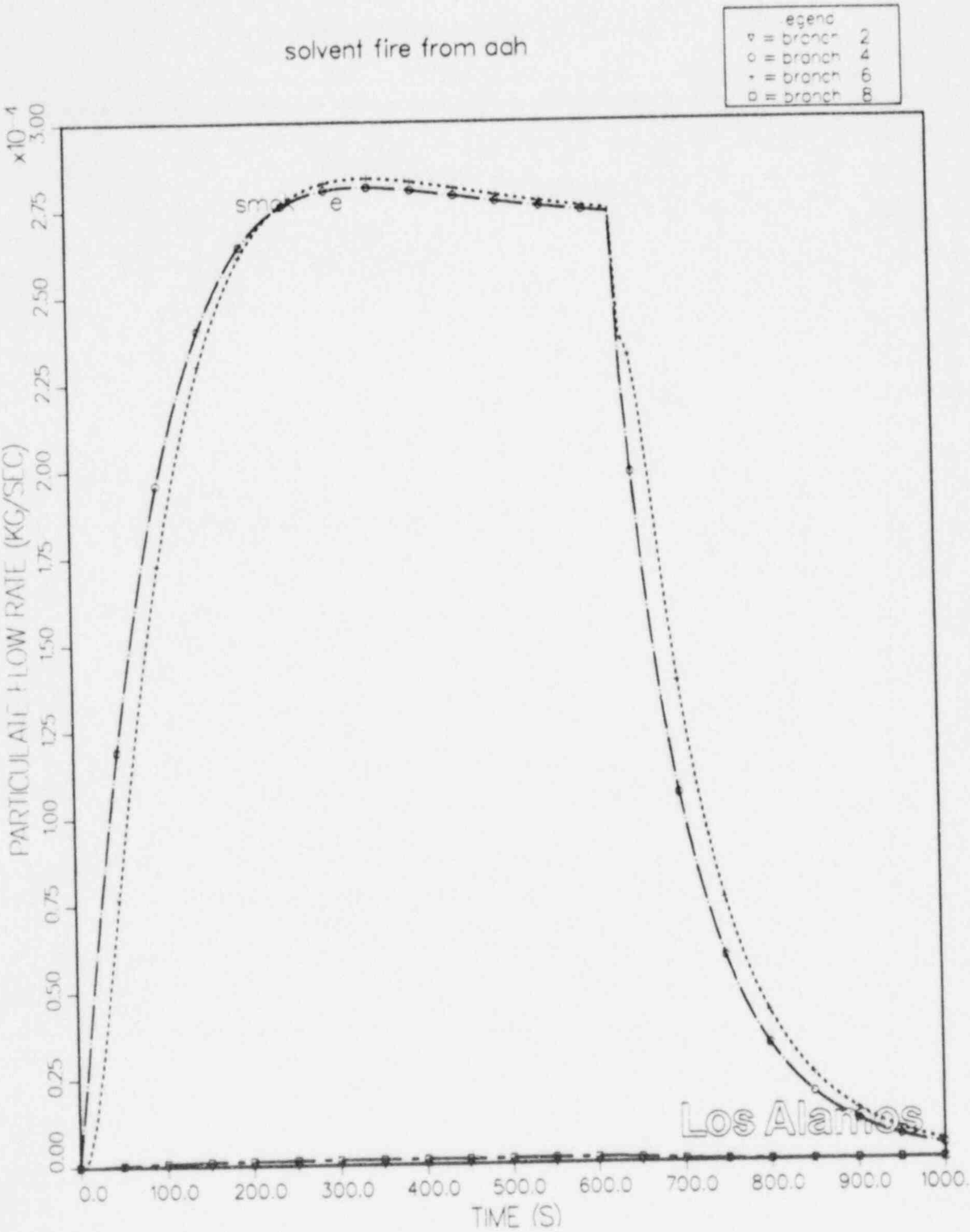


FIGURE 5.39. Smoke Flow Rate Time Histories for the Hand-Calculated Source Term for the Solvent Extraction Fire for Branches 2, 4, 6, and 8

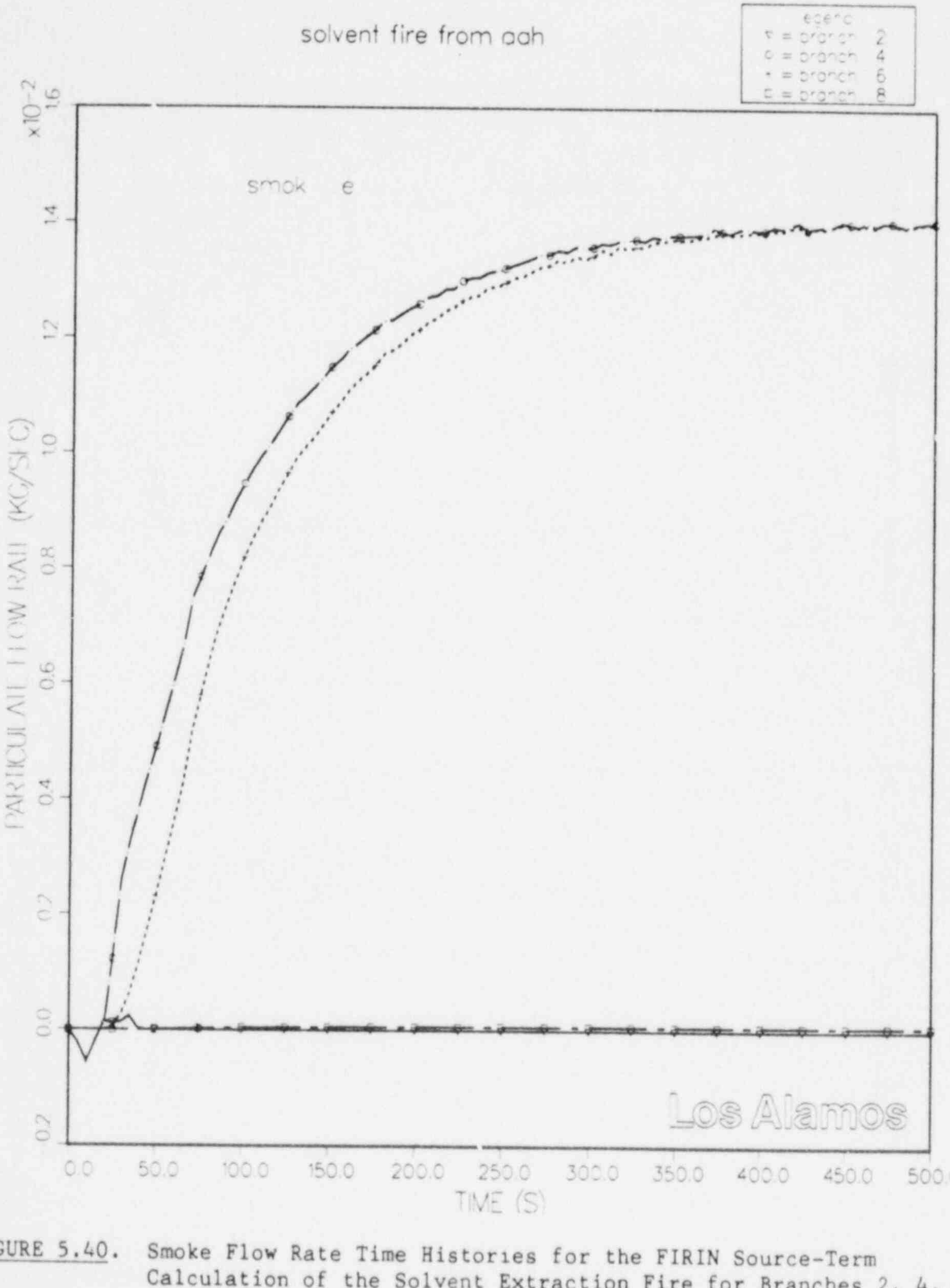


FIGURE 5.40. Smoke Flow Rate Time Histories for the FIRIN Source-Term Calculation of the Solvent Extraction Fire for Branches 2, 4, 6, and 8

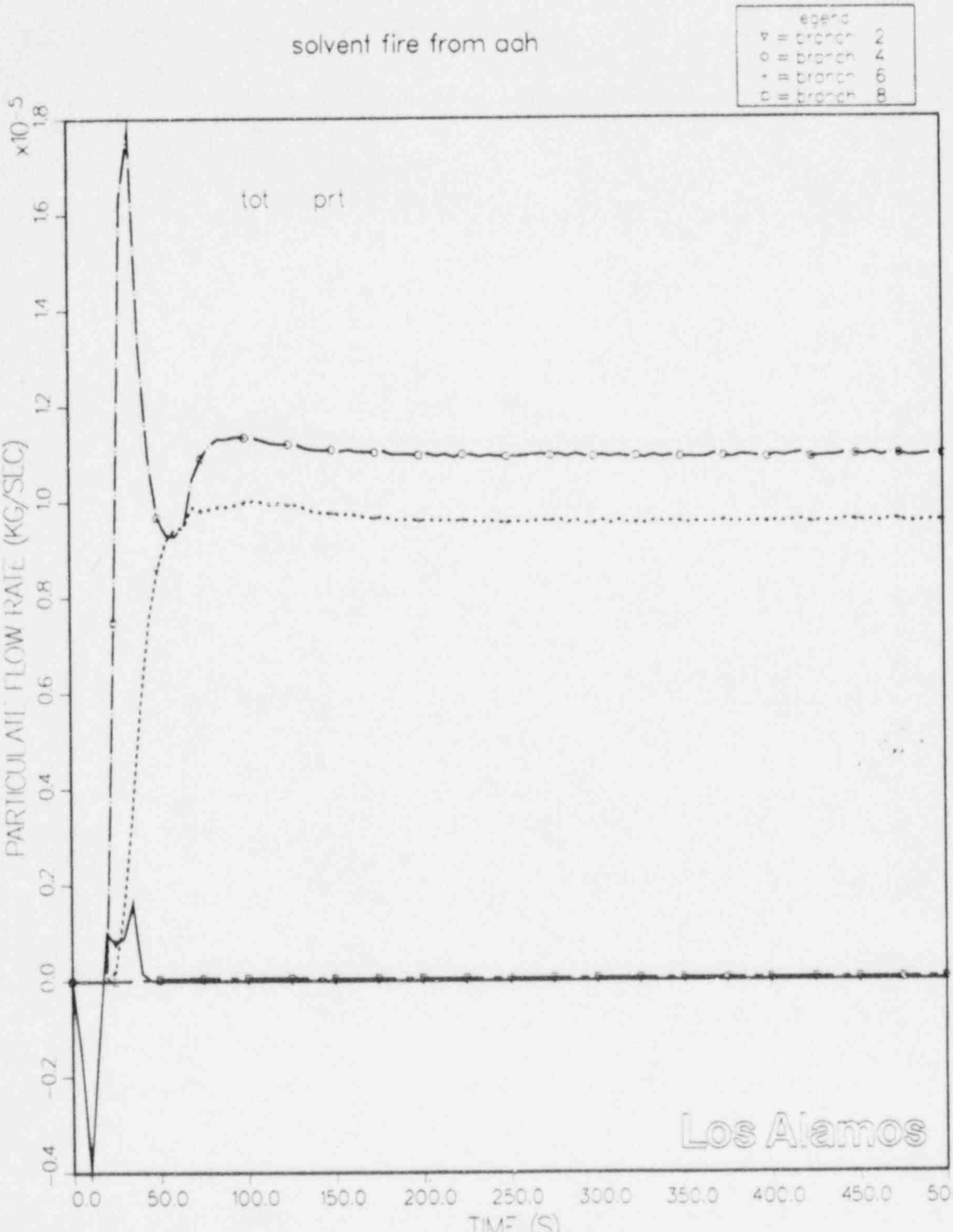


FIGURE 5.41. Total Radioactive Particulate Flow Rate Time Histories for the FIRIN Source-Term Calculation of the Solvent Extraction Fire for Branches 2, 4, 6, and 8

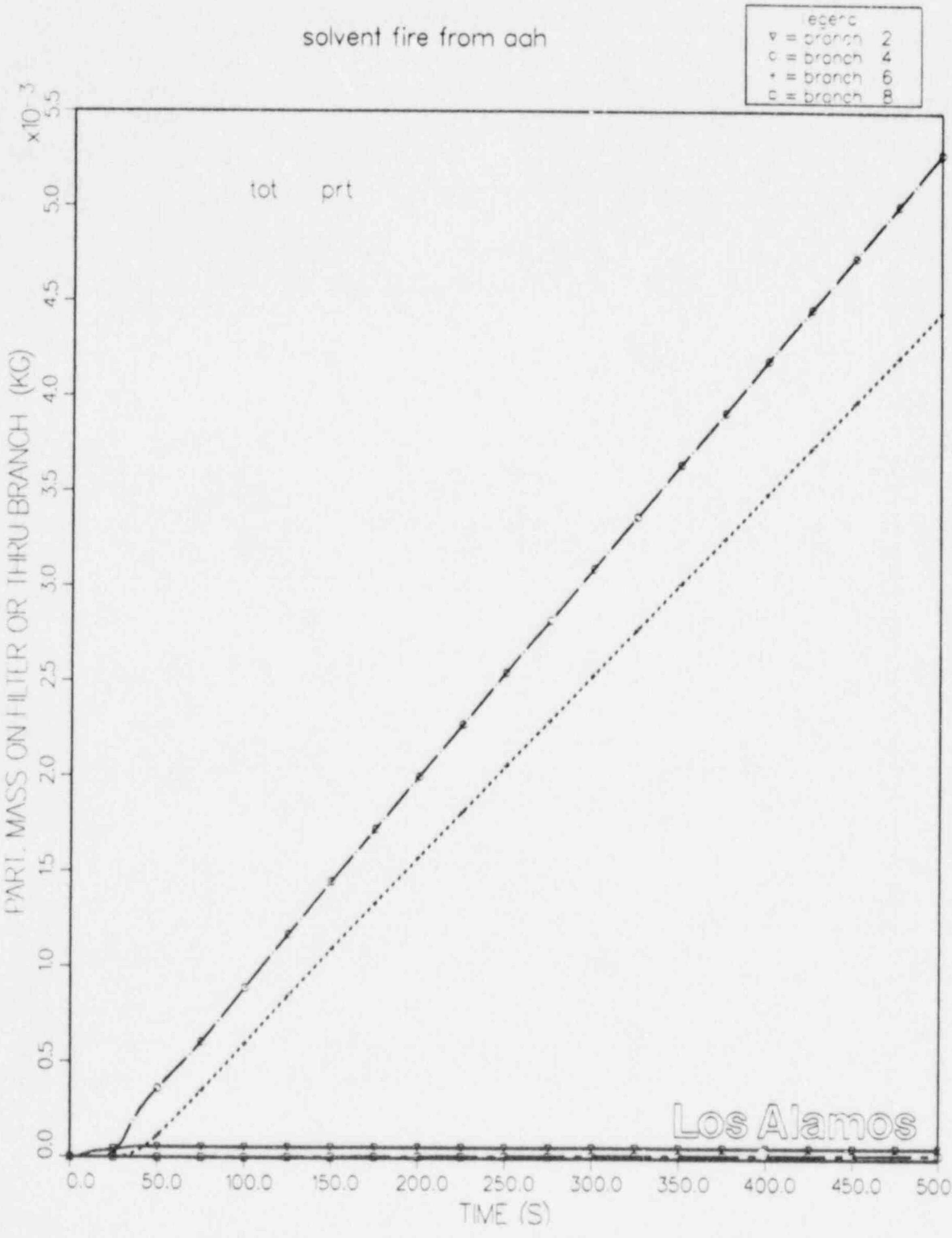


FIGURE 5.42. Total Radioactive Particulate Mass Accumulated on a Filter or That Flowed Through a Branch as a Function of Time for the FIRIN Source-Term Calculation of the Solvent Extraction Fire for Branches 2, 4, 6, and 8

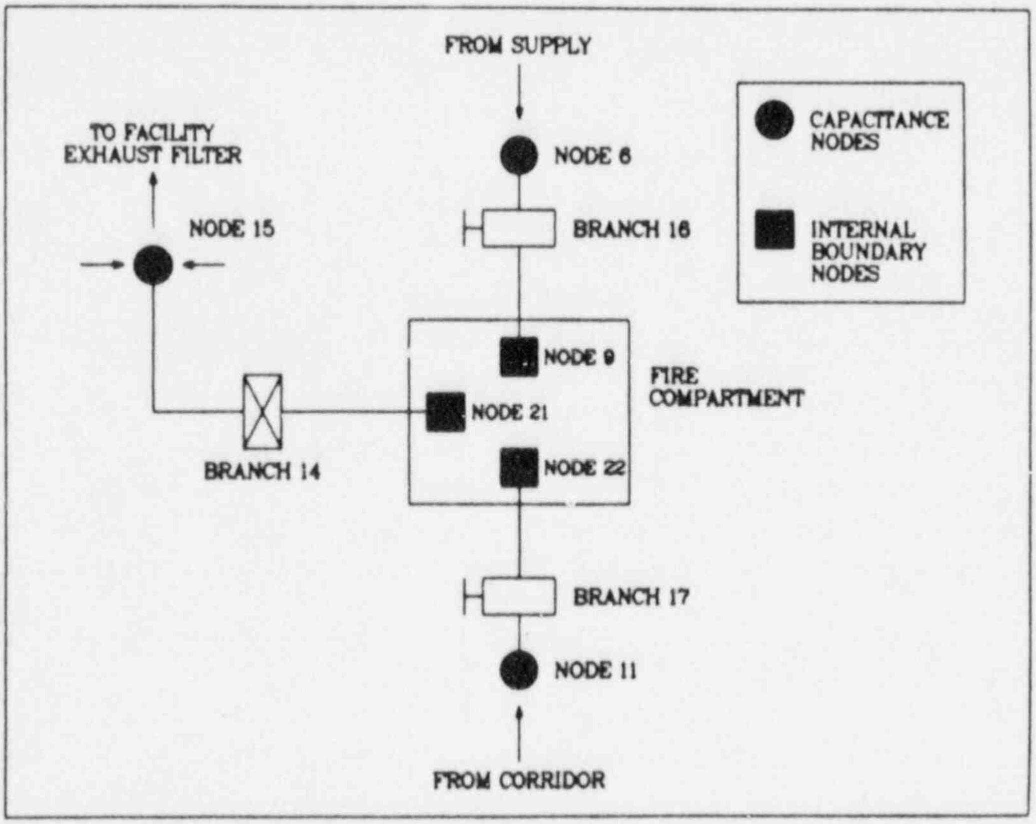


FIGURE 5.43. Close-Up System Schematic Near the Fire

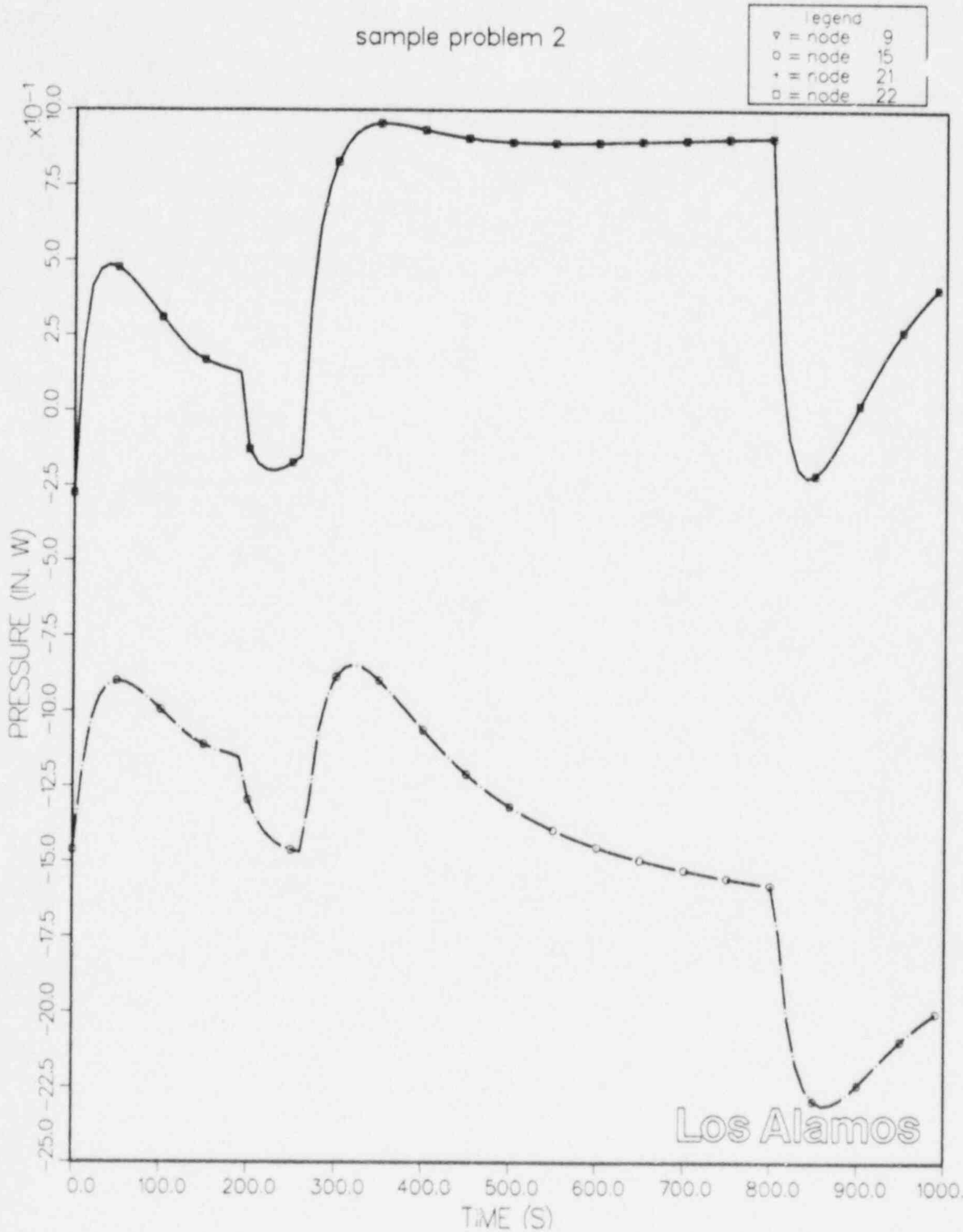


FIGURE 5.44. Pressure Response for Nodes 9, 15, 21, and 22

FIGURE 5.45. Fire Compartment Volumetric Flow Rates (Branches 14, 16, and 17)

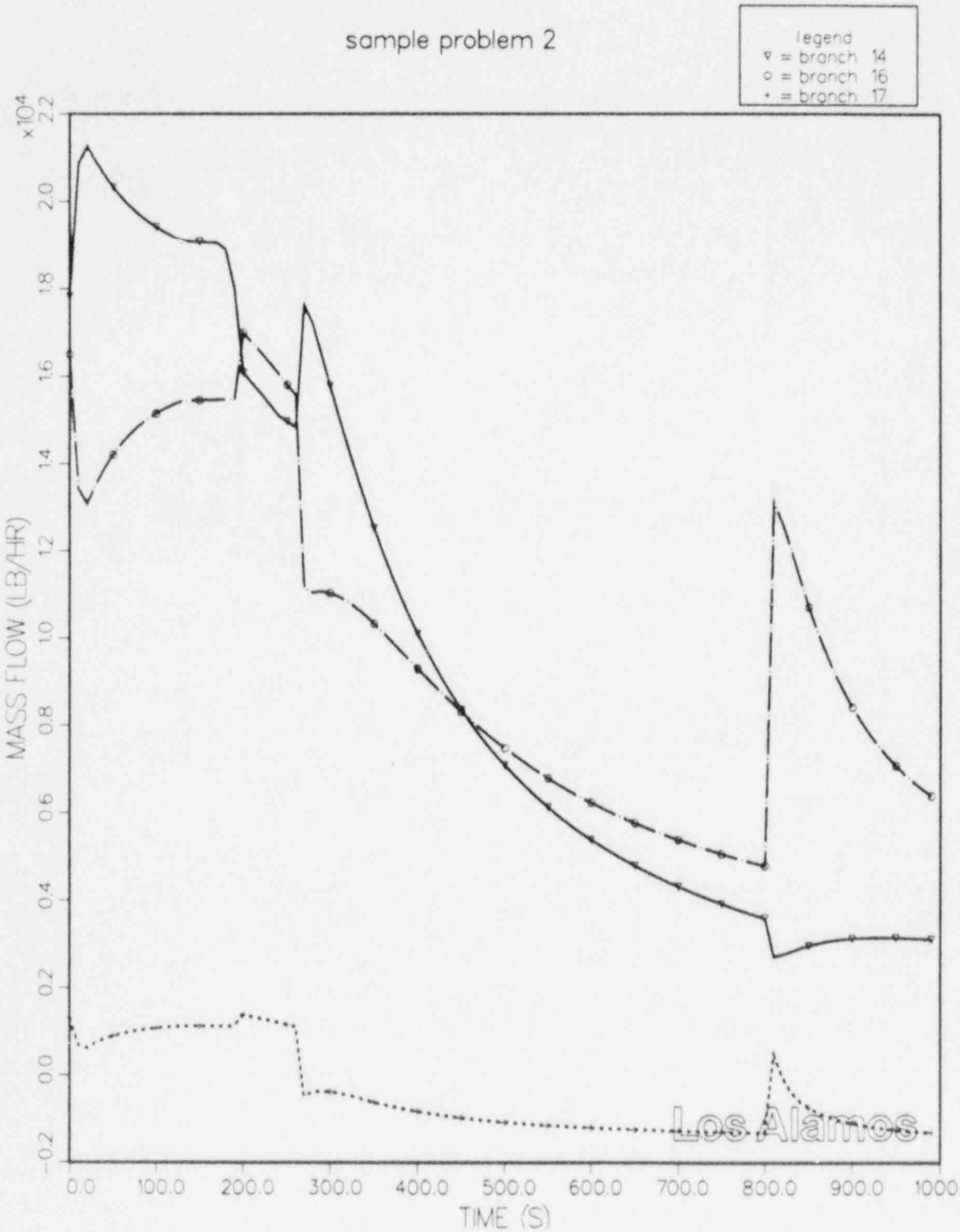


FIGURE 5.46. Fire Compartment Mass Flow Rates (Branches 14, 16, and 17)

SAMPLE PROBLEM 2

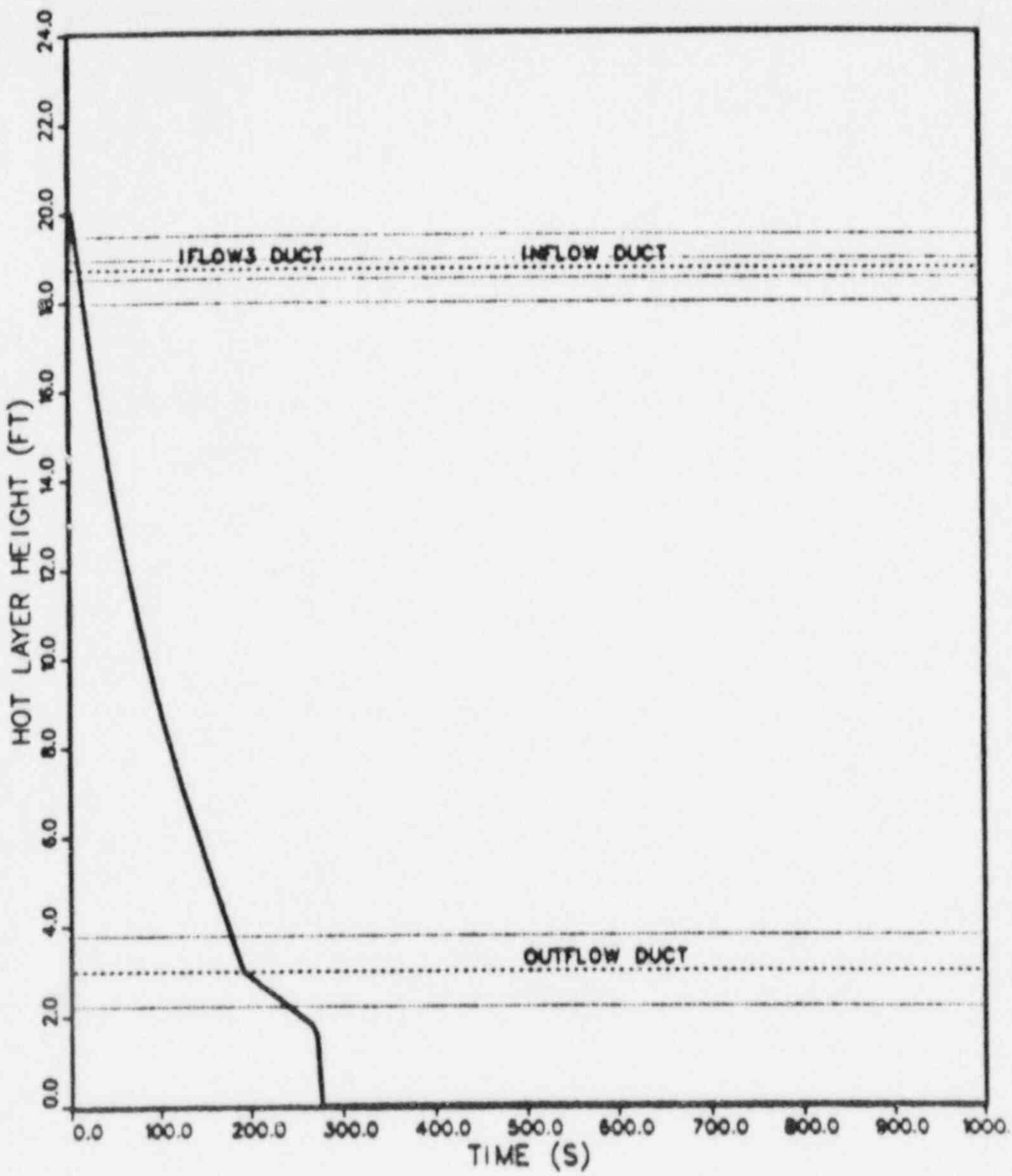


FIGURE 5.47. Hot-Layer Height vs Time

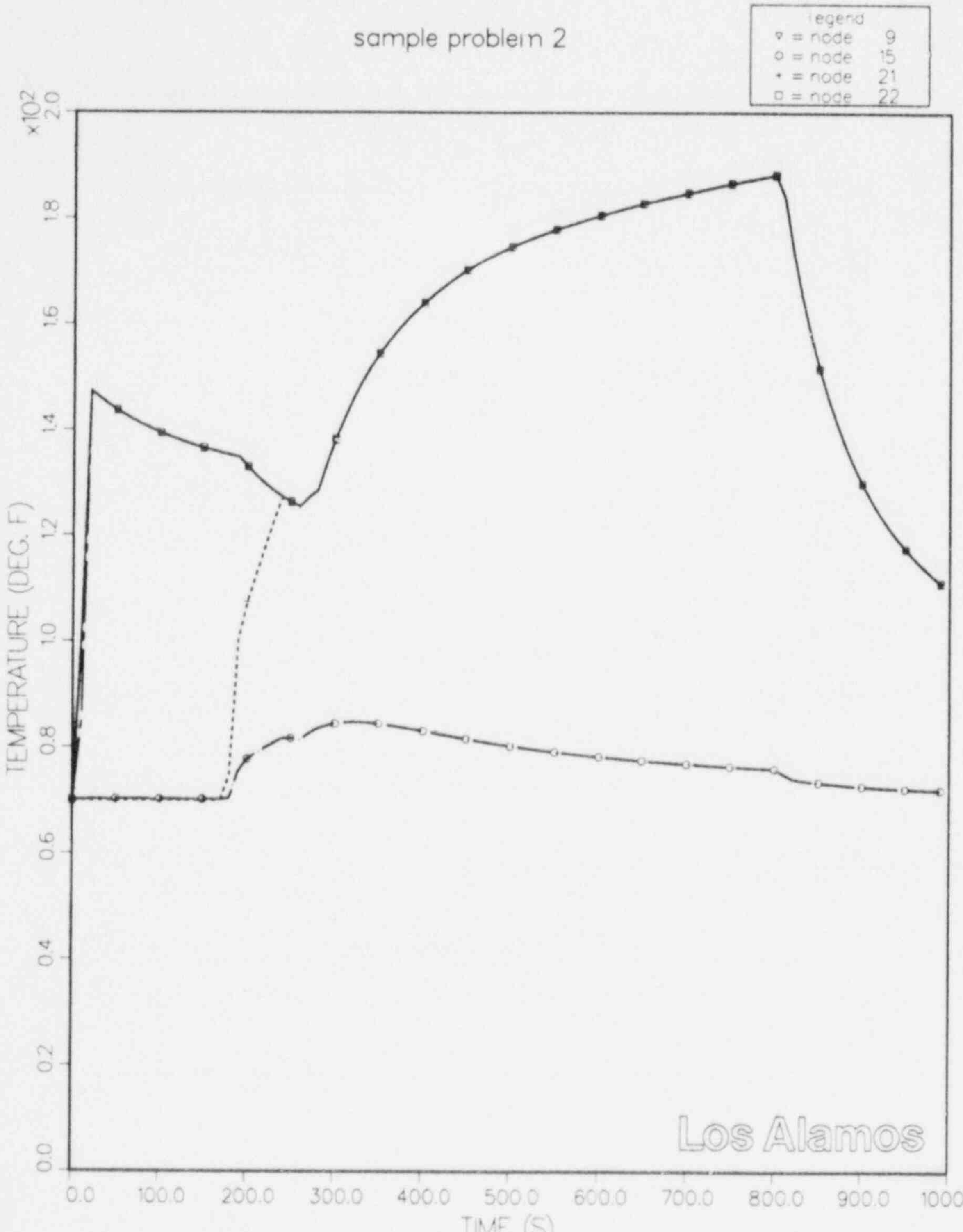


FIGURE 5.48. Temperature Response for Nodes 9, 15, 21, and 22

SAMPLE PROBLEM 2

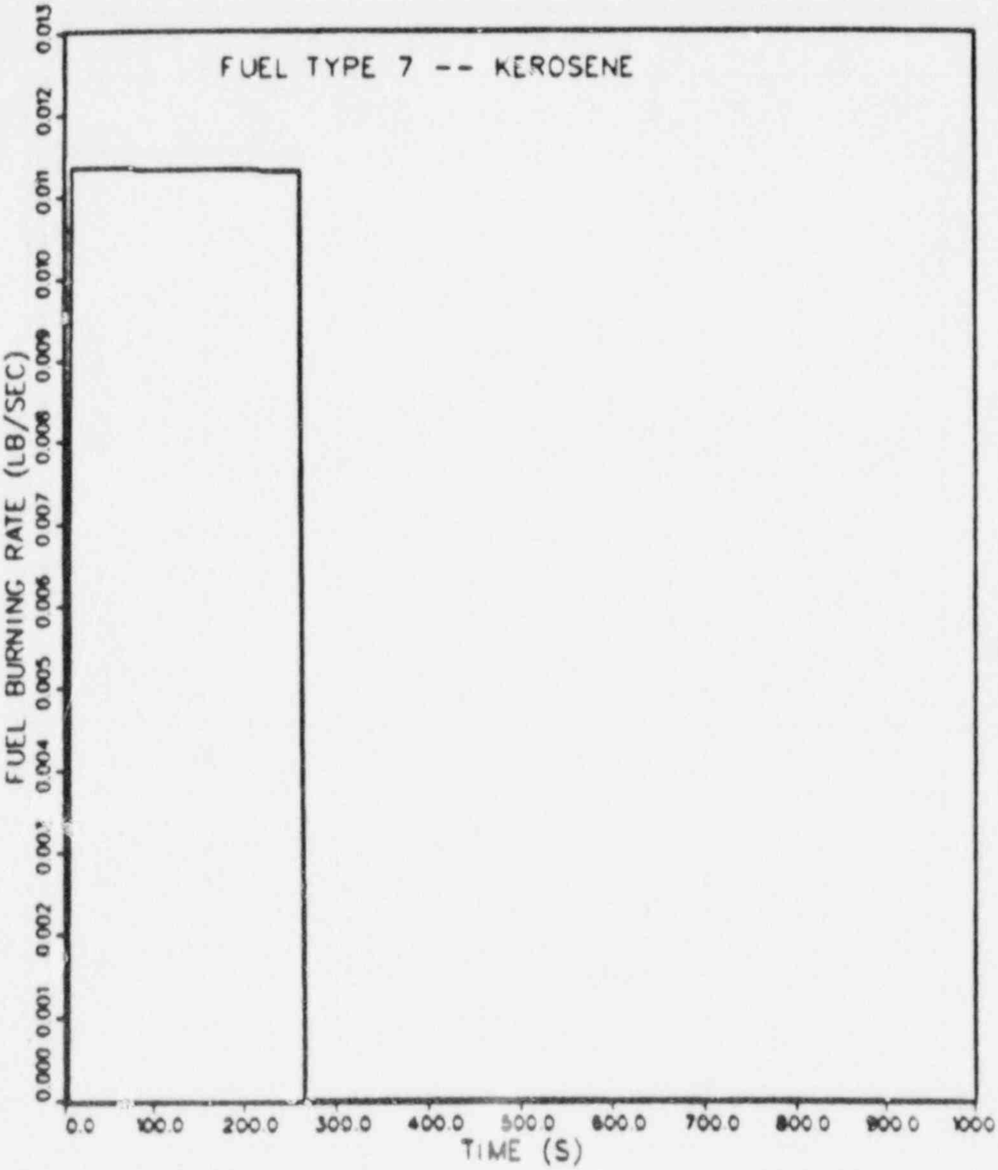


FIGURE 5.49. Kerosene Burning Rate vs Time

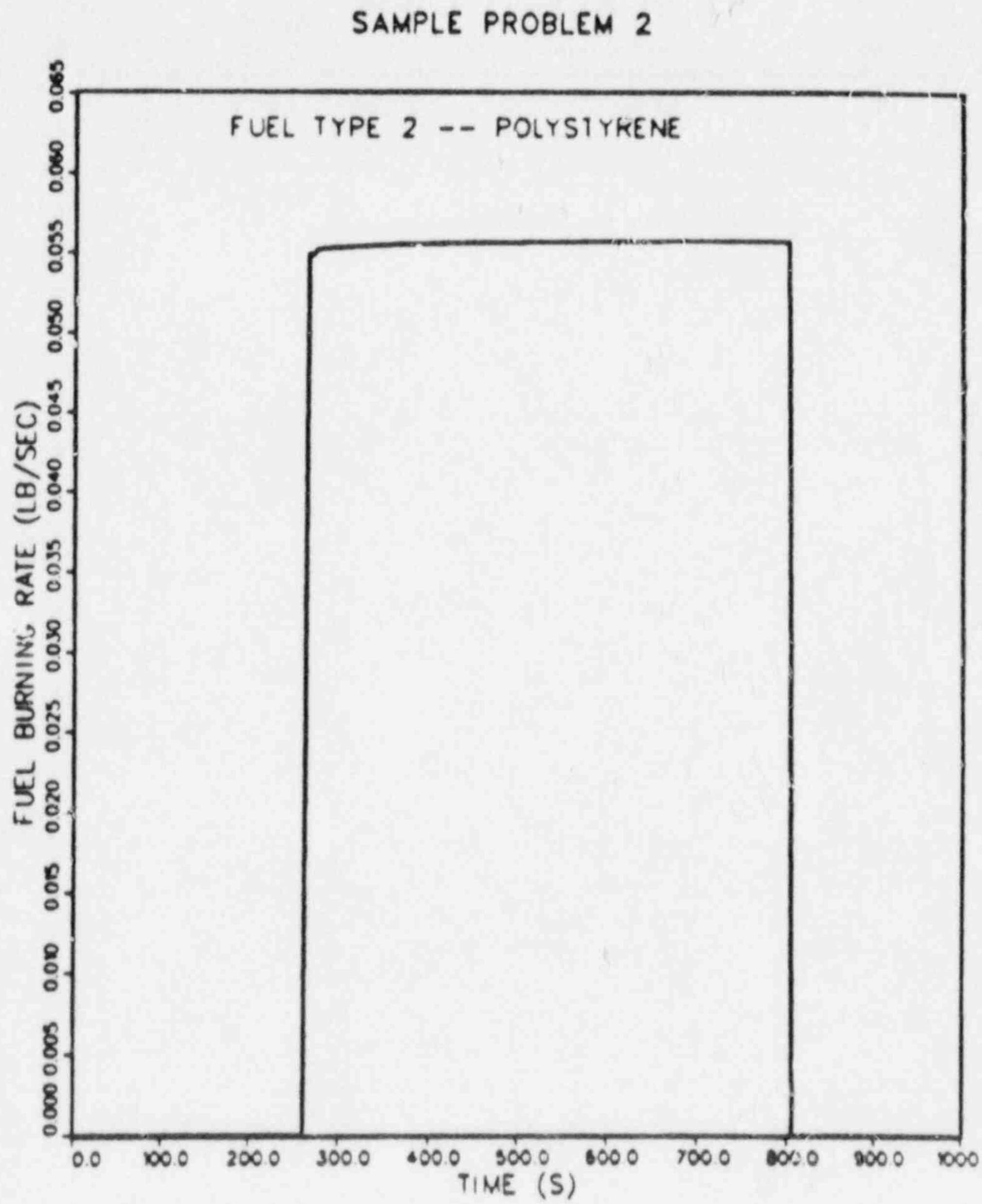


FIGURE 5.50. Polystyrene Burning Rate vs Time

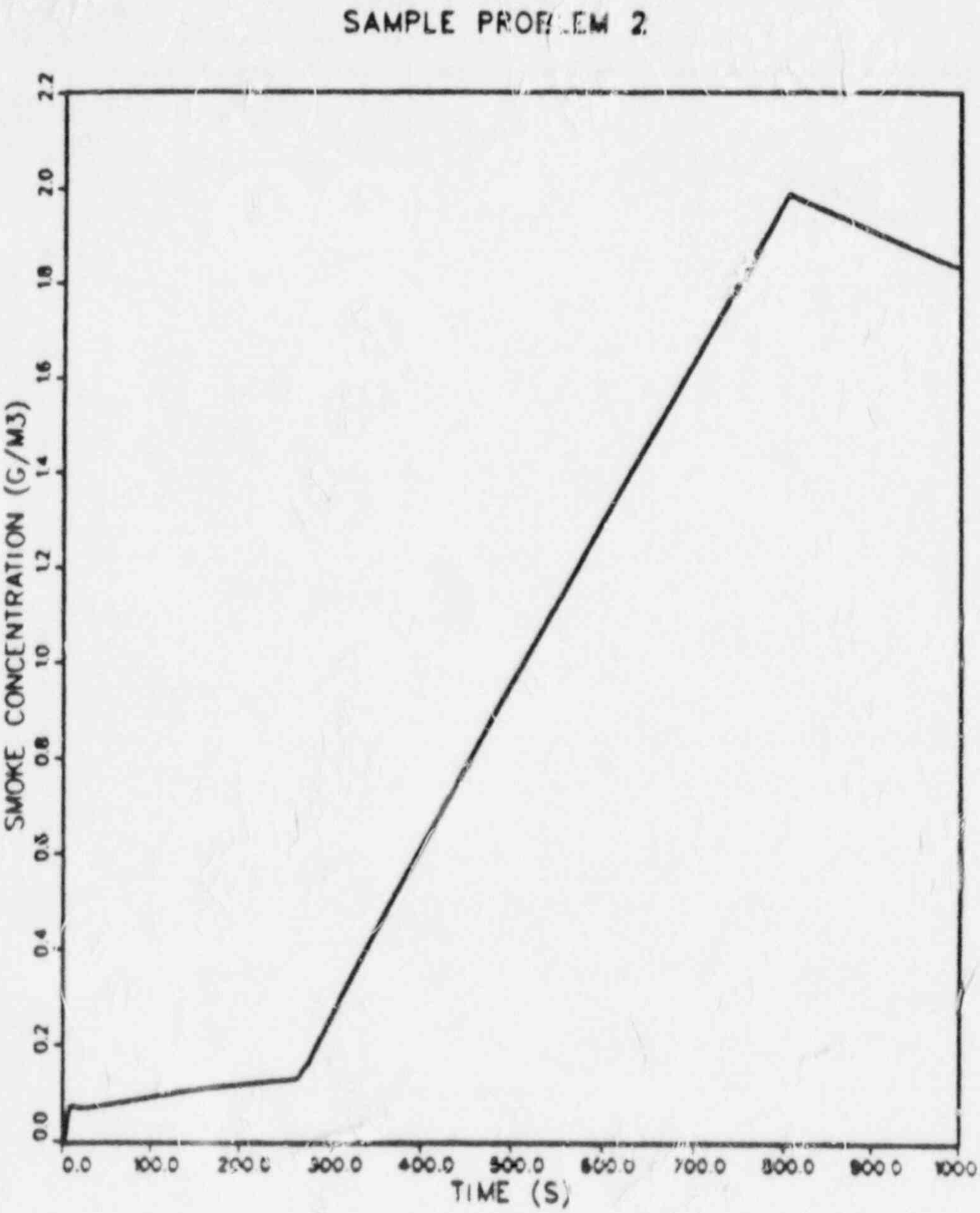


FIGURE 5.51. Fire Compartment Smoke Concentration vs Time

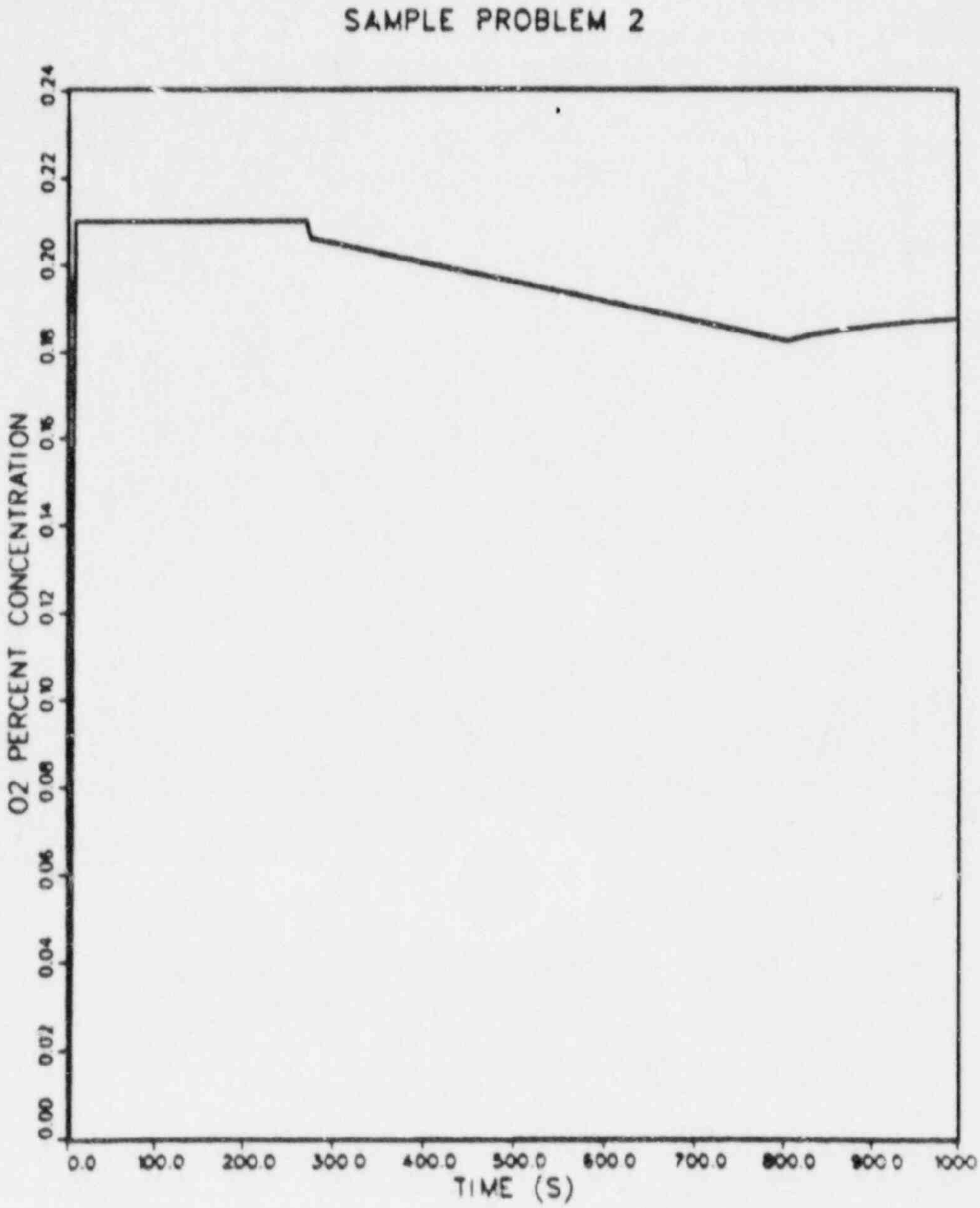


FIGURE 5.52. Fire Compartment Oxygen Concentration vs Time

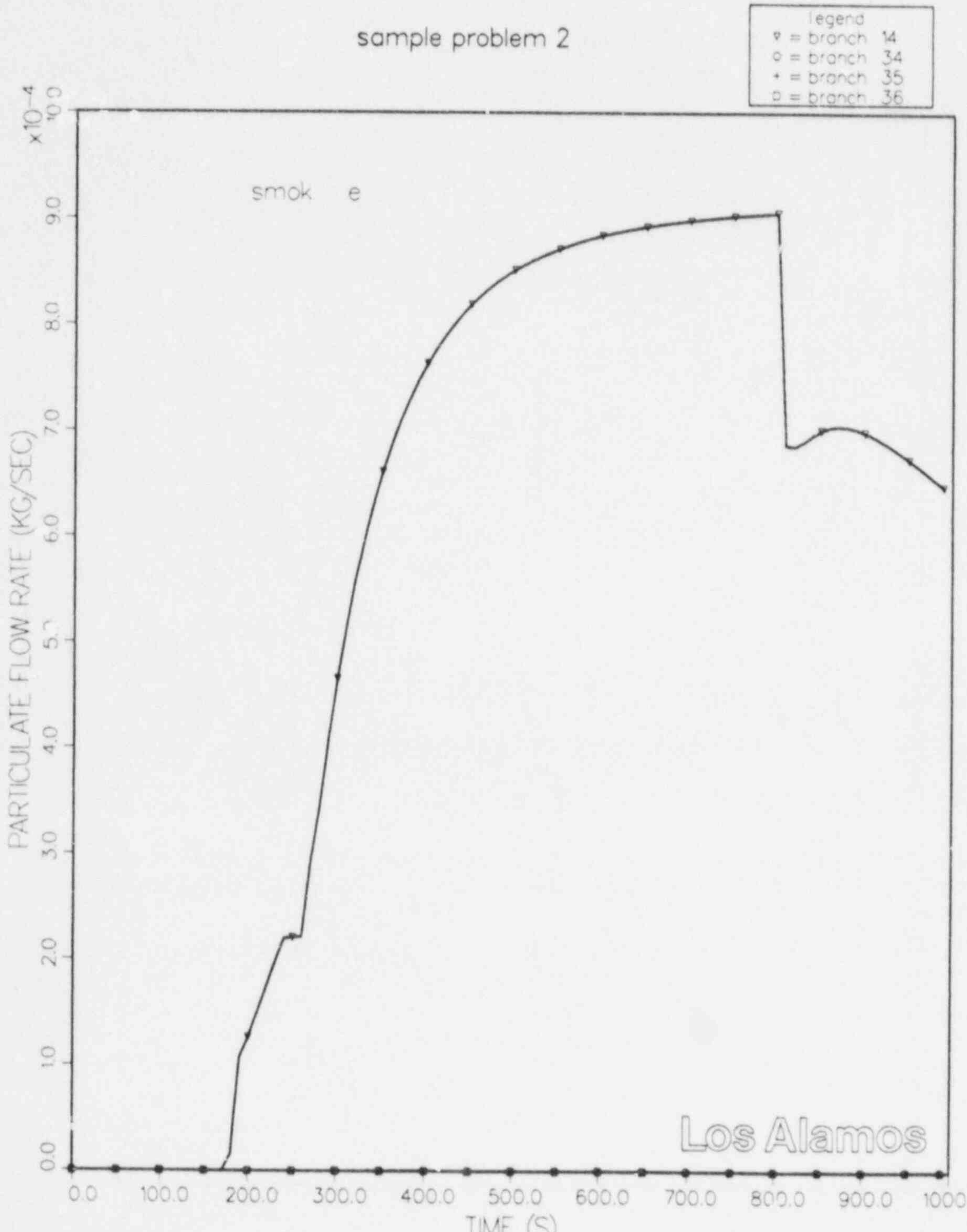


FIGURE 5.53. Smoke Particulate Mass Flow Rates for Branches 14, 34, 35, and 36

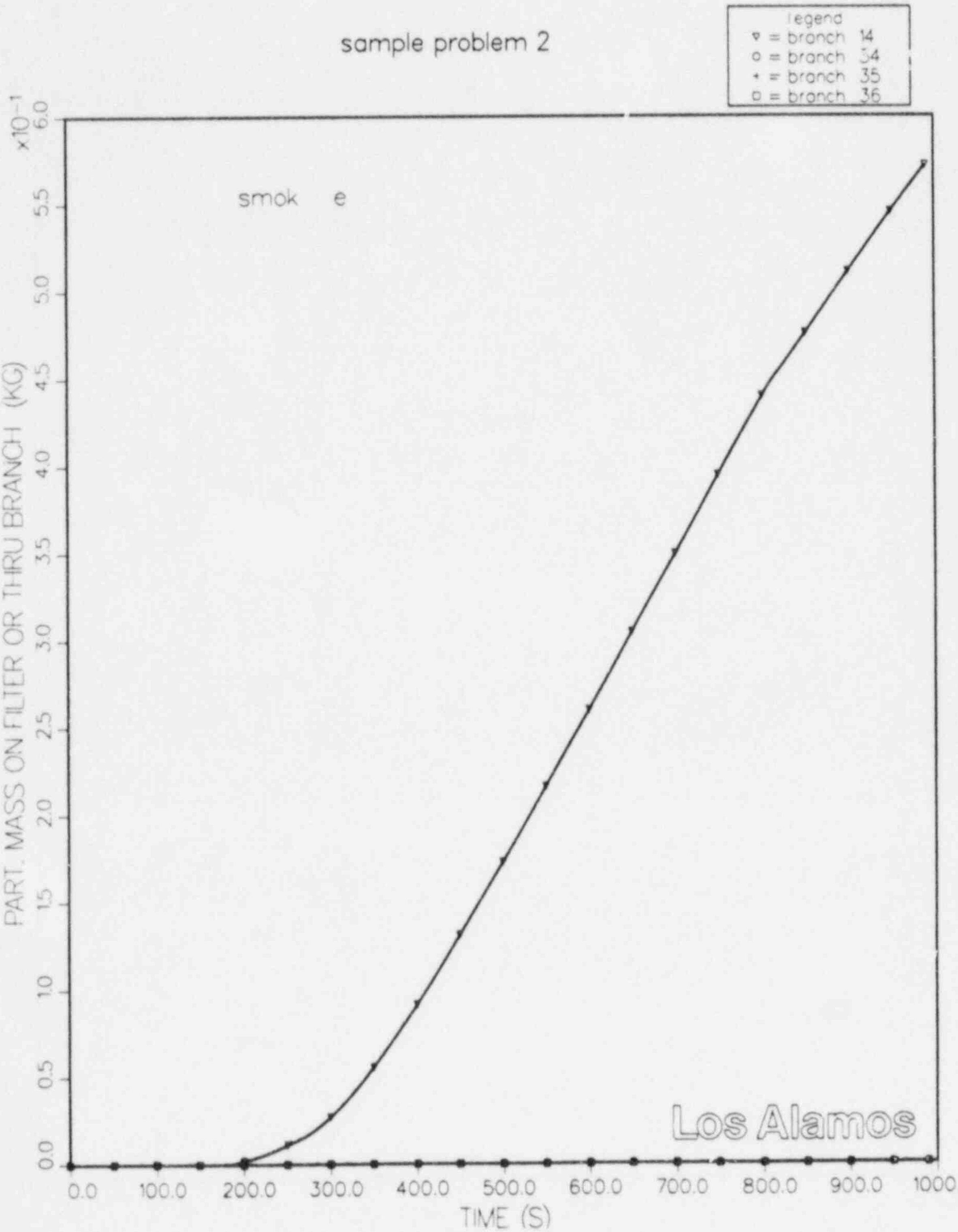


FIGURE 5.54. Accumulated Smoke Particulate Mass for Branches 14, 34, 35, and 36

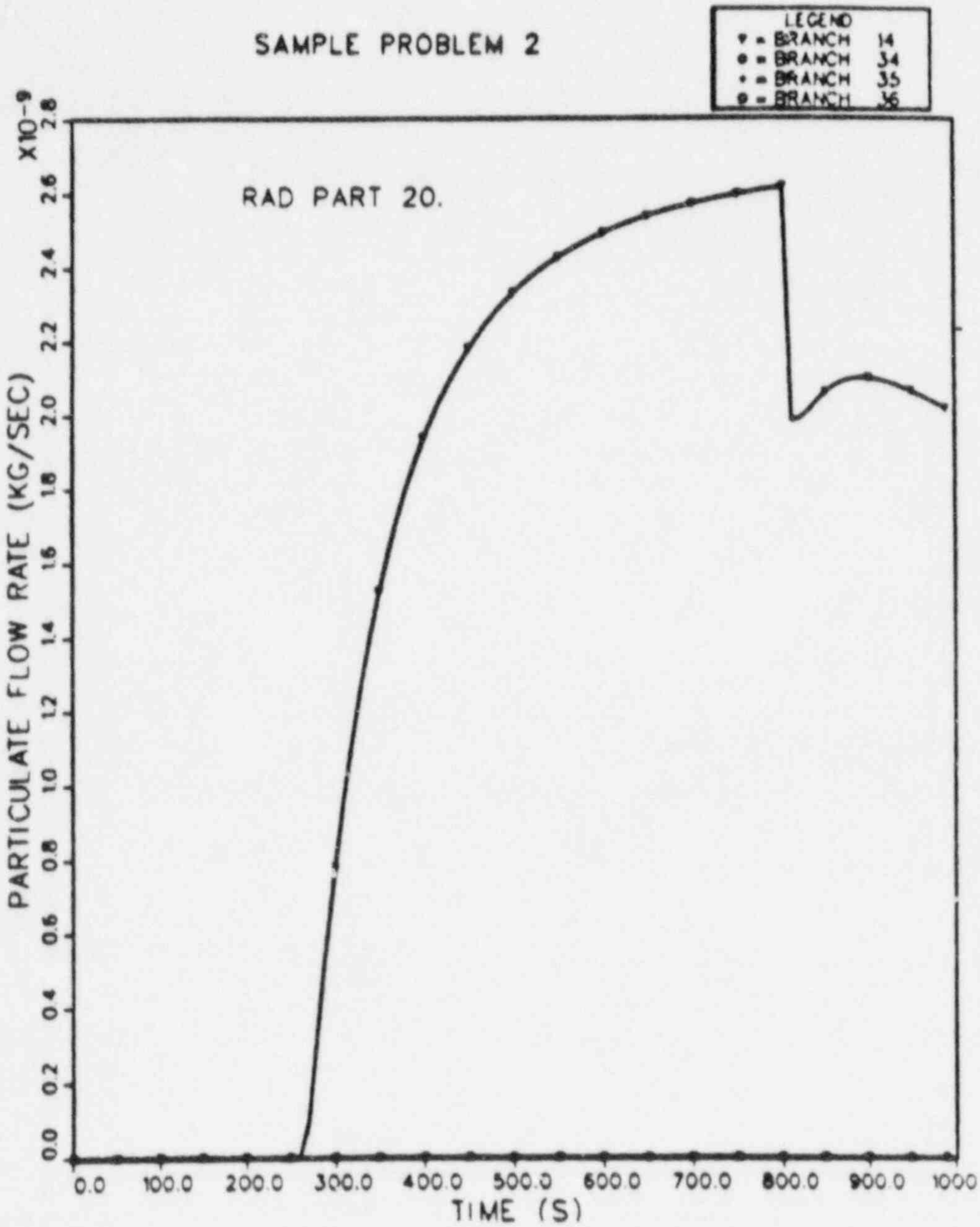


FIGURE 5.55. 20-μm Radioactive Particulate Mass Flow Rates for Branches 14, 34, 35, and 36

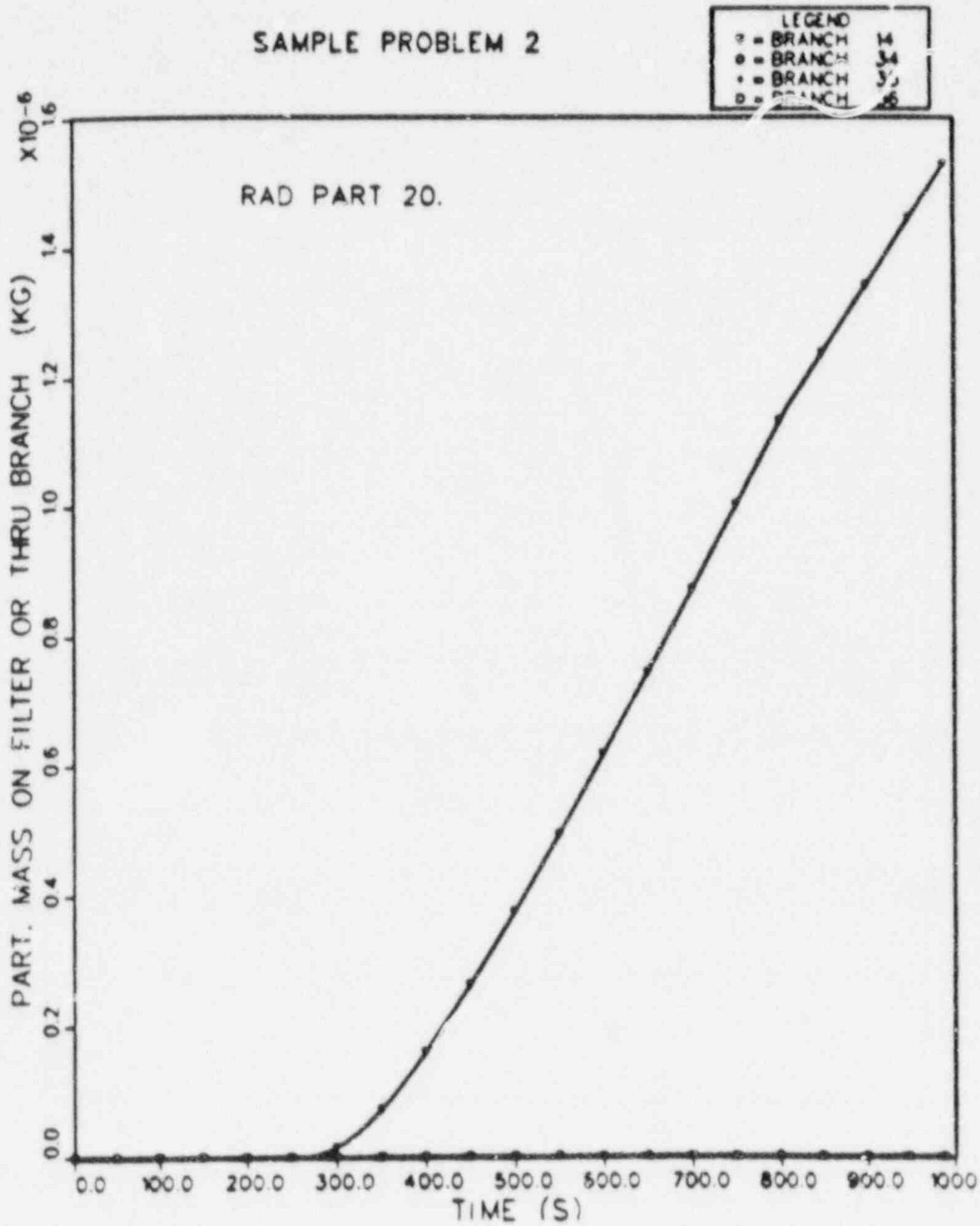


FIGURE 5.56. 20-μm Radioactive Particulate Mass for Branches 14, 34, 35, and 36

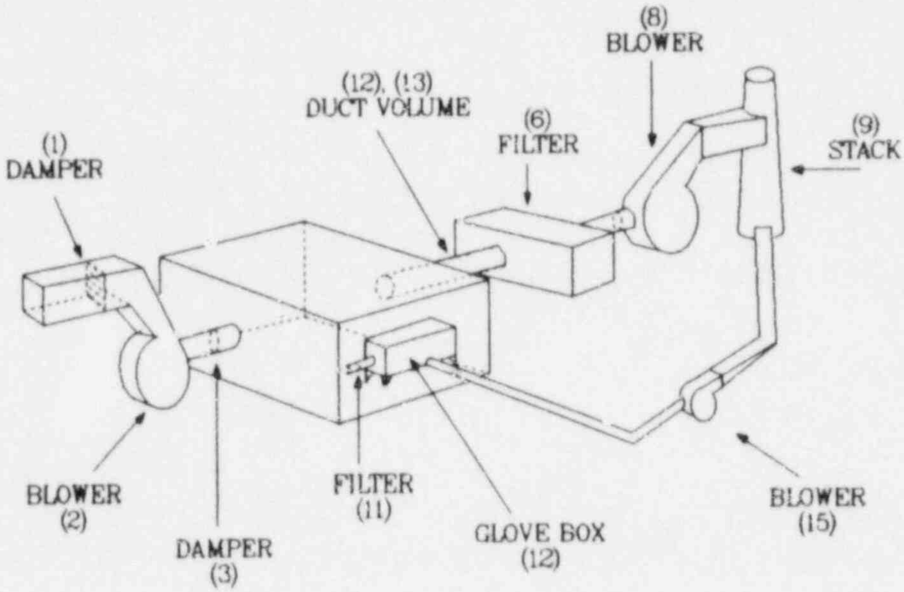


FIGURE 5.57. Sketch of the Explosion Sample Problem Ventilation System

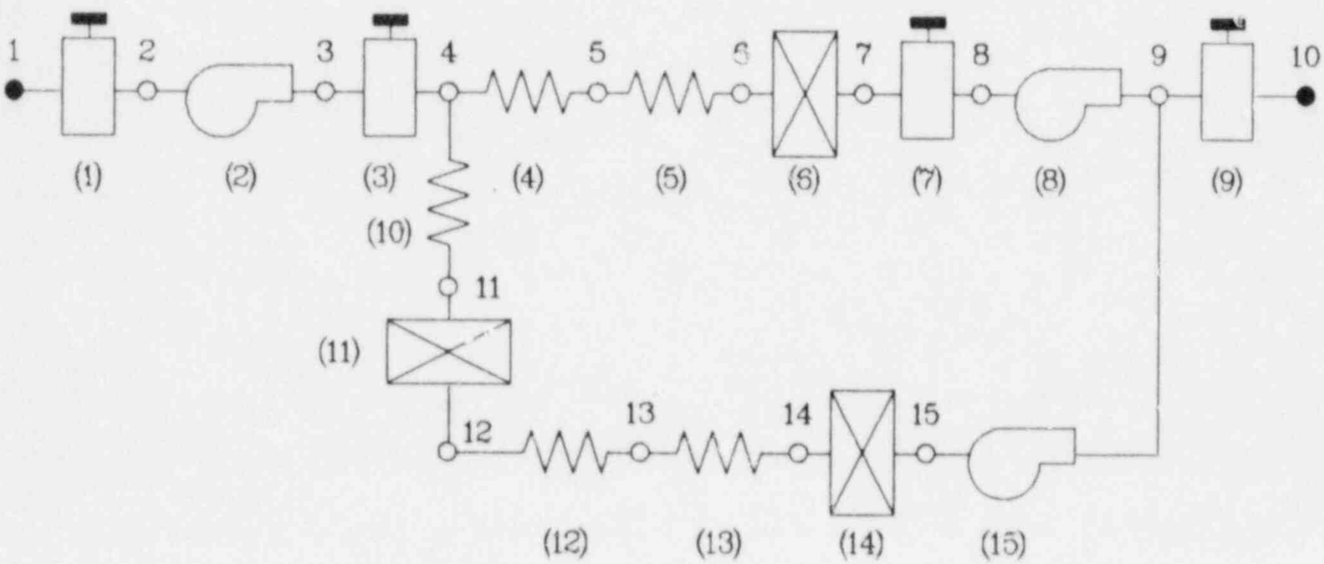


FIGURE 5.58. Network Schematic of the Explosion Sample Problem Ventilation System

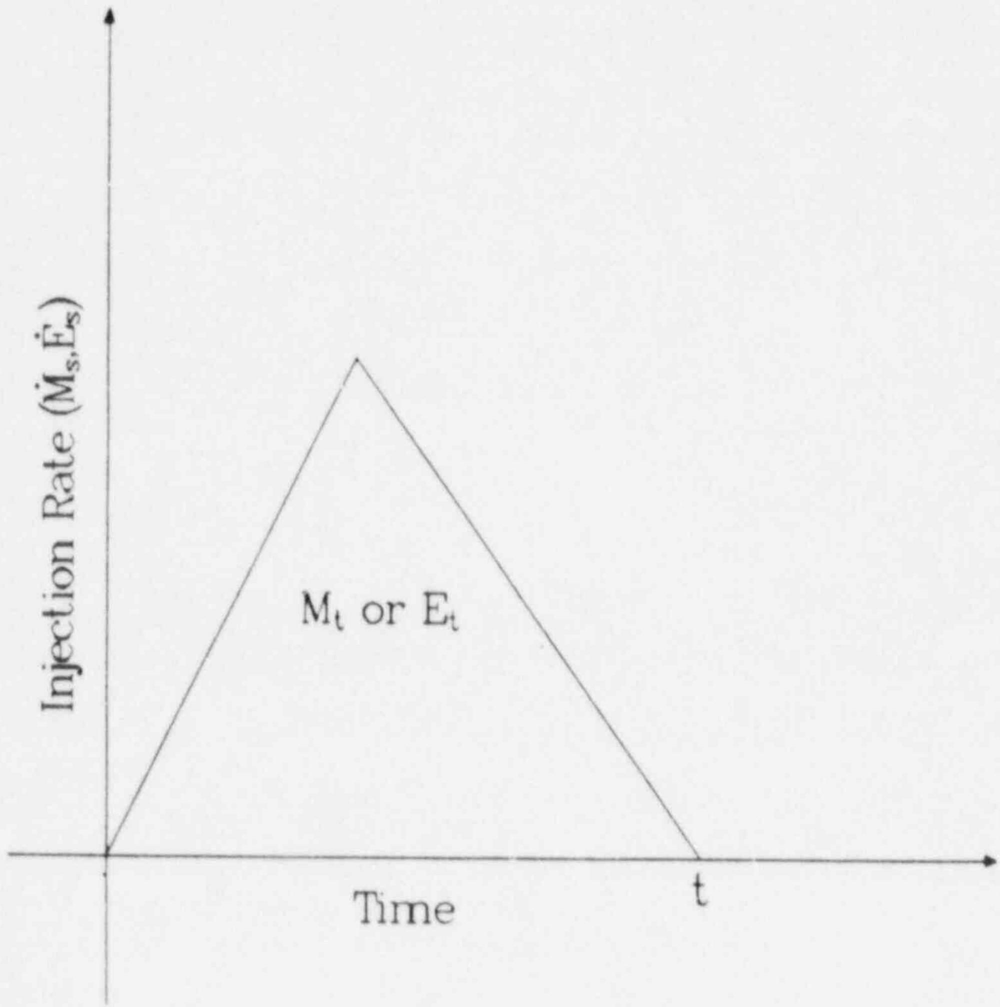


FIGURE 5.59. Mass and Energy Injection for Glovebox Sample Problem Explosion

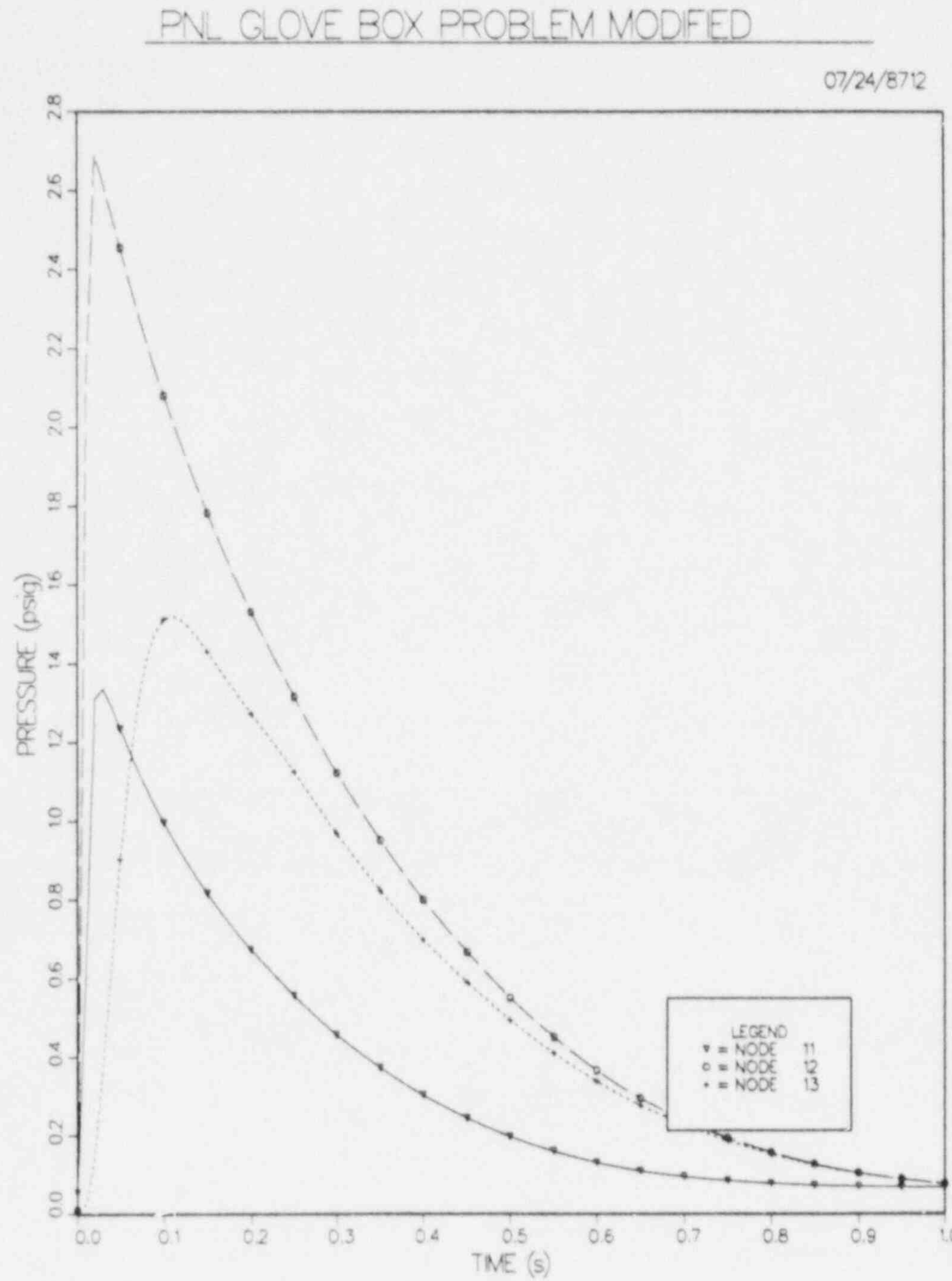


FIGURE 5.60. Pressure Time Histories for the TNT/Glovebox Explosion for Nodes 11, 12, and 13

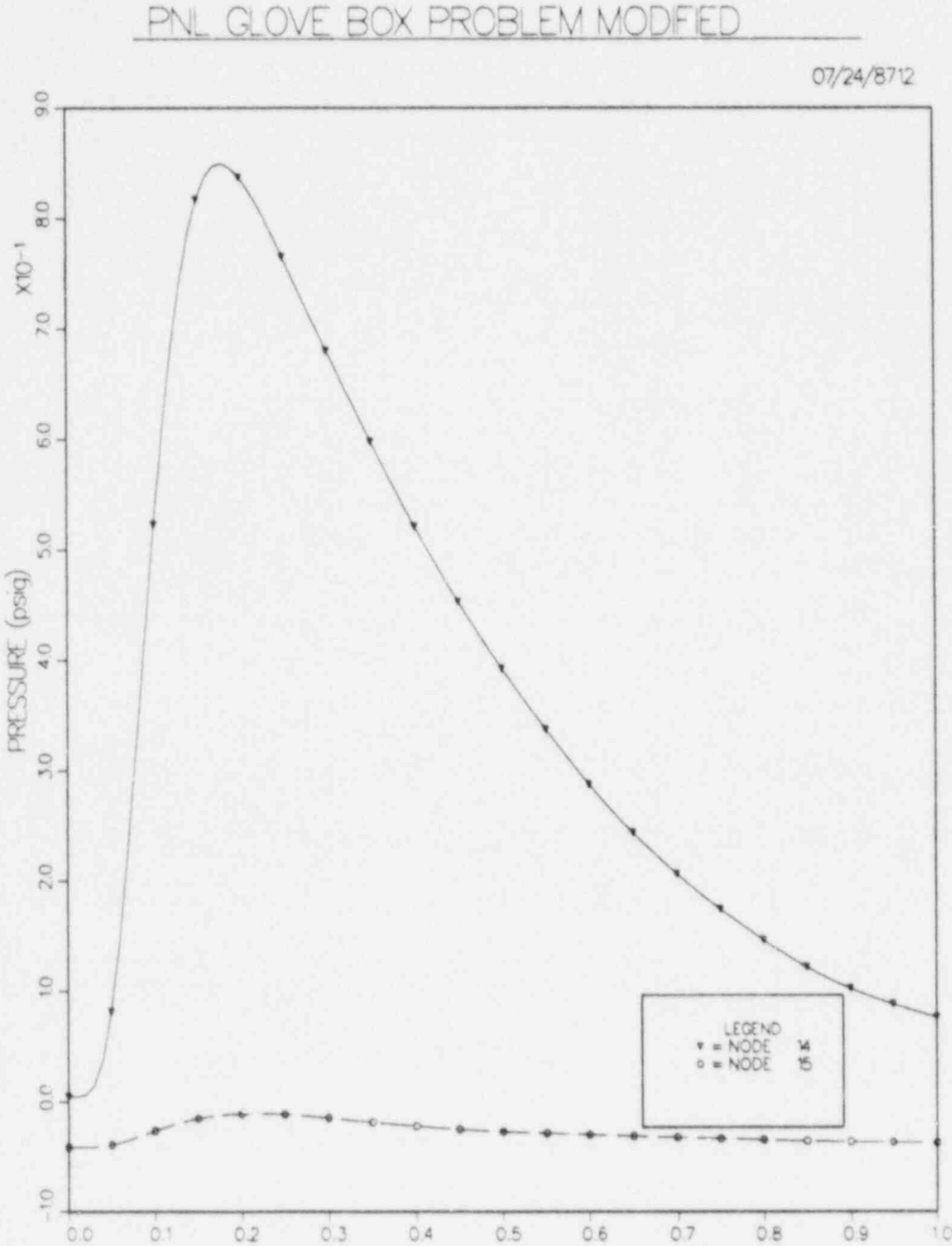


FIGURE 5.61. Pressure Time Histories for the TNT Glovebox Explosion for Nodes 14 and 15

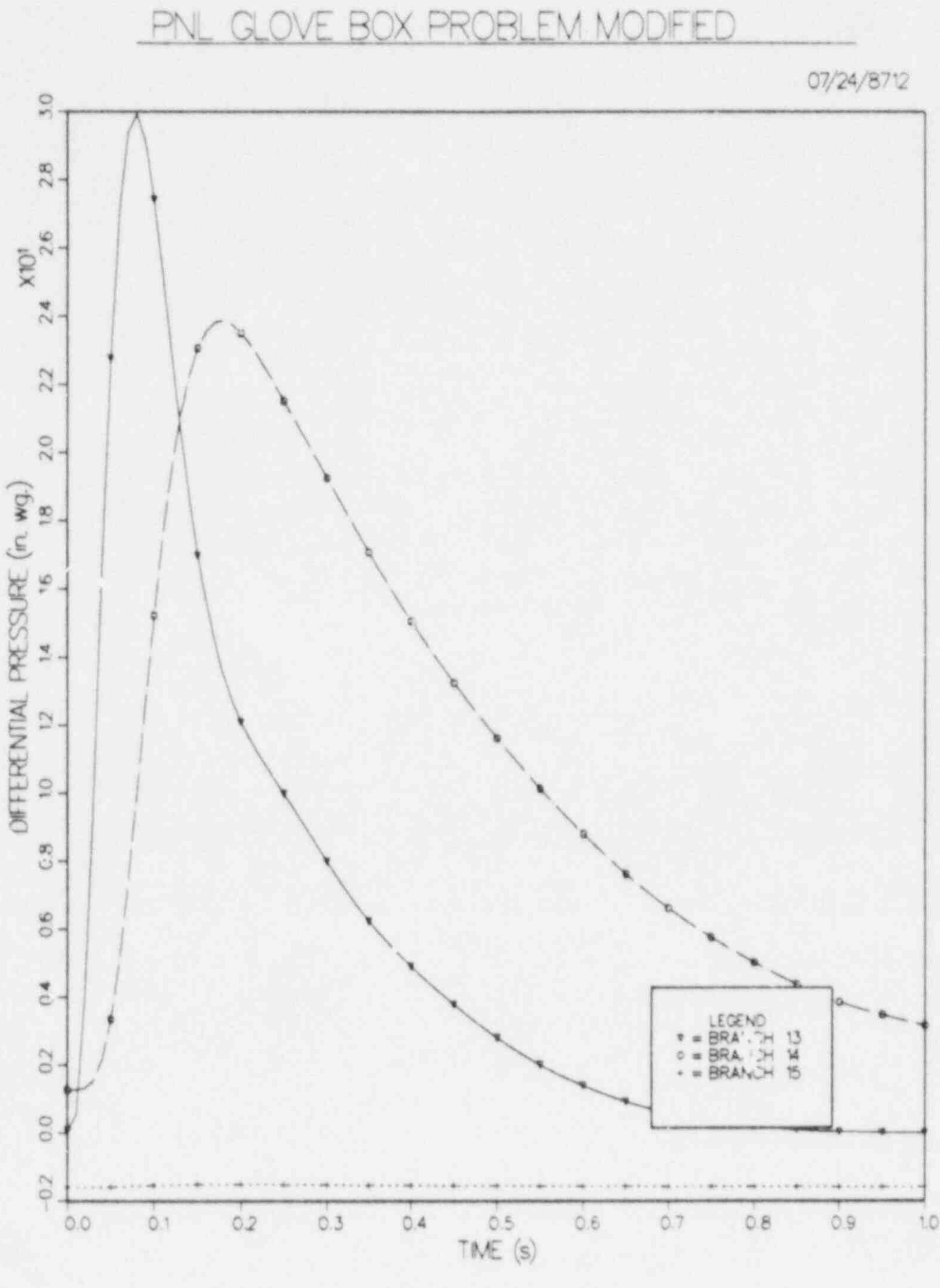


FIGURE 5.62. Differential Pressure Time Histories for the TNT/Glovebox Explosion for Branches 13, 14, and 15

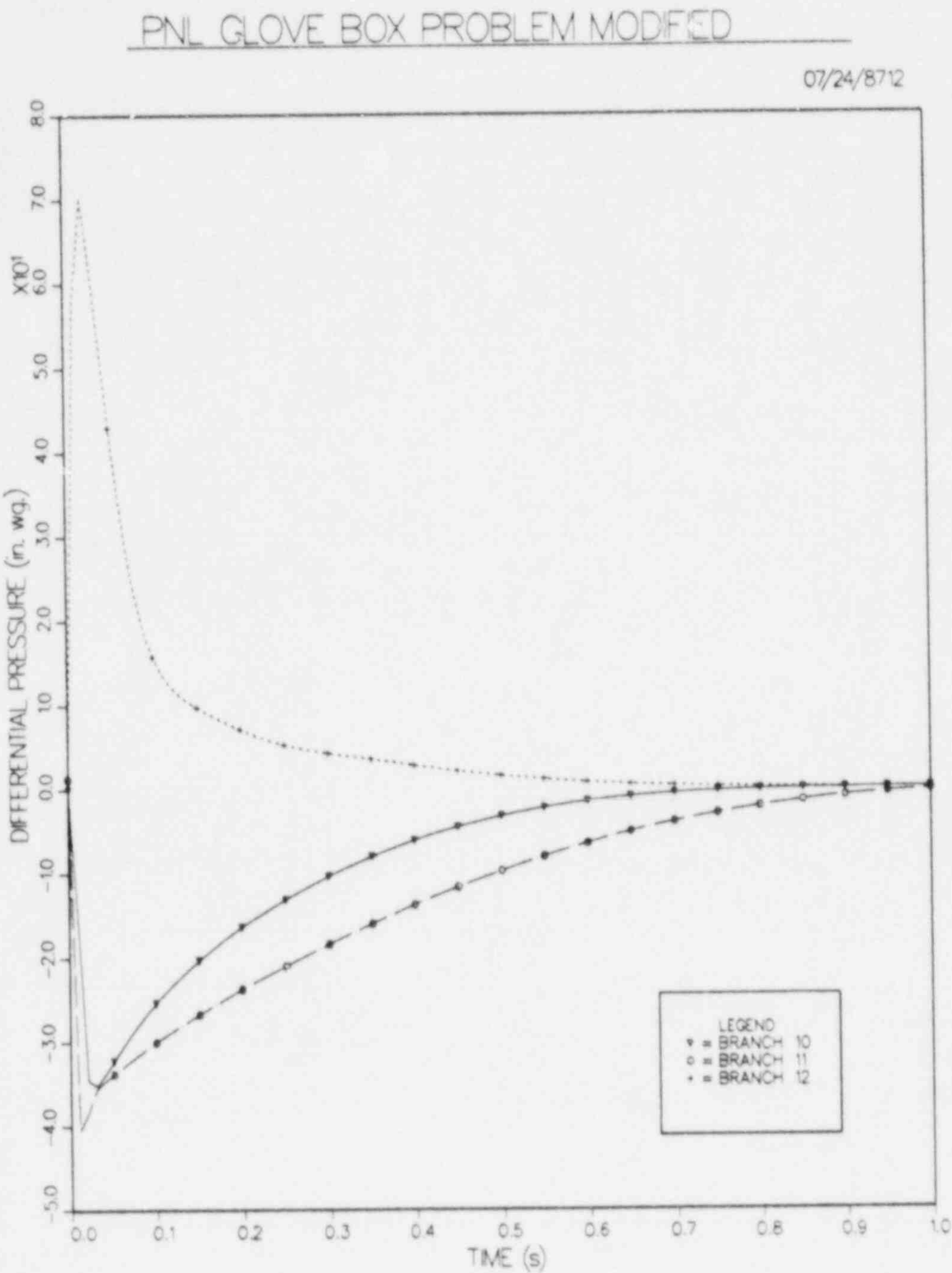


FIGURE 5.63. Differential Pressure Time Histories for the TNT/Glovebox Explosion for Branches 10, 11, and 12

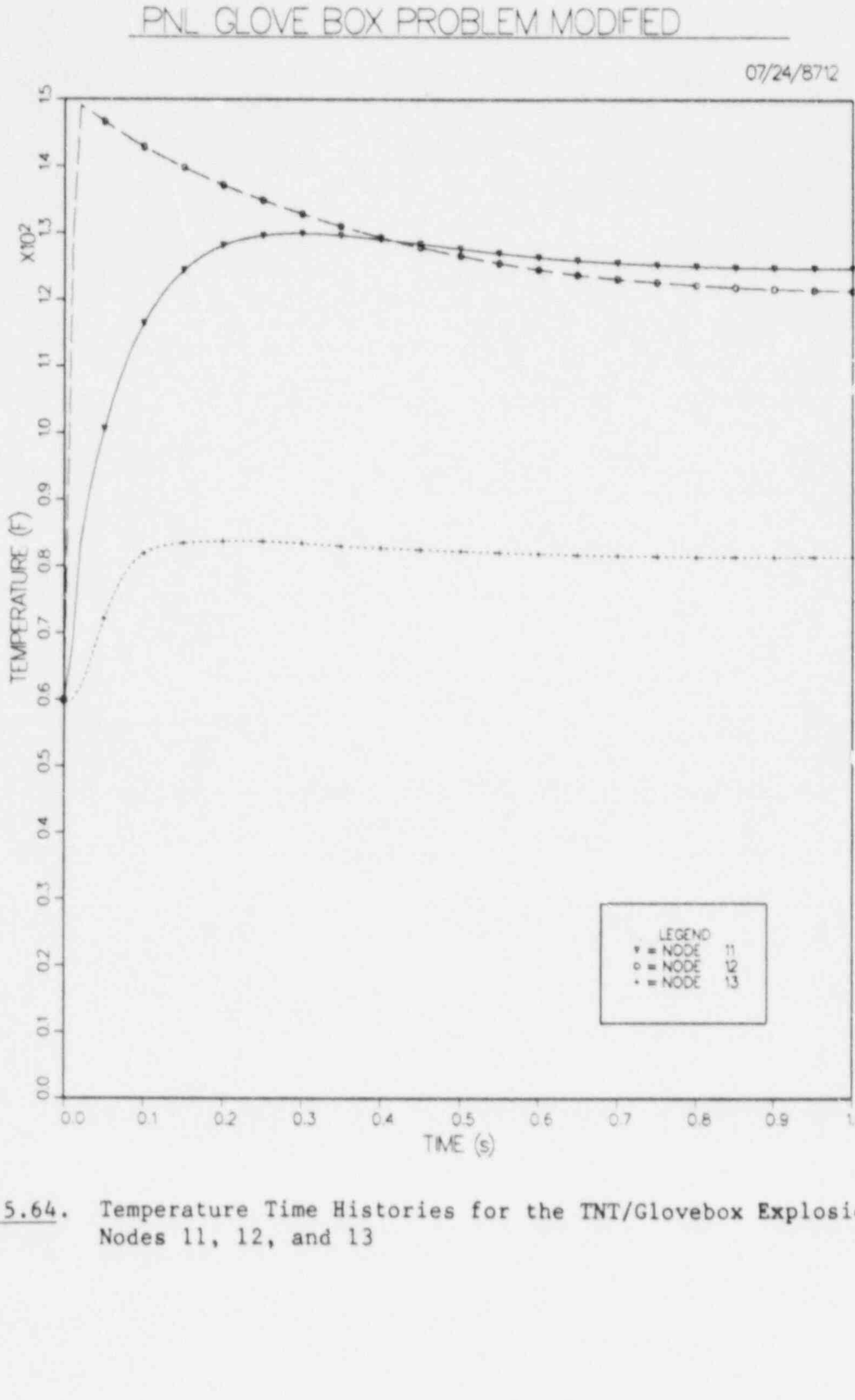


FIGURE 5.64. Temperature Time Histories for the TNT/Glovebox Explosion for Nodes 11, 12, and 13

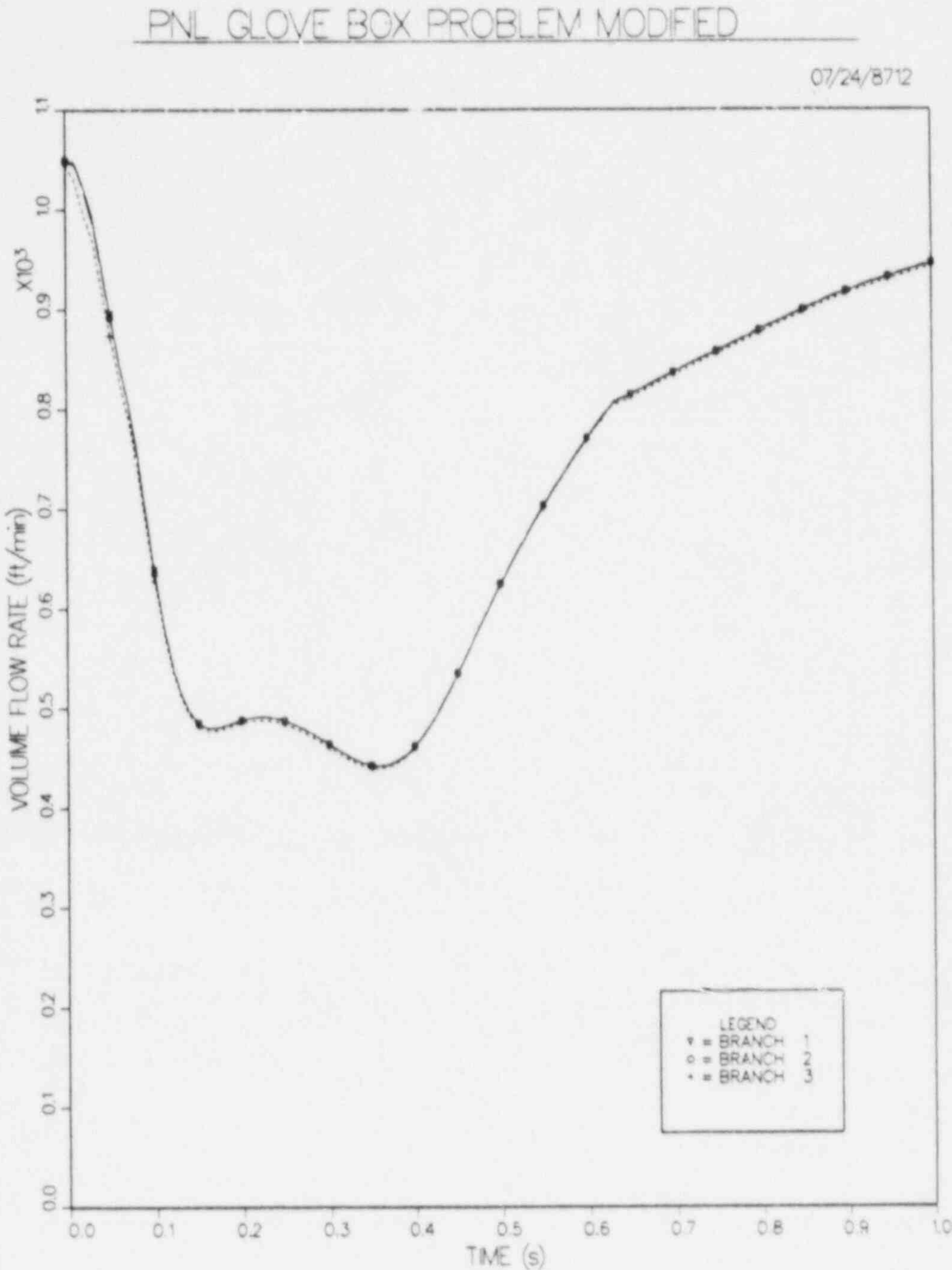


FIGURE 5.65. Volumetric Flow Rate Time Histories for the TNT/Glovebox Explosion for Branches 10, 11, and 12

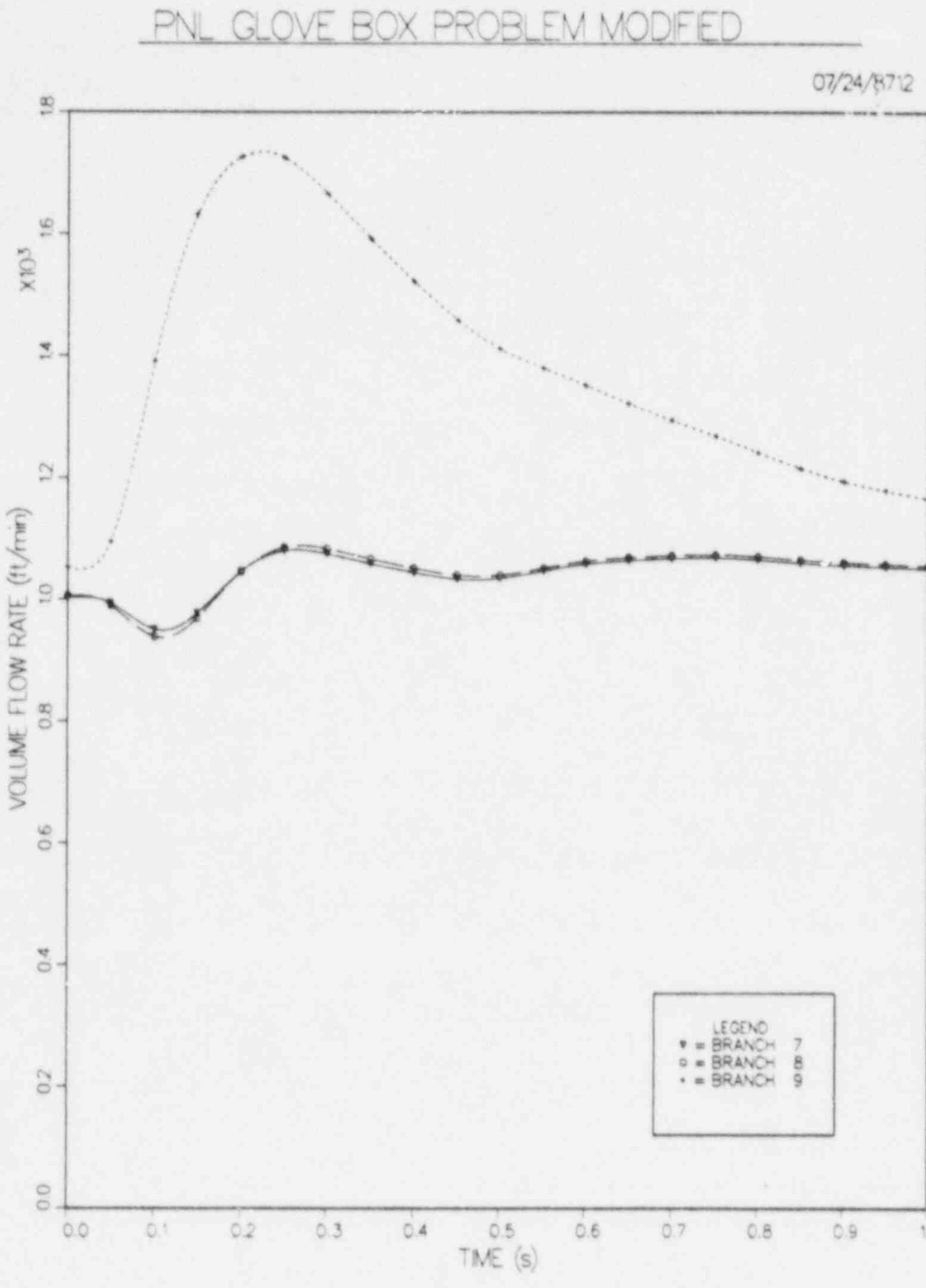


FIGURE 5.66. Volumetric Flow Rate Time Histories for the TNT/Glovebox Explosion for Branches 7, 8, and 9

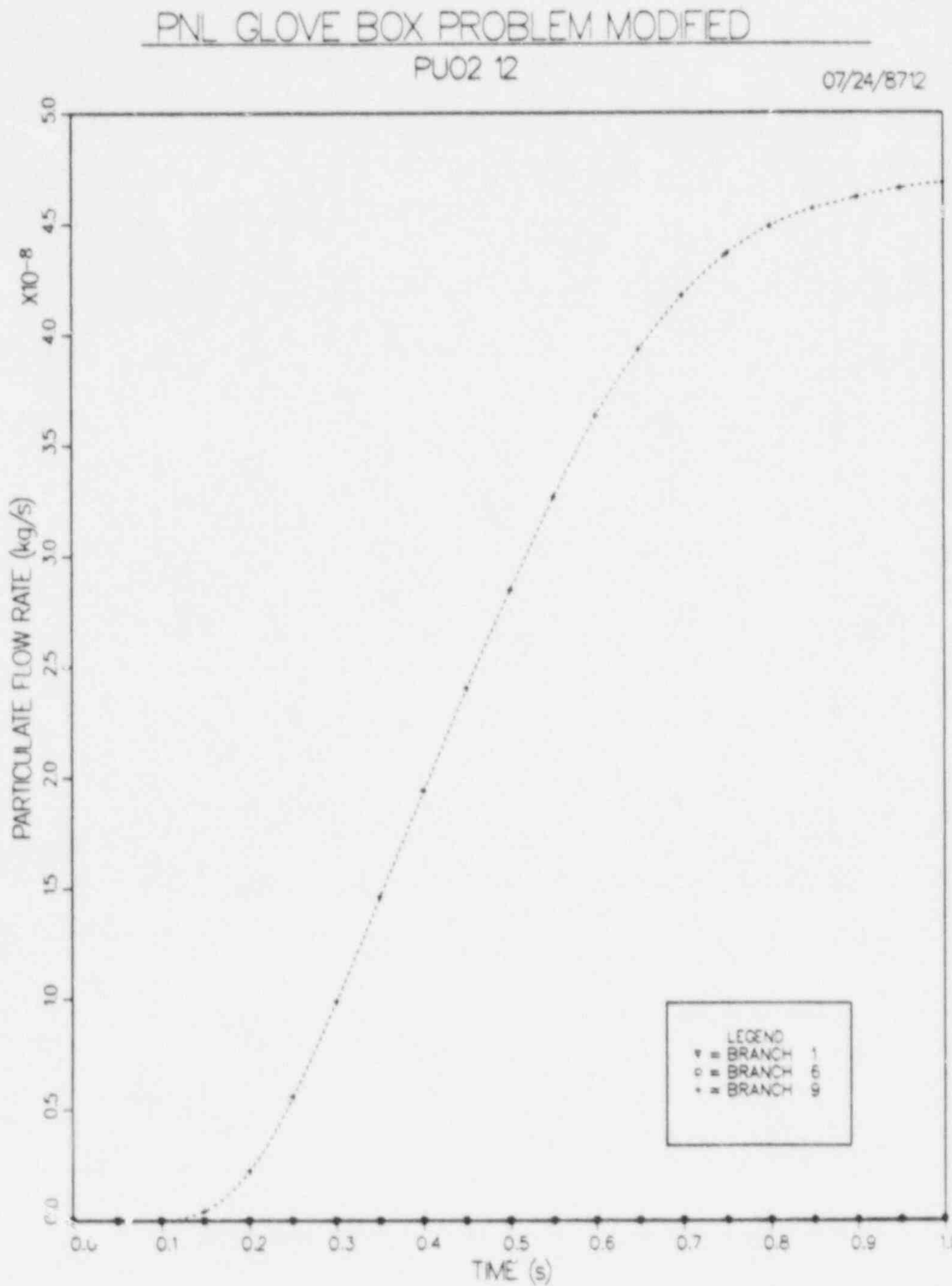


FIGURE 5.67. 12-μm PuO_2 Particulate Mass Flow Rate Time Histories for the TNT/Glovebox Explosion for Branches 1, 6, and 9

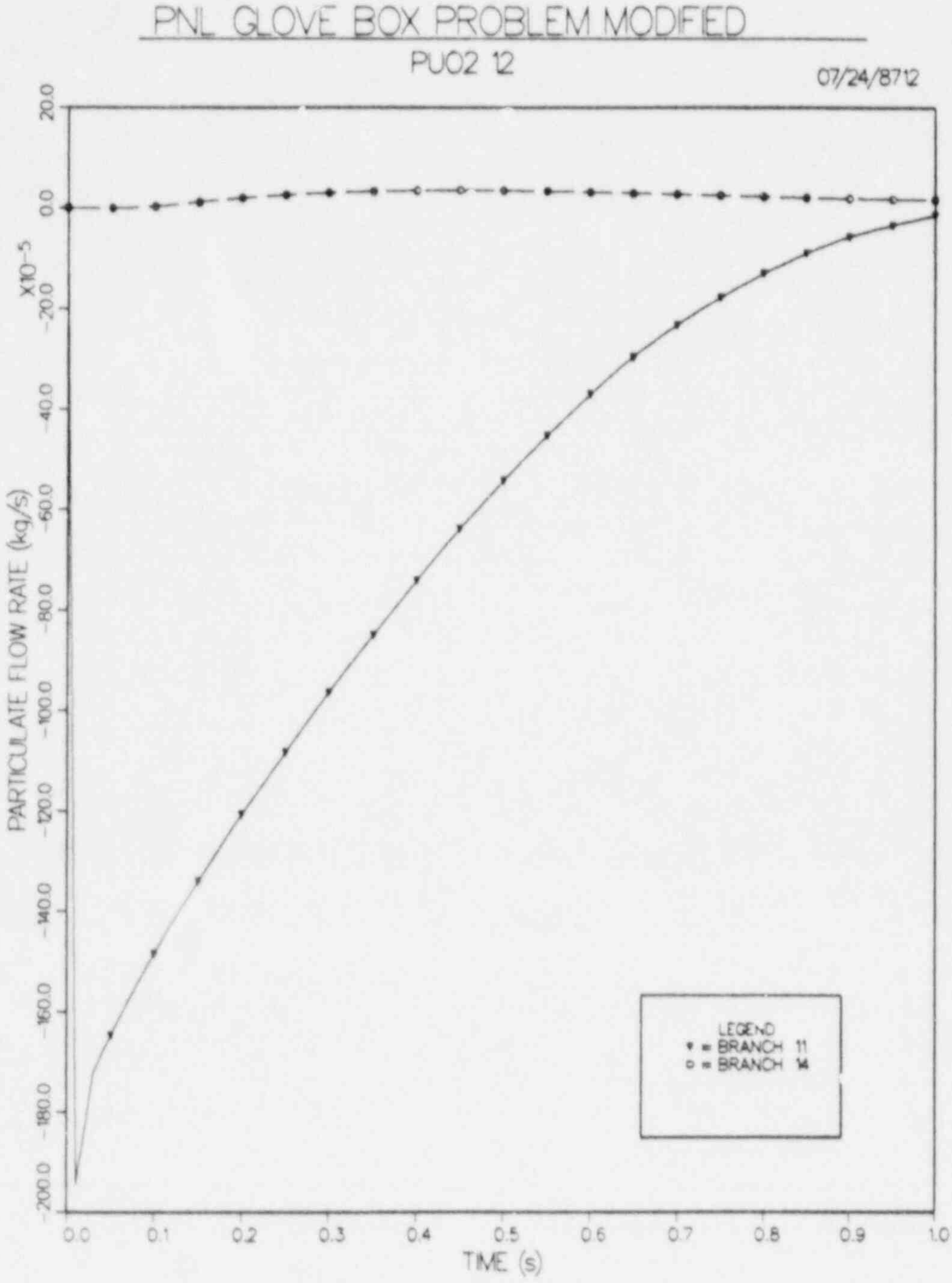


FIGURE 5.68. 12-μm PuO_2 Particulate Mass Flow Rate Time Histories for the TNT/Glovebox Explosion for Branches 11 and 14

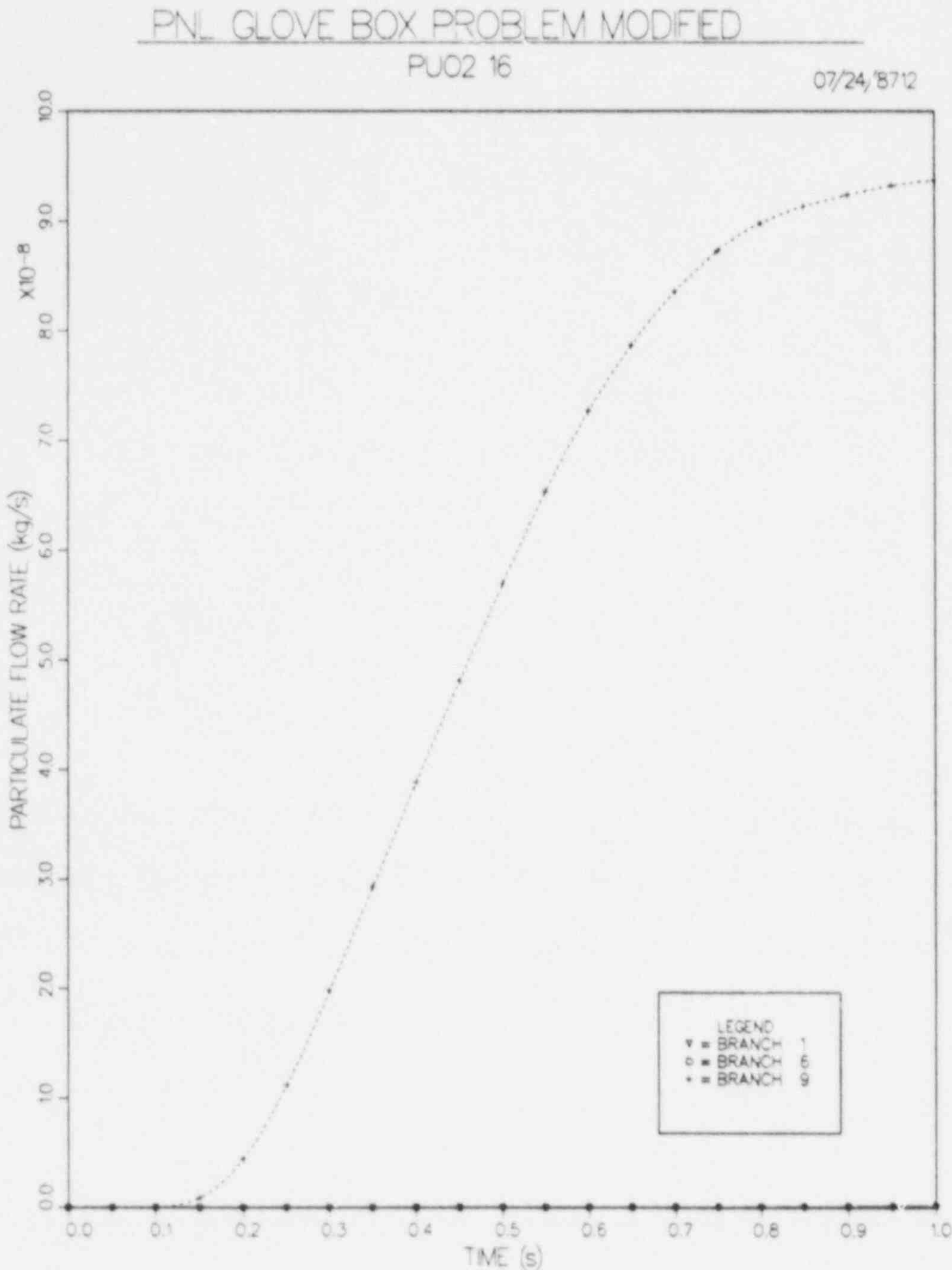


FIGURE 5.69. 16-μm PuO_2 Particulate Mass Flow Rate Time Histories for the TNT/Glovebox Explosion for Branches 1, 6, and 9

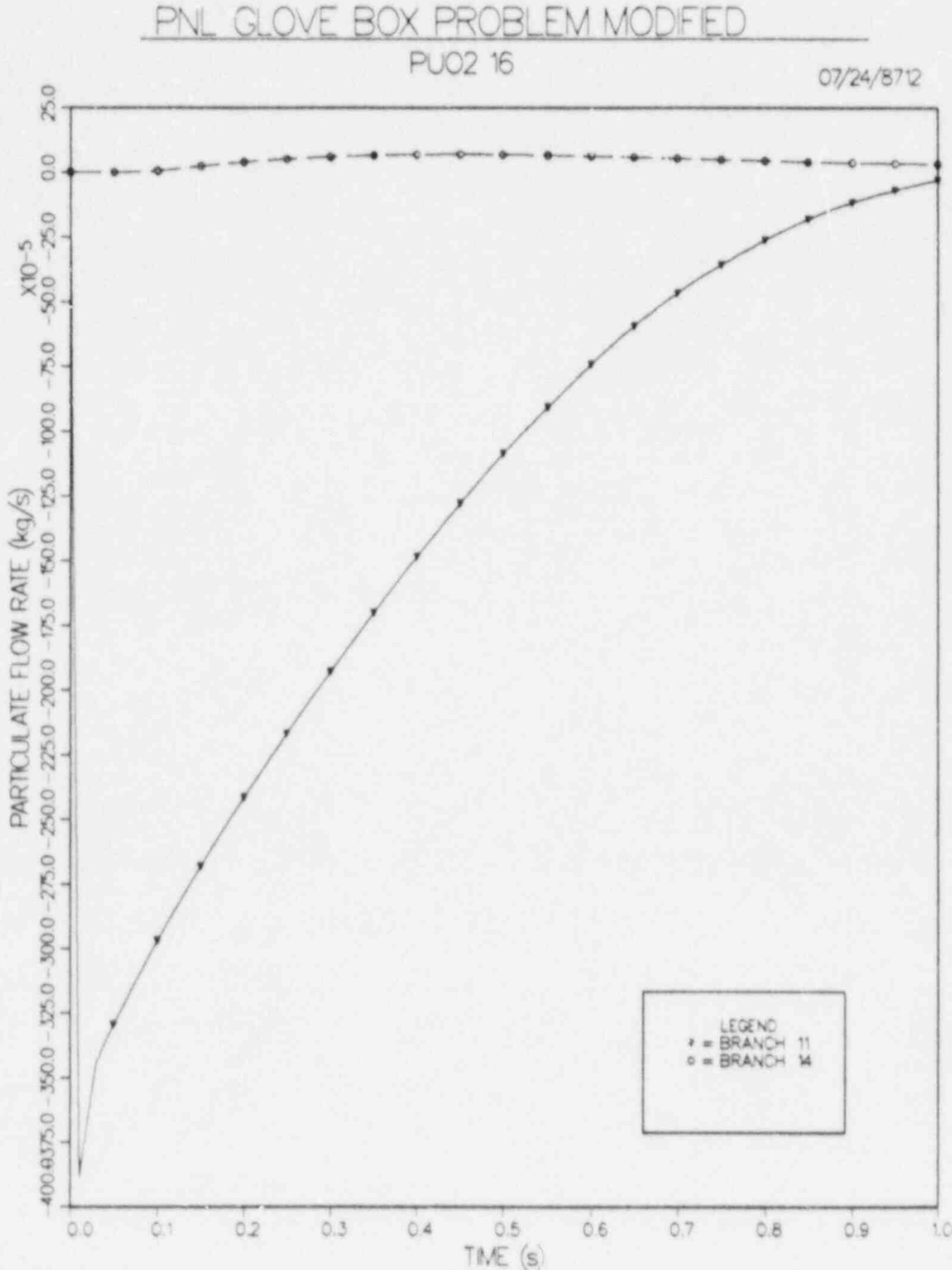


FIGURE 5.70. 16-μm PuO_2 Particulate Mass Flow Rate Time Histories for the TNT/Glovebox Explosion for Branches 11 and 14

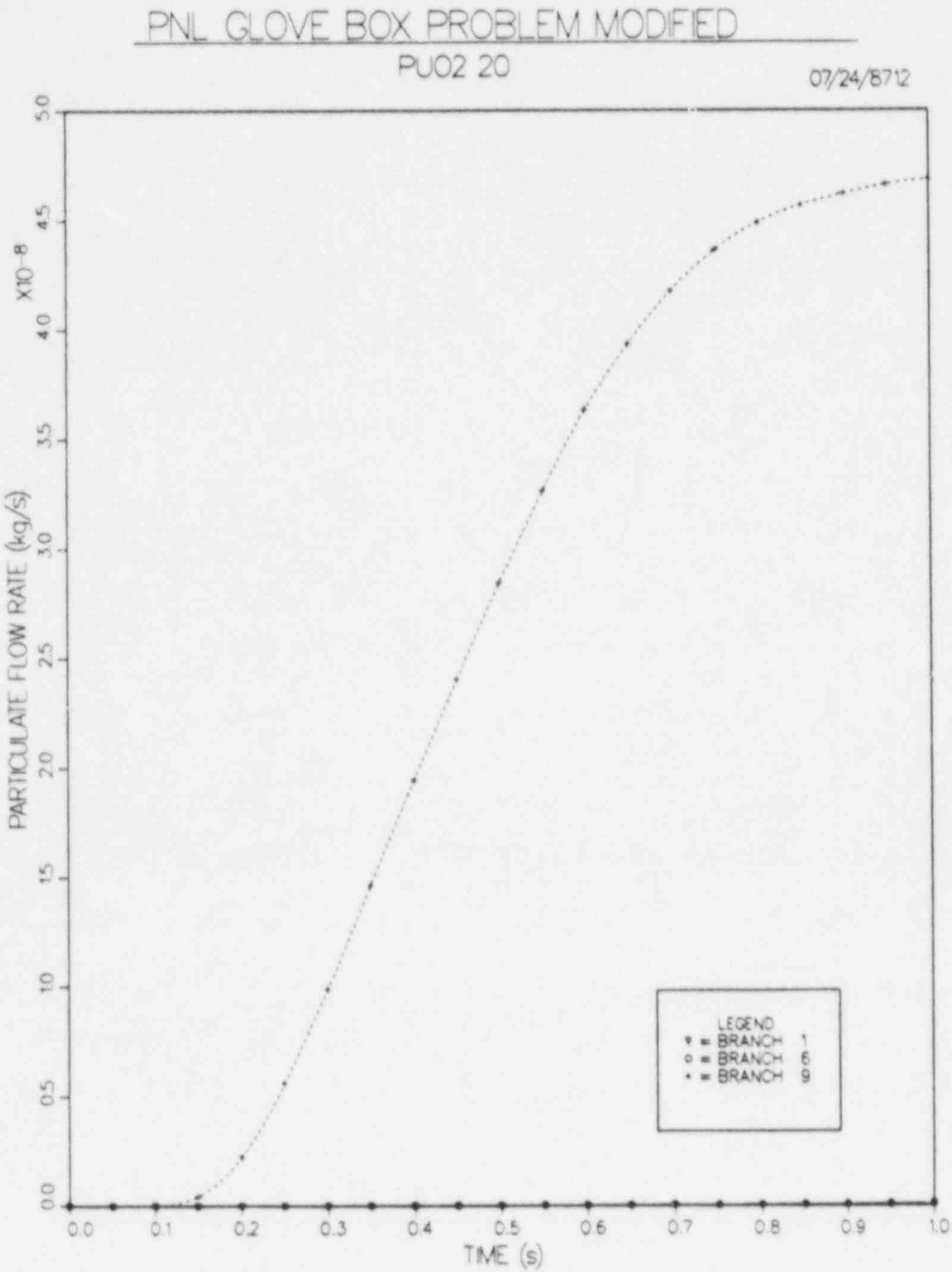


FIGURE 5.71. 20-μm PuO_2 Particulate Mass Flow Rate Time Histories for the TNT/Glovebox Explosion for Branches 1, 6 and 9

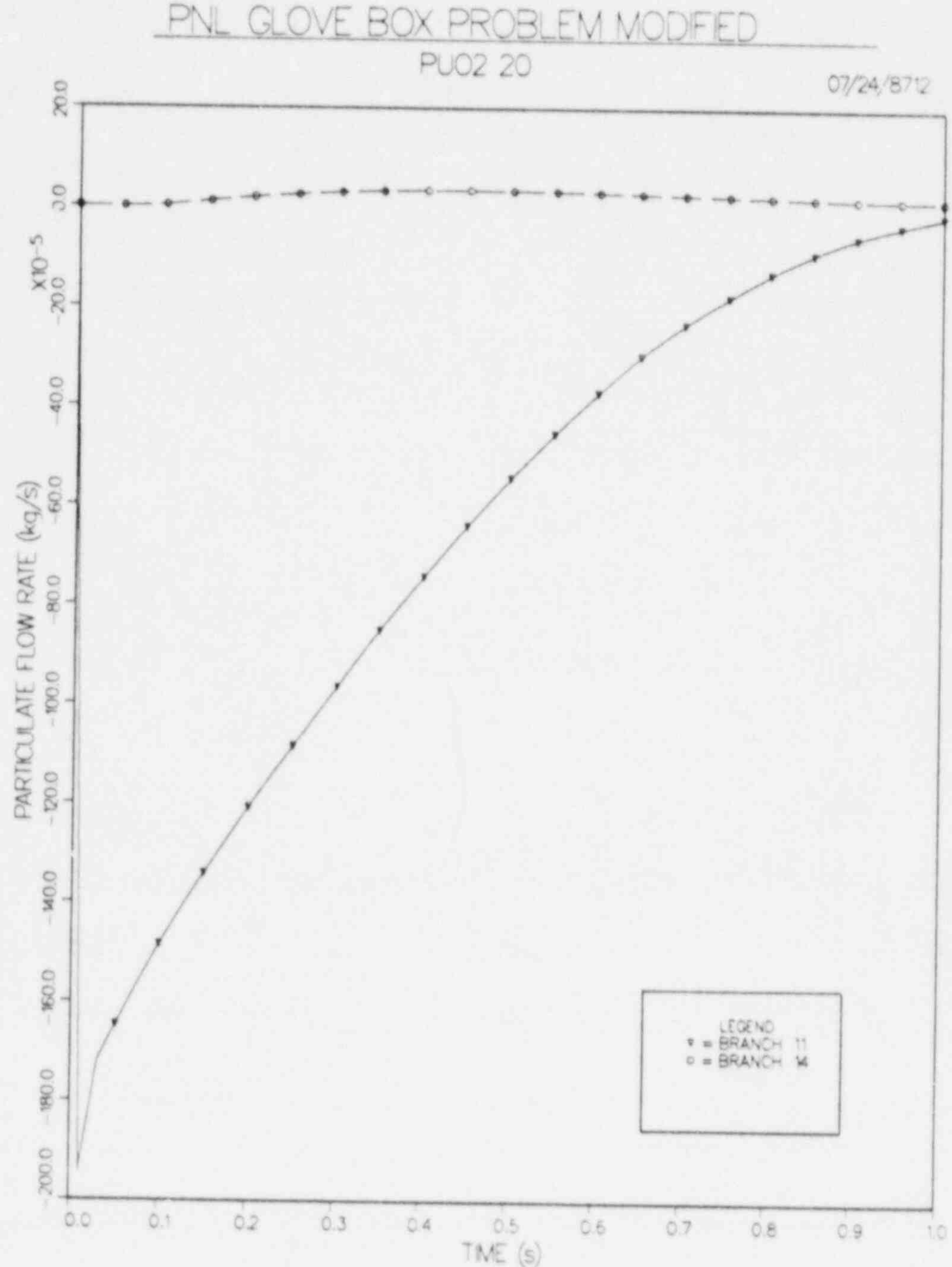


FIGURE 5.72. 20-μm PuO_2 Particulate Mass Flow Rate Time Histories for the TNT/Glovebox Explosion for Branches 11 and 14

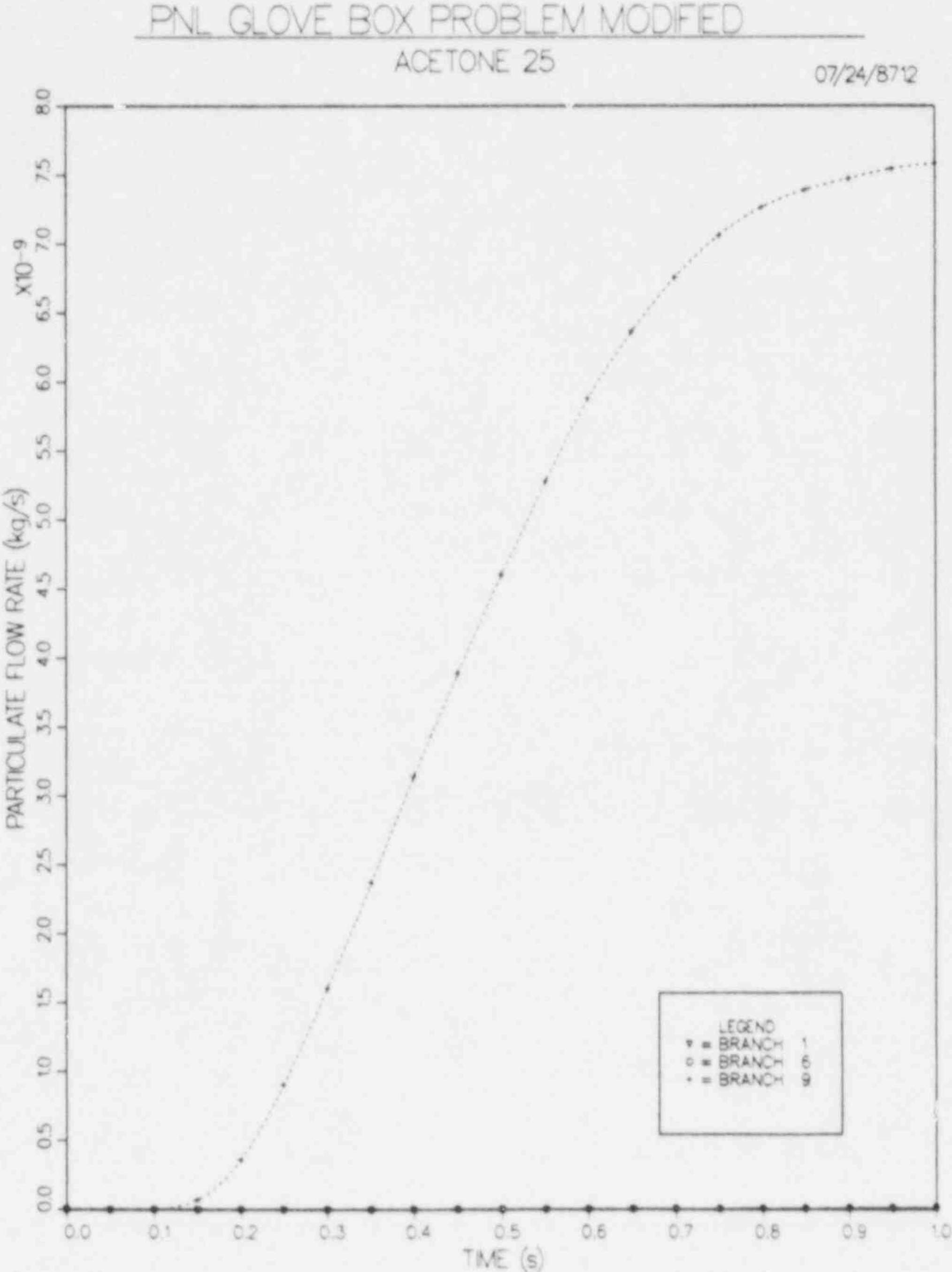


FIGURE 5.73. 25-μm Acetone Aerosol Mass Flow Rate Time Histories for the TNT/Glovebox Explosion for Branches 1, 6 and 9

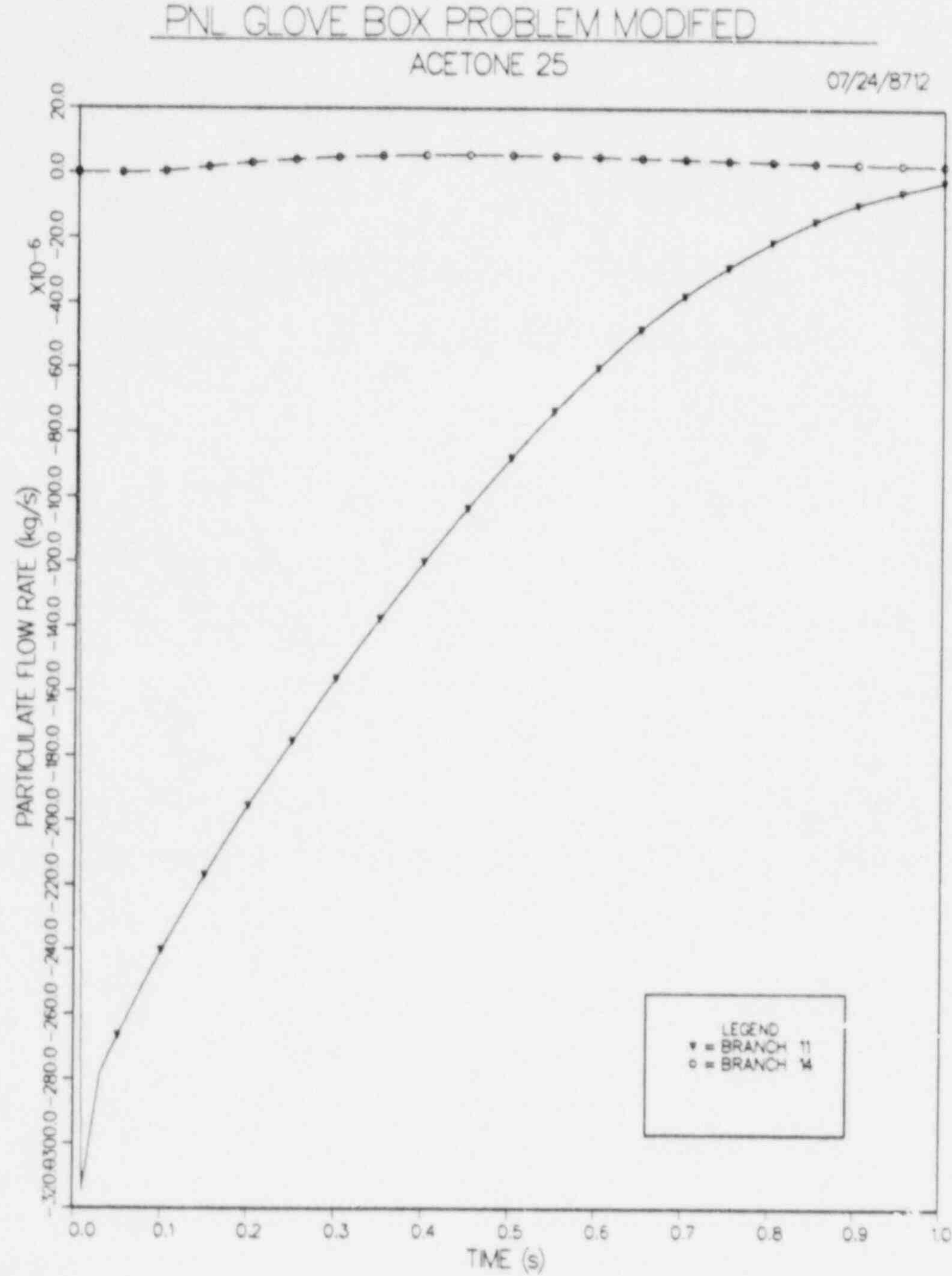


FIGURE 5.74. 25-μm Acetone Aerosol Mass Flow Rate Time Histories for the TNT/Glovebox Explosion for Branches 11 and 14

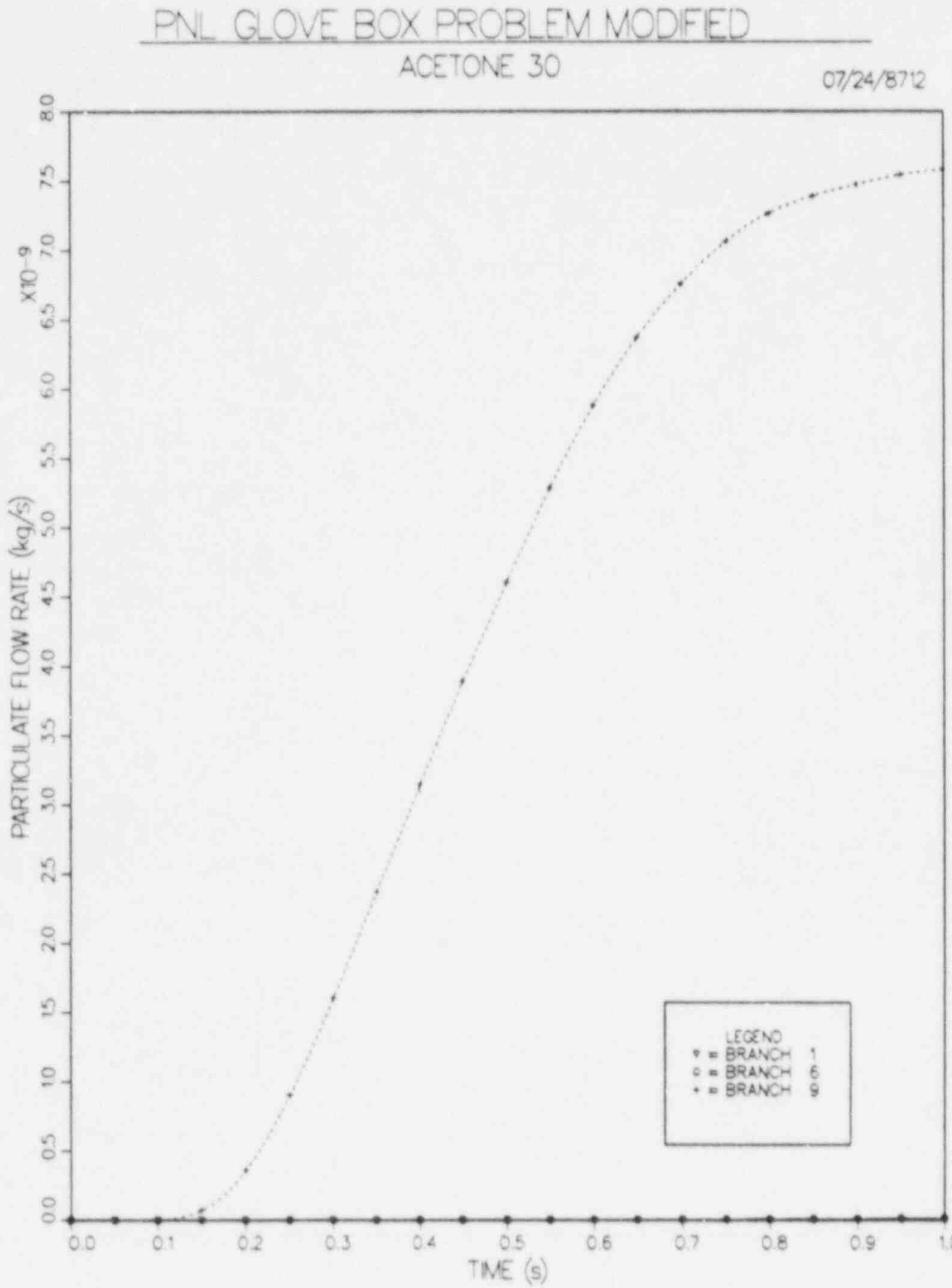


FIGURE 5.75. 30-μm Acetone Aerosol Mass Flow Rate Time Histories for the TNT/Glovebox Explosion for Branches 1, 6 and 9

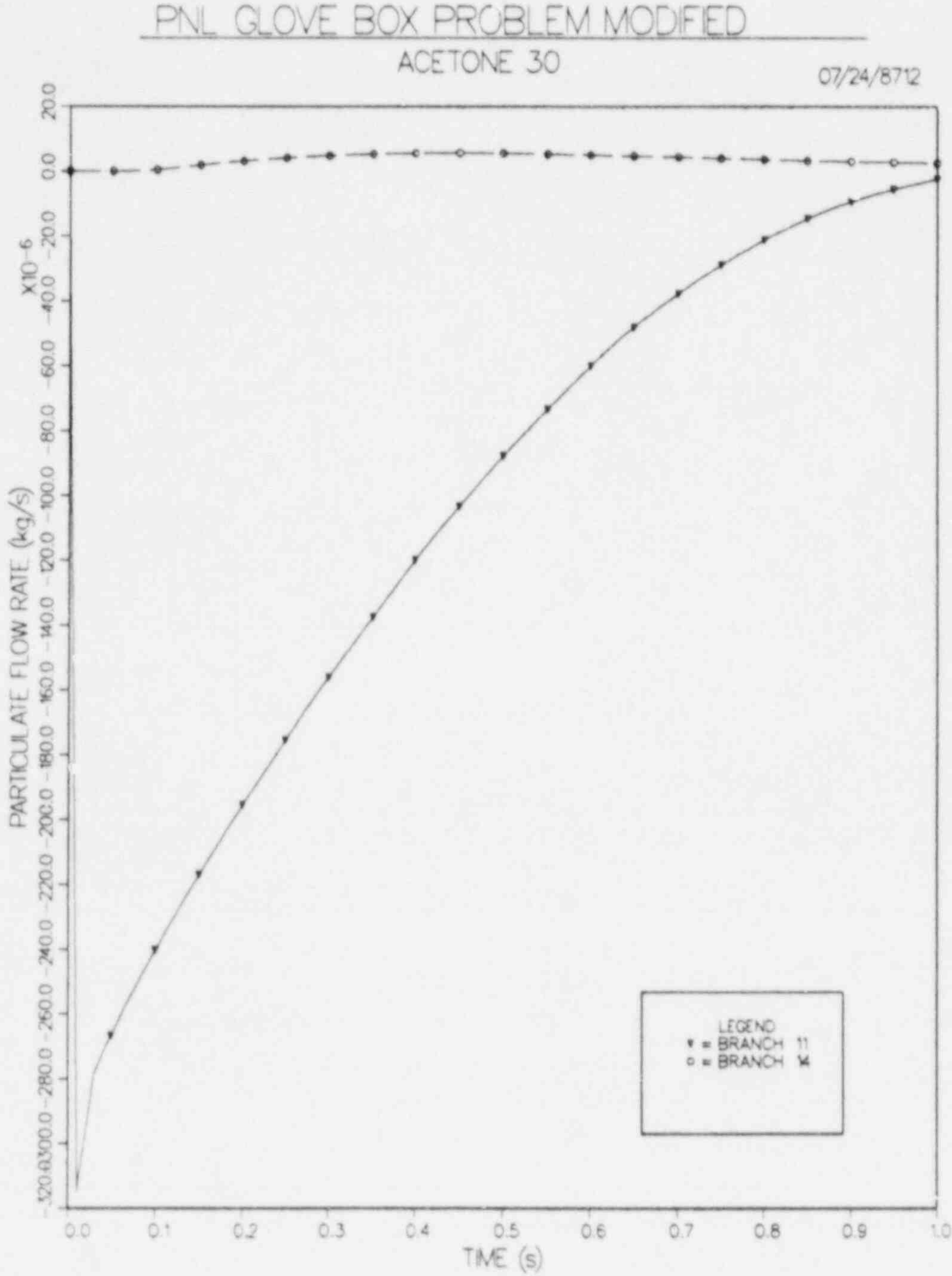


FIGURE 5.76. 30-μm Acetone Aerosol Mass Flow Rate Time Histories for the TNT/Glovebox Explosion for Branches 11 and 14

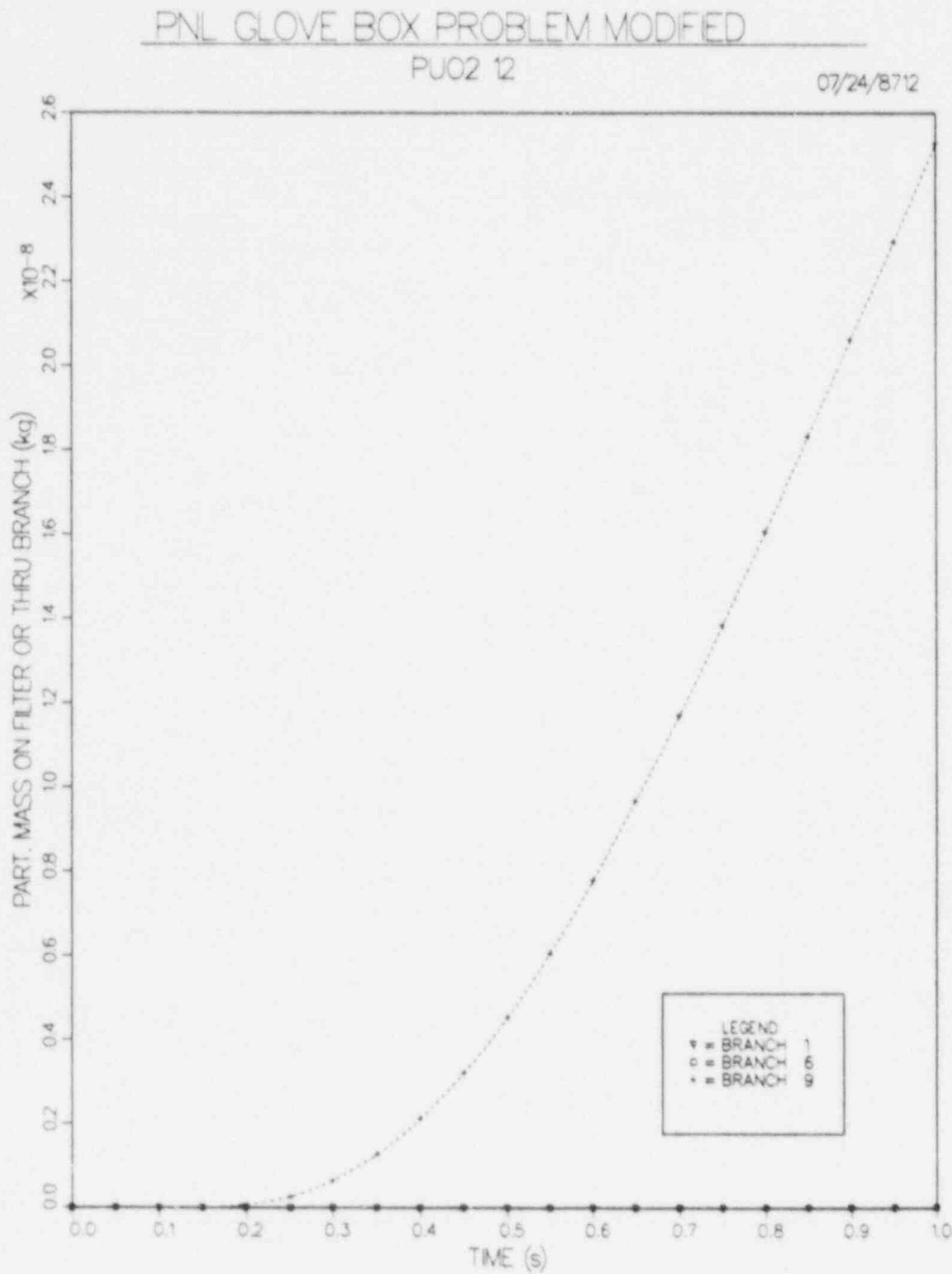


FIGURE 5.77. 12-μm PuO_2 Particulate Mass Accumulated on a Filter or Moved Through a Branch as a Function of Time for the TNT/Glovebox Explosion for Branches 1, 6, and 9

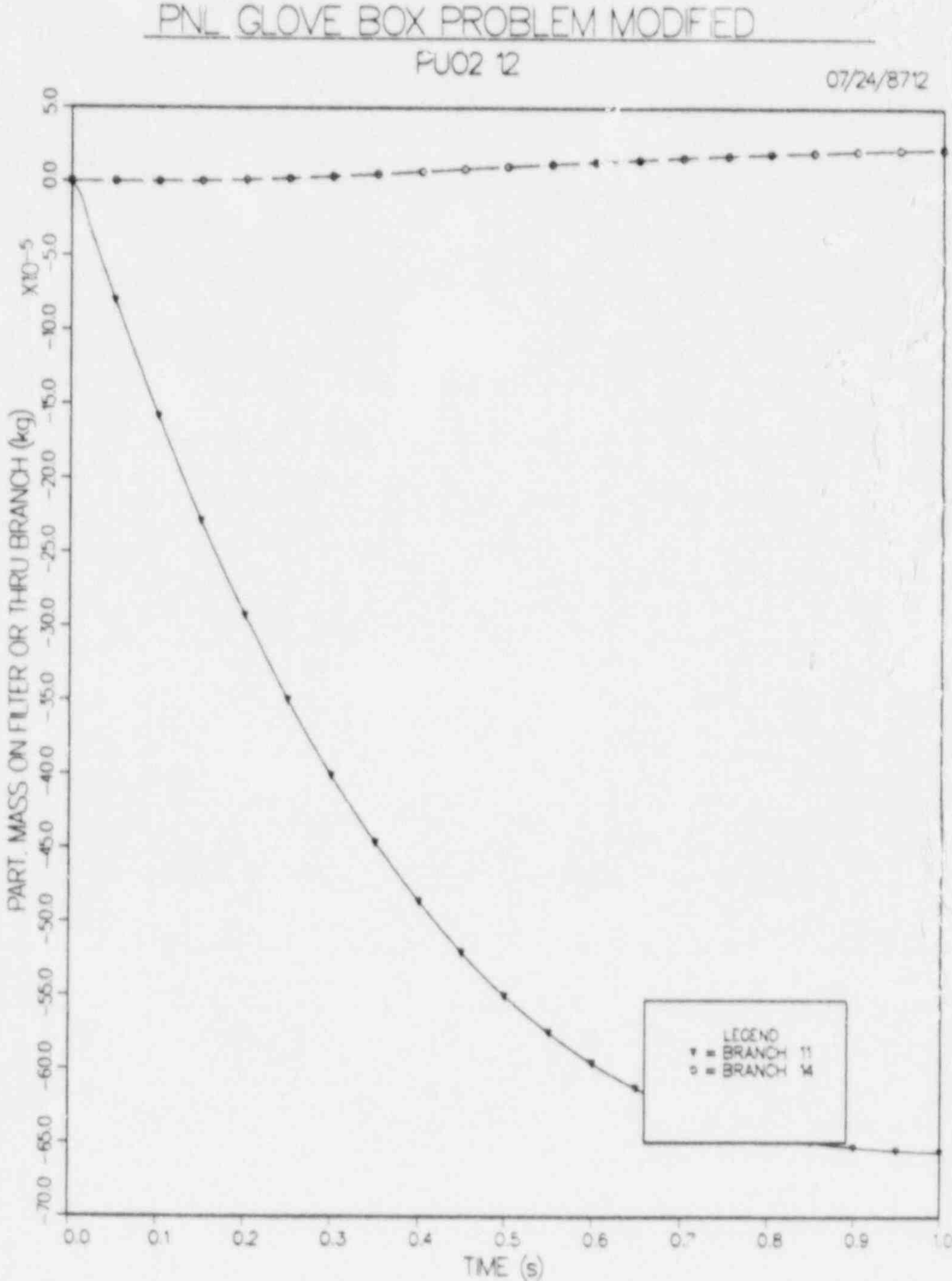


FIGURE 5.78. 12-μm PuO_2 Particulate Mass Accumulated on a Filter or Moved Through a Branch as a Function of Time for the TNT/Glovebox Explosion for Branches 11 and 14

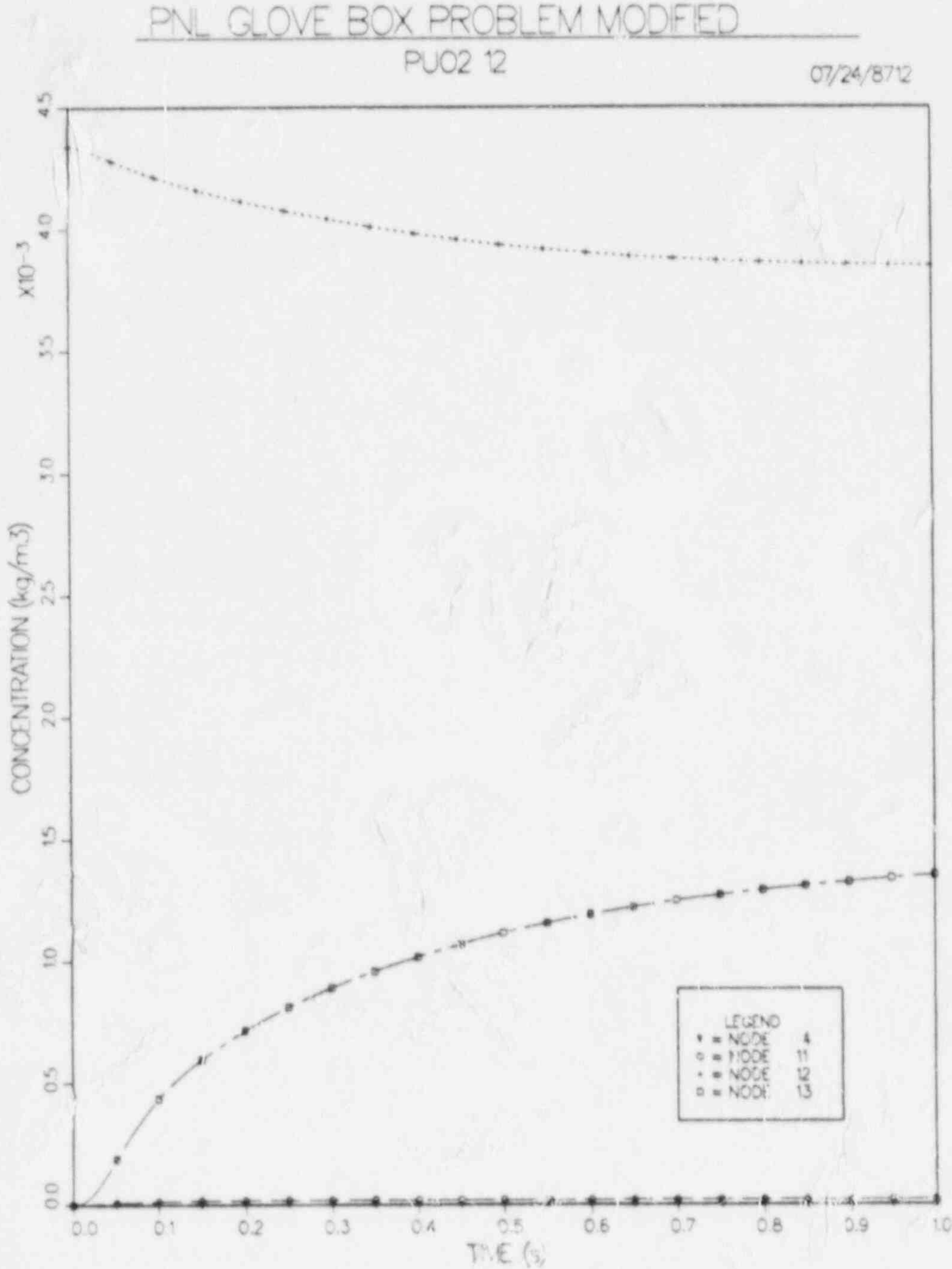


FIGURE 5.79. 12-μm PuO_2 Particulate Mass Concentration as a Function of Time for the TNT/Glovebox Explosion for Nodes 4, 11, 12, and 13

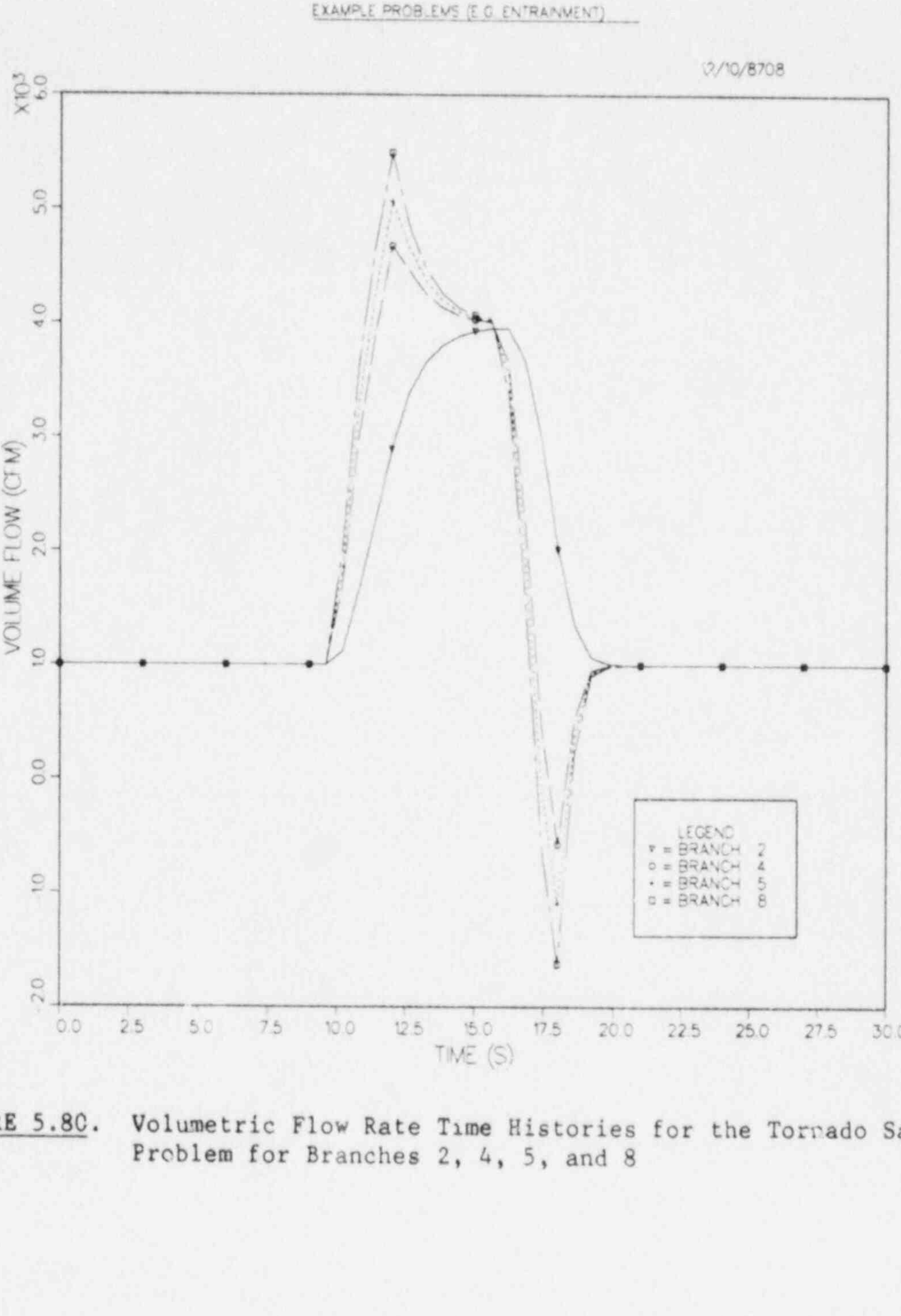


FIGURE 5.80. Volumetric Flow Rate Time Histories for the Tornado Sample Problem for Branches 2, 4, 5, and 8

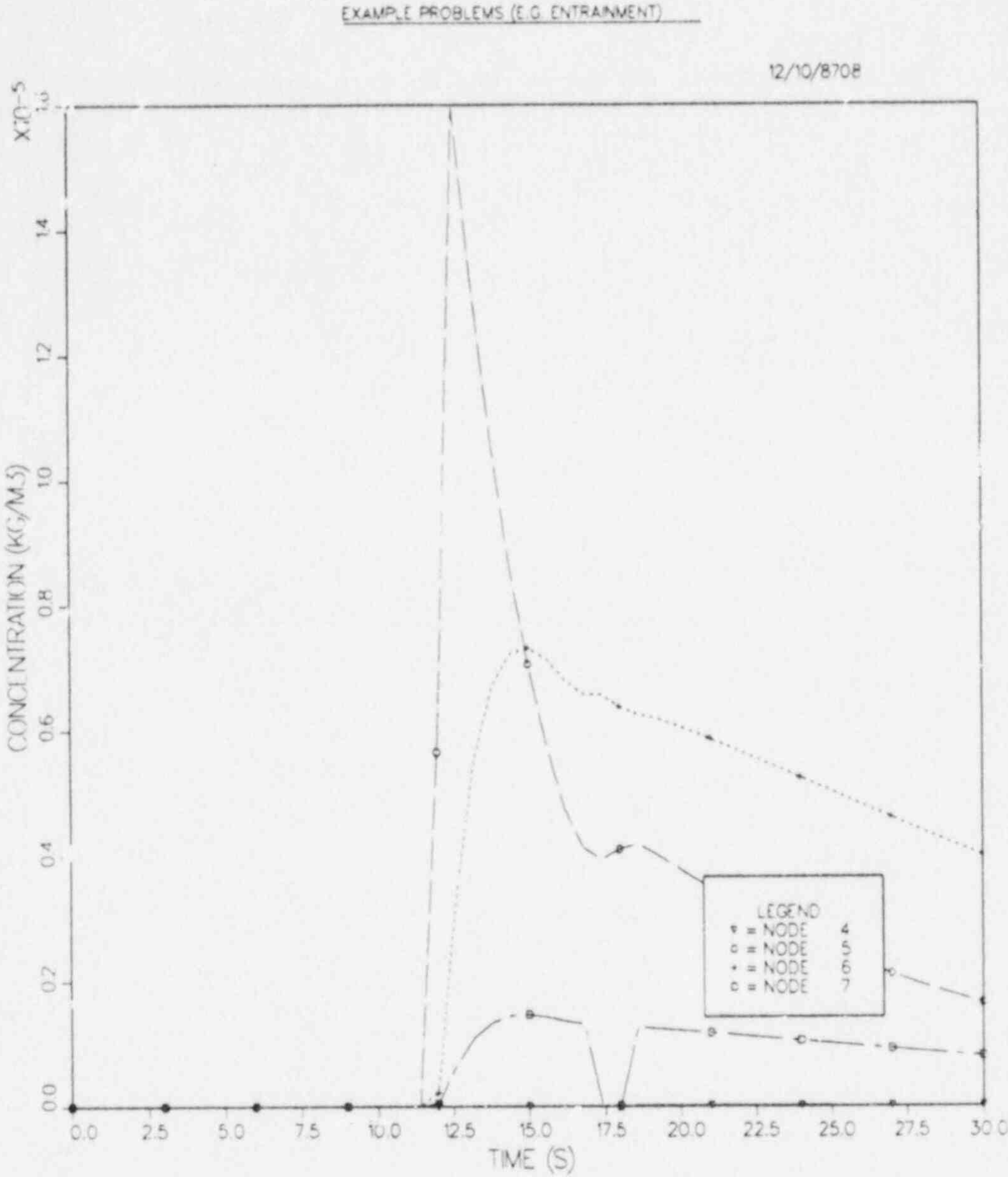


FIGURE 5.81. Particulate Mass Concentration as a Function for the Tornado Sample Problem for Nodes 4, 5, 6, and 7

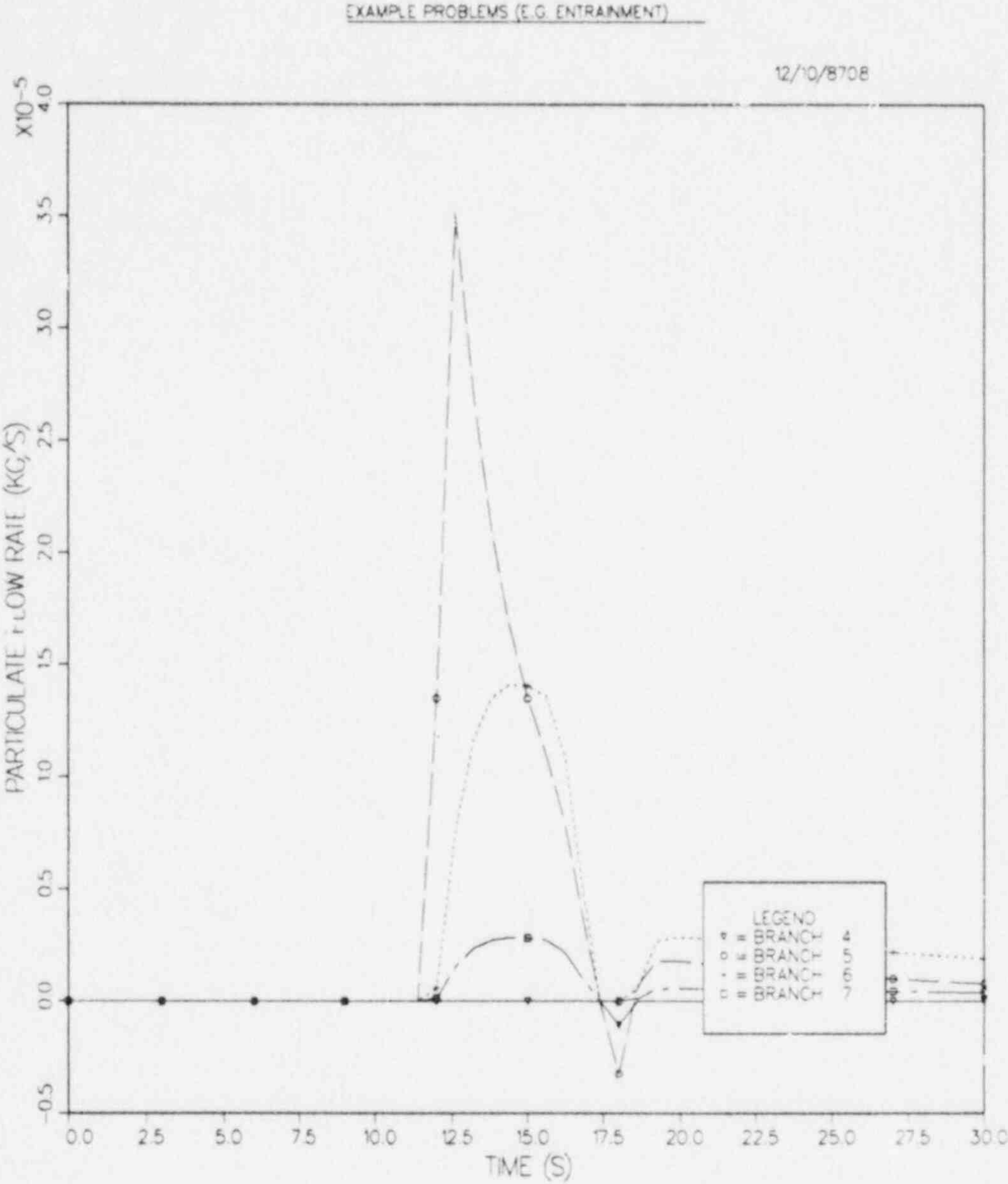


FIGURE 5.82. Particulate Mass Flow Rate Time Histories for the Tornado Sample Problem for Branches 4, 5, 6, and 7

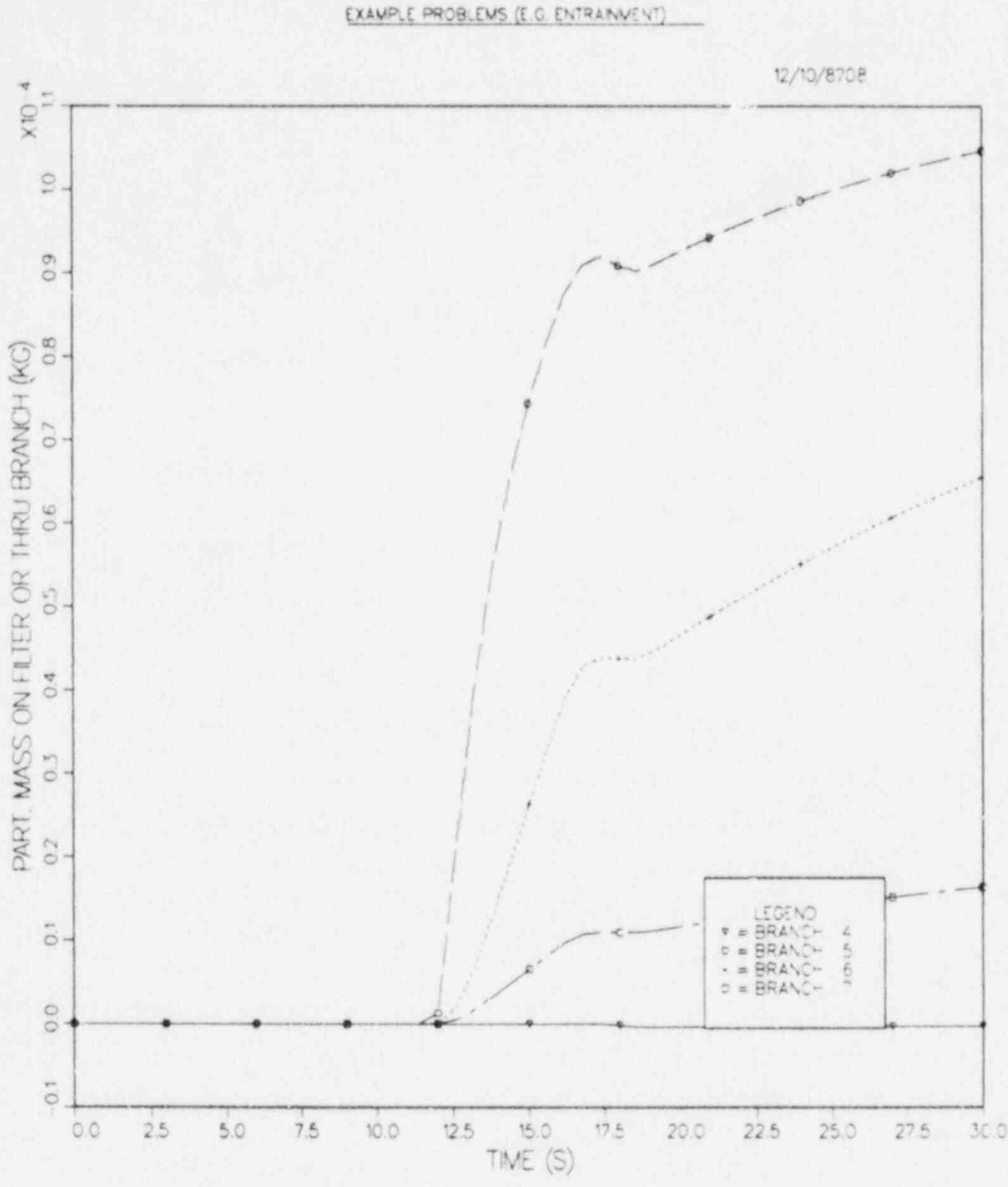


FIGURE 5.83. Particulate Mass Accumulated on a Filter or Moved Through a Branch as a Function of Time for the Tornado Sample Problem for Branches 4, 5, 6, and 7

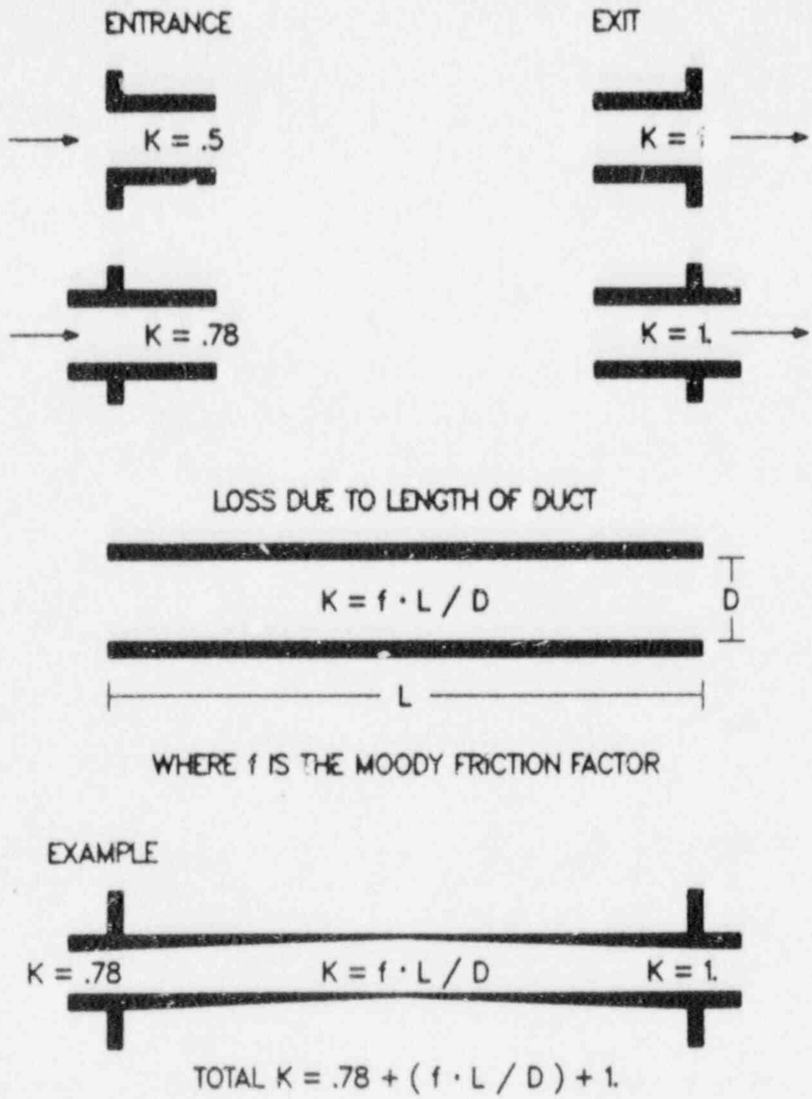
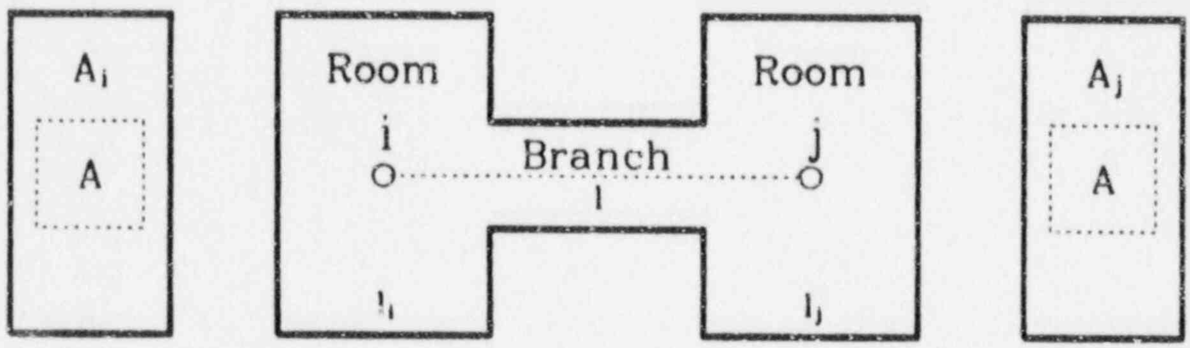


FIGURE 5.84. Effective Resistance Coefficient Parameter Definition Sketch

INERTIA



$$l_I = \frac{l_i}{2}\left(\frac{A}{A_I}\right) + l + \frac{l_j}{2}\left(\frac{A}{A_J}\right)$$

FIGURE 5.85. Branch Resistance Calculation Form

APPENDIX A

SUPPORTING DOCUMENTS

APPENDIX A

SUPPORTING DOCUMENTS

Ballinger, M. Y., J. W. Buck, P. C. Owczarski, and J. E. Ayer. 1987. Methods for Describing Airborne Fractions of Free Fall Spills of Powders and Liquids. NUREG/CR-4997, U.S. Nuclear Regulatory Commission, Washington, D.C.

Ballinger, M. Y., and W. H. Hodgson. 1986. Aerosols Generated by Spills of Viscous Solutions and Slurries. NUREG/CR-4658, U.S. Nuclear Regulatory Commission, Washington, D.C.

Ballinger, M. Y., S. L. Sutter, and W. H. Hodgson. 1987. New Data for Aerosols Generated by Releases of Pressurized Powders and Solutions in Static Air. NUREG/CR-4779, U.S. Nuclear Regulatory Commission, Washington, D.C.

Chan, M.K.W., and J. Mishima. 1983. Characteristics of Combustion Products: A Review of the Literature. NUREG/CR-2658, U.S. Nuclear Regulatory Commission, Washington, D.C.

Chan, M.K.W., M. Y. Ballinger, P. C. Owczarski, and S. L. Sutter. 1985. Draft: User's Manual for FIRIN: A Computer Code to Estimate Accidental Fire and Radioactive Source Term Releases in Nuclear Fuel Cycle Facilities. NUREG/CR-3037, U.S. Nuclear Regulatory Commission, Washington, D.C.

Glissmeyer, J. A. 1983. Review of Models Applicable to Accident Aerosols. NUREG/CR-2835, U.S. Nuclear Regulatory Commission, Washington, D.C.

Gregory, W., S., R. W. Andrea, J. W. Bolstad, R. A. Martih, and P. K. Tang. 1985. TORAC User's Manual: A Computer Code for Analysis of Tornado-Induced Flow and Material Transport in Nuclear Facilities. LA-10435-M, NUREG/CR-4260, los Alamos National Laboratory, Los Alamos, New Mexico.

Halverson, M. A., and J. Mishima. 1986. Initial Concepts on Energetics and Mass Releases During Explosive Events in Fuel Cycle Facilities. NUREG/CR-4593, U.S. Nuclear Regulatory Commission, Washington, D.C.

Halverson, M. A., M. Y. Ballinger and G. W. Dennis. 1987. Combustion Aerosols Formed During Burning of Radioactively Contaminated Materials-Experimental Results. NUREG/CR-4736, U.S. Nuclear Regulatory Commission, Washington, D.C.

Nichals, B. D., and W. S. Gregory. 1986. FIRAC User's Manual: A Computer Code to Simulate Fire Accidents in Nuclear Facilities. NUREG/CR-4561, U.S. Nuclear Regulatory Commission, Washington, D.C.

Steciak, J. A. Tewarson, and J. S. Newman. 1983. Fire Properties of Combustible Materials Commonly Found in Nuclear Fuel Cycle Facilities. FMRC J. 1. 0G3R8.RC, Factory Mutual Research, Norwood, Massachusetts.

Sutter, S. L., J. W. Johnston, J. Mishima. 1981. Aerosols Generated by Free Fall Spills of Powders and Solutions in Static Air. NUREG/CR-2139, U.S. Nuclear Regulatory Commission, Washington, D.C.

Sutter, S. L. 1982. Accident Generated Particulate Materials and Their Characteristics--A Review of Background Information. NUREG/CR-2651, U.S. Nuclear Regulatory Commission, Washington, D.C.

Sutter, S. L. 1983. Aerosols Generated by Releases of Pressurized Powders and Solutions in Static Air. NUREG/CR-3093, U.S. Nuclear Regulatory Commission, Washington, D.C.

APPENDIX B

PREL DESCRIPTION AND COMPUTER CODE LISTING

APPENDIX B

PREL DESCRIPTION AND COMPUTER CODE LISTING

Computer code PREL was developed to calculate the amount of powder made airborne from the rupture of a container of powder under pressure. The code uses a model for drag force on an expanding "ball" of powder and air after expulsion from a rupture hole. The model is nearly identical to the model used in the free fall of powders (Ballinger et al. 1987). The initial conditions are different, but in both cases a container boundary (e.g., ceiling, wall, or floor) stops the movement of the powder. The effect of the boundary in stopping the aerosol formation mechanism is the unique feature of the PREL model. See the above reference for the differential equations solved.

Figure B.1 shows the generalized space parameters of code PREL. In this figure the only input parameters required in the listed program are XMAX (m) and GCOS. The other space parameters in the listed program (A and B) are those of the PNL data base (Ballinger, Sutter, and Hodgson 1987). However, the user can reprogram PREL for A and B. A note of caution: the angle α must be less than 90 degrees. For pressurized releases with $\alpha \geq 90°$, a different model is needed.

Other parameters in the input file are:

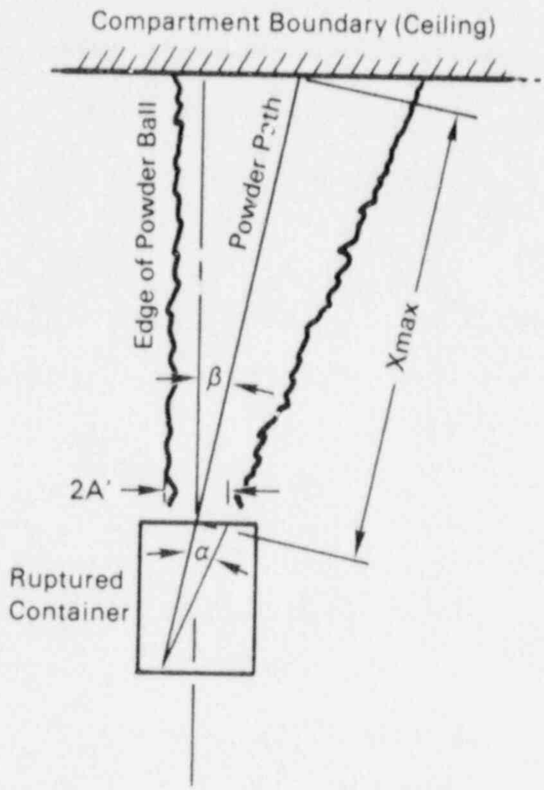
EMO = container powder mass, kg

PRES = container gauge pressure, psig

DELT = PREL time step, s

NPRINT = number of time steps between output prints during powder movement

VO = initial powder velocity, m/s.



PREL Variables:

GCOS = COS (β)
Xmax = Xmax, Distance to Boundary
A = A' (GCOS)
B = tan (α)

FIGURE B.1. Generalized Space Parameters in PREL

The initial powder velocity VO is obtained by

$$VO = 117.4*(PRES*\nu_t/EMO)^{1/2}$$

where ν_t = the void space in container (m^3)
PRES = release pressure
EMO = mass

The output variables are of two types. The first type follows the powder along its path, and at each multiple of NPRINT time steps the time (s), the position (m), velocity (m/s), and the particle mass made airborne (g) are printed. The second type is after impact. Then the total mass airborne (g) and percent of EMO made airborne are printed.

REFERENCES

Ballinger, M. Y., J. W. Buck, P. C. Owczarski, and J. E. Ayer. 1987. Methods for Describing Airborne Fractions of Free Fall Spills of Powders and Liquids. NUREG/CR-4997, U.S. Nuclear Regulatory Commission, Washington, D.C.

Ballinger, M. Y., S. L. Sutter, and W. H. Hodgson. 1987. New Data for Aerosols Generated by Releases of Pressurized Powders and Solutions in Static Air. NUREG/CR-4779, U.S. Nuclear Regulatory Commission, Washington, D.C.

APPENDIX C

TABULATED VALUES OF INERT MATERIAL INITIALLY AIRBORNE FROM DETONATIONS BY THE DETIN CODE

```
EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.ØØ INERT WT(G) = Ø.1ØØE+Ø1 STD. DEV. = 8.ØØ # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   Ø.ØØ TO     3.ØØ  Ø.8Ø543E+ØØ            Ø.8Ø543
   3.ØØ TO    1Ø.ØØ  Ø.11984E+ØØ            Ø.11984
  1Ø.ØØ TO    3Ø.ØØ  Ø.5Ø153E-Ø1            Ø.Ø5Ø15
  3Ø.ØØ TO   1ØØ.ØØ  Ø.19229E-Ø1            Ø.Ø1923
           >  1ØØ.ØØ  Ø.53436E-Ø2            Ø.ØØ534
 TOTAL MASS AIRBORNE=  Ø.1ØØØØE+Ø1     FRAC. INERT  AIRBORNE= Ø.1ØØØØE+Ø1

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.ØØ INERT WT(G) = Ø.2ØØE+Ø1 STD. DEV. = 8.ØØ # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   Ø.ØØ TO     3.ØØ  Ø.3Ø725E+ØØ            Ø.15363
   3.ØØ TO    1Ø.ØØ  Ø.35[illegible]44E+ØØ            Ø.17522
  1Ø.ØØ TO    3Ø.ØØ  Ø.41Ø22E+ØØ            Ø.2Ø511
  3Ø.ØØ TO   1ØØ.ØØ  Ø.42598E+ØØ            Ø.21299
           >  1ØØ.ØØ  Ø.5Ø611E+ØØ            Ø.253Ø6
 TOTAL MASS AIRBORNE=  Ø.2ØØØØE+Ø1     FRAC. INERT  AIRBORNE= Ø.1ØØØØE+Ø1

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.ØØ INERT WT(G) = Ø.3ØØE+Ø1 STD. DEV. = 8.ØØ # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   Ø.ØØ TO     3.ØØ  Ø.312Ø6E+ØØ            Ø.1Ø4Ø2
   3.ØØ TO    1Ø.ØØ  Ø.43287E+ØØ            Ø.14429
  1Ø.ØØ TO    3Ø.ØØ  Ø.57496E+ØØ            Ø.19165
  3Ø.ØØ TO   1ØØ.ØØ  Ø.67728E+ØØ            Ø.22576
           >  1ØØ.ØØ  Ø.1ØØ28E+Ø1            Ø.33428
 TOTAL MASS AIRBORNE=  Ø.3ØØØØE+Ø1     FRAC. INERT  AIRBORNE= Ø.1ØØØØE+Ø1

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.ØØ INERT WT(G) = Ø.4ØØE+Ø1 STD. DEV. = 8.ØØ # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   Ø.ØØ TO     3.ØØ  Ø.33866E+ØØ            Ø.Ø8466
   3.ØØ TO    1Ø.ØØ  Ø.51529E+ØØ            Ø.12882
  1Ø.ØØ TO    3Ø.ØØ  Ø.[illegible]2579E+ØØ            Ø.18145
  3Ø.ØØ TO   1ØØ.ØØ  Ø.91158E+ØØ            Ø.22789
           >  1ØØ.ØØ  Ø.15[illegible]7E+Ø1            Ø.37717
 TOTAL MASS AIRBORNE=  Ø.4ØØØØE+Ø1     FRAC. INERT  AIRBORNE= Ø.1ØØØØE+Ø1

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.ØØ INERT WT(G) = Ø.5ØØE+Ø1 STD. DEV. = 8.ØØ # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   Ø.ØØ TO     3.ØØ  Ø.36749E+ØØ            Ø.Ø735Ø
   3.ØØ TO    1Ø.ØØ  Ø.5934ØE+ØØ            Ø.11868
  1Ø.ØØ TO    3Ø.ØØ  Ø.86914E+ØØ            Ø.17383
  3Ø.ØØ TO   1ØØ.ØØ  Ø.11382E+Ø1            Ø.22764
           >  1ØØ.ØØ  Ø.2Ø318E+Ø1            Ø.4Ø636
 TOTAL MASS AIRBORNE=  Ø.5ØØØØE+Ø1     FRAC. INERT  AIRBORNE= Ø.1ØØØØE+Ø1

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.ØØ INERT WT(G) = Ø.6ØØE+Ø1 STD. DEV. = 8.ØØ # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   Ø.ØØ TO     3.ØØ  Ø.35382E+ØØ            Ø.Ø665Ø
   3.ØØ TO    1Ø.ØØ  Ø.5947ØE+ØØ            Ø.11177
  1Ø.ØØ TO    3Ø.ØØ  Ø.89523E+ØØ            Ø.16825
  3Ø.ØØ TO   1ØØ.ØØ  Ø.12Ø61E+Ø1            Ø.22669
           >  1ØØ.ØØ  Ø.227Ø8E+Ø1            Ø.42679
 TOTAL MASS AIRBORNE=  Ø.532Ø7E+Ø1     FRAC. INERT  AIRBORNE= Ø.88679E+ØØ

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.ØØ INERT WT(G) = Ø.7ØØE+Ø1 STD. DEV. = 8.ØØ # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   Ø.ØØ TO     3.ØØ  Ø.34481E+ØØ            Ø.Ø6129
   3.ØØ TO    1Ø.ØØ  Ø.59812E+ØØ            Ø.1Ø632
  1Ø.ØØ TO    3Ø.ØØ  Ø.92660E+ØØ            Ø.16364
  3Ø.ØØ TO   1ØØ.ØØ  Ø.12686E+Ø1            Ø.22549
           >  1ØØ.ØØ  Ø.24937E+Ø1            Ø.44327
 TOTAL MASS AIRBORNE=  Ø.56258E+Ø1     FRAC. INERT  AIRBORNE= Ø.8Ø369E+ØØ

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.ØØ INERT WT(G) = Ø.8ØØE+Ø1 STD. DEV. = 8.ØØ # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   Ø.ØØ TO     3.ØØ  Ø.345ØØE+ØØ            Ø.Ø5843
   3.ØØ TO    1Ø.ØØ  Ø.6Ø931E+ØØ            Ø.1Ø32Ø
  1Ø.ØØ TO    3Ø.ØØ  Ø.95ØØ8E+ØØ            Ø.16Ø92
  3Ø.ØØ TO   1ØØ.ØØ  Ø.13262E+Ø1            Ø.22462
           >  1ØØ.ØØ  Ø.26736E+Ø1            Ø.45283
 TOTAL MASS AIRBORNE=  Ø.59Ø42E+Ø1     FRAC. INERT  AIRBORNE= Ø.738Ø2E+ØØ

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.ØØ INERT WT(G) = Ø.9ØØE+Ø1 STD. DEV. = 8.ØØ # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   Ø.ØØ TO     3.ØØ  Ø.345Ø3E+ØØ            Ø.056ØØ
   3.ØØ TO    1Ø.ØØ  Ø.619Ø4E+ØØ            Ø.1ØØ47
  1Ø.ØØ TO    3Ø.ØØ  Ø.97645E+ØØ            Ø.15848
  3Ø.ØØ TO   1ØØ.ØØ  Ø.13786E+Ø1            Ø.22375
           >  1ØØ.ØØ  Ø.28421E+Ø1            Ø.46129
 TOTAL MASS AIRBORNE=  Ø.61612E+Ø1     FRAC. INERT  AIRBORNE= Ø.68457E+ØØ

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.ØØ INERT WT(G) = Ø.1ØØE+Ø2 STD. DEV. = 8.ØØ # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   Ø.ØØ TO     3.ØØ  Ø.34496E+ØØ            Ø.Ø539Ø
   3.ØØ TO    1Ø.ØØ  Ø.62762E+ØØ            Ø.Ø98Ø6
  1Ø.ØØ TO    3Ø.ØØ  Ø.1ØØØ3E+Ø1            Ø.15629
  3Ø.ØØ TO   1ØØ.ØØ  Ø.14266E+Ø1            Ø.22289
           >  1ØØ.ØØ  Ø.3ØØ1ØE+Ø1            Ø.46887
 TOTAL MASS AIRBORNE=  Ø.64ØØ5E+Ø1     FRAC. INERT  AIRBORNE= Ø.64ØØ5E+ØØ

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.ØØ INERT WT(G) = Ø.11ØE+Ø2 STD. DEV. = 8.ØØ # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   Ø.ØØ TO     3.ØØ  Ø.34481E+ØØ            Ø.Ø52Ø5
   3.ØØ TO    1Ø.ØØ  Ø.63527E+ØØ            Ø.Ø9589
  1Ø.ØØ TO    3Ø.ØØ  Ø.1Ø221E+Ø1            Ø.15428
  3Ø.ØØ TO   1ØØ.ØØ  Ø.14711E+Ø1            Ø.222Ø5
           >  1ØØ.ØØ  Ø.31517E+Ø1            Ø.47573
 TOTAL MASS AIRBORNE=  Ø.6626ØE+Ø1     FRAC. INERT  AIRBORNE= Ø.6Ø227E+ØØ

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.ØØ INERT WT(G) = Ø.12ØE+Ø2 STD. DEV. = 8.ØØ # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   Ø.ØØ TO     3.ØØ  Ø.3446ØE+ØØ            Ø.Ø5Ø4Ø
   3.ØØ TO    1Ø.ØØ  Ø.64216E+ØØ            Ø.Ø9393
  1Ø.ØØ TO    3Ø.ØØ  Ø.1Ø422E+Ø1            Ø.15244
  3Ø.ØØ TO   1ØØ.ØØ  Ø.15125E+Ø1            Ø.22123
           >  1ØØ.ØØ  Ø.32953E+Ø1            Ø.482ØØ
 TOTAL MASS AIRBORNE=  Ø.68368E+Ø1     FRAC. INERT  AIRBORNE= Ø.56973E+ØØ

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.ØØ INERT WT(G) = Ø.13ØE+Ø2 STD. DEV. = 8.ØØ # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   Ø.ØØ TO     3.ØØ  Ø.34435E+ØØ            Ø.Ø4893
   3.ØØ TO    1Ø.ØØ  Ø.64842E+ØØ            Ø.Ø9214
  1Ø.ØØ TO    3Ø.ØØ  Ø.1Ø6Ø8E+Ø1            Ø.15Ø73
  3Ø.ØØ TO   1ØØ.ØØ  Ø.15513E+Ø1            Ø.22Ø43
           >  1ØØ.ØØ  Ø.34327E+Ø1            Ø.48777
 TOTAL MASS AIRBORNE=  Ø.7Ø376E+Ø1     FRAC. INERT  AIRBORNE= Ø.54136E+ØØ
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.140E+02 STD. DEV. = 6.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.34406E+00            0.04760
   3.00 TO    10.00  0.65414E+00            0.09049
  10.00 TO    30.00  0.10782E+01            0.14915
  30.00 TO   100.00  0.15879E+01            0.21966
          >  100.00  0.35646E+01            0.49311
 TOTAL MASS AIRBORNE=  0.72288E+01     FRAC. INERT  AIRBORNE= 0.51634E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.150E+02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.34375E+00            0.04638
   3.00 TO    10.00  0.65941E+00            0.08897
  10.00 TO    30.00  0.10944E+01            0.14766
  30.00 TO   100.00  0.16224E+01            0.21891
          >  100.00  0.36915E+01            0.49808
 TOTAL MASS AIRBORNE=  0.74115E+01     FRAC. INERT  AIRBORNE= 0.49410E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.160E+02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.34342E+00            0.04527
   3.00 TO    10.00  0.66427E+00            0.08756
  10.00 TO    30.00  0.11097E+01            0.14627
  30.00 TO   100.00  0.16594E+01            0.21873
          >  100.00  0.38098E+01            0.50217
 TOTAL MASS AIRBORNE=  0.75865E+01     FRAC. INERT  AIRBORNE= 0.47416E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.170E+02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.34308E+00            0.04424
   3.00 TO    10.00  0.66878E+00            0.08624
  10.00 TO    30.00  0.11241E+01            0.14496
  30.00 TO   100.00  0.16907E+01            0.21802
          >  100.00  0.39281E+01            0.50654
 TOTAL MASS AIRBORNE=  0.77547E+01     FRAC. INERT  AIRBORNE= 0.45616E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.180E+02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.34273E+00            0.04329
   3.00 TO    10.00  0.67299E+00            0.08501
  10.00 TO    30.00  0.11377E+01            0.14371
  30.00 TO   100.00  0.17205E+01            0.21732
          >  100.00  0.40428E+01            0.51066
 TOTAL MASS AIRBORNE=  0.79167E+01     FRAC. INERT  AIRBORNE= 0.43982E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.190E+02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.34237E+00            0.04241
   3.00 TO    10.00  0.67693E+00            0.08385
  10.00 TO    30.00  0.11507E+01            0.14254
  30.00 TO   100.00  0.17490E+01            0.21665
          >  100.00  0.41541E+01            0.51456
 TOTAL MASS AIRBORNE=  0.80731E+01     FRAC. INERT  AIRBORNE= 0.42490E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.200E+02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.34200E+00            0.04158
   3.00 TO    10.00  0.68063E+00            0.08276
  10.00 TO    30.00  0.11630E+01            0.14142
  30.00 TO   100.00  0.17763E+01            0.21599
          >  100.00  0.42623E+01            0.51826
 TOTAL MASS AIRBORNE=  0.82242E+01     FRAC. INERT  AIRBORNE= 0.41121E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.210E+02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.34163E+00            0.04081
   3.00 TO    10.00  0.68410E+00            0.08173
  10.00 TO    30.00  0.11748E+01            0.14035
  30.00 TO   100.00  0.18026E+01            0.21534
          >  100.00  0.43676E+01            0.52177
 TOTAL MASS AIRBORNE=  0.83707E+01     FRAC. INERT  AIRBORNE= 0.39860E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.220E+02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.34125E+00            0.04009
   3.00 TO    10.00  0.68739E+00            0.08075
  10.00 TO    30.00  0.11861E+01            0.13933
  30.00 TO   100.00  0.18278E+01            0.21471
          >  100.00  0.44702E+01            0.52512
 TOTAL MASS AIRBORNE=  0.05127E+01     FRAC. INERT  AIRBORNE= 0.38694E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.230E+02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.34088E+00            0.03940
   3.00 TO    10.00  0.69049E+00            0.07982
  10.00 TO    30.00  0.11968E+01            0.13835
  30.00 TO   100.00  0.18521E+01            0.21410
          >  100.00  0.45703E+01            0.52832
 TOTAL MASS AIRBORNE=  0.86507E+01     FRAC. INERT  AIRBORNE= 0.37612E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.240E+02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.34050E+00            0.03876
   3.00 TO    10.00  0.69344E+00            0.07894
  10.00 TO    30.00  0.12072E+01            0.13742
  30.00 TO   100.00  0.18756E+01            0.21350
          >  100.00  0.46682E+01            0.53139
 TOTAL MASS AIRBORNE=  0.87849E+01     FRAC. INERT  AIRBORNE= 0.36604E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.250E+02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.34012E+00            0.03815
   3.00 TO    10.00  0.69624E+00            0.07809
  10.00 TO    30.00  0.12171E+01            0.13652
  30.00 TO   100.00  0.18983E+01            0.21292
          >  100.00  0.47638E+01            0.53432
 TOTAL MASS AIRBORNE=  0.89155E+01     FRAC. INERT  AIRBORNE= 0.35662E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.260E+02 STD. DEV. = 3.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.33975E+00            0.03757
   3.00 TO    10.00  0.69890E+00            0.07729
  10.00 TO    30.00  0.12267E+01            0.13565
  30.00 TO   100.00  0.19202E+01            0.21235
          >  100.00  0.48574E+01            0.53714
 TOTAL MASS AIRBORNE=  0.90429E+01     FRAC. INERT  AIRBORNE= 0.34780E+00
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.ØØ INERT WT(G) = Ø.27ØE+Ø2 STD. DEV. = 8.ØØ # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
  Ø.ØØ TO    3.ØØ  Ø.33937E+ØØ            Ø.Ø37Ø2
  3.ØØ TO   1Ø.ØØ  Ø.7Ø144E+ØØ            Ø.Ø7652
 1Ø.ØØ TO   3Ø.ØØ  Ø.12359E+Ø1            Ø.13482
 3Ø.ØØ TO  1ØØ.ØØ  Ø.19415E+Ø1            Ø.21)79
        >  1ØØ.ØØ  Ø.4949ØE+Ø1            Ø.53986
 TOTAL MASS AIRBORNE=  Ø.91672E+Ø1     FRAC. INERT  AIRBORNE= Ø.33953E+ØØ

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.ØØ INERT WT(G) = Ø.28ØE+Ø2 STD. DEV. = 8.ØØ # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
  Ø.ØØ TO    3.ØØ  Ø.339ØØE+ØØ            Ø.Ø365Ø
  3.ØØ TO   1Ø.ØØ  Ø.7Ø387E+ØØ            Ø.Ø7578
 1Ø.ØØ TO   3Ø.ØØ  Ø.12448E+Ø1            Ø.134Ø2
 3Ø.ØØ TC  1ØØ.ØØ  Ø.19621E+Ø1            Ø.21124
        >  1ØØ.ØØ  Ø.5Ø388E+Ø1            Ø.54247
 TOTAL MASS AIRBORNE=  Ø.92886E+Ø1     FRAC. INERT  AIRBORNE= Ø.33174E+ØØ

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.ØØ INERT WT(G) = Ø.29ØE+Ø2 STD. DEV. = 8.ØØ # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
  Ø.ØØ TO    3.ØØ  Ø.33862E+ØØ            Ø.Ø36ØØ
  3.ØØ TO   1Ø.ØØ  Ø.7Ø619E+ØØ            Ø.Ø75Ø7
 1Ø.ØØ TO   3Ø.ØØ  Ø.12534E+Ø1            Ø.13324
 3Ø.ØØ TO  1ØØ.ØØ  Ø.19822E+Ø1            Ø.21Ø71
        >  1ØØ.ØØ  Ø.51268E+Ø1            Ø.54499
 TOTAL MASS AIRBORNE=  Ø.94Ø72E+Ø1     FRAC. INERT  AIRBORNE= Ø.32439E+ØØ

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.ØØ INERT WT(G) = Ø.3ØØE+Ø2 STD. DEV. = 8.ØØ # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
  Ø.ØØ TO    3.ØØ  Ø.33825E+ØØ            Ø.Ø3552
  3.ØØ TO   1Ø.ØØ  Ø.7Ø841E+ØØ            Ø.Ø7439
 1Ø.ØØ TO   3Ø.ØØ  Ø.12517E+Ø1            Ø.13249
 3Ø.ØØ TO  1ØØ.ØØ  Ø.2ØØ16E+Ø1            Ø.21Ø18
        >  1ØØ.ØØ  Ø.52133E+Ø1            Ø.54742
 TOTAL MASS AIRBORNE=  Ø.95233E+Ø1     FRAC. INERT  AIRBORNE= Ø.31744E+ØØ

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.ØØ INERT WT(G) = Ø.31ØE+Ø2 STD. DEV. = 8.ØØ # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
  Ø.ØØ TO    3.ØØ  Ø.33788E+ØØ            Ø.Ø35Ø6
  3.ØØ TO   1Ø.ØØ  Ø.71Ø54E+ØØ            Ø.Ø7373
 1Ø.ØØ TO   3Ø.ØØ  Ø.12698E+Ø1            Ø.13176
 3Ø.ØØ TO  1ØØ.ØØ  Ø.2Ø2Ø6E+Ø1            Ø.2Ø967
        >  1ØØ.ØØ  Ø.52981E+Ø1            Ø.54977
 TOTAL MASS AIRBORNE=  Ø.96369E+Ø1     FRAC. INERT  AIPBORNE= Ø.31Ø87E+ØØ

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.ØØ INERT WT(G) = Ø.32ØE+Ø2 STD. DEV. = 8.ØØ # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
  Ø.ØØ TO    3.ØØ  Ø.33752E+ØØ            Ø.Ø3462
  3.ØØ TO   1Ø.ØØ  Ø.71259E+ØØ            Ø.Ø731Ø
 1Ø.ØØ TO   3Ø.ØØ  Ø.12776E+Ø1            Ø.131Ø6
 3Ø.ØØ TO  1ØØ.ØØ  Ø.2Ø39ØE+Ø1            Ø.2Ø917
        >  1ØØ.ØØ  Ø.53815E+Ø1            Ø.552Ø5
 TOTAL MASS AIRBORNE=  Ø.97482E+Ø1     FRAC. INERT  AIRBORNE= Ø.3Ø463E+ØØ

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.ØØ INERT WT(G) = Ø.33ØE+Ø2 STD. DEV. = 8.ØØ # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
  Ø.ØØ TO    3.ØØ  Ø.33715E+ØØ            Ø.Ø342Ø
  3.ØØ TO   1Ø.ØØ  Ø.71456E+ØØ            Ø.Ø7249
 1Ø.ØØ TO   3Ø.ØØ  Ø.12862E+Ø1            Ø.13Ø38
 3Ø.ØØ TO  1ØØ.ØØ  Ø.2Ø57ØE+Ø1            Ø.2Ø868
        >  1ØØ.ØØ  Ø.54634E+Ø1            Ø.55425
 TOTAL MASS AIRBORNE=  Ø.98573E+Ø1     FRAC. INERT  AIRBORNE= Ø.29871E+ØØ

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.ØØ INERT WT(G) = Ø.34ØE+Ø2 STD. DEV. = 8.ØØ # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
  Ø.ØØ TO    3.ØØ  Ø.33679E+ØØ            Ø.Ø338Ø
  3.ØØ TO   1Ø.ØØ  Ø.71645E+ØØ            Ø.Ø719Ø
 1Ø.ØØ TO   3Ø.ØØ  Ø.12925E+Ø1            Ø.12971
 3Ø.ØØ TO  1ØØ.ØØ  Ø.2Ø745E+Ø1            Ø.2Ø82Ø
        >  1ØØ.ØØ  Ø.5544ØE+Ø1            Ø.55639
 TOTAL MASS AIRBORNE=  Ø.99644E+Ø1     FRAC. INERT  AIRBORNE= Ø.293Ø7E+ØØ

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.ØØ INERT WT(G) = Ø.35ØE+Ø2 STD. DEV. = 8.ØØ # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
  Ø.ØØ TO    3.ØØ  Ø.33643E+ØØ            Ø.Ø3341
  3.ØØ TO   1Ø.ØØ  Ø.71827E+ØØ            Ø.Ø7133
 1Ø.ØØ TO   3Ø.ØØ  Ø.12997E+Ø1            Ø.129Ø7
 3Ø.ØØ TO  1ØØ.ØØ  Ø.2Ø916E+Ø1            Ø.2Ø772
        >  1ØØ.ØØ  Ø.56234E+Ø1            Ø.55846
 TOTAL MASS AIRBORNE=  Ø.1ØØ69E+Ø2     FRAC. INERT  AIRBORNE= Ø.2877ØE+ØØ

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.ØØ INERT WT(G) = Ø.36ØE+Ø2 STD. DEV. = 8.ØØ # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
  Ø.ØØ TO    3.ØØ  Ø.336Ø8E+ØØ            Ø.Ø33Ø4
  3.ØØ TO   1Ø.ØØ  Ø.72ØØ3E+ØØ            Ø.Ø7Ø78
 1Ø.ØØ TO   3Ø.ØØ  Ø.13Ø66E+Ø1            Ø.12845
 3Ø.ØØ TO  1ØØ.ØØ  Ø.21Ø84E+Ø1            Ø.2Ø726
        >  1ØØ.ØØ  Ø.57Ø14E+Ø1            Ø.56Ø47
 TOTAL MASS AIRBORNE=  Ø.1Ø173E+Ø2     FRAC. INERT  AIRBORNE= Ø.28257E+ØØ

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.ØØ INERT WT(G) = Ø.37ØE+Ø2 STD. DEV. = 8.ØØ # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
  Ø.ØØ TO    3.ØØ  Ø.33572E+ØØ            Ø.Ø3268
  3.ØØ TO   1Ø.ØØ  Ø.72173E+ØØ            Ø.Ø7Ø25
 1Ø.ØØ TO   3Ø.ØØ  Ø.13134E+Ø1            Ø.12784
 3Ø.ØØ TO  1ØØ.ØØ  Ø.21247E+Ø1            Ø.2Ø681
        >  1ØØ.ØØ  Ø.57783E+Ø1            Ø.56243
 TOTAL MASS AIRBORNE=  Ø.1Ø274E+Ø2     FRAC. INERT  AIRBORNE= Ø.27767E+ØØ

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.ØØ INERT WT(G) = Ø.38ØE+Ø2 STD. DEV. = 8.ØØ # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
  Ø.ØØ TO    3.ØØ  Ø.335?7E+ØØ            Ø.Ø3233
  3.ØØ TO   1Ø.ØØ  Ø.723?7E+ØØ            Ø.Ø6973
 1Ø.ØØ TO   3Ø.ØØ  Ø.13199E+Ø1            Ø.12724
 3Ø.ØØ TO  1ØØ.ØØ  Ø.214Ø6E+Ø1            Ø.2Ø636
        >  1ØØ.ØØ  Ø.58541E+Ø1            Ø.56433
 TOTAL MASS AIRBORNE=  Ø.1Ø373E+Ø2     FRAC. INERT  AIRBORNE= Ø.27298E+ØØ

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.ØØ INERT WT(G) = Ø.39ØE+Ø2 STD. DEV. = 8.ØØ # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
  Ø.ØØ TO    3.ØØ  Ø.335Ø3E+ØØ            Ø.Ø3199
  3.ØØ TO   1Ø.ØØ  Ø.72496E+ØØ            Ø.Ø6923
 1Ø.ØØ TO   3Ø.ØØ  Ø.13264E+Ø1            Ø.12667
 3Ø.ØØ TO  1ØØ.ØØ  Ø.21563E+Ø1            Ø.2Ø592
        >  1ØØ.ØØ  Ø.59287E+Ø1            Ø.56619
 TOTAL MASS AIRBORNE=  Ø.1Ø471E+Ø2     FRAC. INERT  AIRBORNE= Ø.2685ØE+ØØ
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.400E-02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.33468E+00             0.03167
   3.00 TO    10.00  0.72650E+00             0.06875
  10.00 TO    30.00  0.13326E+01             0.12610
  30.00 TO   100.00  0.21715E+01             0.20549
         >   100.00  0.60023E+01             0.56799
 TOTAL MASS AIRBORNE=  0.10568E+02     FRAC. INERT  AIRBORNE= 0.26419E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.410E-02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.33434E+00             0.03136
   3.00 TO    10.00  0.72798E+00             0.06828
  10.00 TO    30.00  0.13387E+01             0.12555
  30.00 TO   100.00  0.21865E+01             0.20507
         >   100.00  0.60749E+01             0.56975
 TOTAL MASS AIRBORNE=  0.10662E+02     FRAC. INERT  AIRBORNE= 0.26006E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.420E-02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.33400E+00             0.03105
   3.00 TO    10.00  0.72942E+00             0.06782
  10.00 TO    30.00  0.13447E+01             0.12502
  30.00 TO   100.00  0.22012E+01             0.20465
         >   100.00  0.61465E+01             0.57146
 TOTAL MASS AIRBORNE=  0.10756E+02     FRAC. INERT  AIRBORNE= 0.25609E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.430E-02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.33366E+00             0.03076
   3.00 TO    10.00  0.73082E+00             0.06737
  10.00 TO    30.00  0.13505E+01             0.12449
  30.00 TO   100.00  0.22155E+01             0.20424
         >   100.00  0.62172E+01             0.57314
 TOTAL MASS AIRBORNE=  0.10848E+02     FRAC. INERT  AIRBORNE= 0.25227E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.440E-02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.33333E+00             0.03047
   3.00 TO    10.00  0.73218E+00             0.06694
  10.00 TO    30.00  0.13562E+01             0.12398
  30.00 TO   100.00  0.22296E+01             0.20384
         >   100.00  0.62870E+01             0.57477
 TOTAL MASS AIRBORNE=  0.10938E+02     FRAC. INERT  AIRBORNE= 0.24860E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.450E-02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.33300E+00             0.03020
   3.00 TO    10.00  0.73349E+00             0.06651
  10.00 TO    30.00  0.13617E+01             0.12348
  30.00 TO   100.00  0.22435E+01             0.20344
         >   100.00  0.63559E+01             0.57636
 TOTAL MASS AIRBORNE=  0.11028E+02     FRAC. INERT  AIRBORNE= 0.24506E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.460E-02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.33267E+00             0.02993
   3.00 TO    10.00  0.73477E+00             0.06610
  10.00 TO    30.00  0.13671E+01             0.12299
  30.00 TO   100.00  0.22570E+01             0.20305
         >   100.00  0.64240E+01             0.57792
 TOTAL MASS AIRBORNE=  0.11116E+02     FRAC. INERT  AIRBORNE= 0.24164E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.470E-02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.33234E+00             0.02967
   3.00 TO    10.00  0.73602E+00             0.06570
  10.00 TO    30.00  0.13725E+01             0.12251
  30.00 TO   100.00  0.22704E+01             0.20267
         >   100.00  0.64912E+01             0.57945
 TOTAL MASS AIRBORNE=  0.11202E+02     FRAC. INERT  AIRBORNE= 0.23835E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.480E-02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.33202E+00             0.02941
   3.00 TO    10.00  0.73723E+00             0.06531
  10.00 TO    30.00  0.13777E+01             0.12205
  30.00 TO   100.00  0.22835E+01             0.20229
         >   100.00  0.65577E+01             0.58094
 TOTAL MASS AIRBORNE=  0.11288E+02     FRAC. INERT  AIRBORNE= 0.23517E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.490E-02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.33170E+00             0.02917
   3.00 TO    10.00  0.73840E+00             0.06493
  10.00 TO    30.00  0.13828E+01             0.12159
  30.00 TO   100.00  0.22963E+01             0.20192
         >   100.00  0.66234E+01             0.58240
 TOTAL MASS AIRBORNE=  0.11373E+02     FRAC. INERT  AIRBORNE= 0.23209E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.500E-02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.33138E+00             0.02893
   3.00 TO    10.00  0.73955E+00             0.06456
  10.00 TO    30.00  0.13877E+01             0.12114
  30.00 TO   100.00  0.23090E+01             0.20155
         >   100.00  0.66883E+01             0.58383
 TOTAL MASS AIRBORNE=  0.11456E+02     FRAC. INERT  AIRBORNE= 0.22912E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.510E-02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.33107E+00             0.02869
   3.00 TO    10.00  0.74066E+00             0.06419
  10.00 TO    30.00  0.13926E+01             0.12070
  30.00 TO   100.00  0.23214E+01             0.20119
         >   100.00  0.67525E+01             0.58523
 TOTAL MASS AIRBORNE=  0.11538E+02     FRAC. INERT  AIRBORNE= 0.22624E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.520E-02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.33076E+00             0.02847
   3.00 TO    10.00  0.74175E+00             0.06384
  10.00 TO    30.00  0.13974E+01             0.12026
  30.00 TO   100.00  0.23336E+01             0.20084
         >   100.00  0.68160E+01             0.58660
 TOTAL MASS AIRBORNE=  0.11620E+02     FRAC. INERT  AIRBORNE= 0.22345E+00
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.530E+02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.33046E+00            0.02824
   3.00 TO    10.00  0.74281E+00            0.06349
  10.00 TO    30.00  0.14021E+01            0.11984
  30.00 TO   100.00  0.23457E+01            0.20049
         >   100.00  0.68789E+01            0.58794
 TOTAL MASS AIRBORNE=  0.11700E+02     FRAC. INERT  AIRBORNE= 0.22075E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.540E+02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.33014E+00            0.02803
   3.00 TO    10.00  0.74385E+00            0.06315
  10.00 TO    30.00  0.14067E+01            0.11943
  30.00 TO   100.00  0.23575E+01            0.20014
         >   100.00  0.69411E+01            0.58926
 TOTAL MASS AIRBORNE=  0.11779E+02     FRAC. INERT  AIRBORNE= 0.21814E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.550E+02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.32983E+00            0.02782
   3.00 TO    10.00  0.74485E+00            0.06282
  10.00 TO    30.00  0.14113E+01            0.11902
  30.00 TO   100.00  0.23692E+01            0.19980
         >   100.00  0.70026E+01            0.59056
 TOTAL MASS AIRBORNE=  0.11858E+02     FRAC. INERT  AIRBORNE= 0.21560E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.560E+02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.32953E+00            0.02761
   3.00 TO    10.00  0.74584E+00            0.06249
  10.00 TO    30.00  0.14157E+01            0.11862
  30.00 TO   100.00  0.[illegible]806E+01            0.19946
         >   100.00  0.[illegible]636E+01            0.59182
 TOTAL MASS AIRBORNE=  0.11935E+02     FRAC. INERT  AIRBORNE= 0.21313E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.570E+02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.32923E+00            0.02741
   3.00 TO    10.00  0.74680E+00            0.06217
  10.00 TO    30.00  0.14201E+01            0.11822
  30.00 TO   100.00  0.23919E+01            0.19913
         >   100.00  0.71239E+01            0.59307
 TOTAL MASS AIRBORNE=  0.12012E+02     FRAC. INERT  AIRBORNE= 0.21074E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.580E+02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.32894E+00            0.02721
   3.00 TO    10.00  0.74774E+00            0.06186
  10.00 TO    30.00  0.14244E+01            0.11784
  30.00 TO   100.00  0.24031E+01            0.19880
         >   100.00  0.71836E+01            0.59429
 TOTAL MASS AIRBORNE=  0.12088E+02     FRAC. INERT  AIRBORNE= 0.20841E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.590E+02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.32864E+00            0.02702
   3.00 TO    10.00  0.74866E+00            0.06155
  10.00 TO    30.00  0.14286E+01            0.11746
  30.00 TO   100.00  0.24141E+01            0.19848
         >   100.00  0.72428E+01            0.59549
 TOTAL MASS AIRBORNE=  0.12163E+02     FRAC. INERT  AIRBORNE= 0.20615E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.600E+02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.32835E+00            0.02683
   3.00 TO    10.00  0.74956E+00            0.06125
  10.00 TO    30.00  0.14327E+01            0.11708
  30.00 TO   100.00  0.24249E+01            0.19816
         >   100.00  0.73014E+01            0.59667
 TOTAL MASS AIRBORNE=  0.12237E+02     FRAC. INERT  AIRBORNE= 0.20395E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.610E+02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.32806E+00            0.02665
   3.00 TO    10.00  0.75044E+00            0.06096
  10.00 TO    30.00  0.14368E+01            0.11671
  30.00 TO   100.00  0.24356E+01            0.19785
         >   100.00  0.73594E+01            0.59783
 TOTAL MASS AIRBORNE=  0.12310E+02     FRAC. INERT  AIRBORNE= 0.20181E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.620E+02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.32777E+00            0.02647
   3.00 TO    10.00  0.75130E+00            0.06067
  10.00 TO    30.00  0.14408E+01            0.11635
  30.00 TO   100.00  0.24461E+01            0.19754
         >   100.00  0.74169E-01            0.59897
 TOTAL MASS AIRBORNE=  0.12383E+02     FRAC. INERT  AIRBORNE= 0.19972E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.630E+02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.32748E+00            0.02629
   3.00 TO    10.00  0.75214E+00            0.06039
  10.00 TO    30.00  0.14447E+01            0.11600
  30.00 TO   100.00  0.24565E+01            0.19723
         >   100.00  0.74739E+01            0.60009
 TOTAL MASS AIRBORNE=  0.12455E+02     FRAC. INERT  AIRBORNE= 0.19769E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.640E+02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.32720E+00            0.02612
   3.00 TO    10.00  0.75296E+00            0.06011
  10.00 TO    30.00  0.14486E+01            0.11565
  30.00 TO   100.00  0.24667E+01            0.19693
         >   100.00  0.75304E+01            0.60119
 TOTAL MASS AIRBORNE=  0.12526E+02     FRAC. INERT  AIRBORNE= 0.19572E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.650E+02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.32692E+00            0.02595
   3.00 TO    10.00  0.75376E+00            0.05984
  10.00 TO    30.00  0.14524E+01            0.11530
  30.00 TO   100.00  0.24768E+01            0.19663
         >   100.00  0.75864E+01            0.60227
 TOTAL MASS AIRBORNE=  0.12596E+02     FRAC. INERT  AIRBORNE= 0.19379E+00
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.660E+02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.32664E+00             0.02479
   3.00 TO    10.00  0.75455E+00             0.0595[illegible]
  10.00 TO    30.00  0.14562E+01             0.11497
  30.00 TO   100.00  0.24868E+01             0.19633
         >   100.00  0.76420E+01             0.60334
 TOTAL MASS AIRBORNE=  0.12666E+02     FRAC. INERT  AIRBORNE= 0.19191E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.670E+02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.32636E+00             0.02563
   3.00 TO    10.00  0.75633E+00             0.05931
  10.00 TO    30.00  0.14596E+01             0.11463
  30.00 TO   100.00  0.24966E+01             0.19604
         >   100.00  0.76970E+01             0.60439
 TOTAL MASS AIRBORNE=  0.12735E+02     FRAC. INERT  AIRBORNE= 0.19008E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.680E+02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.32609E+00             0.02547
   3.00 TO    10.00  0.75608E+00             0.05905
  10.00 TO    30.00  0.14635E+01             0.11430
  30.00 TO   100.00  0.25063E+01             0.19575
         >   100.00  0.77516E+01             0.60542
 TOTAL MASS AIRBORNE=  0.12804E+02     FRAC. INERT  AIRBORNE= 0.18829E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.690E+02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.32581E+00             0.02531
   3.00 TO    10.00  0.75683E+00             0.05880
  10.00 TO    30.00  0.14671E+01             0.11398
  30.00 TO   100.00  0.25159E+01             0.19547
         >   100.00  0.78057E+01             0.60644
 TOTAL MASS AIRBORNE=  0.12871E+02     FRAC. INERT  AIRBORNE= 0.18654E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.700E+02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.32554E+00             0.02516
   3.00 TO    10.00  0.75755E+00             0.05855
  10.00 TO    30.00  0.14706E+01             0.11366
  30.00 TO   100.00  0.25254E+01             0.19519
         >   100.00  0.78594E+01             0.60744
 TOTAL MASS AIRBORNE=  0.12939E+02     FRAC. INERT  AIRBORNE= 0.18484E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.710E+02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.32527E+00             0.02501
   3.00 TO    10.00  0.75827E+00             0.05831
  10.00 TO    30.00  0.14741E+01             0.11335
  30.00 TO   100.00  0.25348E+01             0.19491
         >   100.00  0.79127E+01             0.60843
 TOTAL MASS AIRBORNE=  0.13005E+02     FRAC. INERT  AIRBORNE= 0.18317E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.720E+02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.32501E+00             0.02486
   3.00 TO    10.00  0.75897E+00             0.05806
  10.00 TO    30.00  0.14775E+01             0.11304
  30.00 TO   100.00  0.25440E+01             0.19463
         >   100.00  0.79656E+01             0.60940
 TOTAL MASS AIRBORNE=  0.13071E+02     FRAC. INERT  AIRBORNE= 0.18154E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.730E+02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.32474E+00             0.02472
   3.00 TO    10.00  0.75966E+00             0.05783
  10.00 TO    30.00  0.14809E+01             0.11273
  30.00 TO   100.00  0.25532E+01             0.19436
         >   100.00  0.80180E+01             0.61036
 TOTAL MASS AIRBORNE=  0.13136E+02     FRAC. INERT  AIRBORNE= 0.17995E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.740E+02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.32448E+00             0.02458
   3.00 TO    10.00  0.76033E+00             0.05760
  10.00 TO    30.00  0.14842E+01             0.11243
  30.00 TO   100.00  0.25622E+01             0.19409
         >   100.00  0.80700E+01             0.61131
 TOTAL MASS AIRBORNE=  0.13201E+02     FRAC. INERT  AIRBORNE= 0.17839E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.750E+02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.32422E+00             0.02444
   3.00 TO    10.00  0.76099E+00             0.05737
  10.00 TO    30.00  0.14876E+01             0.11213
  30.00 TO   100.00  0.25711E+01             0.19382
         >   100.00  0.81216E+01             0.61224
 TOTAL MASS AIRBORNE=  0.13265E+02     FRAC  INERT  AIRBORNE= 0.17687E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.760E+02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.32396E+00             0.02430
   3.00 TO    10.00  0.76164E+00             0.05714
  10.00 TO    30.00  0.14907E+01             0.11184
  30.00 TO   100.00  0.25800E+01             0.19356
         >   100.00  0.81729E+01             0.61316
 TOTAL MASS AIRBORNE=  0.13329E+02     FRAC. INERT  AIRBORNE= 0.17538E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.770E+02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.32370E+00             0.02417
   3.00 TO    10.00  0.76228E+00             0.05692
  10.00 TO    30.00  0.14939E+01             0.11155
  30.00 TO   100.00  0.25887E+01             0.19330
         >   100.00  0.82238E+01             0.61406
 TOTAL MASS AIRBORNE=  0.13392E+02     FRAC. INERT  AIRBORNE= 0.17393E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.780E+02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.32344E+00             0.02404
   3.00 TO    10.00  0.76291E+00             0.05670
  10.00 TO    30.00  0.14971E+01             0.11126
  30.00 TO   100.00  0.25973E+01             0.19304
         >   100.00  0.82743E+01             0.61496
 TOTAL MASS AIRBORNE=  0.13455E+02     FRAC. INERT  AIRBORNE= 0.17250E+00
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.790E+02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.32319E+00            0.02391
   3.00 TO    10.00  0.76352E+00            0.05649
  10.00 TO    30.00  0.15002E+01            0.11098
  30.00 TO   100.00  0.26059E+01            0.19278
         >   100.00  0.83244E+01            0.61584
 TOTAL MASS AIRBORNE=  0.13517E+02     FRAC. INERT  AIRBORNE= 0.17110E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.800E+02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.32294E+00            0.02378
   3.00 TO    10.00  0.76413E+00            0.05627
  10.00 TO    30.00  0.15032E+01            0.11070
  30.00 TO   100.00  0.26143E+01            0.19253
         >   100.00  0.83742E+01            0.61671
 TOTAL MASS AIRBORNE=  0.13579E+02     FRAC. INERT  AIRBORNE= 0.16973E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.810E+02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.32269E+00            0.02366
   3.00 TO    10.00  0.76472E+00            0.05607
  10.00 TO    30.00  0.15063E+01            0.11043
 [illegible]00 TO   100.00  0.26227E+01            0.19228
         >   100.00  0.84236E+01            0.61757
 TOTAL MASS AIRBORNE=  0.13640E+02     FRAC. INERT  AIRBORNE= 0.16839E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.820E+02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.32244E+00            0.02353
   3.00 TO    10.00  0.76531E+00            0.05586
  10.00 TO    30.00  0.15092E+01            0.11016
  30.00 TO   100.00  0.26310E+01            0.19203
         >   100.00  0.84727E+01            0.61841
 TOTAL MASS AIRBORNE=  0.13701E+02     FRAC. INERT  AIRBORNE= 0.16708E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.830E+02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.32219E+00            0.02341
   3.00 TO    10.00  0.76588E+00            0.05566
  10.00 TO    30.00  0.15122E+01            0.10989
  30.00 TO   100.00  0.26391E+01            0.19179
         >   100.00  0.85214E+01            0.61925
 TOTAL MASS AIRBORNE=  0.13761E+02     FRAC. INERT  AIRBORNE= 0.16579E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.840E+02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.32194E+00            0.02329
   3.00 TO    10.00  0.76645E+00            0.05546
  10.00 TO    30.00  0.15151E+01            0.10963
  30.00 TO   100.00  0.26472E+01            0.19154
         >   100.00  0.85698E+01            0.62008
 TOTAL MASS AIRBORNE=  0.13821E+02     FRAC. INERT  AIRBORNE= 0.16453E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.850E+02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.32170E+00            0.02318
   3.00 TO    10.00  0.76701E+00            0.05526
  10.00 TO    30.00  0.15180E+01            0.10937
  30.00 TO   100.00  0.26553E+01            0.19130
         >   100.00  0.86179E+01            0.62089
 TOTAL MASS AIRBORNE=  0.13880E+02     FRAC. INERT  AIRBORNE= 0.16329E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.860E+02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.32146E+00            0.02306
   3.00 TO    10.00  0.76755E+00            0.05507
  10.00 TO    30.00  0.15208E+01            0.10911
  30.00 TO   100.00  0.26632E+01            0.19107
         >   100.00  0.86657E+01            0.62170
 TOTAL MASS AIRBORNE=  0.13939E+02     FRAC. INERT  AIRBORNE= 0.16208E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.870E+02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.32122E+00            0.02295
   3.00 TO    10.00  0.76809E+[illegible]            0.05488
  10.00 TO    30.00  0.152[illegible]            0.10885
  30.00 TO   100.00  0.2671[illegible]E+01            0.19083
         >   100.00  0.87131E+01            0.62249
 TOTAL MASS AIRBORNE=  0.13997E+0[illegible]     FRAC. INERT  AIRBORNE= 0.16089E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.880E+02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.32098E+00            0.02284
   3.00 TO    10.00  0.76862E+00            0.05469
  10.00 TO    30.00  0.15264E+01            0.10860
  30.00 TO   100.00  0.26788E+01            0.19060
         >   100.00  0.87602E+01            0.62328
 TOTAL MASS AIRBORNE=  0.14055E+02     FRAC. INERT  AIRBORNE= 0.15972E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.890E+02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.32074E+00            0.02273
   3.00 TO    10.00  0.76914E+00            0.05450
  10.00 TO    30.00  0.15291E+01            0.10835
  30.00 TO   100.00  0.26865E+01            0.19036
         >   100.00  0.88071E+01            0.62406
 TOTAL MASS AIRBORNE=  0.14113E+02     FRAC. INERT  AIRBORNE= 0.15857E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.900E+02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.32050E+00            0.02262
   3.00 TO    10.00  0.76966E+00            0.05432
  10.00 TO    30.00  0.15318E+01            0.10811
  30.00 TO   100.00  0.26942E+01            0.19013
         >   100.00  0.88536E+01            0.62482
 TOTAL MASS AIRBORNE=  0.14170E+02     FRAC. INERT  AIRBORNE= 0.15744E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.910E+02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.32027E+00            0.02251
   3.00 TO    10.00  0.77016E+00            0.05414
  10.00 TO    30.00  0.15345E+01            0.10786
  30.00 TO   100.00  0.27017E+01            0.18991
         >   100.00  0.88999E+01            0.62558
 TOTAL MASS AIRBORNE=  0.14227E+02     FRAC. INERT  AIRBORNE= 0.15634E+00
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.920E+02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.32003E+00            0.02241
   3.00 TO   10.00  0.77066E+00            0.05396
  10.00 TO   30.00  0.15371E+01            0.10762
  30.00 TO  100.00  0.27092E+01            0.18968
         >  100.00  0.89458E+01            0.62633
 TOTAL MASS AIRBORNE=  0.14283E+02     FRAC. INERT  AIRBORNE= 0.15525E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.930E+02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.31980E+00            0.02230
   3.00 TO   10.00  0.77115E+00            0.05378
  10.00 TO   30.00  0.15398E+01            0.10738
  30.00 TO  100.00  0.27166E+01            0.18946
         >  100.00  0.89915E+01            0.62707
 TOTAL MASS AIRBORNE=  0.14339E+02     FRAC. INERT  AIRBORNE= 0.15418E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.940E+02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.31957E+00            0.02220
   3.00 TO   10.00  0.77163E+00            0.05361
  10.00 TO   30.00  0.15423E+01            0.10715
  30.00 TO  100.00  0.27240E+01            0.18924
         >  100.00  0.90369E+01            0.62781
 TOTAL MASS AIRBORNE=  0.14394E+02     FRAC. INERT  AIRBORNE= 0.15313E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.950E+02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.31934E+00            0.02210
   3.00 TO   10.00  0.77211E+00            0.05343
  10.00 TO   30.00  0.15449E+01            0.10692
  30.00 TO  100.00  0.27312E+01            0.18902
         >  100.00  0.90820E+01            0.62853
 TOTAL MASS AIRBORNE=  0.14450E+02     FRAC. INERT  AIRBORNE= 0.15210E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.960E+02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.31912E+00            0.02200
   3.00 TO   10.00  0.77257E+00            0.05326
  10.00 TO   30.00  0.15474E+01            0.10669
  30.00 TO  100.00  0.27385E+01            0.18880
         >  100.00  0.91269E+01            0.62925
 TOTAL MASS AIRBORNE=  0.14504E+02     FRAC. INERT  AIRBORNE= 0.15109E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.970E+02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.31889E+00            0.02190
   3.00 TO   10.00  0.77303E+00            0.05310
  10.00 TO   30.00  0.15499E+01            0.10646
  30.00 TO  100.00  0.27456E+01            0.18859
         >  100.00  0.91715E+01            0.62996
 TOTAL MASS AIRBORNE=  0.14559E+02     FRAC. INERT  AIRBORNE= 0.15009E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.980E+02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.31867E+00            0.02181
   3.00 TO   10.00  0.77349E+00            0.05293
  10.00 TO   30.00  0.15524E+01            0.10623
  30.00 TO  100.00  0.27527E+01            0.18837
         >  100.00  0.92158E+01            0.63066
 TOTAL MASS AIRBORNE=  0.14613E+02     FRAC. INERT  AIRBORNE= 0.14911E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.990E+02 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.31844E+00            0.02171
   3.00 TO   10.00  0.77394E+00            0.05277
  10.00 TO   30.00  0.15548E+01            0.10601
  30.00 TO  100.00  0.27597E+01            0.18816
         >  100.00  0.92599E+01            0.63135
 TOTAL MASS AIRBORNE=  0.14667E+02     FRAC. INERT  AIRBORNE= 0.14815E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.100E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.31822E+00            0.02162
   3.00 TO   10.00  0.77438E+00            0.05261
  10.00 TO   30.00  0.15572E+01            0.10579
  30.00 TO  100.00  0.27667E+01            0.18795
         >  100.00  0.93037E+01            0.63204
 TOTAL MASS AIRBORNE=  0.14720E+02     FRAC. INERT  AIRBORNE= 0.14720E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.101E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.31800E+00            0.02153
   3.00 TO   10.00  0.77482E+00            0.05245
  10.00 TO   30.00  0.15596E+01            0.10557
  30.00 TO  100.00  0.27736E+01            0.18774
         >  100.00  0.93472E+01            0.63271
 TOTAL MASS AIRBORNE=  0.14773E+02     FRAC. INERT  AIRBORNE= 0.14627E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.102E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.31778E+00            0.02143
   3.00 TO   10.00  0.77524E+00            0.05229
  10.00 TO   30.00  0.15620E+01            0.10536
  30.00 TO  100.00  0.27804E+01            0.18754
         >  100.00  0.93906E+01            0.63339
 TOTAL MASS AIRBORNE=  0.14826E+02     FRAC. INERT  AIRBORNE= 0.14535E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.103E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.31756E+00            0.02134
   3.00 TO   10.00  0.77567E+00            0.05213
  10.00 TO   30.00  0.15643E+01            0.10514
  30.00 TO  100.00  0.27872E+01            0.18733
         >  100.00  0.94337E+01            0.63405
 TOTAL MASS AIRBORNE=  0.14878E+02     FRAC. INERT  AIRBORNE= 0.14445E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.104E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.31734E+00            0.02125
   3.00 TO   10.00  0.77609E+00            0.05198
  10.00 TO   30.00  0.15667E+01            0.10493
  30.00 TO  100.00  0.27939E+01            0.18713
         >  100.00  0.94765E+01            0.63471
 TOTAL MASS AIRBORNE=  0.14930E+02     FRAC. INERT  AIRBORNE= 0.14356E+00
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.105E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.31713E+00            0.02117
   3.00 TO    10.00  0.77650E+00            0.05183
  10.00 TO    30.00  0.15689E+01            0.10472
  30.00 TO   100.00  0.2800[illegible]E+01            0.18693
         >   100.00  0.95191E+01            0.63536
 TOTAL MASS AIRBORNE=  0.14982E+02     FRAC. INERT  AIRBORNE= 0.14269E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.106E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.31691E+00            0.02108
   3.00 TO    10.00  0.77690E+00            0.05168
  10.00 TO    30.00  0.15712E+01            0.10451
  30.00 TO   100.00  0.28072E+01            0.18673
         >   100.00  0.95615E+01            0.63600
 TOTAL MASS AIRBORNE=  0.15034E+02     FRAC. INERT  AIRBORNE= 0.14183E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.107E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.31670E+00            0.02099
   3.00 TO    10.00  0.77730E+00            0.05153
  10.00 TO    30.00  0.157[illegible]6E+01            0.10431
  30.00 TO   100.00  0.28138E+01            0.18653
         >   100.00  0.96036E+01            0.63664
 TOTAL MASS AIRBORNE=  0.15085E+02     FRAC. INERT  AIRBORNE= 0.14098E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.108E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.31649E+00            0.02091
   3.00 TO    10.00  0.77770E+00            0.05138
  10.00 TO    30.00  0.15757E+01            0.10410
  30.00 TO   100.00  0.28203E+01            0.18633
         >   100.00  0.96456E+01            0.63[illegible]27
 TOTAL MASS AIRBORNE=  0.15136E+[illegible]2     FRAC. INERT  AIRBORNE= 0.14015E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.109E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.31628E+00            0.02083
   3.00 TO    10.00  0.77809E+00            0.05124
  10.00 TO    30.00  0.15779E+01            0.10390
  30.00 TO   100.00  0.28267E+01            0.18614
         >   100.00  0.96873E+01            0.63790
 TOTAL MASS AIRBORNE=  0.15186E+02     FRAC. INERT  AIRBORNE= 0.13932E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.110E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.31607E+00            0.02074
   3.00 TO    10.00  0.77847E+00            0.05109
  10.00 TO    30.00  0.15801E+01            0.10370
  30.00 TO   100.00  0.28331E+01            0.18594
         >   100.00  0.97288E+01            0.63852
 TOTAL MASS AIRBORNE=  0.15236E+02     FRAC. INERT  AIRBORNE= 0.13851E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.111E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.31586E+00            0.02066
   3.00 TO    10.00  0.77885E+00            0.05095
  10.00 TO    30.00  0.15822E+01            0.10350
  30.00 TO   100.00  0.28395E+01            0.18575
         >   100.00  0.97700E+01            0.63913
 TOTAL MASS AIRBORNE=  0.15286E+02     FRAC. INERT  AIRBORNE= 0.13772E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.112E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.31565E+00            0.02058
   3.00 TO    10.00  0.77923E+00            0.05081
  10.00 TO    30.00  0.15844E+01            0.10331
  30.00 TO   100.00  0.28458E+01            0.18556
         >   100.00  0.98111E+01            0.63974
 TOTAL MASS AIRBORNE=  0.15336E+02     FRAC. INERT  AIRBORNE= 0.13693E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.113E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.31545E+00            0.02050
   3.00 TO    10.00  0.77960E+00            0.05067
  10.00 TO    30.00  0.15865E+01            0.10311
  30.00 TO   100.00  0.28520E+01            0.18537
         >   100.00  0.98519E+01            0.64034
 TOTAL MASS AIRBORNE=  0.15386E+02     FRAC. INERT  AIRBORNE= 0.13615E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.114E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.31524E+00            0.02042
   3.00 TO    10.00  0.77996E+00            0.05053
  10.00 TO    30.00  0.15886E+01            0.10292
  30.00 TO   100.00  0.28582E+01            0.18518
         >   100.00  0.98926E+01            0.64094
 TOTAL MASS AIRBORNE=  0.15435E+02     FRAC. INERT  AIRBORNE= 0.13539E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.115E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.31504E+00            0.02035
   3.00 TO    10.00  0.78032E+00            0.05040
  10.00 TO    30.00  0.15906E+01            0.10273
  30.00 TO   100.00  0.28644E+01            0.18500
         >   100.00  0.90330E+01            0.64153
 TOTAL MASS AIRBORNE=  0.15483E+02     FRAC. INERT  AIRBORNE= 0.13464E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.116E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.31484E+00            0.02027
   3.00 TO    10.00  0.78068E+00            0.05026
  10.00 TO    30.00  0.15927E+01            0.10254
  30.00 TO   100.00  0.28705E+01            0.18481
         >   100.00  0.99733E+01            0.64211
 TOTAL MASS AIRBORNE=  0.15532E+02     FRAC. INERT  AIRBORNE= 0.13390E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.117E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.31464E+00            0.02019
   3.00 TO    10.00  0.78103E+00            0.05013
  10.00 TO    30.00  0.15947E+01            0.10236
  30.00 TO   100.00  0.28766E+01            0.18463
         >   100.00  0.10013E+02            0.64269
 TOTAL MASS AIRBORNE=  0.15580E+02     FRAC. INERT  AIRBORNE= 0.13317E+00
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.118E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.31443E+00             0.02012
   3.00 TO   10.00  0.78138E+00             0.05000
  10.00 TO   30.00  0.15968E+01             0.10217
  30.00 TO  100.00  0.28826E+01             0.18445
          >  100.00  0.10053E+02             0.64326
 TOTAL MASS AIRBORNE=  0.15628E+02      FRAC. INERT  AIRBORNE= 0.13244E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.119E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.31423E+00             0.02005
   3.00 TO   10.00  0.78172E+00             0.04987
  10.00 TO   30.00  0.15988E+01             0.10199
  30.00 TO  100.00  0.28886E+01             0.18427
          >  100.00  0.10093E+02             0.64383
 TOTAL MASS AIRBORNE=  0.15676E+02      FRAC. INERT  AIRBORNE= 0.13172E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.120E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.31404E+00             0.01997
   3.00 TO   10.00  0.78206E+00             0.04974
  10.00 TO   30.00  0.16007E+01             0.10180
  30.00 TO  100.00  0.28945E+01             0.18409
          >  100.00  0.10132E+02             0.64440
 TOTAL MASS AIRBORNE=  0.15724E+02      FRAC. INERT  AIRBORNE= 0.13103E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.121E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.31384E+00             0.01990
   3.00 TO   10.00  0.78239E+00             0.04961
  10.00 TO   30.00  0.16027E+01             0.10162
  30.00 TO  100.00  0.29004E+01             0.18391
          >  100.00  0.10172E+02             0.64496
 TOTAL MASS AIRBORNE=  0.15771E+02      FRAC. INERT  AIRBORNE= 0.13034E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.122E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.31364E+00             0.01983
   3.00 TO   10.00  0.78272E+00             0.04948
  10.00 TO   30.00  0.16047E+01             0.10145
  30.00 TO  100.00  0.29063E+01             0.18373
          >  100.00  0.10211E+02             0.64551
 TOTAL MASS AIRBORNE=  0.15818E+02      FRAC. INERT  AIRBORNE= 0.12966E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.123E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.31345E+00             0.01976
   3.00 TO   10.00  0.78305E+00             0.04936
  10.00 TO   30.00  0.16066E+01             0.10127
  30.00 TO  100.00  0.29121E+01             0.18356
          >  100.00  0.10250E+02             0.64606
 TOTAL MASS AIRBORNE=  0.15865E+02      FRAC. INERT  AIRBORNE= 0.12898E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.124E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRPBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.31325E+00             0.01969
   3.00 TO   10.00  0.78337E+00             0.04923
  10.00 TO   30.00  0.16085E+01             0.10109
  30.00 TO  100.00  0.29178E+01             0.18338
          >  100.00  0.10288E+02             0.64660
 TOTAL MASS AIRBORNE=  0.15911E+02      FRAC. INERT  AIRBORNE= 0.12832E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.125E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.31306E+00             0.01962
   3.00 TO   10.00  0.78369E+00             0.04911
  10.00 TO   30.00  0.16104E+01             0.10092
  30.00 TO  100.00  0.29236E+01             0.18321
          >  100.00  0.10327E+02             0.64714
 TOTAL MASS AIRBORNE=  0.15958E+02      FRAC. INERT  AIRBORNE= 0.12766E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.126E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.31287E+00             0.01955
   3.00 TO   10.60  0.78401E+00             0.04899
  10.00 TO   30.00  0.16123E+01             0.10074
  30.00 TO  100.00  0.29292E+01             0.18304
          >  100.00  0.10365E+02             0.64768
 TOTAL MASS AIRBORNE=  0.16004E+02      FRAC. INERT  AIRBORNE= 0.12701E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.127E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.31268E+00             0.01948
   3.00 TO   10.00  0.78432E+00             0.04887
  10.00 TO   30.00  0.16141E+01             0.10057
  30.00 TO  100.00  0.29349E+01             0.18287
          >  100.00  0.10403E+02             0.64821
 TOTAL MASS AIRBORNE=  0.16049E+02      FRAC. INERT  AIRBORNE= 0.12637E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.128E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.31249E+00             0.01942
   3.00 TO   10.00  0.78462E+00             0.04875
  10.00 TO   30.00  0.16160E+01             0.10040
  30.00 TO  100.00  0.29405E+01             0.18270
          >  100.00  0.10441E+02             0.64874
 TOTAL MASS AIRBORNE=  0.16095E+02      FRAC. INERT  AIRBORNE= 0.12574E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.129E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.31230E+00             0.01935
   3.00 TO   10.00  0.78493E+00             0.04863
  10.00 TO   30.00  0.16178E+01             0.10023
  30.00 TO  100.00  0.29461E+01             0.18253
          >  100.00  0.10479E+02             0.64926
 TOTAL MASS AIRBORNE=  0.16140E+02      FRAC. INERT  AIRBORNE= 0.12512E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.130E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.31211E+00             0.01928
   3.00 TO   10.00  0.78523E+00             0.04851
  10.00 TO   30.00  0.16196E+01             0.10007
  30.00 TO  100.00  0.29516E+01             0.18236
          >  100.00  0.10517E+02             0.64976
 TOTAL MASS AIRBORNE=  0.16186E+02      FRAC. INERT  AIRBORNE= 0.12450E+00
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.131E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.31192E+00           0.01922
   3.00 TO   10.00  0.78553E+00           0.04840
  10.00 TO   30.00  0.16214E+01           0.09990
  30.00 TO  100.00  0.29571E+01           0.18219
         >  100.00  0.10554E+02           0.65029
 TOTAL MASS AIRBORNE=  0.16230E+02     FRAC. INERT  AIRBORNE= 0.12390E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.132E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.31173E+00           0.01915
   3.00 TO   10.00  0.78582E+00           0.04828
  10.00 TO   30.00  0.16232E+01           0.09974
  30.00 TO  100.00  0.29625E+01           0.18203
         >  100.00  0.10592E+02           0.65080
 TOTAL MASS AIRBORNE=  0.16275E+02     FRAC. INERT  AIRBORNE= 0.12330E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.133E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.31155E+00           0.01909
   3.00 TO   10.00  0.78611E+00           0.04817
  10.00 TO   30.00  0.16250E+01           0.09957
  30.00 TO  100.00  0.29680E+01           0.18186
         >  100.00  0.10629E+02           0.65130
 TOTAL MASS AIRBORNE=  0.16320E+02     FRAC. INERT  AIRBORNE= 0.12270E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.134E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.31136E+00           0.01903
   3.00 TO   10.00  0.78640E+00           0.04806
  10.00 TO   30.00  0.16267E+01           0.09941
  30.00 TO  100.00  0.29734E+01           0.18170
         >  100.00  0.10666E+02           0.65180
 TOTAL MASS AIRBORNE=  0.16364E+02     FRAC. INERT  AIRBORNE= 0.12212E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.135E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.31118E+00           0.01897
   3.00 TO   10.00  0.78668E+00           0.04794
  10.00 TO   30.00  0.16285E+01           0.09925
  30.00 TO  100.00  0.29787E+01           0.18154
         >  100.00  0.10703E+02           0.65230
 TOTAL MASS AIRBORNE=  0.16408E+02     FRAC. INERT  AIRBORNE= 0.12154E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.136E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.31100E+00           0.01890
   3.00 TO   10.00  0.78696E+00           0.04783
  10.00 TO   30.00  0.16302E+01           0.09909
  30.00 TO  100.00  0.29840E+01           0.18138
         >  100.00  0.10740E+02           0.65279
 TOTAL MASS AIRBORNE=  0.16452E+02     FRAC. INERT  AIRBORNE= 0.12097E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.137E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.31081E+00           0.01884
   3.00 TO   10.00  0.78724E+00           0.04772
  10.00 TO   30.00  0.16319E+01           0.09893
  30.00 TO  100.00  0.29893E+01           0.18122
         >  100.00  0.10776E+02           0.65328
 TOTAL MASS AIRBORNE=  0.16495E+02     FRAC. INERT  AIRBORNE= 0.12040E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.138E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.31063E+00           0.01878
   3.00 TO   10.00  0.78751E+00           0.04762
  10.00 TO   30.00  0.16336E+01           0.09877
  30.00 TO  100.00  0.29945E+01           0.18106
         >  100.00  0.10813E+02           0.65377
 TOTAL MASS AIRBORNE=  0.16539E+02     FRAC. INERT  AIRBORNE= 0.11985E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.139E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.31045E+00           0.01872
   3.00 TO   10.00  0.78778E+00           0.04751
  10.00 TO   30.03  0.16353E+01           0.09862
  30.00 TO  100.00  0.29998E+01           0.18090
         >  100.00  0.10849E+02           0.65425
 TOTAL MASS AIRBORNE=  0.16582E+02     FRAC. INERT  AIRBORNE= 0.11930E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.140E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.31027E+00           0.01866
   3.00 TO   10.00  0.78805E+00           0.04740
  10.00 TO   30.00  0.16370E+01           0.09846
  30.00 TO  100.00  0.30049E+01           0.18075
         >  100.00  0.10885E+02           0.65473
 TOTAL MASS AIRBORNE=  0.16625E+02     FRAC. INERT  AIRBURNE= 0.11875E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.141E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.31009E+00           0.01860
   3.00 TO   10.00  0.78832E+00           0.04730
  10.00 TO   30.00  0.16386E+01           0.09831
  30.00 TO  100.00  0.30101E+01           0.18059
         >  100.00  0.10921E+02           0.65520
 TOTAL MASS AIRBORNE=  0.16668E+02     FRAC. INERT  AIRBORNE= 0.11821E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.142E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.30992E+00           0.01855
   3.00 TO   10.00  0.78858E+00           0.04719
  10.00 TO   30.00  0.16403E+01           0.09816
  30.00 TO  100.00  0.30152E+01           0.18043
         >  100.00  0.10957E+02           0.65567
 TOTAL MASS AIRBORNE=  0.16711E+02     FRAC. INERT  AIRBORNE= 0.11768E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.143E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.30974E+00           0.01849
   3.00 TO   10.00  0.78884E+00           0.04709
  10.00 TO   30.00  0.16419E+01           0.09801
  30.00 TO  100.00  0.30203E+01           0.18028
         >  100.00  0.10992E+02           0.65614
 TOTAL MASS AIRBORNE=  0.16753E+02     FRAC. INERT  AIRBORNE= 0.11716E+00
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.144E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.30956E+00            0.01843
   3.00 TO   10.00  0.78910E+00            0.04698
  10.00 TO   30.00  0.16436E+01            0.09786
  30.00 TO  100.00  0.30253E+01            0.18013
         >  100.00  0.11028E+02            0.65660
 TOTAL MASS AIRBORNE=  0.16796E+02     FRAC. INERT  AIRBORNE= 0.11664E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.145E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.30939E+00            0.01837
   3.00 TO   10.00  0.78935E+00            0.04688
  10.00 TO   30.00  0.16452E+01            0.09771
  30.00 TO  100.00  0.30304E+01            0.17998
         >  100.00  0.11063E+02            0.65706
 TOTAL MASS AIRBORNE=  0.16838E+02     FRAC. INERT  AIRBORNE= 0.11612E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.146E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.30921E+00            0.01832
   3.00 TO   10.00  0.78960E+00            0.04678
  10.00 TO   30.00  0.16468E+01            0.09756
  30.00 TO  100.00  0.30354E+01            0.17982
         >  100.00  0.11099E+02            0.65752
 TOTAL MASS AIRBORNE=  0.16880E+02     FRAC. INERT  AIRBORNE= 0.11561E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.147E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.30904E+00            0.01826
   3.00 TO   10.00  0.78985E+00            0.04668
  10.00 TO   30.00  0.16483E+01            0.09741
  30.00 TO  100.00  0.30403E+01            0.17967
         >  100.00  0.11134E+02            0.65797
 TOTAL MASS AIRBORNE=  0.16921E+02     FRAC. INERT  AIRBORNE= 0.11511E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.148E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.30887E+00            0.01821
   3.00 TO   10.00  0.79010E+00            0.04658
  10.00 TO   30.00  0.16499E+01            0.09727
  30.00 TO  100.00  0.30452E+01            0.17953
         >  100.00  0.11169E+02            0.65842
 TOTAL MASS AIRBORNE=  0.16963E+02     FRAC. INERT  AIRBORNE= 0.11461E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.149E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.30869E+00            0.01815
   3.00 TO   10.00  0.79034E+00            0.04648
  10.00 TO   30.00  0.16515E+01            0.09712
  30.00 TO  100.00  0.30501E+01            0.17938
         >  100.00  0.11203E+02            0.65887
 TOTAL MASS AIRBORNE=  0.17004E+02     FRAC. INERT  AIRBORNE= 0.11412E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.150E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.30852E+00            0.01810
   3.00 TO   10.00  0.79059E+00            0.04638
  10.00 TO   30.00  0.16530E+01            0.09698
  30.00 TO  100.00  0.30550E+01            0.17923
         >  100.00  0.11238E+02            0.65931
 TOTAL MASS AIRBORNE=  0.17045E+02     FRAC. INERT  AIRBORNE= 0.11364E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.151E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.30835E+00            0.01805
   3.00 TO   10.00  0.79082E+00            0.04628
  10.00 TO   30.00  0.16546E+01            0.09684
  30.00 TO  100.00  0.30599E+01            0.17908
         >  100.00  0.11273E+02            0.65975
 TOTAL MASS AIRBORNE=  0.17086E+02     FRAC. INERT  AIRBORNE= 0.11315E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.152E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.30818E+00            0.01799
   3.00 TO   10.00  0.79106E+00            0.04619
  10.00 TO   30.00  0.16561E+01            0.09669
  30.00 TO  100.00  0.30647E+01            0.17894
         >  100.00  0.11307E+02            0.66019
 TOTAL MASS AIRBORNE=  0.17127E+02     FRAC. INERT  AIRBORNE= 0.11268E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.153E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.30801E+00            0.01794
   3.00 TO   10.00  0.79129E+00            0.04609
  10.00 TO   30.00  0.16576E+01            0.09655
  30.00 TO  100.00  0.30695E+01            0.17879
         >  100.00  0.11341E+02            0.66062
 TOTAL MASS AIRBORNE=  0.17168E+02     FRAC. INERT  AIRBORNE= 0.11221E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.154E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.30784E+00            0.01789
   3.00 TO   10.00  0.79153E+00            0.04600
  10.00 TO   30.00  0.16591E+01            0.09641
  30.00 TO  100.00  0.30742E+01            0.17865
         >  100.00  0.11376E+02            0.66105
 TOTAL MASS AIRBORNE=  0.17208E+02     FRAC. INERT  AIRBORNE= 0.11174E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.155E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.30768E+00            0.01784
   3.00 TO   10.00  0.79176E+00            0.04590
  10.00 TO   30.00  0.16606E+01            0.09627
  30.00 TO  100.00  0.30790E+01            0.17850
         >  100.00  0.11410E+02            0.66148
 TOTAL MASS AIRBORNE=  0.17249E+02     FRAC. INERT  AIRBORNE= 0.11128E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.156E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.30751E+00            0.01779
   3.00 TO   10.00  0.79198E+00            0.04581
  10.00 TO   30.00  0.16621E+01            0.09614
  30.00 TO  100.00  0.30837E+01            0.17836
         >  100.00  0.11444E+02            0.66191
 TOTAL MASS AIRBORNE=  0.17289E+02     FRAC. INERT  AIRBORNE= 0.11083E+00
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.157E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.30734E+00            0.01774
   3.00 TO   10.00  0.79221E+00            0.04572
  10.00 TO   30.00  0.16636E+01            0.09600
  30.00 TO  100.00  0.30684E+01            0.17822
          >  100.00  0.11477E+02            0.66233
 TOTAL MASS AIRBORNE=  0.17329E+02     FRAC. INERT  AIRBORNE= 0.11037E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.158E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.30718E+00            0.01769
   3.00 TO   10.00  0.79243E+00            0.04562
  10.00 TO   30.00  0.16650E+01            0.09586
  30.00 TO  100.00  0.30930E+01            0.17808
          >  100.00  0.11611E+02            0.66275
 TOTAL MASS AIRBORNE=  0.17369E+02     FRAC. INERT  AIRBORNE= 0.10993E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.159E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.30701E+00            0.01764
   3.00 TO   10.00  0.79265E+00            0.04553
  10.00 TO   30.00  0.16665E+01            0.09573
  30.00 TO  100.00  0.30976E+01            0.17794
          >  100.00  0.11545E+02            0.66316
 TOTAL MASS AIRBORNE=  0.17408E+02     FRAC. INERT  AIRBORNE= 0.10949E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.160E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.30685E+00            0.01759
   3.00 TO   10.00  0.79287E+00            0.04544
  10.00 TO   30.00  0.16679E+01            0.09559
  30.00 TO  100.00  0.31022E+01            0.17780
          >  100.00  0.11578E+02            0.66358
 TOTAL MASS AIRBORNE=  0.17448E+02     FRAC. INERT  AIRBORNE= 0.10905E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.161E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.30669E+00            0.01754
   3.00 TO   10.00  0.79309E+00            0.04535
  10.00 TO   30.00  0.16693E+01            0.09546
  30.00 TO  100.00  0.31068E+01            0.17766
          >  100.00  0.11611E+02            0.66399
 TOTAL MASS AIRBORNE=  0.17487E+02     FRAC. INERT  AIRBORNE= 0.10862E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.162E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.30652E+00            0.01749
   3.00 TO   10.00  0.79330E+00            0.04526
  10.00 TO   30.00  0.16708E+01            0.09533
  30.00 TO  100.00  0.31114E+01            0.17752
          >  100.00  0.11645E+02            0.66440
 TOTAL MASS AIRBORNE=  0.17526E+02     FRAC. INERT  AIRBORNE= 0.10819E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.163E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.30636E+00            0.01744
   3.00 TO   10.00  0.79351E+00            0.04517
  10.00 TO   30.00  0.16722E+01            0.09520
  30.00 TO  100.00  0.31159E+01            0.17739
          >  100.00  0.11678E+02            0.66480
 TOTAL MASS AIRBORNE=  0.175[illegible]E+02     FRAC. INERT  AIRBORNE= 0.10776E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.164E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.30620E+00            0.01739
   3.00 TO   10.00  0.79372E+00            0.04509
  10.00 TO   30.00  0.16736E+01            0.09507
  30.00 TO  100.00  0.31204E+01            0.17725
          >  100.00  0.11711E+02            0.66520
 TOTAL MASS AIRBORNE=  0.17604E+02     FRAC. INERT  AIRBORNE= 0.10734E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.165E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.30604E+00            0.01735
   3.00 TO   10.00  0.79393E+00            0.04500
  10.00 TO   30.00  0.16750E+01            0.09494
  30.00 TO  100.00  0.31249E+01            0.17712
          >  100.00  0.11743E+02            0.66560
 TOTAL MASS AIRBORNE=  0.17643E+02     FRAC. INERT  AIRBORNE= 0.10693E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.166E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.30588E+00            0.01730
   3.00 TO   10.00  0.79414E+00            0.04491
  10.00 TO   30.00  0.16764E+01            0.09481
  30.00 TO  100.00  0.31293E+01            0.17698
          >  100.00  0.11776E+02            0.66600
 TOTAL MASS AIRBORNE=  0.17682E+02     FRAC. INERT  AIRBORNE= 0.10652E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.167E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.30572E+00            0.01725
   3.00 TO   10.00  0.79434E+00            0.04483
  10.00 TO   30.00  0.16777E+01            0.09468
  30.00 TO  100.00  0.31338E+01            0.17685
          >  100.00  0.11809E+02            0.66640
 TOTAL MASS AIRBORNE=  0.17720E+02     FRAC. INERT  AIRBORNE= 0.10611E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.168E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.30556[illegible]+00            0.01721
   3.00 TO   10.00  0.79454E+00            0.04474
  10.00 TO   30.00  0.16791E+01            0.09455
  30.00 TO  100.00  0.31382E+01            0.17671
          >  100.00  0.11841E+02            0.66679
 TOTAL MASS AIRBORNE=  0.17759E+02     FRAC. INERT  AIRBORNE= 0.10571E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.169E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.30540E+00            0.01716
   3.00 TO   10.00  0.79474E+00            0.04466
  10.00 TO   30.00  0.16805E+01            0.09443
  30.00 TO  100.00  0.31425E+01            0.17658
          >  100.00  0.11874E+02            0.66718
 TOTAL MASS AIRBORNE=  0.17797E+02     FRAC. INERT  AIRBORNE= 0.10531E+00
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) = 1.00 INERT WT(G) = 0.170E+03 STD. DEV. = 8.00 # BINS = 4

SIZE RANGE(MICRONS)	MASS AIRBORNE	MASS AIRBORNE/TOTAL AIRBORNE
0.00 TO 3.00	0.30525E+00	0.01712
3.00 TO 10.00	0.79494E+00	0.04457
10.00 TO 30.00	0.16818E+01	0.09430
30.00 TO 100.00	0.31469E+01	0.17646
> 100.00	0.11906E+02	0.66756

TOTAL MASS AIRBORNE= 0.17835E+02 FRAC. INERT AIRBORNE= 0.10491E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) = 1.00 INERT WT(G) = 0.171E+03 STD. DEV. = 8.00 # BINS = 4

SIZE RANGE(MICRONS)	MASS AIRBORNE	MASS AIRBORNE/TOTAL AIRBORNE
0.00 TO 3.00	0.30509E+00	0.01707
3.00 TO 10.00	0.79514E+00	0.04449
10.00 TO 30.00	0.16831E+01	0.09417
30.00 TO 100.00	0.31512E+01	0.17632
> 100.00	0.11938E+02	0.66795

TOTAL MASS AIRBORNE= 0.17873E+02 FRAC. INERT AIRBORNE= 0.10452E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) = 1.00 INERT WT(G) = 0.172E+03 STD. DEV. = 8.00 # BINS = 4

SIZE RANGE(MICRONS)	MASS AIRBORNE	MASS AIRBORNE/TOTAL AIRBORNE
0.00 TO 3.00	0.30493E+00	0.01703
3.00 TO 10.00	0.79533E+00	0.04441
10.00 TO 30.00	0.16845E+01	0.09405
30.00 TO 100.00	0.31556E+01	0.17619
> 100.00	0.11970E+02	0.66833

TOTAL MASS AIRBORNE= 0.17910E+02 FRAC. INERT AIRBORNE= 0.10413E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) = 1.00 INERT WT(G) = 0.173E+03 STD. DEV. = 8.00 # BINS = 4

SIZE RANGE(MICRONS)	MASS AIRBORNE	MASS AIRBORNE/TOTAL AIRBORNE
0.00 TO 3.00	0.30478E+00	0.01698
3.00 TO 10.00	0.79553E+00	0.04432
10.00 TO 30.00	0.16858E+01	0.09393
30.00 TO 100.00	0.31599E+01	0.17606
> 100.00	0.12002E+02	0.66871

TOTAL MASS AIRBORNE= 0.17948E+02 FRAC. INERT AIRBORNE= 0.10375E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) = 1.00 INERT WT(G) = 0.174E+03 STD. DEV. = 8.00 # BINS = 4

SIZE RANGE(MICRONS)	MASS AIRBORNE	MASS AIRBORNE/TOTAL AIRBORNE
0.00 TO 3.00	0.30462E+00	0.01694
3.00 TO 10.00	0.79572E+00	0.04424
10.00 TO 30.00	0.16871E+01	0.09380
30.00 TO 100.00	0.31641E+01	0.17593
> 100.00	0.12034E+02	0.66909

TOTAL MASS AIRBORNE= 0.17985E+02 FRAC. INERT AIRBORNE= 0.10336E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) = 1.00 INERT WT(G) = 0.175E+03 STD. DEV. = 8.00 # BINS = 4

SIZE RANGE(MICRONS)	MASS AIRBORNE	MASS AIRBORNE/TOTAL AIRBORNE
0.00 TO 3.00	0.30447E+00	0.0168[illegible]
3.00 TO 10.00	0.79591E+00	0.04416
10.00 TO 30.00	0.16884E+01	0.09368
30.00 TO 100.00	0.31684E+01	0.17580
> 100.00	0.12068E+02	0.66946

TOTAL MASS AIRBORNE= 0.18023E+02 FRAC. INERT AIRBORNE= 0.10299E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) = 1.00 INERT WT(G) = 0.176E+03 STD. DEV. = 8.00 # BINS = 4

SIZE RANGE(MICRONS)	MASS AIRBORNE	MASS AIRBORNE/TOTAL AIRBORNE
0.00 TO 3.00	0.30431E+00	0.01685
3.00 TO 10.00	0.79609E+00	0.04408
10.00 TO 30.00	0.16897E+01	0.09356
30.00 TO 100.00	0.31726E+01	0.17567
> 100.00	0.12097E+02	0.66984

TOTAL MASS AIRBORNE= 0.18060E+02 FRAC. INERT AIRBORNE= 0.10261E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) = 1.00 INERT WT(G) = 0.177E+03 STD. DEV. = 8.00 # BINS = 4

SIZE RANGE(MICRONS)	MASS AIRBORNE	MASS AIRBORNE/TOTAL AIRBORNE
0.00 TO 3.00	0.30416E+00	0.01681
3.00 TO 10.00	0.79628E+00	0.04400
10.00 TO 30.00	0.16910E+01	0.09344
30.00 TO 100.00	0.31768E+01	0.17554
> 100.00	0.12129E+02	0.67021

TOTAL MASS AIRBORNE= 0.18097E+02 FRAC. INERT AIRBORNE= 0.10224E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) = 1.00 INERT WT(G) = 0.178E+03 STD. DEV. = 8.00 # BINS = 4

SIZE RANGE(MICRONS)	MASS AIRBORNE	MASS AIRBORNE/TOTAL AIRBORNE
0.00 TO 3.00	0.30401E+00	0.01676
3.00 TO 10.00	0.79646E+00	0.04392
10.00 TO 30.00	0.16923E+01	0.0933[illegible]
30.00 TO 100.00	0.31810E+01	0.175[illegible]
> 100.00	0.12160E+02	0.670[illegible]8

TOTAL MASS AIRBORNE= 0.18134E+02 FRAC. INERT AIRBORNE= 0.[illegible]188E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) = 1.00 INERT WT(G) = 0.179E+03 STD. DEV. = 8.00 # BINS = 4

SIZE RANGE(MICRONS)	MASS AIRBORNE	MASS AIRBORNE/TOTAL AIRBORNE
0.00 TO 3.00	0.30386E+00	0.01672
3.00 TO 10.00	0.79665E+00	0.04384
10.00 TO 30.00	0.16935E+01	0.09320
30.00 TO 100.00	0.31852E+01	0.17529
> 100.00	0.12191E+02	0.67094

TOTAL MASS AIRBORNE= 0.18171E+02 FRAC. INERT AIRBORNE= 0.10151E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) = 1.00 INERT WT(G) = 0.180E+03 STD. DEV. = 8.00 # BINS = 4

SIZE RANGE(MICRONS)	MASS AIRBORNE	MASS AIRBORNE/TOTAL AIRBORNE
0.00 TO 3.00	0.30371E+00	0.01668
3.00 TO 10.00	0.79683E+00	0.0[illegible]76
10.00 TO 30.00	0.16948E+01	0.09308
30.00 TO 100.00	0.31893E+01	0.17517
> 100.00	0.12223E+02	0.67131

TOTAL MASS AIRBORNE= 0.18207E+02 FRAC. INERT AIRBORNE= 0.10115E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) = 1.00 INERT WT(G) = 0.181E+03 STD. DEV. = 8.00 # BINS = 4

SIZE RANGE(MICRONS)	MASS AIRBORNE	MASS AIRBORNE/TOTAL AIRBORNE
0.00 TO 3.00	0.30356E+00	0.01664
3.00 TO 10.00	0.79701E+00	0.04369
10.00 TO 30.00	0.16961E+01	0.09297
30.00 TO 100.00	0.31934E+01	0.17504
> 100.00	0.12254E+02	0.67167

TOTAL MASS AIRBORNE= 0.18244E+02 FRAC. INERT AIRBORNE= 0.10079E+00

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) = 1.00 INERT WT(G) = 0.182E+03 STD. DEV. = 8.00 # BINS = 4

SIZE RANGE(MICRONS)	MASS AIRBORNE	MASS AIRBORNE/TOTAL AIRBORNE
0.00 TO 3.00	0.30340E+00	0.01680
3.00 TO 10.00	0.79718E+00	0.04361
10.00 TO 30.00	0.16973E+01	0.09285
30.00 TO 100.00	0.31975E+01	0.17492
> 100.00	0.12285E+02	0.67203

TOTAL MASS AIRBORNE= 0.18280E+02 FRAC. INERT AIRBORNE= 0.10044E+00

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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.183E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.30326E+00               0.01656
   3.00 TO   10.00  0.79736E+00               0.04353
  10.00 TO   30.00  0.16980E+01               0.09273
  30.00 TO  100.00  [illegible]               0.17479
        >  100.00   [illegible]               0.67238
 TOTAL MASS AIRBORNE= [illegible]E+02     FRAC. INERT  AIRBORNE= 0.10009E+00

EXPLOSION [illegible] SOURCE TERM
TNT [illegible] INERT WT(G) = 0.184E+03 STD. DEV. = 8.00 # BINS = 4
SIZE [illegible] AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   [illegible]  [illegible]E+00               0.01652
   [illegible]  [illegible]E+00               0.04346
   [illegible]  [illegible]E+01               0.09262
   [illegible]  0.32[illegible]E+01           0.17467
   [illegible]  0.12347E+02                   0.67274
 [illegible]= 0.18353E+02     FRAC. INERT  AIRBORNE= 0.99742E-01

[illegible]TIVE SOURCE TERM
[illegible]00 INERT WT(G) = 0.185E+03 STD. DEV. = 8.00 # BINS = 4
[illegible]AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   [illegible]E+00               0.01648
   [illegible]771E+00            0.04338
   [illegible]10E+01             0.09250
  30.00 [illegible]2097E+01      0.17455
   [illegible]12377E+02          0.67309
 TOTAL MASS AIRBORNE= 0.18389E+02     FRAC. INERT  AIRBORNE= 0.99398E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.186E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.30281E+00               0.01644
   3.00 TO   10.00  0.79788E+00               0.04331
  10.00 TO   30.00  0.17022E+01               0.09239
  30.00 TO  100.00  0.32137E+01               0.17443
        >  100.00   0.12408E+02               0.67344
 TOTAL MASS AIRBORNE= 0.18425E+02     FRAC. INERT  AIRBORNE= 0.99057E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.187E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.30266E+00               0.01640
   3.00 TO   10.00  0.79805E+00               0.04323
  10.00 TO   30.00  0.17034E+01               0.09228
  30.00 TO  100.00  0.32177E+01               0.17431
        >  100.00   0.12[illegible]38E+02     0.67379
 TOTAL MASS AIRBORNE= 0.18460E+02     FRAC. INERT  AIRBORNE= 0.98718E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.188E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.30252E+00               0.01636
   3.00 TO   10.00  0.79822E+00               0.04316
  10.00 TO   30.00  0.17046E+01               0.09216
  30.00 TO  100.00  0.32217E+01               0.17419
        >  100.00   0.12469E+02               0.67414
 TOTAL MASS AIRBORNE= 0.18496E+02     FRAC. INERT  AIRBORNE= 0.98383E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.189E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.30237E+00               0.01632
   3.00 TO   10.00  0.79838E+00               0.04308
  10.00 TO   30.00  0.17058E+01               0.09206
  30.00 TO  100.00  0.32257[illegible]01      0.17407
        >  100.00   0.124[illegible]02        0.67448
 TOTAL MASS AIRBORNE= 0.[illegible]1E+02     FRAC. INERT  AIRBORNE= 0.98050E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.190E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.30223E+00               0.01620
   3.00 TO   10.00  0.79855E+00               0.04301
  10.00 TO   30.00  0.17070E+01               0.09194
  30.00 TO  100.00  0.32296E+01               0.17395
        >  100.00   0.12529E+02               0.67483
 TOTAL MASS AIRBORNE= 0.18567E+02     FRAC. INERT  AIRBORNE= 0.97720E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.191E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.30208E+00               0.01624
   3.00 TO   10.00  0.79871E+00               0.04294
  10.00 TO   30.00  0.17082E+01               0.09183
  30.00 TO  100.00  0.32336E+01               0.17383
        >  100.00   0.12560E+02               0.67517
 TOTAL MASS AIRBORNE= 0.18602E+02     FRAC. INERT  AIRBORNE= 0.97393E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.192E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.30194E+00               0.01620
   3.00 TO   10.00  0.79888E+00               0.04286
  10.00 TO   30.00  0.17094E+01               0.09172
  30.00 TO  100.00  0.32375E+01               0.17371
        >  100.00   0.12590E+02               0.67551
 TOTAL MASS AIRBORNE= 0.18637E+02     FRAC. INERT  AIRBORNE= 0.97069E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.193E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.30179E+00               0.01616
   3.00 TO   10.00  0.79904E+00               0.04279
  10.00 TO   30.00  0.17105E+01               0.09161
  30.00 TO  100.00  0.32414E+01               0.17359
        >  100.00   0.12620E+02               0.67584
 TOTAL MASS AIRBORNE= 0.18672E+02     FRAC. INERT  AIRBORNE= 0.96748E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.194E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.30165E+00               0.01612
   3.00 TO   10.00  0.79920E+00               0.04272
  10.00 TO   30.00  0.17117E+01               0.09150
  30.00 TO  100.00  0.32453E+01               0.17348
        >  100.00   0.12650E+02               0.67618
 TOTAL MASS AIRBORNE= 0.18707E+02     FRAC. INERT  AIRBORNE= 0.96429E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.195E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.301[illegible]E+00      0.01609
   3.00 TO   10.00  0.79[illegible]36E+00     0.04265
  10.00 TO   30.00  0.17128E+01               0.09139
  30.00 TO  100.00  0.32491E+01               0.17336
        >  100.00   0.12679E+02               0.67651
 TOTAL MASS AIRBORNE= 0.18742E+02     FRAC. INERT  AIRBORNE= 0.96113E-01
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) = 1.00 INERT WT(G) = 0.196E+03 STD. DEV. = 8.00 # BINS = 4

SIZE RANGE(MICRONS)			MASS AIRBORNE	MASS AIRBORNE/TOTAL AIRBORNE
0.00	TO	3.00	0.30[illegible]	0.01605
3.00	TO	10.00	0.799[illegible]+00	0.04258
10.00	TO	30.00	0.17140E+01	0.09128
30.00	TO	100.00	0.32530E+01	0.17324
	>	100.00	0.12709E+02	0.67685

TOTAL MASS AIRBORNE= 0.18777E+02 FRAC. INERT AIRBORNE= 0.95800E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) = 1.00 INERT WT(G) = 0.197E+03 STD. DEV. = 8.00 # BINS = 4

SIZE RANGE(MICRONS)			MASS AIRBORNE	MASS AIRBORNE/TOTAL AIRBORNE
0.00	TO	3.00	0.30122E+00	0.01601
3.00	TO	10.00	0.79967E+00	0.04251
10.00	TO	30.00	0.17151E+01	0.09117
30.00	TO	100.00	0.32568E+01	0.17313
	>	100.00	0.12739E+02	0.67718

TOTAL MASS AIRBORNE= 0.18811E+02 FRAC. INERT AIRBORNE= 0.95489E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) = 1.00 INERT WT(G) = 0.198E+03 STD. DEV. = 8.00 # BINS = 4

SIZE RANGE(MICRONS)			MASS AIRBORNE	MASS AIRBORNE/TOTAL AIRBORNE
0.00	TO	3.00	0.3010[illegible]E+00	0.01598
3.00	TO	10.00	0.79983E+00	0.04244
10.00	TO	30.00	0.17163E+01	0.09107
30.00	TO	100.00	0.32606E+01	0.17301
	>	100.00	0.12768E+02	0.67750

TOTAL MASS AIRBORNE= 0.18846E+02 FRAC. INERT AIRBORNE= 0.95181E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) = 1.00 INERT WT(G) = 0.199E+03 STD. DEV. = 8.00 # BINS = 4

SIZE RANGE(MICRONS)			MASS AIRBORNE	MASS AIRBORNE/TOTAL AIRBORNE
0.00	TO	3.00	0.30094E+00	0.01594
3.00	TO	10.00	0.79998E+00	0.04237
10.00	TO	30.00	0.17174E+01	0.09096
30.00	TO	100.00	0.32644E+01	0.17290
	>	100.00	0.12798E+02	0.67783

TOTAL MASS AIRBORNE= 0.18880E+02 FRAC. INERT AIRBORNE= 0.94876E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) = 1.00 INERT WT(G) = 0.200E+03 STD. DEV. = 8.00 # BINS = 4

SIZE RANGE(MICRONS)			MASS AIRBORNE	MASS AIRBORNE/TOTAL AIRBORNE
0.00	TO	3.00	0.30080E+00	0.01590
3.00	TO	10.00	0.80013E+00	0.04230
10.00	TO	30.00	0.17185E+01	0.09086
30.00	TO	100.00	0.32681E+01	0.17278
	>	100.00	0.12827E+02	0.67815

TOTAL MASS AIRBORNE= 0.18915E+02 FRAC. INERT AIRBORNE= 0.94573E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) = 1.00 INERT WT(G) = 0.201E+03 STD. DEV. = 8.00 # BINS = 4

SIZE RANGE(MICRONS)			MASS AIRBORNE	MASS AIRBORNE/TOTAL AIRBORNE
0.00	TO	3.00	0.30066E+00	0.01587
3.00	TO	10.00	0.80028E+00	0.04223
10.00	TO	30.00	0.17196E+01	0.09075
30.00	TO	100.00	0.32719E+01	0.17267
	>	100.00	0.12856E+02	0.67848

TOTAL MASS AIRBORNE= 0.18949E+02 FRAC. INERT AIRBORNE= 0.94272E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) = 1.00 INERT WT(G) = 0.202E+03 STD. DEV. = 8.00 # BINS = 4

SIZE RANGE(MICRONS)			MASS AIRBORNE	MASS AIRBORNE/TOTAL AIRBORNE
0.00	TO	3.00	0.300[illegible]2E+00	0.01583
3.00	TO	10.00	0.80043E+00	0.04217
10.00	TO	30.00	0.17207E+01	0.09065
30.00	TO	100.00	0.[illegible]756E+01	0.17256
	>	100.00	0.128[illegible]E+02	0.67880

TOTAL MASS AIRBORNE= 0.18983E+02 FRAC. INERT AIRBORNE= 0.93974E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) = 1.00 INERT WT(G) = 0.203E+03 STD. DEV. = 8.00 # BINS = 4

SIZE RANGE(MICRONS)			MASS AIRBORNE	MASS AIRBORNE/TOTAL AIRBORNE
0.00	TO	3.00	0.30038E+00	0.01580
3.00	TO	10.00	0.80058E+00	0.04210
10.00	TO	30.00	0.17218E+01	0.09054
30.00	TO	100.00	0.32793E+01	0.17245
	>	100.00	0.12915E+02	0.67912

TOTAL MASS AIRBORNE= 0.19017E+02 FRAC. INERT AIRBORNE= 0.93678E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) = 1.00 INERT WT(G) = 0.204E+03 STD. DEV. = 8.00 # BINS = 4

SIZE RANGE(MICRONS)			MASS AIRBORNE	MASS AIRBORNE/TOTAL AIRBORNE
0.00	TO	3.00	0.30024E+00	0.01576
3.00	TO	10.00	0.80073E+00	0.04203
10.00	TO	30.00	0.17229E+01	0.09044
30.00	TO	100.00	0.32830E+01	0.17233
	>	100.00	0.12944E+02	0.67943

TOTAL MASS AIRBORNE= 0.19051E+02 FRAC. INERT AIRBORNE= 0.93385E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) = 1.00 INERT WT(G) = 0.205E+03 STD. DEV. = 8.00 # BINS = 4

SIZE RANGE(MICRONS)			MASS AIRBORNE	MASS AIRBORNE/TOTAL AIRBORNE
0.00	TO	3.00	0.30011E+00	0.01573
3.00	TO	10.00	0.80087E+00	0.04197
10.00	TO	30.00	0.17240E+01	0.09034
30.00	TO	100.00	0.32867E+01	0.17222
	>	100.00	0.12972E+02	0.67976

TOTAL MASS AIRBORNE= 0.19084E+02 FRAC. INERT AIRBORNE= 0.93094E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) = 1.00 INERT WT(G) = 0.206E+03 STD. DEV. = 8.00 # BINS = 4

SIZE RANGE(MICRONS)			MASS AIRBORNE	MASS AIRBORNE/TOTAL AIRBORNE
0.00	TO	3.00	0.29997E+00	0.01569
3.00	TO	10.00	0.80102E+00	0.04190
10.00	TO	30.00	0.17251E+01	0.09024
30.00	TO	100.00	0.32904E+01	0.17211
	>	100.00	0.13001E+02	0.68006

TOTAL MASS AIRBORNE= 0.19118E+02 FRAC. INERT AIRBORNE= 0.92806E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) = 1.00 INERT WT(G) = 0.207E+03 STD. DEV. = 8.00 # BINS = 4

SIZE RANGE(MICRONS)			MASS AIRBORNE	MASS AIRBORNE/TOTAL AIRBORNE
0.00	TO	3.00	0.29983E+00	0.01566
3.00	TO	10.00	0.80116E+00	0.04183
10.00	TO	30.00	0.17262E+01	0.09013
30.00	TO	100.00	0.32941E+01	0.17200
	>	100.00	0.13030E+02	0.6[illegible]38

TOTAL MASS AIRBORNE= 0.19151E+02 FRAC. INERT AIRBORNE= 0.92519E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) = 1.00 INERT WT(G) = 0.208E+03 STD. DEV. = 8.00 # BINS = 4

SIZE RANGE(MICRONS)			MASS AIRBORNE	MASS AIRBORNE/TOTAL AIRBORNE
0.00	TO	3.00	0.29969E+00	0.01562
3.00	TO	10.00	0.80130E+00	0.0[illegible]77
10.00	TO	30.00	0.17273E+01	0.09003
30.00	TO	100.00	0.32977E+01	0.17189
	>	100.00	0.13059E+02	0.68069

TOTAL MASS AIRBORNE= 0.19185E+02 FRAC. INERT AIRBORNE= 0.92234E-01

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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.209E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.29956E-00            0.01559
   3.00 TO   10.00  0.80144E-00            0.04170
  10.00 TO   30.00  0.17283E+01            0.08993
  30.00 TO  100.00  0.33013E+01            0.17178
         >  100.00  0.13087E+02            0.68100
 TOTAL MASS AIRBORNE=  0.19218E+02     FRAC. INERT  AIRBORNE= 0.91953E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.210E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.29942E-00            0.01566
   3.00 TO   10.00  0.80158E-00            0.04164
  10.00 TO   30.00  0.17294E+01            0.08983
  30.00 TO  100.00  0.33049E+01            0.17167
         >  100.00  0.13116E+02            0.68130
 TOTAL MASS AIRBORNE=  0.19251E+02     FRAC. INERT  AIRBORNE  0.91673E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.211E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.29929E-00            0.01552
   3.00 TO   10.00  0.80172E-00            0.04157
  10.00 TO   30.00  0.17304E+01            0.08973
  30.00 TO  100.00  0.33085E+01            0.17156
         >  100.00  0.13144E+02            0.68161
 TOTAL MASS AIRBORNE=  0.19284E+02     FRAC. INERT  AIRBORNE= 0.91395E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.212E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.29915E-00            0.01549
   3.00 TO   10.00  0.80186E-00            0.04151
  10.00 TO   30.00  0.17315E+01            0.08963
  30.00 TO  100.00  0.33121E+01            0.17146
         >  100.00  0.13173E+02            0.68191
 TOTAL MASS AIRBORNE=  0.19317E+02     FRAC. INERT  AIRBORNE= 0.91120E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.213E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.29902E-00            0.01545
   3.00 TO   10.00  0.80200E-00            0.04145
  10.00 TO   30.00  0.17325E+01            0.08953
  30.00 TO  100.00  0.33157E+01            0.17135
         >  100.00  0.13201E+02            0.68222
 TOTAL MASS AIRBORNE=  0.19350E+02     FRAC. INERT  AIRBORNE= 0.90847E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.214E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.29889E-00            0.01542
   3.00 TO   10.00  0.80213E-00            0.04138
  10.00 TO   30.00  0.17336E+01            0.08944
  30.00 TO  100.00  0.33192E+01            0.17124
         >  100.00  0.13229E+02            0.68252
 TOTAL MASS AIRBORNE=  0.19383E+02     FRAC. INERT  AIRBORNE= 0.90575E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.215E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.29875E-00            0.01539
   3.00 TO   10.00  0.80227E-00            0.04132
  10.00 TO   30.00  0.17346E+01            0.08934
  30.00 TO  100.00  0.33227E+01            0.17114
         >  100.00  0.13257E+02            0.68282
 TOTAL MASS AIRBORNE=  0.19416E+02     FRAC. INERT  AIRBORNE= 0.90306E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.216E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.29862E-00            0.01535
   3.00 TO   10.00  0.80240E-00            0.04126
  10.00 TO   30.00  0.17356E+01            0.08924
  30.00 TO  100.00  0.33263E+01            0.17103
         >  100.00  0.13286E+02            0.68312
 TOTAL MASS AIRBORNE=  0.19448E+02     FRAC. INERT  AIRBORNE= 0.90039E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.217E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.29849E-00            0.01532
   3.00 TO   10.00  0.80253E-00            0.04120
  10.00 TO   30.00  0.17366E+01            0.08914
  30.00 TO  100.00  0.33298E+01            0.17092
         >  100.00  0.13314E+02            0.68341
 TOTAL MASS AIRBORNE=  0.19481E+02     FRAC. INERT  AIRBORNE= 0.89774E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.218E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.29836E-00            0.01529
   3.00 TO   10.00  0.80266E-00            0.04113
  10.00 TO   30.00  0.17376E+01            0.08905
  30.00 TO  100.00  0.33333E+01            0.17082
         >  100.00  0.13341E+02            0.68371
 TOTAL MASS AIRBORNE=  0.19513E+02     FRAC. INERT  AIRBORNE= 0.89511E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.219E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.29823E-00            0.01526
   3.00 TO   10.00  0.80280E-00            0.04107
  10.00 TO   30.00  0.17387E+01            0.08895
  30.00 TO  100.00  0.33367E+01            0.17071
         >  100.00  0.13369E+02            0.68400
 TOTAL MASS AIRBORNE=  0.19546E+02     FRAC. INERT  AIRBORNE= 0.89250E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.220E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.29810E-00            0.01523
   3.00 TO   10.00  0.80292E-00            0.04101
  10.00 TO   30.00  0.17397E+01            0.08886
  30.00 TO  100.00  0.33402E+01            0.17061
         >  100.00  0.13397E+02            0.68429
 TOTAL MASS AIRBORNE=  0.19578E+02     FRAC. INERT  AIRBORNE= 0.88991E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.221E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.29796E-00            0.01519
   3.00 TO   10.00  0.80305E-00            0.04095
  10.00 TO   30.00  0.17407E+01            0.08876
  30.00 TO  100.00  0.33436E+01            0.17051
         >  100.00  0.13425E+02            0.68459
 TOTAL MASS AIRBORNE=  0.19610E+02     FRAC. INERT  AIRBORNE= 0.88734E-01
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.222E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.29783E+00             0.01516
   3.00 TO    10.00  0.80318E+00             0.04089
  10.00 TO    30.00  0.17417E+01             0.08867
  30.00 TO   100.00  0.33471E+01             0.17040
          >  100.00  0.13452E+02             0.68488
 TOTAL MASS AIRBORNE=  0.19642E+02     FRAC. INERT  AIRBORNE= 0.89478E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.223E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.29771E+00             0.01513
   3.00 TO    10.00  0.80330E+00             0.04083
  10.00 TO    30.00  0.17426E+01             0.08858
  30.00 TO   100.00  0.33505E+01             0.17030
          >  100.00  0.13480E+02             0.68516
 TOTAL MASS AIRBORNE=  0.19674E+02     FRAC. INERT  AIRBORNE= 0.88225E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.224E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.29758E+00             0.01510
   3.00 TO    10.00  0.80343E+00             0.04077
  10.00 TO    30.00  0.17436E+01             0.08848
  30.00 TO   100.00  0.33539E+01             0.17020
          >  100.00  0.13507E+02             0.68545
 TOTAL MASS AIRBORNE=  0.19706E+02     FRAC. INERT  AIRBORNE= 0.87973E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.225E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.29745E+00             0.01507
   3.00 TO    10.00  0.80356E+00             0.04071
  10.00 TO    30.00  0.17446E+01             0.08839
  30.00 TO   100.00  0.3[illegible]73E+01             0.17009
          >  100.00  0.1[illegible]536E+02             0.68574
 TOTAL MASS AIRBORNE=  0.19738E+02     FRAC. INERT  AIRBORNE= 0.87723E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.226E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.29732E+00             0.01504
   3.00 TO    10.00  0.80368E+00             0.04065
  10.00 TO    30.00  0.17456E+01             0.08830
  30.00 TO   100.00  0.3360[illegible]E+01             0.16999
          >  100.00  0.13562E+02             0.68[illegible]2
 TOTAL MASS AIRBORNE=  0.19769E+02     FRAC. INERT  AIRBORNE= 0.87475E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.227E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.29719E+00             0.01501
   3.00 TO    10.00  0.80380E+00             0.04059
  10.00 TO    30.00  0.1746[illegible]E+01             0.08820
  30.00 TO   100.00  0.33640E+01             0.16989
          >  100.00  0.13589E+02             0.68630
 TOTAL MASS AIRBORNE=  0.19801E+02     FRAC. INERT  AIRBORNE= 0.87229E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.228E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.297[illegible]6E+00             0.01498
   3.00 TO    10.00  0.80392E+00             0.04054
  10.00 TO    30.00  0.17475E+01             0.08811
  30.00 TO   100.00  0.33674E+01             0.16979
          >  100.00  0.13617E+02             0.68658
 TOTAL MASS AIRBORNE=  0.19833E+02     FRAC. INERT  AIRBORNE= 0.86985E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.229E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.29694E+00             0.01495
   3.00 TO    10.00  0.80404E+00             0.04048
  10.00 TO    30.00  0.17485E+01             0.08802
  30.00 TO   100.00  0.33707E+01             0.16969
          >  100.00  0.13644E+02             0.68686
 TOTAL MASS AIRBORNE=  0.19864E+02     FRAC. INERT  AIRBORNE= 0.86742E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.230E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.29681E+00             0.01492
   3.00 TO    10.00  0.80416E+00             0.04042
  10.00 TO    30.00  0.17494E+01             0.08793
  30.00 TO   100.00  0.33740E+01             0.16959
          >  100.00  0.13[illegible]71E+02             0.68714
 TOTAL MASS AIRBORNE=  0.19895E+02     FRAC. INERT  AIRBORNE= 0.86501E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.231E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.29668E+00             0.01489
   3.00 TO    10.00  0.80428E+00             0.04036
  10.00 TO    30.00  0.17504E+01             0.08784
  30.00 TO   100.00  0.33773E+01             0.16949
          >  100.00  0.13696E+02             0.68742
 TOTAL MASS AIRBORNE=  0.19927E+02     FRAC. INERT  AIRBORNE= 0.86262E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.232E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.2965[illegible]E+00             0.01486
   3.00 TO    10.00  0.80440E+00             0.04031
  10.00 TO    30.00  0.17513E+01             0.08775
  30.00 TO   100.00  0.33806E+01             0.16939
          >  100.00  0.13725E+02             0.68769
 TOTAL MASS AIRBORNE=  0.19958E+02     FRAC. INERT  AIRBORNE= 0.86025E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.233E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.29643E+00             0.01483
   3.00 TO    10.00  0.80452E+00             0.04025
  10.00 TO    30.00  0.17523E+01             0.08766
  30.00 TO   100.00  0.33839E+01             0.16929
          >  100.00  0.13752E+02             0.68797
 TOTAL MASS AIRBORNE=  0.19989E+02     FRAC. INERT  AIRBORNE= 0.85789E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.234E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.29631E+00             0.01480
   3.00 TO    10.00  0.80463E+00             0.04019
  10.00 TO    30.00  0.17532E+01             0.08757
  30.00 TO   100.00  0.33872E+01             0.16919
          >  100.00  0.13778E+02             0.68824
 TOTAL MASS AIRBORNE=  0.20020E+02     FRAC. INERT  AIRBORNE= 0.85554E-01
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.235E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.29618E+00            0.01477
   3.00 TO    10.00  0.80475E+00            0.04014
  10.00 TO    30.00  0.17541E+01            0.08748
  30.00 TO   100.00  0.33905E+01            0.16909
         >   100.00  0.13805E+02            0.68851
 TOTAL MASS AIRBORNE=  0.20051E+02     FRAC. INERT  AIRBORNE= 0.85322E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.236E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.29606E+00            0.01474
   3.00 TO    10.00  0.80486E+00            0.04008
  10.00 TO    30.00  0.17550E+01            0.08740
  30.00 TO   100.00  0.33937E+01            0.16900
         >   100.00  0.13832E+02            0.68878
 TOTAL MASS AIRBORNE=  0.20081E+02     FRAC. INERT  AIRBORNE= 0.85091E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.237E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.2[illegible]E+00            0.01471
   3.00 TO    10.00  0.[illegible]497E+00            0.04002
  10.00 TO    30.00  0.175[illegible]0E+01            0.08731
  30.00 TO   100.00  0.33969E+01            0.16890
         >   100.00  0.13858E+02            0.68905
 TOTAL MASS AIRBORNE=  0.[illegible]0112E+02     FRAC. INERT  AIRBORNE= 0.84862E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.238E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.29581E+00            0.01469
   3.00 TO    10.00  0.80509E+00            0.03997
  10.00 TO    30.00  0.17569E+01            0.08722
  30.00 TO   100.00  0.34002E+01            0.16880
         >   100.00  0.13885E+02            0.68932
 TOTAL MASS AIRBORNE=  0.20143E+02     FRAC. INERT  AIRBORNE= 0.84634E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.239E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.29569E+00            0.01466
   3.00 TO    10.00  0.80520E+00            0.03991
  10.00 TO    30.00  0.17578E+01            0.08713
  30.00 TO   100.00  0.34034E+01            0.16871
         >   100.00  0.13911E+02            0.68959
 TOTAL MASS AIRBORNE=  0.20173E+02     FRAC. INERT  AIRBORNE= 0.84408E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.240E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.29557E+00            0.01463
   3.00 TO    10.00  0.80531E+00            0.03986
  10.00 TO    30.00  0.17587E+01            0.08705
  30.00 TO   100.00  0.34066E+01            0.16861
         >   100.00  0.13938E+02            0.68985
 TOTAL MASS AIRBORNE=  0.20204E+02     FRAC. INERT  AIRBORNE= 0.84133E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.241E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.29544E+00            0.01460
   3.00 TO    10.00  0.80542E+00            0.03980
  10.00 TO    30.00  0.17596E+01            0.08696
  30.00 TO   100.00  0.34098E+01            0.16851
         >   100.00  0.13964E+02            0.69012
 TOTAL MASS AIRBORNE=  0.20234E+02     FRAC. INERT  AIRBORNE= 0.83960E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.242E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.29532E+00            0.01457
   3.00 TO    10.00  0.80553E+00            0.03975
  10.00 TO    30.00  0.17605E+01            0.08688
  30.00 TO   100.00  0.34129E+01            0.16842
         >   100.00  0.13990E+02            0.69038
 TOTAL MASS AIRBORNE=  0.20265E+02     FRAC. INERT  AIRBORNE= 0.83738E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.243E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.29520E+00            0.01455
   3.00 TO    10.00  0.805[illegible]4E+00            0.03970
  10.00 TO    30.00  0.176[illegible]4E+01            0.08679
  30.00 TO   100.00  0.34161E+01            0.16832
         >   100.00  0.14017E+02            0.69064
 TOTAL MASS AIRBORNE=  0.20295E+02     FRAC. INERT  AIRBORNE= 0.83518E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.244E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.29508E+00            0.01452
   3.00 TO    10.00  0.80575E+00            0.03964
  10.00 TO    30.00  0.17623E+01            0.08671
  30.00 TO   100.00  0.34192E+01            0.16823
         >   100.00  0.14043E+02            0.69091
 TOTAL MASS AIRBORNE=  0.20325E+02     FRAC. INERT  AIRBORNE= 0.83299E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.245E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.29496E+00            0.01449
   3.00 TO    10.00  0.80585E+00            0.03959
  10.00 TO    30.00  0.17632E+01            0.08662
  30.00 TO   100.00  0.34224E+01            0.16813
         >   100.00  0.14069E+02            0.69117
 TOTAL MASS AIRBORNE=  0.20356E+02     FRAC. INERT  AIRBORNE= 0.83082E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.246E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.29484E+00            0.01446
   3.00 TO    10.00  0.80596E+00            0.03954
  10.00 TO    30.00  0.17641E+01            0.08654
  30.00 TO   100.00  0.34255E+01            0.16804
         >   100.00  0.14095E+02            0.69142
 TOTAL MASS AIRBORNE=  0.20385E+02     FRAC. INERT  AIRBORNE= 0.82867E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.247E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.29472E+00            0.01444
   3.00 TO    10.00  0.80606E+00            0.03948
  10.00 TO    30.00  0.17649E+01            0.08645
  30.00 TO   100.00  0.34286E+01            0.16796
         >   100.00  0.14121E+02            0.69168
 TOTAL MASS AIRBORNE=  0.20415E+02     FRAC. INERT  AIRBORNE= 0.82652E-01
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =    1.00 INERT WT(G) = 0.248E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.29460E+00          0.01441
   3.00 TO   10.00  0.80617E+00          0.03943
  10.00 TO   30.00  0.17658E+01          0.08637
  30.00 TO  100.00  0.34317E+01          0.16785
         >  100.00  0.14147E+02          0.69194
 TOTAL MASS AIRBORNE=  0.20445E+02     FRAC. INERT  AIRBORNE= 0.82439E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =    1.00 INERT WT(G) = 0.249E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.29448E+00          0.01438
   3.00 TO   10.00  0.80627E+00          0.03938
  10.00 TO   30.00  0.17667E+01          0.08629
  30.00 TO  100.00  0.34348E+01          0.16776
         >  100.00  0.14172E+02          0.69219
 TOTAL MASS AIRBORNE=  0.20475E+02     FRAC. INERT  AIRBORNE= 0.82228E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =    1.00 INERT WT(G) = 0.250E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.29436E+00          0.01436
   3.00 TO   10.00  0.80638E+00          0.03933
  10.00 TO   30.00  0.17676E+01          0.08620
  30.00 TO  100.00  0.34379E+01          0.16767
         >  100.00  0.14198E+02          0.69245
 TOTAL MASS AIRBORNE=  0.20504E+02     FRAC. INERT  AIRBORNE= 0.82018E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =    1.00 INERT WT(G) = 0.251E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.29424E+00          0.01433
   3.00 TO   10.00  0.80648E+00          0.03928
  10.00 TO   30.00  0.17684E+01          0.08612
  30.00 TO  100.00  0.34410E+01          0.16757
         >  100.00  0.14224E+02          0.69270
 TOTAL MASS AIRBORNE=  0.20534E+02     FRAC. INERT  AIRBORNE= 0.81809E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =    1.00 INERT WT(G) = 0.252E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.29412E+00          0.01430
   3.00 TO   10.00  0.80658E+00          0.03922
  10.00 TO   30.00  0.17693E+01          0.08604
  30.00 TO  100.00  0.34440E+01          0.16748
         >  100.00  0.14250E+02          0.69295
 TOTAL MASS AIRBORNE=  0.20564E+02     FRAC. INERT  AIRBORNE= 0.81602E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =    1.00 INERT WT(G) = 0.253E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.29400E+00          0.01428
   3.00 TO   10.00  0.80668E+00          0.03917
  10.00 TO   30.00  0.17701E+01          0.08596
  30.00 TO  100.00  0.34471E+01          0.16739
         >  100.00  0.14275E+02          0.69320
 TOTAL MASS AIRBORNE=  0.20593E+02     FRAC. INERT  AIRBORNE= 0.81396E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =    1.00 INERT WT(G) = 0.254E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.29389E+00          0.01426
   3.00 TO   10.00  0.80678E+00          0.03912
  10.00 TO   30.00  0.17710E+01          0.08588
  30.00 TO  100.00  0.34501E+01          0.16730
         >  100.00  0.14301E+02          0.69345
 TOTAL MASS AIRBORNE=  0.20623E+02     FRAC. INERT  AIRBORNE= 0.81191E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =    1.00 INERT WT(G) = 0.255E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.29377E+00          0.01422
   3.00 TO   10.00  0.80688E+00          0.03907
  10.00 TO   30.00  0.17718E+01          0.08580
  30.00 TO  100.00  0.34531E+01          0.16721
         >  100.00  0.14326E+02          0.69370
 TOTAL MASS AIRBORNE=  0.20652E+02     FRAC. INERT  AIRBORNE= 0.80988E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =    1.00 INERT WT(G) = 0.256E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.29365E+00          0.01420
   3.00 TO   10.00  0.80698E+00          0.03902
  10.00 TO   30.00  0.17727E+01          0.08571
  30.00 TO  100.00  0.34562E+01          0.16712
         >  100.00  0.14352E+02          0.69396
 TOTAL MASS AIRBORNE=  0.20681E+02     FRAC. INERT  AIRBORNE= 0.80786E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =    1.00 INERT WT(G) = 0.257E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.29354E+00          0.01417
   3.00 TO   10.00  0.80708E+00          0.03897
  10.00 TO   30.00  0.17735E+01          0.08563
  30.00 TO  100.00  0.34592E+01          0.16703
         >  100.00  0.14377E+02          0.69420
 TOTAL MASS AIRBORNE=  0.20710E+02     FRAC. INERT  AIRBORNE= 0.80585E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =    1.00 INERT WT(G) = 0.258E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.29342E+00          0.01415
   3.00 TO   10.00  0.80717E+00          0.03892
  10.00 TO   30.00  0.17743E+01          0.08555
  30.00 TO  100.00  0.34622E+01          0.16694
         >  100.00  0.14402E+02          0.69444
 TOTAL MASS AIRBORNE=  0.20739E+02     FRAC. INERT  AIRBORNE= 0.80385E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =    1.00 INERT WT(G) = 0.259E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.29330E+00          0.01412
   3.00 TO   10.00  0.80727E+00          0.03887
  10.00 TO   30.00  0.17752E+01          0.08547
  30.00 TO  100.00  0.34651E+01          0.16685
         >  100.00  0.14428E+02          0.69469
 TOTAL MASS AIRBORNE=  0.20768E+02     FRAC. INERT  AIRBORNE= 0.80187E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =    1.00 INERT WT(G) = 0.260E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.29319E+00          0.01410
   3.00 TO   10.00  0.80736E+00          0.03882
  10.00 TO   30.00  0.17760E+01          0.08540
  30.00 TO  100.00  0.34681E+01          0.16676
         >  100.00  0.14453E+02          0.69493
 TOTAL MASS AIRBORNE=  0.20797E+02     FRAC. INERT  AIRBORNE= 0.79990E-01
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.261E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.29307E+00          0.01407
   3.00 TO    10.00  0.80746E+00          0.03877
  10.00 TO    30.00  0.17768E+01          0.08532
  30.00 TO   100.00  0.34711E+01          0.16667
         >   100.00  0.14478E+02          0.69517
 TOTAL MASS AIRBORNE=  0.20826E+02     FRAC. INERT  AIRBORNE= 0.79794E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.262E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.29296E+00          0.01405
   3.00 TO    10.00  0.80756E+00          0.03872
  10.00 TO    30.00  0.17776E+01          0.08524
  30.00 TO   100.00  0.34740E+01          0.16658
         >   100.00  0.14503E+02          0.69541
 TOTAL MASS AIRBORNE=  0.20855E+02     FRAC. INERT  AIRBORNE= 0.79600E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.263E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.29284E+00          0.01402
   3.00 TO    10.00  0.80765E+00          0.03867
  10.00 TO    30.00  0.17785E+01          0.08516
  30.00 TO   100.00  0.34770E+01          0.16649
         >   100.00  0.14528E+02          0.69565
 TOTAL MASS AIRBORNE=  0.20884E+02     FRAC. INERT  AIRBORNE= 0.79406E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.264E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.29273E+00          0.01400
   3.00 TO    10.00  0.80774E+00          0.03862
  10.00 TO    30.00  0.17793E+01          0.08508
  30.00 TO   100.00  0.34799E+01          0.16640
         >   100.00  0.14553E+02          0.69589
 TOTAL MASS AIRBORNE=  0.20913E+02     FRAC. INERT  AIRBORNE= 0.79214E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.265E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.29262E+00          0.01397
   3.00 TO    10.00  0.80783E+00          0.03858
  10.00 TO    30.00  0.17801E+01          0.08500
  30.00 TO   100.00  0.34828E+01          0.16631
         >   100.00  0.14578E+02          0.69613
 TOTAL MASS AIRBORNE=  0.20941E+02     FRAC. INERT  AIRBORNE= 0.79023E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.266E+03 STL. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.29250E+00          0.01395
   3.00 TO    10.00  0.80793E+00          0.03853
  10.00 TO    30.00  0.17809E+01          0.08493
  30.00 TO   100.00  0.34857E+01          0.16623
         >   100.00  0.14603E+02          0.69637
 TOTAL MASS AIRBORNE=  0.20970E+02     FRAC. INERT  AIRBORNE= 0.78834E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.267E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.29239E+00          0.01392
   3.00 TO    10.00  0.80802E+00          0.03848
  10.00 TO    30.00  0.17817E+01          0.08485
  30.00 TO   100.00  0.34886E+01          0.16614
         >   100.00  0.14627E+02          0.69661
 TOTAL MASS AIRBORNE=  0.20998E+02     FRAC. INERT  AIRBORNE= 0.78645E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.268E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.29228E+00          0.01390
   3.00 TO    10.00  0.80811E+00          0.03843
  10.00 TO    30.00  0.17825E+01          0.08477
  30.00 TO   100.00  0.34915E+01          0.16605
         >   100.00  0.14652E+02          0.69684
 TOTAL MASS AIRBORNE=  0.21027E+02     FRAC. INERT  AIRBORNE= 0.78458E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.269E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.29216E+00          0.01388
   3.00 TO    10.00  0.80820E+00          0.03839
  10.00 TO    30.00  0.17833E+01          0.08470
  30.00 TO   100.00  0.34944E+01          0.16597
         >   100.00  0.14677E+02          0.69708
 TOTAL MASS AIRBORNE=  0.21055E+02     FRAC. INERT  AIRBORNE= 0.78271E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.270E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.29205E+00          0.01385
   3.00 TO    10.00  0.80829E+00          0.03834
  10.00 TO    30.00  0.17841E+01          0.08462
  30.00 TO   100.00  0.34973E+01          0.16588
         >   100.00  0.14702E+02          0.69731
 TOTAL MASS AIRBORNE=  0.21083E+02     FRAC. INERT  AIRBORNE= 0.78086E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.271E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.29194E+00          0.01382
   3.00 TO    10.00  0.80838E+00          0.03829
  10.00 TO    30.00  0.17849E+01          0.08454
  30.00 TO   100.00  0.35002E+01          0.16579
         >   100.00  0.14726E+02          0.69754
 TOTAL MASS AIRBORNE=  0.21111E+02     FRAC. INERT  AIRBORNE= 0.77902E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.272E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.29183E+00          0.01380
   3.00 TO    10.00  0.80846E+00          0.03824
  10.00 TO    30.00  0.17856E+01          0.08447
  30.00 TO   100.00  0.35030E+01          0.16571
         >   100.00  0.14751E+02          0.69777
 TOTAL MASS AIRBORNE=  0.21140E+02     FRAC. INERT  AIRBORNE= 0.77719E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.273E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.29172E+00          0.01378
   3.00 TO    10.00  0.80855E+00          0.03820
  10.00 TO    30.00  0.17864E+01          0.08439
  30.00 TO   100.00  0.35058E+01          0.16562
         >   100.00  0.14775E+02          0.69800
 TOTAL MASS AIRBORNE=  0.21168E+02     FRAC. INERT  AIRBORNE= 0.77537E-01
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.274E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.29161E+00           0.01376
   3.00 TO   10.00  0.80864E+00           0.03815
  10.00 TO   30.00  0.17872E+01           0.08432
  30.00 TO  100.00  0.35087E+01           0.16554
          >  100.00  0.14800E+02           0.69823
 TOTAL MASS AIRBORNE=  0.21196E+02      FRAC. INERT   AIRBORNE= 0.77357E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.275E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.29150E+00           0.01373
   3.00 TO   10.00  0.80873E+00           0.03810
  10.00 TO   30.00  0.17880E+01           0.08424
  30.00 TO  100.00  0.35115E+01           0.16545
          >  100.00  0.14824E+02           0.69846
 TOTAL MASS AIRBORNE=  0.21224E+02      FRAC. INERT   AIRBORNE= 0.77177E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.276E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.29139E+00           0.01371
   3.00 TO   10.00  0.80881E+00           0.03806
  10.00 TO   30.00  0.17888E+01           0.08417
  30.00 TO  100.00  0.35143E+01           0.16537
          >  100.00  0.14848E+02           0.69869
 TOTAL MASS AIRBORNE=  0.21252E+02      FRAC. INERT   AIRBORNE= 0.76998E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.277E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.29127E+00           0.01369
   3.00 TO   10.00  0.80890E+00           0.03801
  10.00 TO   30.00  0.17895E+01           0.08410
  30.00 TO  100.00  0.35171E+01           0.16528
          >  100.00  0.14873E+02           0.69892
 TOTAL MASS AIRBORNE=  0.21279E+02      FRAC. INERT   AIRBORNE= 0.76821E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.278E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.29117E+00           0.01367
   3.00 TO   10.00  0.80898E+00           0.03797
  10.00 TO   30.00  0.17903E+01           0.08402
  30.00 TO  100.00  0.35199E+01           0.16520
          >  100.00  0.14897E+02           0.69914
 TOTAL MASS AIRBORNE=  0.21307E+02      FRAC. INERT   AIRBORNE= 0.76644E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.279E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.29106E+00           0.01364
   3.00 TO   10.00  0.80906E+00           0.03792
  10.00 TO   30.00  0.17911E+01           0.08395
  30.00 TO  100.00  0.35227E+01           0.16512
          >  100.00  0.14921E+02           0.69937
 TOTAL MASS AIRBORNE=  0.21335E+02      FRAC. INERT   AIRBORNE= 0.76469E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.280E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.29095E+00           0.01362
   3.00 TO   10.00  0.80915E+00           0.03788
  10.00 TO   30.00  0.17918E+01           0.08388
  30.00 TO  100.00  0.35255E+01           0.16503
          >  100.00  0.14945E+02           0.69959
 TOTAL MASS AIRBORNE=  0.21362E+02      FRAC. INERT   AIRBORNE= 0.76294E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.281E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.29084E+00           0.01360
   3.00 TO   10.00  0.80923E+00           0.03783
  10.00 TO   30.00  0.17926E+01           0.08380
  30.00 TO  100.00  0.35283E+01           0.16495
          >  100.00  0.14969E+02           0.69982
 TOTAL MASS AIRBORNE=  0.21390E+02      FRAC. INERT   AIRBORNE= 0.76121E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.282E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.29073E+00           0.01357
   3.00 TO   10.00  0.80931E+00           0.03779
  10.00 TO   30.00  0.17933E+01           0.08373
  30.00 TO  100.00  0.35310E+01           0.16487
          >  100.00  0.14993E+02           0.70004
 TOTAL MASS AIRBORNE=  0.21417E+02      FRAC. INERT   AIRBORNE= 0.75948E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.283E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.29062E+00           0.01355
   3.00 TO   10.00  0.80939E+00           0.03774
  10.00 TO   30.00  0.17941E+01           0.08366
  30.00 TO  100.00  0.35338E+01           0.16478
          >  100.00  0.15017E+02           0.70026
 TOTAL MASS AIRBORNE=  0.21445E+02      FRAC. INERT   AIRBORNE= 0.75777E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.284E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.29051E+00           0.01353
   3.00 TO   10.00  0.80947E+00           0.03770
  10.00 TO   30.00  0.17948E+01           0.08359
  30.00 TO  100.00  0.35365E+01           0.16470
          >  100.00  0.15041E+02           0.70048
 TOTAL MASS AIRBORNE=  0.21472E+02      FRAC. INERT   AIRBORNE= 0.75607E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.285E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.29041E+00           0.01351
   3.00 TO   10.00  0.80956E+00           0.03765
  10.00 TO   30.00  0.17956E+01           0.08352
  30.00 TO  100.00  0.35393E+01           0.16462
          >  100.00  0.15065E+02           0.70070
 TOTAL MASS AIRBORNE=  0.21500E+02      FRAC. INERT   AIRBORNE= 0.75437E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.286E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.29030E+00           0.01349
   3.00 TO   10.00  0.80963E+00           0.03761
  10.00 TO   30.00  0.17963E+01           0.08344
  30.00 TO  100.00  0.35420E+01           0.16454
          >  100.00  0.15089E+02           0.70092
 TOTAL MASS AIRBORNE=  0.21527E+02      FRAC. INERT   AIRBORNE= 0.75269E-01
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.287E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.29019E+00           0.01346
   3.00 TO    10.00  0.80971E+00           0.03757
  10.00 TO    30.00  0.17970E+01           0.08337
  30.00 TO   100.00  0.35447E+01           0.16446
          >  100.00  0.15112E+02           0.70114
 TOTAL MASS AIRBORNE=  0.21554E+02     FRAC. INERT  AIRBORNE= 0.75101E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.288E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.29008E+00           0.01344
   3.00 TO    10.00  0.80979E+00           0.03752
  10.00 TO    30.00  0.17978E+01           0.08330
  30.00 TO   100.00  0.35474E+01           0.16437
          >  100.00  0.15136E+02           0.70136
 TOTAL MASS AIRBORNE=  0.21581E+02     FRAC. INERT  AIRBORNE= 0.74935E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.289E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.28998E+00           0.01342
   3.00 TO    10.00  0.80987E+00           0.03748
  10.00 TO    30.00  0.17985E+01           0.08323
  30.00 TO   100.00  0.35501E+01           0.16429
          >  100.00  0.15160E+02           0.70157
 TOTAL MASS AIRBORNE=  0.21608E+02     FRAC. INERT  AIRBORNE= 0.74769E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.290E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.28987E+00           0.01340
   3.00 TO    10.00  0.80995E+00           0.03744
  10.00 TO    30.00  0.17992E+01           0.08316
  30.00 TO   100.00  0.35528E+01           0.16421
          >  100.00  0.15183E+02           0.70179
 TOTAL MASS AIRBORNE=  0.21635E+02     FRAC. INERT  AIRBORNE= 0.74604E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.291E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.28977E+00           0.01338
   3.00 TO    10.00  0.81003E+00           0.03739
  10.00 TO    30.00  0.18000E+01           0.08309
  30.00 TO   100.00  0.35555E+01           0.16413
          >  100.00  0.15207E+02           0.70201
 TOTAL MASS AIRBORNE=  0.21662E+02     FRAC. INERT  AIRBORNE= 0.74441E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.292E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.28966E+00           0.01336
   3.00 TO    10.00  0.81010E+00           0.03735
  10.00 TO    30.00  0.18007E+01           0.08302
  30.00 TO   100.00  0.35582E+01           0.16405
          >  100.00  0.15231E+02           0.70222
 TOTAL MASS AIRBORNE=  0.21689E+02     FRAC. INERT  AIRBORNE= 0.74278E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.293E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.28956E+00           0.01333
   3.00 TO    10.00  0.81018E+00           0.03731
  10.00 TO    30.00  0.18014E+01           0.08295
  30.00 TO   100.00  0.35608E+01           0.16397
          >  100.00  0.15254E+02           0.70243
 TOTAL MASS AIRBORNE=  0.21716E+02     FRAC. INERT  AIRBORNE= 0.74116E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.294E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.28945E+00           0.01331
   3.00 TO    10.00  0.81026E+00           0.03727
  10.00 TO    30.00  0.18021E+01           0.08288
  30.00 TO   100.00  0.35635E+01           0.16389
          >  100.00  0.15277E+02           0.70265
 TOTAL MASS AIRBORNE=  0.21743E+02     FRAC. INERT  AIRBORNE= 0.73955E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.295E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.28935E+00           0.01329
   3.00 TO    10.00  0.81033E+00           0.03722
  10.00 TO    30.00  0.18028E+01           0.08281
  30.00 TO   100.00  0.35661E+01           0.16381
          >  100.00  0.15301E+02           0.70286
 TOTAL MASS AIRBORNE=  0.21769E+02     FRAC. INERT  AIRBORNE= 0.73795E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.296E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.28924E+00           0.01327
   3.00 TO    10.00  0.81041E+00           0.03718
  10.00 TO    30.00  0.18035E+01           0.08275
  30.00 TO   100.00  0.35688E+01           0.16373
          >  100.00  0.15324E+02           0.70307
 TOTAL MASS AIRBORNE=  0.21796E+02     FRAC. INERT  AIRBORNE= 0.73636E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.297E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.28914E+00           0.01325
   3.00 TO    10.00  0.81048E+00           0.03714
  10.00 TO    30.00  0.18042E+01           0.08268
  30.00 TO   100.00  0.35714E+01           0.16365
          >  100.00  0.15347E+02           0.70328
 TOTAL MASS AIRBORNE=  0.21823E+02     FRAC. INERT  AIRBORNE= 0.73477E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.298E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.28903E+00           0.01323
   3.00 TO    10.00  0.81055E+00           0.03710
  10.00 TO    30.00  0.18049E+01           0.08261
  30.00 TO   100.00  0.35740E+01           0.16358
          >  100.00  0.15371E+02           0.70349
 TOTAL MASS AIRBORNE=  0.21849E+02     FRAC. INERT  AIRBORNE= 0.73320E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.299E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.28893E+00           0.01321
   3.00 TO    10.00  0.81063E+00           0.03706
  10.00 TO    30.00  0.18056E+01           0.08254
  30.00 TO   100.00  0.35766E+01           0.16350
          >  100.00  0.15394E+02           0.70370
 TOTAL MASS AIRBORNE=  0.21876E+02     FRAC. INERT  AIRBORNE= 0.73163E-01
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.300E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.2[illegible]883E+00           0.01319
   3.00 TO    10.00  0.81370E+00           0.03701
  10.00 TO    30.00  0.18063E+01           0.08247
  30.00 TO   100.00  0.35792E+01           0.16342
         >   100.00  0.15417E+02           0.70391
 TOTAL MASS AIRBORNE=  0.21902E+02     FRAC. INERT  AIRBORNE= 0.73007E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.301E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.28872E+00           0.01317
   3.00 TO    10.00  0.81077E+00           0.03697
  10.00 TO    30.00  0.18070E+01           0.08241
  30.00 TO   100.00  0.35819E+01           0.16334
         >   100.00  0.15440E+02           0.70411
 TOTAL MASS AIRBORNE=  0.21929E+02     FRAC. INERT  AIRBORNE= 0.72852E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.302E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.28862E+00           0.01315
   3.00 TO    10.00  0.81085E+00           0.03693
  10.00 TO    30.00  0.18077E+01           0.08234
  30.00 TO   100.00  0.35844E+01           0.16326
         >   100.00  0.15463E+02           0.70432
 TOTAL MASS AIRBORNE=  0.21955E+02     FRAC. INERT  AIRBORNE= 0.72698E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.303E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.28852E+00           0.01313
   3.00 TO    10.00  0.81092E+00           0.03689
  10.00 TO    30.00  0.18084E+01           0.08227
  30.00 TO   100.00  0.35870E+01           0.16319
         >   100.00  0.15486E+02           0.70453
 TOTAL MASS AIRBORNE=  0.21981E+02     FRAC. INERT  AIRBORNE= 0.72545E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.304E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.28341E+00           0.01311
   3.00 TO    10.00  0.81099E+00           0.03685
  10.00 TO    30.00  0.18091E+01           0.08220
  30.00 TO   100.00  0.35896E+01           0.16311
         >   100.00  0.15509E+02           0.70473
 TOTAL MASS AIRBORNE=  0.22007E+02     FRAC. INERT  AIRBORNE= 0.72393E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.305E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.28831E+00           0.01309
   3.00 TO    10.00  0.81106E+00           0.03681
  10.00 TO    30.00  0.18098E+01           0.08214
  30.00 TO   100.00  0.35922E+01           0.16303
         >   100.00  0.15532E+02           0.70493
 TOTAL MASS AIRBORNE=  0.22034E+02     FRAC. INERT  AIRBORNE= 0.72241E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.306E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.28821E+00           0.01307
   3.00 TO    10.00  0.81113E+00           0.03677
  10.00 TO    30.00  0.18105E+01           0.08207
  30.00 TO   100.00  0.35947E+01           0.16296
         >   100.00  0.15555E+02           0.70514
 TOTAL MASS AIRBORNE=  0.22060E+02     FRAC. INERT  AIRBORNE= 0.72090E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.307E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.28811E+00           0.01305
   3.00 TO    10.00  0.81120E+00           0.03673
  10.00 TO    30.00  0.18112E+01           0.08201
  30.00 TO   100.00  0.35973E+01           0.16288
         >   100.00  0.15578E+02           0.70534
 TOTAL MASS AIRBORNE=  0.22086E+02     FRAC. INERT  AIRBORNE= 0.71940E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.308E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.28801E+00           0.01303
   3.00 TO    10.00  0.81127E+00           0.03669
  10.00 TO    30.00  0.18118E+01           0.08194
  30.00 TO   100.00  0.35998E+01           0.16280
         >   100.00  0.15601E+02           0.70554
 TOTAL MASS AIRBORNE=  0.22112E+02     FRAC. INERT  AIRBORNE= 0.71791E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.309E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.28791E+00           0.01301
   3.00 TO    10.00  0.81133E+00           0.03665
  10.00 TO    30.00  0.18125E+01           0.08187
  30.00 TO   100.00  0.36024E+01           0.16273
         >   100.00  0.15624E+02           0.70574
 TOTAL MASS AIRBORNE=  0.22138E+02     FRAC. INERT  AIRBORNE= 0.71643E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.310E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.28781E+00           0.01299
   3.00 TO    10.00  0.81140E+00           0.03661
  10.00 TO    30.00  0.18132E+01           0.08181
  30.00 TO   100.00  0.36049E+01           0.16265
         >   100.00  0.15646E+02           0.70594
 TOTAL MASS AIRBORNE=  0.22164E+02     FRAC. INERT  AIRBORNE= 0.71495E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.311E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.28771E+00           0.01297
   3.00 TO    10.00  0.81147E+00           0.03657
  10.00 TO    30.00  0.18139E+01           0.08174
  30.00 TO   100.00  0.36074E+01           0.16257
         >   100.00  0.15669E+02           0.70614
 TOTAL MASS AIRBORNE=  0.22189E+02     FRAC. INERT  AIRBORNE= 0.71348E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.312E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.28761E+00           0.01295
   3.00 TO    10.00  0.811[illegible]E+00           0.03653
  10.00 TO    30.00  0.18145E+01           0.08166
  30.00 TO   100.00  0.36099E+01           0.16250
         >   100.00  0.15692E+02           0.70634
 TOTAL MASS AIRBORNE=  0.22215E+02     FRAC. INERT  AIRBORNE= 0.71202E-01
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.313E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.28750E+00           0.01293
   3.00 TO   10.00  0.81160E+00           0.03649
  10.00 TO   30.00  0.18152E+01           0.08162
  30.00 TO  100.00  0.36125E+01           0.16242
          >  100.00  0.15714E+02           0.70654
 TOTAL MASS AIRBORNE=  0.22241E+02     FRAC. INERT  AIRBORNE= 0.71057E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.314E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.28741E+00           0.01291
   3.00 TO   10.00  0.81167E+00           0.03645
  10.00 TO   30.00  0.18159E+01           0.08155
  30.00 TO  100.00  0.36150E+01           0.16235
          >  100.00  0.15737E+02           0.70674
 TOTAL MASS AIRBORNE=  0.22267E+02     FRAC. INERT  AIRBORNE= 0.70913E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.315E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.28731E+00           0.01289
   3.00 TO   10.00  0.81174E+00           0.03641
  10.00 TO   30.00  0.18165E+01           0.08149
  30.00 TO  100.00  0.36175E+01           0.16227
          >  100.00  0.15759E+02           0.70694
 TOTAL MASS AIRBORNE=  0.22292E+02     FRAC. INERT  AIRBORNE= 0.70769E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.316E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.28721E+00           0.01287
   3.00 TO   10.00  0.81180E+00           0.03637
  10.00 TO   30.00  0.18172E+01           0.08142
  30.00 TO  100.00  0.36199E+01           0.16220
          >  100.00  0.15782E+02           0.70713
 TOTAL MASS AIRBORNE=  0.22318E+02     FRAC. INERT  AIRBORNE= 0.70626E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.317E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.28711E+00           0.01285
   3.00 TO   10.00  0.81187E+00           0.03634
  10.00 TO   30.00  0.18178E+01           0.08136
  30.00 TO  100.00  0.36224E+01           0.16213
          >  100.00  0.15804E+02           0.70733
 TOTAL MASS AIRBORNE=  0.22343E+02     FRAC. INERT  AIRBORNE= 0.70483E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.318E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.28701E+00           0.01283
   3.00 TO   10.00  0.81193E+00           0.03630
  10.00 TO   30.00  0.18185E+01           0.08130
  30.00 TO  100.00  0.36249E+01           0.16205
          >  100.00  0.15826E+02           0.70752
 TOTAL MASS AIRBORNE=  0.22369E+02     FRAC. INERT  AIRBORNE= 0.70342E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.319E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.28691E+00           0.01281
   3.00 TO   10.00  0.81200E+00           0.03626
  10.00 TO   30.00  0.18191E+01           0.08125
  30.00 TO  100.00  0.36274E+01           0.16198
          >  100.00  0.15849E+02           0.70772
 TOTAL MASS AIRBORNE=  0.22394E+02     FRAC. INERT  AIRBORNE= 0.70201E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.320E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.28681E+00           0.01279
   3.00 TO   10.00  0.81206E+00           0.03622
  10.00 TO   30.00  0.18198E+01           0.08117
  30.00 TO  100.00  0.36298E+01           0.16190
          >  100.00  0.15871E+02           0.70791
 TOTAL MASS AIRBORNE=  0.22420E+02     FRAC. INERT  AIRBORNE= 0.70061E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.321E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.28671E+00           0.01277
   3.00 TO   10.00  0.81212E+00           0.03618
  10.00 TO   30.00  0.18204E+01           0.08111
  30.00 TO  100.00  0.36323E+01           0.16183
          >  100.00  0.15893E+02           0.70811
 TOTAL MASS AIRBORNE=  0.22445E+02     FRAC. INERT  AIRBORNE= 0.69922E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.322E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.28662E+00           0.01276
   3.00 TO   10.00  0.81219E+00           0.03615
  10.00 TO   30.00  0.18211E+01           0.08104
  30.00 TO  100.00  0.36347E+01           0.16176
          >  100.00  0.15916E+02           0.70830
 TOTAL MASS AIRBORNE=  0.22470E+02     FRAC. INERT  AIRBORNE= 0.69783E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.323E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.28652E+00           0.01274
   3.00 TO   10.00  0.81225E+00           0.03611
  10.00 TO   30.00  0.18217E+01           0.08098
  30.00 TO  100.00  0.36371E+01           0.16168
          >  100.00  0.15938E+02           0.70849
 TOTAL MASS AIRBORNE=  0.22495E+02     FRAC. INERT  AIRBORNE= 0.69646E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.324E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.28642E+00           0.01272
   3.00 TO   10.00  0.81231E+00           0.03607
  10.00 TO   30.00  0.18223E+01           0.08092
  30.00 TO  100.00  0.36396E+01           0.16161
          >  100.00  0.15960E+02           0.70868
 TOTAL MASS AIRBORNE=  0.22520E+02     FRAC. INERT  AIRBORNE= 0.69508E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.325E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.28632E+00           0.01270
   3.00 TO   10.00  0.81237E+00           0.03603
  10.00 TO   30.00  0.18230E+01           0.08086
  30.00 TO  100.00  0.36420E+01           0.16154
          >  100.00  0.15982E+02           0.70887
 TOTAL MASS AIRBORNE=  0.22546E+02     FRAC. INERT  AIRBORNE= 0.69371E-01
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.326E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.28623E+00           0.01268
   3.00 TO   10.00  0.81243E+00           0.03600
  10.00 TO   30.00  0.18236E+01           0.08080
  30.00 TO  100.00  0.36444E+01           0.16147
          >  100.00  0.16004E+02           0.70906
 TOTAL MASS AIRBORNE=  0.22571E+02     FRAC. INERT  AIRBORNE= 0.69235E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.327E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.28613E+00           0.01266
   3.00 TO   10.00  0.81249E+00           0.03596
  10.00 TO   30.00  0.18242E+01           0.08073
  30.00 TO  100.00  0.36468E+01           0.16139
          >  100.00  0.16026E+02           0.70925
 TOTAL MASS AIRBORNE=  0.22596E+02     FRAC. INERT  AIRBORNE= 0.69100E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.328E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.28603E+00           0.01264
   3.00 TO   10.00  0.81255E+00           0.03592
  10.00 TO   30.00  0.18249E+01           0.08067
  30.00 TO  100.00  0.36492E+01           0.16132
          >  100.00  0.10048E-02           0.70944
 TOTAL MASS AIRBORNE=  0.22621E+02     FRAC. INERT  AIRBORNE= 0.68965E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.329E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.28594E+00           0.01263
   3.00 TO   10.00  0.81262E+00           0.03588
  10.00 TO   30.00  0.18255E+01           0.08061
  30.00 TO  100.00  0.36516E+01           0.16125
          >  100.00  0.16070E+02           0.70963
 TOTAL MASS AIRBORNE=  0.22646E+02     FRAC. INERT  AIRBORNE= 0.63831E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.330E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.28584E+00           0.01261
   3.00 TO   10.00  0.81268E+00           0.03585
  10.00 TO   30.00  0.18261E+01           0.08055
  30.90 TO  100.00  0.36540E+01           0.16118
          >  100.00  0.16092E+02           0.70981
 TOTAL MASS AIRBORNE=  0.22670E+02     FRAC. INERT  AIRBORNE= 0.68698E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.331E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.28575E+00           0.01259
   3.00 TO   10.00  0.81274E+00           0.03581
  10.00 TO   30.00  0.18267E+01           0.08049
  30.00 TO  100.00  0.36564E+01           0.16111
          >  100.00  0.16[illegible]14E+02           0.71000
 TOTAL MASS AIRBORNE=  0.22695E+02     FRAC. INERT  AIRBORNE= 0.68566E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.332E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.28565E+00           0.01257
   3.00 TO   10.00  0.81279E+00           0.03577
  10.00 TO   30.00  0.18274E+01           0.08043
  30.00 TO  100.00  0.36588E+01           0.16104
          >  100.00  0.16135E+02           0.71019
 TOTAL MASS AIRBORNE=  0.22720E+02     FRAC. INERT  AIRBORNE= 0.68434E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.333E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.28556E+00           0.01255
   3.00 TO   10.00  0.81285E+00           0.03574
  10.00 TO   30.00  0.18280E+01           0.08037
  30.00 TO  100.00  0.36611E+01           0.16097
          >  100.00  0.16157E+02           0.71037
 TOTAL MASS AIRBORNE=  0.22746E+02     FRAC. INERT  AIRBORNE= 0.68303E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.334E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.28546E+00           0.012[illegible]4
   3.00 TO   10.00  0.81291E+00           0.03570
  10.00 TO   30.00  0.18286E+01           0.08031
  30.00 TO  100.00  0.36635E+01           0.16090
          >  100.00  0.16179E+02           0.71056
 TOTAL MASS AIRBORNE=  0.22769E+02     FRAC. INERT  AIRBORNE= 0.68172E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.335F+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.28536E+00           0.01252
   3.00 TO   10.00  0.81297E+00           0.03567
  10.00 TO   30.00  0.18292E+01           0.08025
  30.00 TO  100.00  0.36659E+01           0.16083
          >  100.00  0.16201E+02           0.71074
 TOTAL MASS AIRBORNE=  0.22794E+02     FRAC. INERT  AIRBORNE= 0.68042E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.336E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.28527[illegible]           0.01250
   3.00 TO   10.00  0.81303E+00           0.03563
  10.00 TO   30.00  0.1[illegible]298E+01           0.08019
  30.00 TO  100.00  0.36682E+01           0.16075
          >  100.00  0.16222E+02           0.71092
 TOTAL MASS AIRBORNE=  0.22819E+02     FRAC. INERT  AIRBORNE= 0.67913E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.337E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.28518E+00           0.01248
   3.00 TO   10.00  0.81308E+00           0.03559
  10.00 TO   30.00  0.18304E+01           0.08013
  30.00 TO  100.00  0.36706E+01           0.16068
          >  100.00  0.16244E+02           0.71111
 TOTAL MASS AIRBORNE=  0.22843E+02     FRAC. INERT  AIRBORNE= 0.67784E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.338E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.28508E+00           0.01247
   3.00 TO   10.00  0.81314E+00           0.03556
  10.00 TO   30.00  0.18310E+01           0.08007
  30.00 TO  100.00  0.36729E+01           0.16061
          >  100.00  0.16266E+02           0.71129
 TL [illegible]L MASS AIRBORNE=  0.22868E+02     FRAC. INERT  AIRBORNE= 0.67656E-01
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.339E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.28499E+00            0.01245
   3.00 TO   10.00  0.81320E+00            0.03552
  10.00 TO   30.00  0.18317E+01            0.08001
  30.00 TO  100.00  0.36752E+01            0.16055
         >  100.00  0.16287E+02            0.71147
 TOTAL MASS AIRBORNE=  0.22892E+02     FRAC. INERT  AIRBORNE= 0.67528E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(C) = 0.340E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.28489E+00            0.01243
   3.00 TO   10.00  0.81325E+00            0.03549
  10.00 TO   30.00  0.18323E+01            0.07995
  30.00 TO  100.00  0.36775E+01            0.16048
         >  100.00  0.16309E+02            0.71165
 TOTAL MASS AIRBORNE=  0.22917E+02     FRAC. INERT  AIRBORNE= 0.67402E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.341E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.28480E+00            0.01241
   3.00 TO   10.00  0.81331E+00            0.03545
  10.00 TO   30.00  0.18329E+01            0.07989
  30.00 TO  100.00  0.36799E+01            0.16041
         >  100.00  0.16330E+02            0.71183
 TOTAL MASS AIRBORNE=  0.22941E+02     FRAC. INERT  AIRBORNE= 0.67275E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.342E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.28471E+00            0.01240
   3.00 TO   10.00  0.81336E+00            0.03542
  10.00 TO   30.00  0.18335E+01            0.07984
  30.00 TO  100.00  0.36822E+01            0.16034
         >  100.00  0.16352E+02            0.71201
 TOTAL MASS AIRBORNE=  0.22965E+02     FRAC. INERT  AIRBORNE= 0.67150E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.343E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.28462E+00            0.01238
   3.00 TO   10.00  0.81342E+00            0.03538
  10.00 TO   30.00  0.18340E+01            0.07978
  30.00 TO  100.00  0.36845E+01            0.16027
         >  100.00  0.16373E+02            0.71219
 TOTAL MASS AIRBORNE=  0.22989E+02     FRAC  INERT  AIRBORNE= 0.67025E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.344E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.28452E+00            0.01236
   3.00 TO   10.00  0.81347E+00            0.03535
  10.00 TO   30.00  0.18346E+01            0.07972
  30.00 TO  100.00  0.36868E+01            0.16020
         >  100.00  0.16394E+02            0.71237
 TOTAL MASS AIRBORNE=  0.23014E+02     FRAC. INERT  AIRBORNE= 0.66900E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 I ERT WT(G) = 0.345E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.28443E+00            0.01235
   3.00 TO   10.00  0.81353E+00            0.03531
  10.00 TO   30.00  0.18352E+01            0.07966
  30.00 TO  100.00  0.36891E+01            0.16013
         >  100.00  0.16416E+02            0.71255
 TOTAL MASS AIRBORNE=  0.23038E+02     FRAC. INERT  AIRBORNE= 0.66776E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.346E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.28434E+00            0.01233
   3.00 TO   10.00  0.81358E+00            0.03528
  10.00 TO   30.00  0.18358E+01            0.07960
  30.00 TO  100.00  0.36914E+01            0.16006
         >  100.00  0.16437E+02            0.71273
 TOTAL MASS AIRBORNE=  0.23062E+02     FRAC. INERT  AIRBORNE= 0.66653E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.347E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.28424E+00            0.01231
   3.00 TO   10.00  0.81364E+00            0.03524
  10.00 TO   30.00  0.18364E+01            0.07955
  30.00 TO  100.00  0.36936E+01            0.15999
         >  100.00  0.16458E+02            0.71290
 TOTAL MASS AIRBORNE=  0.23086E+02     FRAC. INERT  AIRBORNE= 0.66531E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.348E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.28415E+00            0.01230
   3.00 TO   10.00  0.81369E+00            0.03521
  10.00 TO   30.00  0.18370E+01            0.07949
  30.00 TO  100.00  0.36959E+01            0.15993
         >  100.00  0.16479E+02            0.71308
 TOTAL MASS AIRBORNE=  0.23110E+02     FRAC. INERT  AIRBORNE= 0.56408E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.349E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.28406E+06            0.01228
   3.00 TO   10.00  0.81374E+00            0.03518
  10.00 TO   30.00  0.18376E+01            0.07943
  30.00 TO  100.00  0.36982E+01            0.15986
         >  100.00  0.16501E+02            0.71326
 TOTAL MASS AIRBORNE=  0.23134E+02     FRAC. INERT  AIRBORNE= 0.66287E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.350E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.28397E+00            0.01226
   3.00 TO   10.00  0.81380E+00            0.03514
  10.00 TO   30.00  0.18382E+01            0.07937
  30.00 TO  100.00  0.37004E+01            0.15979
         >  100.00  0.16522E+02            0.71343
 TOTAL MASS AIRBORNE=  0.23158E+02     FRAC. INERT  AIRBORNE= 0.66166E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.351E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.28388E+00            0.01225
   3.00 TO   10.00  0.81385E+00            0.03511
  10.00 TO   30.00  0.18387E+01            0.07932
  30.00 TO  100.00  0.37027E+01            0.15972
         >  100.00  0.16543E+02            0.71361
 TOTAL MASS AIRBORNE=  0.23182E+02     FRAC. INERT  AIRBORNE= 0.66046E-01
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.352E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.28379E+00            0.01223
   3.00 TO   10.00  0.81390E+00            0.03507
  10.00 TO   30.00  0.18393E+01            0.07926
  30.00 TO  100.00  0.37050E+01            0.15966
          > 100.00  0.16564E+02            0.71378
 TOTAL MASS AIRBORNE=  0.23206E+02     FRAC. INERT  AIRBORNE= 0.65926E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.353E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBURNE
   0.00 TO    3.00  0.28370E+00            0.01221
   3.00 TO   10.00  0.81395E+00            0.03504
  10.00 TO   30.00  0.18399E+01            0.07920
  30.00 TO  100.00  0.37072E+01            0.15959
          > 100.00  0.16585E+02            0.71395
 TOTAL MASS AIRBORNE=  0.23230E+02     FRAC. INERT  AIRBORNE= 0.65806E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.354E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.28360E+00            0.01220
   3.00 TO   10.00  0.81400E+00            0.03501
  10.00 TO   30.00  0.18405E+01            0.07915
  30.00 TO  100.00  0.37094E+01            0.15952
          > 100.00  0.16606E+02            0.71413
 TOTAL MASS AIRBORNE=  0.23253E+02     FRAC. INERT  AIRBORNE= 0.65688E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.355E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.28351E+00            0.01218
   3.00 TO   10.00  0.81405E+00            0.03497
  10.00 TO   30.00  0.18410E+01            0.07909
  30.00 TO  100.00  0.37117E+01            0.15946
          > 100.00  0.16627E+02            0.71430
 TOTAL MASS AIRBORNE=  0.23277E+02     FRAC. INERT  AIRBORNE= 0.65570E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.356E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.28343E+00            0.01216
   3.00 TO   10.00  0.81410E+00            0.03494
  10.00 TO   30.00  0.18416E+01            0.07904
  30.00 TO  100.00  0.37139E+01            0.15939
          > 100.00  0.16648E+02            0.71447
 TOTAL MASS AIRBORNE=  0.23301E+02     FRAC. INERT  AIRBORNE= 0.65452E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.357E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.28333E+00            0.01215
   3.00 TO   10.00  0.81415E+00            0.03491
  10.00 TO   30.00  0.18422E+01            0.07898
  30.00 TO  100.00  0.37161E+01            0.15932
          > 100.00  0.16669E+02            0.71464
 TOTAL MASS AIRBORNE=  0.23325E+02     FRAC. INERT  AIRBORNE= 0.65335E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.358E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.28324E+00            0.01213
   3.00 TO   10.00  0.81421E+00            0.03487

  10.00 TO   30.00  0.18428E+01            0.07892
  30.00 TO  100.00  0.37183E+01            0.15926
          > 100.00  0.16690E+02            0.71482
 TOTAL MASS AIRBORNE=  0.23348E+02     FRAC. INERT  AIRBORNE= 0.65218E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.359E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.28316E+00            0.01212
   3.00 TO   10.00  0.81425E+00            0.03484
  10.00 TO   30.00  0.18433E+01            0.07887
  30.00 TO  100.00  0.37205E+01            0.15919
          > 100.00  0.16710E+02            0.71499
 TOTAL MASS AIRBORNE=  0.23372E+02     FRAC. INERT  AIRBORNE= 0.65102E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.360E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.28307E+00            0.01210
   3.00 TO   10.00  0.81430E+00            0.03481
  10.00 TO   30.00  0.18439E+01            0.07881
  30.00 TO  100.00  0.37227E+01            0.15912
          > 100.00  0.16731E+02            0.71516
 TOTAL MASS AIRBORNE=  0.23395E+02     FRAC. INERT  AIRBORNE= 0.64987E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.361E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.28298E+00            0.01208
   3.00 TO   10.00  0.81435E+00            0.03477
  10.00 TO   30.00  0.18444E+01            0.07876
  30.00 TO  100.00  0.37249E+01            0.15906
          > 100.00  0.16752E+02            0.71533
 TOTAL MASS AIRBORNE=  0.23419E+02     FRAC. INERT  AIRBORNE= 0.64872E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.362E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.28289E+00            0.01207
   3.00 TO   10.00  0.81440E+00            0.03474
  10.00 TO   30.00  0.18450E+01            0.07870
  30.00 TO  100.00  0.37271E+01            0.15899
          > 100.00  0.16773E+02            0.71549
 TOTAL MASS AIRBORNE=  0.23442E+02     FRAC. INERT  AIRBORNE= 0.64757E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.363E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.28280E+00            0.01205
   3.00 TO   10.00  0.81445E+00            0.03471
  10.00 TO   30.00  0.18456E+01            0.07865
  30.00 TO  100.00  0.37293E+01            0.15893
          > 100.00  0.16793E+02            0.71566
 TOTAL MASS AIRBORNE=  0.23466E+02     FRAC. INERT  AIRBORNE= 0.64643E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.364E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.28271E+00            0.01204
   3.00 TO   10.00  0.81450E+00            0.03468
  10.00 TO   30.00  0.18461E+01            0.07860
  30.00 TO  100.00  0.37315E+01            0.15886
          > 100.00  0.16814E+02            0.71583
 TOTAL MASS AIRBORNE=  0.23489E+02     FRAC. INERT  AIRBORNE= 0.64530E-01
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.365E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.28262E+00            0.01202
   3.00 TO    10.00  0.81455E+00            0.03464
  10.00 TO    30.00  0.18467E+01            0.07854
  30.00 TO   100.00  0.37337E+01            0.15880
          >  100.00  0.16835E+02            0.71600
 TOTAL MASS AIRBORNE=  0.23512E+02     FRAC. INERT  AIRBORNE= 0.64417E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.366E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.28253E+00            0.01200
   3.00 TO    10.00  0.81459E+00            0.03461
  10.00 TO    30.00  0.18472E+01            0.07849
  30.00 TO   100.00  0.37359E+01            0.15873
          >  100.00  0.16855F-02            0.71617
 TOTAL MASS AIRBORNE=  0.23[illegible]6E+02     FRAC. INERT  AIRBORNE= 0.64305E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.367E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.28244E+00            0.01199
   3.00 TO    10.00  0.81464E+00            0.03458
  10.00 TO    30.00  0.18478E+01            0.07843
  30.00 TO   100.00  0.37380E+01            0.15867
          >  100.00  0.16876E+02            0.71633
 TOTAL MASS AIRBORNE=  0.23559E+02     FRAC. INERT  AIRBORNE= 0.64193E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.368E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.28236E+00            0.01197
   3.00 TO    10.00  0.81469E+00            0.03455
  10.00 TO    30.00  0.18483E+01            0.07838
  30.00 TO   100.00  0.37402E+01            0.15860
          >  100.00  0.16896E+02            0.71650
 TOTAL MASS AIRBORNE=  0.23582E+02     FRAC. INERT  AIRBORNE= 0.64081E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.369E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.28227E+00            0.01196
   3.00 TO    10.00  0.81473E+00            0.03452
  10.00 TO    30.00  0.18489E+01            0.07832
  30.00 TO   100.00  0.37423E+01            0.15854
          >  100.00  0.16917E+02            0.71666
 TOTAL MASS AIRBORNE=  0.23605E+02     FRAC. INERT  AIRBORNE= 0.63971E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.370E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.28218E+00            0.01194
   3.00 TO    10.00  0.81478E+00            0.03448
  10.00 TO    30.00  0.18494E+01            0.07027
  30.00 TO   100.00  0.37445E+01            0.15847
          >  100.00  0.16937E+02            0.71683
 TOTAL MASS AIRBORNE=  0.23628E+02     FRAC. INERT  AIRBORNE= 0.63860E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.371E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.28209E+00            0.01193
   3.00 TO    10.00  0.81483E+00            0.03445
  10.00 TO    30.00  0.18500E+01            0.07822
  30.00 TO   100.00  0.37466E+01            0.15841
          >  100.00  0.16958E+02            0.71699
 TOTAL MASS AIRBORNE=  0.23651E+02     FRAC. INERT  AIRBORNE= 0.63750E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.372E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.28201E+00            0.01191
   3.00 TO    10.00  0.81487E+00            0.03442
  10.00 TO    30.00  0.18506E+01            0.07816
  30.00 TO   100.00  0.37488E+01            0.15835
          >  100.00  0.16978E+02            0.71716
 TOTAL MASS AIRBORNE=  0.23674E+02     FRAC. INERT  AIRBORNE= 0.63641E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.373E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.28192E+00            0.01190
   3.00 TO    10.00  0.81492E+00            0.03439
  10.00 TO    30.00  0.18510E+01            0.078[illegible]
  30.00 TO   100.00  0.37509E-01            0.15828
          >  100.00  0.16999E-02            0.71732
 TOTAL MASS AIRBORNE=  0.23697E+02     FRAC. INERT  AIRBORNE= 0.63532E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.374E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.28183E+00            0.01188
   3.00 TO    10.00  0.81496E+00            0.03436
  10.00 TO    30.00  0.18516E+01            0.07806
  30.00 TO   100.00  0.37530E+01            0.15822
          >  100.00  0.17019E+02            0.71748
 TOTAL MASS AIRBORNE=  0.23720E+02     FRAC. INERT  AIRBORNE= 0.63423E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.375E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.28175E+00            0.01187
   3.00 TO    10.00  0.81501E+00            0.03433
  10.00 TO    30.00  0.18521E+01            0.0780[illegible]
  30.00 TO   100.00  0.37551E+01            0.1581[illegible]
          >  100.00  0.17039E+02            0.71765
 TOTAL MASS AIRBORNE=  0.23743E+02     FRAC. INERT  AIRBORNE= 0.63315E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.376E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.28166E+00            0.01185
   3.00 TO    10.00  0.81505E+00            0.03429
  10.00 TO    30.00  0.18526E+01            0.07795
  30.00 TO   100.00  0.37573E+01            0.15809
          >  100.00  0.17060E+02            0.71781
 TOTAL MASS AIRBORNE=  0.23766E+02     FRAC. INERT  AIRBORNE= 0.63208E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.377E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.28157E+00            0.01184
   3.00 TO    10.00  0.81510E+00            0.03426
  10.00 TO    30.00  0.18532E+01            0.0779[illegible]
  30.00 TO   100.00  0.37594E-01            0.15[illegible]
          >  100.00  0.17080E-02            0.71797
 TOTAL MASS AIRBORNE=  0.23789E+02     FRAC. INERT  AIRBORNE= 0.63101E-01
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.378E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.28149E+00           0.01182
   3.00 TO    10.00  0.81514E+00           0.03423
  10.00 TO    30.00  0.18537E+01           0.07785
  30.00 TO   100.00  0.37615E+01           0.15797
         >   100.00  0.17100E+02           0.71813
 TOTAL MASS AIRBORNE=  0.23812E+02     FRAC. INERT  AIRBORNE= 0.62994E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.379E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.28140E+00           0.01181
   3.00 TO    10.00  0.81519E+00           0.03420
  10.00 TO    30.00  0.18542E+01           0.07780
  30.00 TO   100.00  0.37636E+01           0.15790
         >   100.00  0.17120E+02           0.71829
 TOTAL MASS AIRBORNE=  0.[illegible]835E+02     FRAC. INERT  AIRBORNE= 0.62888E-01

EXPLOSION RADIOACTIVE S[illegible] TERM
TNT WT(G) =     1.00 IN[illegible]T(G) = 0.380E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.[illegible]  0.28132E+00           0.01179
   3.00 TO    10.0[illegible]  [illegible]           0.03417
  [illegible] TO    [illegible]  0.18548E+01           0.07774
  30.00 TO   100.00  0.37657E+01           0.15794
         >   100.00  0.17140E+02           0.71845
 TOTAL MASS AIRBORNE=  0.23857E+02     FRAC. INERT  AIRBORNE= 0.62782E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.381E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.28123E+00           0.01178
   3.00 TO    10.00  0.81527E+00           0.03414
  10.00 TO    30.00  0.18553E+01           0.07769
  30.00 TO   100.00  0.37678E+01           0.15778
         >   100.00  0.17160E+02           0.71861
 TOTAL MASS AIRBORNE=  0.23880E+02     FRAC. INERT  AIRBORNE= 0.62677E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.382E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.28115E+00           0.01176
   3.00 TO    10.00  0.81532E+00           0.03411
  10.00 TO    30.00  0.18558E+01           0.07764
  30.00 TO   100.00  0.37699E+01           0.15772
         >   100.00  0.17180E+02           0.71877
 TOTAL MASS AIRBORNE=  0.23903E+02     FRAC. INERT  AIRBORNE= 0.62572E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.383E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.28106E+00           0.01175
   3.00 TO    10.00  0.81536E+00           0.03408
  10.00 TO    30.00  0.18563E+01           0.07759
  30.00 TO   100.00  0.37719E+01           0.15766
         >   100.00  0.17201E+02           0.71893
 TOTAL MASS AIRBORNE=  0.23925E+02     FRAC. INERT  AIRBORNE= 0.62468E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.[illegible]4E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.2809[illegible]E+00           0.01173
   3.00 TO    10.00  0.815[illegible]E+00           0.03405
  10.00 TO    30.00  0.18569E+01           0.07754
  30.00 TO   100.00  0.37740E+01           0.15759
         >   100.00  0.17221E+02           0.71909
 TOTAL MASS AIRBORNE=  0.23948E+02     FRAC. INER[illegible]  AIRBORN[illegible] 0.62364E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.385E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.28089E+00           0.01172
   3.00 TO    10.00  0.81544E+00           0.03402
  10.00 TO    30.00  0.18574E+01           0.07749
  30.00 TO   100.00  0.37761E+01           0.15753
         >   [illegible]00.00  0.17241E+02           0.71925
 TOTAL MASS AIRBORNE=  0.23970E+02     FRAC. INERT  AIRBORNE= 0.62261E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.386E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.28081E+00           0.01170
   3.00 TO    10.00  0.81549E+00           0.03399
  10.00 TO    30.00  0.18579E+01           0.07744
  30.00 TO   100.00  0.37781E+01           0.15747
         >   100.00  0.17261E+02           0.71940
 TOTAL MASS AIRBORNE=  0.23993E+02     FRAC. INERT  AIRBORNE= 0.62158E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.387E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.28072E+00           0.01169
   3.00 TO    10.00  0.81553E+00           0.03396
  10.00 TO    30.00  0.18584E+01           0.07738
  30.00 TO   100.00  0.37802E+01           0.15741
         >   100.00  0.17280E+02           0.71956
 TOTAL MASS AIRBORNE=  0.24015E+02     FRAC. INERT  AIRBORNE= 0.62055E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.388E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.28064E+00           0.01167
   3.00 TO    10.00  0.81557E+00           0.03393
  10.00 TO    30.00  0.18589E+01           0.07733
  30.00 TO   100.00  0.37823E+01           0.15736
         >   100.00  0.17300E+02           0.71972
 TOTAL MASS AIRBORNE=  0.24038E+02     FRAC. INERT  AIRBORNE= 0.61953E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.389E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.28055E+00           0.01166
   3.00 TO    10.00  0.81561E+00           0.03390
  10.00 TO    30.00  0.18594E+01           0.07728
  30.00 TO   100.00  0.37843E+01           0.15729
         >   100.00  0.17320E+02           0.71987
 TOTAL MASS AIRBORNE=  0.24060E+02     FRAC. INERT  AIRBORNE= 0.61851E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.390E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.28047E+00           0.01165
   3.00 TO    10.00  0.81565E+00           0.03387
  10.00 TO    30.00  0.18599E+01           0.07723
  30.00 TO   100.00  0.37864E+01           0.15722
         >   100.00  0.17340E+02           0.72003
 TOTAL MASS AIRBORNE=  0.24082E+02     FRAC. INERT  AIRBORNE= 0.61750E-01
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.391E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.28039E+00             0.01163
   3.00 TO   10.00  0.81569E+00             0.0338[illegible]
  10.00 TO   30.00  0.18605E+01             0.07718
  30.00 TO  100.00  0.37884E+01             0.15716
           > 100.00  0.17360E+02             0.72018
 TOTAL MASS AIRBORNE=  0.24105E+02      FRAC. INERT  AIRBORNE= 0.61649E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.392E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.28030E+00             0.01162
   3.00 TO   10.00  0.81573E+00             0.03381
  10.00 TO   30.00  0.18610E+01             0.07713
  30.00 TO  100.00  0.37904E+01             0.15710
           > 100.00  0.17380E+02             0.72034
 TOTAL MASS AIRBORNE=  0.24127E+02      FRAC. INERT  AIRBORNE= 0.61549E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.393E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.28022E+00             0.01160
   3.00 TO   10.00  0.81577E+00             0.03378
  10.00 TO   30.00  0.18615E+01             0.07708
  30.00 TO  100.00  0.37925E+01             0.15704
           > 100.00  0.17399E+02             0.72049
 TOTAL MASS AIRBORNE=  0.24149E+02      FRAC. INERT  AIRBORNE= 0.61449E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.394E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.28014E+00             0.01159
   3.00 TO   10.00  0.81581E+00             0.03375
  10.00 TO   30.00  0.18620E+01             0.07703
  30.00 TO  100.00  0.37945E+01             0.15698
           > 100.00  0.17419E+02             0.72065
 TOTAL MASS AIRBORNE=  0.24172E+02      FRAC. INERT  AIRBORNE= 0.61349E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.395E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.28005E+00             0.01158
   3.00 TO   10.00  0.81585E+00             0.03372
  10.00 TO   30.00  0.18625E+01             0.07698
  30.00 TO  100.00  0.37965E+01             0.15692
           > 100.00  0.17439E+02             0.72080
 TOTAL MASS AIRBORNE=  0.24194E+02      FRAC. INERT  AIRBORNE= 0.61250E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.396E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27997E+00             0.01156
   3.00 TO   10.00  0.81589E+00             0.03369
  10.00 TO   30.00  0.18630E+01             0.07693
  30.00 TO  100.00  0.37985E+01             0.15686
           > 100.00  0.17458E+02             0.72095
 TOTAL MASS AIRBORNE=  0.24216E+02      FRAC. INERT  AIRBORNE= 0.61151E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.397E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27989E+00             0.01155
   3.00 TO   10.00  0.81593E+00             0.03366
  10.00 TO   30.00  0.18635E+01             0.07688
  30.00 TO  100.00  0.38006E+01             0.15680
           > 100.00  0.17478E+02             0.72116
 TOTAL MASS AIRBORNE=  0.24238E+02      FRAC. INERT  AIRBORNE= 0.61053E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.398E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27981E+00             0.01153
   3.00 TO   10.00  0.81597E+00             0.03363
  10.00 TO   30.00  0.18640E+01             0.07683
  30.00 TO  100.00  0.38026E+01             0.15674
           > 100.00  0.174[illegible]8E+02             0.72126
 TOTAL MASS AIRBORNE=  0.24260E+02      FRAC. INERT  AIRBORNE= 0.60955E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.399E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27972E+00             0.01152
   3.00 TO   10.00  0.81601E+00             0.0336[illegible]
  10.00 TO   30.00  0.18645E+01             0.07678
  30.00 TO  100.00  0.38046E+01             0.15668
           > 100.00  0.17517E+02             0.72141
 TOTAL MASS AIRBORNE=  0.24282E+02      FRAC. INERT  AIRBORNE= 0.60857E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.400E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27964E+00             0.01151
   3.00 TO   10.00  0.81605E+00             0.03358
  10.00 TO   30.00  0.18650E+01             0.07673
  30.00 TO  100.00  0.38066E+01             0.15662
           > 100.00  0.17537E+02             0.72156
 TOTAL MASS AIRBORNE=  0.24304E+02      FRAC. INERT  AIRBORNE= 0.60760E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.401E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27956E+00             0.01149
   3.00 TO   10.00  0.81609E+00             0.03355
  10.00 TO   30.00  0.18655E+01             0.07669
  30.00 TO  100.00  0.38086E+01             0.15656
           > 100.00  0.17556E+02             0.72171
 TOTAL MASS AIRBORNE=  0.24326E+02      FRAC. INERT  AIRBORNE= 0.60663E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.402E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27948E+00             0.01148
   3.00 TO   10.00  0.81612E+00             0.03352
  10.00 TO   30.00  0.18660E+01             0.07664
  30.00 TO  100.00  0.38105E+01             0.15650
           > 100.00  0.17576E+02             0.72186
 TOTAL MASS AIRBORNE=  0.24348E+02      FRAC. INERT  AIRBORNE= 0.60567E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.403E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27940E+00             0.01146
   3.00 TO   10.00  0.81616E+00             0.03349
  10.00 TO   30.00  0.18664E+01             0.07659
  30.00 TO  100.00  0.38125E+01             0.15644
           > 100.00  0.17595E+02             0.72201
 TOTAL MASS AIRBORNE=  0.24370E+02      FRAC. INERT  AIRBORNE= 0.60471E-01
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.404E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27931E+00            0.01145
   3.00 TO   10.00  0.81620E+00            0.03346
  10.00 TO   30.00  0.18669E+01            0.07654
  30.00 TO  100.00  0.38145E+01            0.15639
         >  100.00  0.17615E+02            0.72216
 TOTAL MASS AIRBORNE=  0.24392E+02     FRAC. INERT  AIRBORNE= 0.60375E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.405E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27923E+00            0.01144
   3.00 TO   10.00  0.81624E+00            0.03343
  10.00 TO   30.00  0.18674E+01            0.07649
  30.00 TO  100.00  0.38165E+01            0.15633
         >  100.00  0.17634E+02            0.72231
 TOTAL MASS AIRBORNE=  0.24413E+02     FRAC. INERT  AIRBORNE= 0.60280E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.406E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27915E+00            0.01142
   3.00 TO   10.00  0.81627E+00            0.03341
  10.00 TO   30.00  0.18679E+01            0.07644
  30.00 TO  100.00  0.38185E+01            0.15627
         >  100.00  0.17653E+02            0.72246
 TOTAL MASS AIRBORNE=  0.24435E+02     FRAC. INERT  AIRBORNE= 0.60185E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.407E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27907E+00            0.01141
   3.00 TO   10.00  0.81631E+00            0.03338
  10.00 TO   30.00  0.18684E+01            0.07640
  30.00 TO  100.00  0.38204E+01            0.15621
         >  100.00  0.17673E+02            0.72261
 TOTAL MASS AIRBORNE=  0.24457E+02     FRAC. INERT  AIRBORNE= 0.60091E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.408E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27899E+00            0.01140
   3.00 TO   10.00  0.81635E+00            0.03335
  10.00 TO   30.00  0.18689E+01            0.07635
  30.00 TO  100.00  0.38224E+01            0.15615
         >  100.00  0.17692E+02            0.72276
 TOTAL MASS AIRBORNE=  0.24479E+02     FRAC. INERT  AIRBORNE= 0.59997E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.409E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27891E+00            0.01138
   3.00 TO   10.00  0.81638E+00            0.03332
  10.00 TO   30.00  0.18694E+01            0.07630
  30.00 TO  100.00  0.38243E+01            0.15609
         >  100.00  0.17711E+02            0.72290
 TOTAL MASS AIRBORNE=  0.24500E+02     FRAC. INERT  AIRBORNE= 0.59903E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.410E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27883E+00            0.01137
   3.00 TO   10.00  0.81642E+00            0.03329
  10.00 TO   30.00  0.18698E+01            0.07625
  30.00 TO  100.00  0.38263E+01            0.15603
         >  100.00  0.17731E+02            0.72305
 TOTAL MASS AIRBORNE=  0.24522E+02     FRAC. INERT  AIRBORNE= 0.59810E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.411E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27875E+00            0.01136
   3.00 TO   10.00  0.81646E+00            0.03327
  10.00 TO   30.00  0.18703E+01            0.07620
  30.00 TO  100.00  0.38282E+01            0.15598
         >  100.00  0.17750E+02            0.72320
 TOTAL MASS AIRBORNE=  0.24544E+02     FRAC. INERT  AIRBORNE= 0.59717E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.412E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27867E+00            0.01134
   3.00 TO   10.00  0.81649E+00            0.03324
  10.00 TO   30.00  0.18708E+01            0.07616
  30.00 TO  100.00  0.38302E+01            0.15592
         >  100.00  0.17769E+02            0.72334
 TOTAL MASS AIRBORNE=  0.24565E+02     FRAC. INERT  AIRBORNE= 0.59624E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.413E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27859E+00            0.01133
   3.00 TO   10.00  0.81653E+00            0.03321
  10.00 TO   30.00  0.18713E+01            0.07611
  30.00 TO  100.00  0.38321E+01            0.15586
         >  100.00  0.17788E+02            0.72349
 TOTAL MASS AIRBORNE=  0.24587E+02     FRAC. INERT  AIRBORNE= 0.59532E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.414E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27851E+00            0.01132
   3.00 TO   10.00  0.81656E+00            0.03318
  10.00 TO   30.00  0.18718E+01            0.07606
  30.00 TO  100.00  0.38341E+01            0.15580
         >  100.00  0.17807E+02            0.72364
 TOTAL MASS AIRBORNE=  0.24608E+02     FRAC. INERT  AIRBORNE= 0.59440E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.415E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27843E+00            0.01130
   3.00 TO   10.00  0.81660E+00            0.03315
  10.00 TO   30.00  0.18722E+01            0.07601
  30.00 TO  100.00  0.38360E+01            0.15575
         >  100.00  0.17827E+02            0.72378
 TOTAL MASS AIRBORNE=  0.24630E+02     FRAC. INERT  AIRBORNE= 0.59349E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.416E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27835E+00            0.01129
   3.00 TO   10.00  0.81663E+00            0.03313
  10.00 TO   30.00  0.18727E+01            0.07597
  30.00 TO  100.00  0.38379E+01            0.15569
         >  100.00  0.17846E+02            0.72393
 TOTAL MASS AIRBORNE=  0.24651E+02     FRAC. INERT  AIRBORNE= 0.59258E-01
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.417E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.27827E+00            0.01128
   3.^0 TO    10.00  0.81667E+00            0.03310
  10 .0 TO    30.00  0.18732E+01            0.07592
  30.00 TO   100.00  0.38398E+01            0.15563
           >  100.00  0.17865E+02            0.72407
 TOTAL MASS AIRBORNE=  0.24673E+02      FRAC. INERT  AIRBORNE= 0.59167E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.418E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.27819E+00            0.01127
   3.00 TO    10.00  0.81670E+00            0.03307
  10.00 TO    30.00  0.18736E+01            0.07587
  30.00 TO   100.00  0.38418E+01            0.15557
           >  100.00  0.17884E+02            0.72421
 TOTAL MASS AIRBORNE=  0.24694E+02      FRAC. INERT  AIRBORNE= 0.59077E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.419E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.27811E+00            0.01125
   3.00 TO    10.00  0.81674E+00            0.03305
  10.00 TO    30.00  0.18741E+01            0.07583
  30.00 TO   100.00  0.38437E+01            0.15552
           >  100.00  0.17903E+02            0.72436
 TOTAL MASS AIRBORNE=  0.24715E+02      FRAC. INERT  AIRBORNE= 0.58987E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.420E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.27803E+00            0.01124
   3.00 TO    10.00  0.81677E+0U            0.03302
  10.00 TO    30.00  0.18746E+01            0.07578
  30.00 TO   100.00  0.38456E+01            0.15546
           >  100.00  0.17922E+02            0.72450
 TOTAL MASS AIRBORNE=  0.24737E+02      FRAC. INERT  AIRBORNE= 0.58897E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.421E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.27795E+00            0.01123
   3.00 TO    10.00  0.81680E+00            0.03299
  10.00 TO    30.00  0.18750E+01            0.07573
  30.00 TO   100.00  0.38475E+01            0.15540
           >  100.00  0.17941E+02            0.72464
 TOTAL MASS AIRBORNE=  0.24758E+02      FRAC. INERT  AIRBORNE= 0.58808E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.422E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.27788E+00            0.01121
   3.00 TO    10.00  0.81684E+00            0.03296
  10.00 TO    30.00  0.18755E+01            0.07569
  30.00 TO   100.00  0.38494E+01            0.15535
           >  100.00  0.17960E+02            0.72479
 TOTAL MASS AIRBORNE=  0.24779E+02      FRAC. INERT  AIRBORNE= 0.58719E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.423E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.27780E+00            0.01120
   3.00 TO    10.00  0.81687E+00            0.03294
  10.00 TO    30.00  0.18760E+01            0.07564
  30.00 TO   100.00  0.38513E+01            0.15529
           >  100.00  0.17979E+02            0.72493
 TOTAL MASS AIRBORNE=  0.24801E+02      FRAC. INERT  AIRBORNE= 0.58630E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.424E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.27772E+00            0.01119
   3.00 TO    10.00  0.81690E+00            0.03291
  10.00 TO    30.00  0.18764E+01            0.07560
  30.00 TO   100.00  0.38532E+01            0.15523
           >  100.00  0.17997E+02            0.72507
 TOTAL MASS AIRBORNE=  0.24822E+02      FRAC. INERT  AIRBORNE= 0.58542E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.425E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.27764E+00            0.01118
   3.00 TO    10.00  0.81694E+00            0.03288
  10.00 TO    30.00  0.18769E+01            0.07555
  30.00 TO   100.00  0.38551E+01            0.15518
           >  100.00  0.18016E+02            0.72521
 TOTAL MASS AIRBORNE=  0.24843E+02      FRAC. INERT  AIRBORNE= 0.58454E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.426E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.27756E+00            0.01116
   3.00 TO    10.00  0.81697E+00            0.03286
  10.00 TO    30.00  0.18774E+01            0.07551
  30.00 TO   100.00  0.38569E+01            0.15512
           >  100.00  0 18035E+02            0.72535
 TOTAL MASS AIRBORNE=  0.24864E+02      FRAC. INERT  AIRBORNE= 0.58366E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.427E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.27749E+00            0.01115
   3.00 TO    10.00  0.81700E+00            0.03283
  10.00 TO    30.00  0.18778E+01            0.07546
  30.00 TO   100.00  0.38588E+01            0.15507
           >  100.00  0.18054E+02            0.72549
 TOTAL MASS AIRBORNE=  0.24885E+02      FRAC. INERT  AIRBORNE= 0.58279E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) :     1.00 INERT WT(G) = 0.428E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.27741E+00            0.01114
   3.00 TO    10.00  0.81703E+00            0.03280
  10.00 TO    30.00  0.18783E+01            0.07541
  30.00 T"   100.00  0.38607E+01            0.15501
           >  100.00  0.18073E+02            0.72563
 TOTAL MASS AIRBORNE=  0.24906E+02      FRAC. INERT  AIRBORNE= 0.58192E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.429E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.27733E+00            0.01113
   3.00 TO    10.00  0.81707E+00            0.03278
  10.00 TO    30.00  0.18787E+01            0.07537
  30.00 TO   100.00  0.38626E+01            0.15495
           >  100.00  0.18091E+02            0.72577
 TOTAL MASS AIRBORNE=  0.24927E+02       RAC. INERT  AIRBORNE= 0.58105E-01
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.430E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27725E-00            0.01111
   3.00 TO   10.00  0.81710E-00            0.03275
  10.00 TO   30.00  0.18792E+01            0.07532
  30.00 TO  100.00  0.38644E+01            0.15490
         >  100.00  0.18110E+02            0.72591
 TOTAL MASS AIRBORNE=  0.24948E+02     FRAC. INERT  AIRBORNE= 0.58019E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.431E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27718E+00            0.01110
   3.00 TO   10.00  0.81713E+00            0.03273
  10.00 TO   30.00  0.18796E+01            0.07528
  30.00 TO  100.00  0.38563E+01            0.15484
         >  100.00  0.18129E+02            0.72605
 TOTAL MASS AIRBORNE=  0.24969E+02     FRAC. INERT  AIRBORNE= 0.57933E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.432E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27710E-00            0.01109
   3.00 TO   10.00  0.81716E-00            0.03270
  10.00 TO   30.00  0.18801E+01            0.07523
  30.00 TO  100.00  0.38682E+01            0.15479
         >  100.00  0.18148E+02            0.72619
 TOTAL MASS AIRBORNE=  0.24990E-02     FRAC. INERT  AIRBORNE= 0.57847E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.433E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27702E+00            0.01108
   3.00 TO   10.00  0.81719E+00            0.03267
  10.00 TO   30.00  0.18805E+01            0.07519
  30.00 TO  100.00  0.38700E+01            0.15473
         >  100.00  0.18166E+02            0.72633
 TOTAL MASS AIRBORNE=  0.25011E-02     FRAC. INERT  AIRBORNE= 0.57762E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.434E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27694E+00            0.01106
   3.00 TO   10.00  0.81722E+00            0.03265
  10.00 TO   30.00  0.18810E+01            0.07514
  30.00 TO  100.00  0.38719E+01            0.15468
         >  100.00  0.18185E+02            0.72647
 TOTAL MASS AIRBORNE=  0.25032E+02     FRAC. INERT  AIRBORNE= 0.57677E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.435E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27687E+00            0.01105
   3.00 TO   10.00  0.81726E+00            0.03262
  10.00 TO   30.00  0.18814E+01            0.07510
  30.00 TO  100.00  0.38737E+01            0.15462
         >  100.00  0.18203E+02            0.72661
 TOTAL MASS AIRBORNE=  0.25053E+02     FRAC. INERT  AIRBORNE= 0.57592E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.436E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27679E+00            0.01104
   3.00 TO   10.00  0.81728E+00            0.03260
  10.00 TO   30.00  0.18819E+01            0.07505
  30.00 TO  100.00  0.38755E+01            0.15457
         >  100.00  0.18222E+02            0.72674
 TOTAL MASS AIRBORNE=  0.25074E+02     FRAC. INERT  AIRBORNE= 0.57508E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.437E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27671E+00            0.01103
   3.00 TO   10.00  0.81732E+00            0.03257
  10.00 TO   30.00  0.18823E+01            0.07501
  30.00 TO  100.00  0.38774E+01            0.15451
         >  100.00  0.18241E+02            0.72688
 TOTAL MASS AIRBORNE=  0.25094E+02     FRAC. INERT  AIRBORNE= 0.57424E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.438E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27664E+00            0.01101
   3.00 TO   10.00  0.81735E+00            0.03254
  10.00 TO   30.00  0.18828E+01            0.07497
  30.00 TO  100.06  0.38792E+01            0.15446
         >  100.00  0.18259E+02            0.72702
 TOTAL MASS AIRBORNE=  0.25115E+02     FRAC. INERT  AIRBORNE= 0.57340E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.439E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27656E+00            0.01100
   3.00 TO   10.00  0.81738E+00            0.03252
  10.00 TO   30.00  0.18832E+01            0.07492
  30.00 TO  100.00  0.38811E+01            0.15440
         >  100.00  0.18278E+02            0.72715
 TOTAL MASS AIRBORNE=  0.25136E+02     FRAC. INERT  AIRBORNE= 0.57257E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.440E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27649E+00            0.01099
   3.00 TO   10.00  0.81741E+00            0.03249
  10.00 TO   30.00  0.18836E+01            0.07488
  30.00 TO  100.00  0.38829E+01            0.15435
         >  100.00  0.18296E+02            0.72729
 TOTAL MASS AIRBORNE=  0.25156E+02     FRAC. INERT  AIRBORNE= 0.57174E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.441E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27641E+00            0.01098
   3.00 TO   10.00  0.81744E+00            0.03247
  10.00 TO   30.00  0.18841E+01            0.07483
  30.00 TO  100.00  0.38847E+01            0.15429
         >  100.00  0.18315E+02            0.72743
 TOTAL MASS AIRBORNE=  0.25177E+02     FRAC. INERT  AIRBORNE= 0.57091E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.442E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27634E+00            0.01097
   3.00 TO   10.00  0.81747E+00            0.03244
  10.00 TO   30.00  0.18845E+01            0.07479
  30.00 TO  100.00  0.38865E+01            0.15424
         >  100.00  0.18333E+02            0.72756
 TOTAL MASS AIRBORNE=  0.25198E+02     FRAC. INERT  AIRBORNE= 0.57009E-01
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.443E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.27626E+00            0.01095
   3.00 TO    10.00  0.81760E+00            0.03242
  10.00 TO    30.00  0.18850E+01            0.07476
  30.00 TO   100.00  0.38883E+01            0.15419
          >  100.00  0.18351E+02            0.72770
 TOTAL MASS AIRBORNE=  0.25218E+02     FRAC. INERT  AIRBORNE= 0.56926E-01

EXPLOSIJN RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.444E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.27619E+00            0.01094
   3.00 TO    10.00  0.81752E+00            0.03239
  10.00 TO    30.00  0.18854E+01            0.07470
  30.00 TO   100.00  0.38902E+01            0.15413
          >  100.00  0.18370E+02            0.72783
 TOTAL MASS AIRBORNE=  0.25239E+02     FRAC. INERT  AIRBORNE= 0.56845E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.445E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.27611E+00            0.01093
   3.00 TO    10.00  0.81755E+00            0.03237
  10.00 TO    30.00  0.18858E+01            0.07466
  30.00 TO   100.00  0.38920E+01            0.15408
          >  100.00  0.18388E+02            0.72797
 TOTAL MASS AIRBORNE=  0.25260E+02     FRAC. INERT  AIRBORNE= 0.56763E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.446E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.27604E+00            0.01092
   3.00 TO    10.00  0.81758E+00            0.03234
  10.00 TO    30.00  0.18863E+01            0.07462
  30.00 TO   100.00  0.38938E+01            0.15403
          >  100.00  0.18406E+02            0.72810
 TOTAL MASS AIRBORNE=  0.25280E+02     FRAC. INERT  AIRBORNE= 0.56682E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.447E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.27596E+00            0.01091
   3.00 TO    10.00  0.81761E+00            0.03232
  10.00 TO    30.00  0.18867E+01            0.07457
  30.00 TO   100.00  0.38956E+01            0.15397
          >  100.00  0.18425E+02            0.72823
 TOTAL MASS AIRBORNE=  0.25301E+02     FRAC. INERT  AIRBORNE= 0.56601E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.448E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.27588E+00            0.01090
   3.00 TO    10.00  0.81764E+00            0.03229
  10.00 TO    30.00  0.18871E+01            0.07453
  30.00 TO   100.00  0.38974E+01            0.15392
          >  100.00  0.18443E+02            0.72837
 TOTAL MASS AIRBORNE=  0.25321E+02     FRAC. INERT  AIRBORNE= 0.56520E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.449E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.27581E+00            0.01088
   3.00 TO    10.00  0.81767E+00            0.03227
  10.00 TO    30.00  0.18876E+01            0.07449
  30.00 TO   100.00  0.38992E+01            0.15386
          >  100.00  0.18461E+02            0.72850
 TOTAL MASS AIRBORNE=  0.25341E+02     FRAC. INERT  AIRBORNE= 0.56440E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.450E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.27574E+00            0.01087
   3.00 TO    10.00  0.81770E+00            0.03224
  10.00 TO    30.00  0.18880E+01            0.07444
  30.00 TO   100.00  0.39009E+01            0.15381
          >  100.00  0.18479E+02            0.72863
 TOTAL MASS AIRBORNE=  0.25362E+02     FRAC. INERT  AIRBORNE= 0.56360E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.451E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.27566E+00            0.01086
   3.00 TO    10.00  0.81772E+00            0.03222
  10.00 TO    30.00  0.18884E+01            0.07440
  30.00 TO   100.00  0.39027E+01            0.15376
          >  100.00  0.18498E+02            0.72876
 TOTAL MASS AIRBORNE=  0.25382E+02     FRAC. INERT  AIRBORNE= 0.56280E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.452E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.27559E+00            0.01085
   3.00 TO    10.00  0.81775E+00            0.03219
  10.00 TO    30.00  0.18889E+01            0.07436
  30.00 TO   100.00  0.39045E+01            0.15371
          >  100.00  0.18516E+02            0.72890
 TOTAL MASS AIRBORNE=  0.25403E+02     FRAC. INERT  AIRBORNE= 0.56200E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.453E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.27551E+00            0.01084
   3.00 TO    10.00  0.81778E+00            0.03217
  10.00 TO    30.00  0.18893E+01            0.07431
  30.00 TO   100.00  0.39063E+01            0.15365
          >  100.00  0.18534E+02            0.72903
 TOTAL MASS AIRBORNE=  0.25423E+02     FRAC. INERT  AIRBORNE= 0.56121E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.454E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.27544E+00            0.01083
   3.00 TO    10.00  0.81781E+00            0.03214
  10.00 TO    30.00  0.18897E+01            0.07427
  30.00 TO   100.00  0.39081E+01            0.15360
          >  100.00  0.18552E+02            0.72916
 TOTAL MASS AIRBORNE=  0.25443E+02     FRAC. INERT  AIRBORNE= 0.56042E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.455E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.27537E+00            0.01081
   3.00 TO    10.00  0.81783E+00            0.03212
  10.00 TO    30.00  0.18901E+01            0.07423
  30.00 TO   100.00  0.39098E+01            0.15355
          >  100.00  0.18570E+02            0.72929
 TOTAL MASS AIRBORNE=  0.25463E+02     FRAC. INERT  AIRBORNE= 0.55963E-01
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.456E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.27529E+00               0.01080
   3.00 TO    10.00  0.81786E+00               0.03209
  10.00 TO    30.00  0.18906E+01               0.07419
  30.00 TO   100.00  0.39116E+01               0.15349
         >   100.00  0.18588E+02               0.72942
 TOTAL MASS AIRBORNE=  0.25484E+02     FRAC. INERT  AIRBORNE= 0.55885E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.457E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.27522E+00               0.01079
   3.00 TO    10.00  0.81789E+00               0.03207
  10.00 TO    30.00  0.18910E+01               0.07414
  30.00 TO   100.00  0.39134E+01               0.15344
         >   100.00  0.18606E+02               0.72955
 TOTAL MASS AIRBORNE=  0.25504E+02     FRAC. INERT  AIRBORNE= 0.55807E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.458E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.27514E+00               0.01078
   3.00 TO    10.00  0.81792E+00               0.03205
  10.00 TO    30.00  0.18914E+01               0.07410
  30.00 TO   100.00  0.39151E+01               0.15339
         >   100.00  0.18624E+02               0.72968
 TOTAL MASS AIRBORNE=  0.25524E+02     FRAC. INERT  AIRBORNE= 0.55729E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.459E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.27507E+00               0.01077
   3.00 TO    10.00  0.81794E+00               0.03202
  10.00 TO    30.00  0.18918E+01               0.07406
  30.00 TO   100.00  0.39169E+01               0.15334
         >   100.00  0.18642E+[illegible]      0.72981
 TOTAL MASS AIRBORNE=  0.25544E+02     FRAC. INERT  AIRBORNE= 0.55652E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.460E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.27500E+00               0.01076
   3.00 TO    10.00  0.81797E+00               0.03200
  10.00 TO    30.00  0.18922E-01               0.07402
  30.00 TO   100.00  0.39186E+01               0.15329
         >   100.00  0.18660E+02               0.72994
 TOTAL MASS AIRBORNE=  0.25564E+02     FRAC. INERT  AIRBORNE= 0.55574E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.461E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.27493E+00               0.01075
   3.00 TO    10.00  0.81799E+00               0.03197
  10.00 TO    30.00  0.18926E+01               0.07398
  30.00 TO   100.00  0.39204E+01               0.15323
         >   100.00  0.18678E+02               0.73007
 TOTAL MASS AIRBORNE=  0.25584E+02     FRAC. INERT  AIRBORNE= 0.55497E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.462E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.27485E+00               0.01073
   3.00 TO    10.00  0.81802E+00               0.03195
  10.00 TO    30.00  0.18931E+01               0.07394
  30.00 TO   100.00  0.39221E+01               0.15318
         >   100.00  0.18696E+02               0.73020
 TOTAL MASS AIRBORNE=  0.25604E+02     FRAC. INERT  AIRBORNE= 0.55421E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.463E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.27478E+00               0.01072
   3.00 TO    10.00  0.81806E+00               0.03192
  10.00 TO    30.00  0.18935E+01               0.07389
  30.00 TO   100.00  0.39239E+01               0.15313
         >   100.00  0.18714E+02               0.73033
 TOTAL MASS AIRBORNE=  0.25624E+02     FRAC. INERT  AIRBORNE= 0.55344E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.464E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.27471E+00               0.01071
   3.00 TO    10.00  0.81807E+00               0.03190
  10.00 TO    30.00  0.18939E+01               0.07385
  30.00 TO   100.00  0.39256E+01               0.15308
         >   100.00  0.18732E+02               0.73046
 TOTAL MASS AIRBORNE=  0.25644E+02     FRAC. INERT  AIRBORNE= 0.55268E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.465E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.27463E+00               0.01070
   3.00 TO    10.00  0.81810E+00               0.03188
  10.00 TO    30.00  0.18943E+01               0.07381
  30.00 TO   100.00  0.39273E+01               0.15303
         >   100.00  0.18750E+02               0.73059
 TOTAL MASS AIRBORNE=  0.25664E+02     FRAC. INERT  AIRBORNE= 0.55192E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.466E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.27456E+00               0.01069
   3.00 TO    10.00  0.81812E+00               0.03186
  10.00 TO    30.00  0.18947E+01               0.07377
  30.00 TO   100.00  0.39291E+01               0.15298
         >   100.00  0.18768E+02               0.73071
 TOTAL MASS AIRBORNE=  0.25684E+02     FRAC. INERT  AIRBORNE= 0.55117E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.467E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.27449E+00               0.01068
   3.00 TO    10.00  0.81815E+00               0.03183
  10.00 TO    30.00  0.18951E+01               0.07373
  30.00 TO   100.00  0.39308E+01               0.15292
         >   100.00  0.18786E+02               0.73084
 TOTAL MASS AIRBORNE=  0.25704E+02     FRAC. INERT  AIRBORNE= 0.55041E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.468E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.27442E+00               0.01067
   3.00 TO    10.00  0.81817E+00               0.03181
  10.00 TO    30.00  0.18955E+01               0.07369
  30.00 TO   100.00  0.39325E+01               0.15287
         >   100.00  0.18804E+02               0.73097
 TOTAL MASS AIRBORNE=  0.25724E+02     FRAC. INERT  AIRBORNE= 0.54966E-01
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.469E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27435E+00            0.01066
   3.00 TO   10.00  0.81820E+00            0.03178
  10.00 TO   30.00  0.18959E+01            0.07365
  30.00 TO  100.00  0.39342E+01            0.15282
          > 100.00  0.18821E+02            0.73109
 TOTAL MASS AIRBORNE=  0.25744E+02     FRAC. INERT  AIRBORNE= 0.54891E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.470E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27427E+00            0.01065
   3.00 TO   10.00  0.81842E+00            0.03176
  10.00 TO   30.00  0.18964E+01            0.07361
  30.00 TO  100.00  0.39360E+01            0.15277
          > 100.00  0.18839E+02            0.73122
 TOTAL MASS AIRBORNE=  0.25764E+02     FRAC. INERT  AIRBORNE= 0.54817E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.471E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27420E+00            0.01063
   3.00 TO   10.00  0.81825E+00            0.03174
  10.00 TO   30.00  0.18968E+01            0.07358
  30.00 TO  100.00  0.39377E+01            0.15272
          > 100.00  0.18857E+02            0.73136
 TOTAL MASS AIRBORNE=  0.25784E+02     FRAC. INERT  AIRBORNE= 0.54742E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.472E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27413E+00            0.01062
   3.00 TO   10.00  0.81827E+00            0.03171
  10.00 TO   30.00  0.18972E+01            0.07352
  30.00 TO  100.00  0.39394E+01            0.15267
          > 100.00  0.18875E+02            0.73147
 TOTAL MASS AIRBORNE=  0.25803E+02     FRAC. INERT  AIRBORNE= 0.54668E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.473E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27406E+00            0.01061
   3.00 TO   10.00  0.81830E+00            0.03169
  10.00 TO   30.00  0.18976E+01            0.07348
  30.00 TO  100.00  0.39411E+01            0.15262
          > 100.00  0.18892E+02            0.73160
 TOTAL MASS AIRBORNE=  0.25823E+02     FRAC. INERT  AIRBORNE= 0.54595E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.474E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27399E+00            0.01060
   3.00 TO   10.00  0.81832E+00            0.03167
  10.00 TO   30.00  0.18980E+01            0.07344
  30.00 TO  100.00  0.39428E+01            0.15257
          > 100.00  0.18910E+02            0.73172
 TOTAL MASS AIRBORNE=  0.25843E+02     FRAC. INERT  AIRBORNE= 0.54521E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.475E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27392E+00            0.01059
   3.00 TO   10.00  0.81835E+00            0.03164
  10.00 TO   30.00  0.18984E+01            0.07340
  30.00 TO  100.00  0.39445E+01            0.15252
          > 100.00  0.18928E+02            0.73186
 TOTAL MASS AIRBORNE=  0.25863E+02     FRAC. INERT  AIRBORNE= 0.54448E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.476E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27385E+00            0.01058
   3.00 TO   10.00  0.81837E+00            0.03162
  10.00 TO   30.00  0.18988E+01            0.07336
  30.00 TO  100.00  0.39462E+01            0.15247
          > 100.00  0.18945E+02            0.73197
 TOTAL MASS AIRBORNE=  0.25882E+02     FRAC. INERT  AIRBORNE= 0.54375E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.477E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27377E+00            0.01057
   3.00 TO   10.00  0.81839E+00            0.03160
  10.00 TO   30.00  0.18992E+01            0.07332
  30.00 TO  100.00  0.39479E+01            0.15242
          > 100.00  0.18963E+02            0.73210
 TOTAL MASS AIRBORNE=  0.25902E+02     FRAC. INERT  AIRBORNE= 0.54302E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.478E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27370E+00            0.01056
   3.00 TO   10.00  0.81842E+00            0.03157
  10.00 TO   30.00  0.18996E+01            0.07328
  30.00 TO  100.00  0.39496E+01            0.15237
          > 100.00  0.18980E+02            0.73222
 TOTAL MASS AIRBORNE=  0.25922E+02     FRAC. INERT  AIRBORNE= 0.54229E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.479E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27363E+00            0.01056
   3.00 TO   10.00  0.81844E+00            0.03155
  10.00 TO   30.00  0.19000E+01            0.07324
  30.00 TO  100.00  0.39513E+01            0.15232
          > 100.00  0.18998E+02            0.73235
 TOTAL MASS AIRBORNE=  0.25941E+02     FRAC. INERT  AIRBORNE= 0.54157E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.480E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27356E+00            0.01054
   3.00 TO   10.00  0.81846E+00            0.03153
  10.00 TO   30.00  0.19004E+01            0.07320
  30.00 TO  100.00  0.39529E+01            0.15227
          > 100.00  0.19015E+02            0.73247
 TOTAL MASS AIRBORNE=  0.25961E+02     FRAC. INERT  AIRBORNE= 0.54085E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.481E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27349E+00            0.01053
   3.00 TO   10.00  0.81849E+00            0.03150
  10.00 TO   30.00  0.19008E+01            0.07316
  30.00 TO  100.00  0.39546E+01            0.15222
          > 100.00  0.19033E+02            0.73259
 TOTAL MASS AIRBORNE=  0.25980E+02     FRAC. INERT  AIRBORNE= 0.54013E-01
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.482E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27342E+00          0.01052
   3.00 TO   10.00  0.81851E+00          0.03148
  10.00 TO   30.00  0.19012E+01          0.07312
  30.00 TO  100.00  0.39563E+01          0.15217
         >  100.00  0.19050E+02          0.73271
 TOTAL MASS AIRBORNE=  0.26000E+02     FRAC. INERT  AIRBORNE= 0.53942E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.483E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27335E+00          0.01051
   3.00 TO   10.00  0.81853E+00          0.03146
  10.00 TO   30.00  0.19016E+01          0.07308
  30.00 TO  100.00  0.39580E+01          0.15212
         >  100.00  0.19068E+02          0.73284
 TOTAL MASS AIRBORNE=  0.26019E+02     FRAC. INERT  AIRBORNE= 0.53870E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.494E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27328E+00          0.01050
   3.00 TO   1C.C0  0.81855E+00          0.03144
  10.00 TO   30.00  0.19019E+01          0.07304
  30.00 TO  100.00  0.39596E+01          0.15207
         >  100.00  0.19085E+02          0.73296
 TOTAL MASS AIRBORNE=  0.26039E+02     FRAC. INERT  AIRBORNE= 0.53799E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.485E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27321E+00          0.01048
   3.00 TO   10.00  0.81858E+00          0.03141
  10.00 TO   30.00  0.19023E+01          0.07300
  30.00 TO  100.00  0.39613E+01          0.15202
         >  100.00  0.19103E+02          0.73308
 TOTAL MASS AIRBORNE=  0.26058E+02     FRAC. INERT  AIRBORNE= 0.53728E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.486E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27314E+00          0.01047
   3.00 TO   10.00  0.81860E+00          0.03139
  10.00 TO   30.00  0.19027E+01          0.07296
  30.00 TO  100.00  0.39630E+01          0.15197
         >  100.00  0.19120E+02          0.73320
 TOTAL MASS AIRBORNE=  0.26078E+02     FRAC. INERT  AIRBORNE= 0.53658E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.487E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27307E+00          0.01046
   3.00 TO   10.00  0.81862E+00          0.03137
  10.00 TO   30.00  0.19031E+01          0.07292
  30.00 TO  100.00  0.39646E+01          0.15192
         >  100.00  0.19138E+02          0.73333
 TOTAL MASS AIRBORNE=  0.26097E+02     FRAC. INERT  AIRBORNE= 0.53587E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = C. 88E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27300E+00          0.01045
   3.00 TO   10.00  0.81864E+00          0.03135
  10.00 TO   30.00  0.19035E+01          0.07289
  30.00 TO  100.00  0.39663E+01          0.15187
         >  100.00  0.19155E+02          0.73346
 TOTAL MASS AIRBORNE=  0.26116E+02     FRAC. INERT  AIRBORNE= 0.53517E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.489E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27293E+00          0.01044
   3.00 TO   10.00  0.81867E+00          0.03132
  10.00 TO   30.00  0.19039E+01          0.07285
  30.00 TO  100.00  0.39679E+01          0.15182
         >  100.00  0.19172E+02          0.73357
 TOTAL MASS AIRBORNE=  0.26136E+02     FRAC. INERT  AIRBORNE= 0.53447E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.490E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    7 00  0.27286E+00          0.01043
   3.00 TO   10.00  0.81869E+00          0.03130
  10.00 TO   30.00  0.19043E+01          0.07281
  30.00 TO  100.00  0.39696E+01          0.15177
         >  100.00  0.19190E+02          0.73369
 TOTAL MASS AIRBORNE=  0.26155E+02     FRAC. INERT  AIRBORNE= 0.53378E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.491E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27280E+00          0.01C42
   3.00 TO   10.00  0.81871E+00          0.03128
  10.00 TO   30.00  0.19047E+01          0.07277
  30.00 TO  100.00  0.39712E+01          0.15172
         >  100.00  0.19207E+02          0.73381
 TOTAL MASS AIRBORNE=  0.26174E+02     FRAC. INERT  AIRBORNE= 0.53308E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.492E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27273E+00          0.01041
   3.00 TO   10.00  0.81873E+00          0.03126
  10.00 TO   30.00  0.19050E+01          0.07273
  30.00 TO  100.00  0.39729E+01          0.15167
         >  100.00  0.19224E+02          0.73393
 TOTAL MASS AIRBORNE=  0.26194E+02     FRAC. INERT  AIRBORNE= 0.53239E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.493E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27266E+00          0.01040
   3.00 TO   10.00  0.81875E+00          0.03123
  10.00 TO   30.00  0.19054E+01          0.07269
  30.00 TO  100.00  0.39745E+01          0.15162
         >  100.00  0.19242E+02          0.73405
 TOTAL MASS AIRBORNE=  0.26213E+02     FRAC. INERT  AIRBORNE= 0.53170E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.494E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27259E+00          0.01039
   3.00 TO   10.00  0.81877E+00          0.03121
  10.00 TO   30.00  0.19058E+01          0.07265
  30.00 TO  100.00  0.39762E+01          0.15158
         >  100.00  0.19259E+02          0.73417
 TOTAL MASS AIRBORNE=  0.26232E+02     FRAC. INERT  AIRBORNE= 0.53102E-01
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.495E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27252E+00           0.01038
   3.00 TO   10.00  0.81879E+00           0.03119
  10.00 TO   30.00  0.19062E+01           0.07261
  30.00 TO  100.00  0.39778E+01           0.15153
         >  100.00  0.19276E+02           0.73429
 TOTAL MASS AIRBORNE=  0.26251E+02     FRAC. INERT  AIRBORNE= 0.53033E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.496E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27245E+00           0.01037
   3.00 TO   10.00  0.81882E+00           0.03117
  10.00 TO   30.00  0.19066E+01           0.07257
  30.00 TO  100.00  0.39794E+01           0.15148
         >  100.00  0.19293E+02           0.73441
 TOTAL MASS AIRBORNE=  0.26271E+02     FRAC. INERT  AIRBORNE= 0.52965E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.497E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27238E+00           0.01036
   3.00 TO   10.00  0.81634E+00           0.03115
  10.00 TO   30.00  0.19070E+01           0.07254
  30.00 TO  100.00  0.39811E+01           0.15143
         >  100.00  0.19310E+02           0.73453
 TOTAL MASS AIRBORNE=  0.26290E+02     FRAC. INERT  AIRBORNE= 0.52897E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.498E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27231E+00           0.01035
   3.00 TO   10.00  0.81886E+00           0.03112
  10.00 TO   30.00  0.19073E+01           0.07250
  30.00 TO  100.00  0.39827E+01           0.15138
         >  100.00  0.19328E+02           0.73464
 TOTAL MASS AIRBORNE=  0.26309E+02     FRAC. INERT  AIRBORNE= 0.52829E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.499E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27225E+00           0.01034
   3.00 TO   10.00  0.81888E+00           0.03110
  10.00 TO   30.00  0.19077E+01           0.07246
  30.00 TO  100.00  0.39843E+01           0.15133
         >  100.00  0.19345E+02           0.73476
 TOTAL MASS AIRBORNE=  0.26328E+02     FRAC. INERT  AIRBORNE= 0.52761E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.500E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27218E-00           0.01033
   3.00 TO   10.00  0.81890E+00           0.03108
  10.00 TO   30.00  0.19081E+01           0.07242
  30.00 TO  100.00  0.39859E+01           0.15129
         >  100.00  0.19362E+02           0.73488
 TOTAL MASS AIRBORNE=  0.26347E+02     FRAC. INERT  AIRBORNE= 0.52694E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.501E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27211E+00           0.01032
   3.00 TO   10.00  0.81892E+00           0.03106
  10.00 TO   30.00  0.19085E+01           0.07238
  30.00 TO  100.00  0.39875E+01           0.15124
         >  100.00  0.19379E+02           0.73500
 TOTAL MASS AIRBORNE=  0.26366E+02     FRAC. INERT  AIRBORNE= 0.52627E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G)   0.502E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27204E+00           0.01031
   3.00 TO   10.00  0.81894E+00           0.03104
  10.00 TO   30.00  0.19088E+01           0.07235
  30.00 TO  100.00  0.39892E+01           0.15119
         >  100.00  0.19396E+02           0.73512
 TOTAL MASS AIRBORNE=  0.26385E+0.     FRAC. INERT  AIRBORNE= 0.52560E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.50[illegible]-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27197E+00           0.01030
   3.00 TO   10.00  0.81896E+00           0.03102
  10.00 TO   30.00  0.19092E+01           0.07231
  30.00 TO  100.00  0.39908E-01           0.15114
         >  100.00  0.19413E+02           0.73523
 TOTAL MASS AIRBORNE=  0.26424E+02     FRAC. INERT  AIRBORNE= 0.52493E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.504E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27191E+00           0.01029
   3.00 TO   10.00  0.81898E+00           0.03099
  10.00 TO   30.00  0.19096E+01           0.07227
  30.00 TO  100.00  0.39924E+01           0.15109
         >  100.00  0.19430E+02           0.73535
 TOTAL MASS AIRBORNE=  0.26423E+02     FRAC. INERT  AIRBORNE= 0.52427E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.505E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27184E+00           0.01028
   3.00 TO   10.00  0.81900E+00           0.03097
  10.00 TO   30.00  0.19100E+01           0.07223
  30.00 TO  100.00  0.39940E+01           0.15105
         >  100.00  0.19447E+02           0.73547
 TOTAL MASS AIRBORNE=  0.26442E+02     FRAC. INERT  AIRBORNE= 0.52360E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.506E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27177E+00           0.01027
   3.00 TO   10.00  0.81902E+00           0.03095
  10.00 TO   30.00  0.19103E+01           0.07219
  30.00 TO  100.00  0.39956E-01           0.15106
         >  100.00  0.19464E+02           0.73558
 TOTAL MASS AIRBORNE=  0.26461E+02     FRAC. INERT  AIRBORNE= 0.52294E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.507E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27170E+00           0.01026
   3.00 TO   10.00  0.81904E+00           0.03093
  10.00 TO   30.00  0.19107E+01           0.07216
  30.00 TO  100.00  0.39972E+01           0.15095
         >  100.00  0.19481E+02           0.73570
 TOTAL MASS AIRBORNE=  0.26480E+02     FRAC. INERT  AIRBORNE= 0.52228E-01
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.508E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27164E+00              0.01025
   3.00 TO   10.00  0.81906E+00              0.03091
  10.00 TO   30.00  0.19:11E+01              0.07212
  30.00 TO  100.00  0.39988E+01              0.15090
         >  100.00  0.19498E+02              0.73582
 TOTAL MASS AIRBORNE=  0.26499E+02     FRAC. INERT  AIRBORNE= 0.52163E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.509E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27157E+00              0.01024
   3.00 TO   10.00  0.81907E+00              0.03089
  10.00 TO   30.00  0.19115E+01              0.07208
  30.00 TO  100.00  0.40004E+01              0.15^96
         >  100.00  0.19515E+02              0.7'69
 TOTAL MASS AIRBORNE=  0.26518E+02     FRAC. INER.  AIRBORNE= 0.52097E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.510E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27150E+00              0.01023
   3.00 TO   10.00  0.81909E+00              0.0308'
  10.00 TO   30.00  0.19118E+01              0.0720
  30.00 TO  100.00  0.40020E+01              0.1508.
         >  100.00  0.19532E+02              0.73605
 TOTAL MASS AIRBORNE=  0.26536E+02     FRAC. INERT  AI!!BORNE= 0.52032E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.511E+03 STD. DEV. = 8.06 # BINS = 4
SIZE RANGE(M    ONS) MASS AIRE.JRNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     .00  0.27144E+00              0.01022
   3.00 TO    .00   0.81911E+00              0.03085
  10.00 TO   30.00  0.19122E+01              0.07201
  30.00 TO  100.00  0.40035E+01              0.15076
         >  100.00  0.19549E+02              0.73610
 TOTAL MASS AIRBORNE=  0.26555E+02     FRAC. INERT  AIRBORNE= 0.51967E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.512E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27137E+00              0.01021
   3.00 TO   10.00  0.81913E+00              0.03082
  10.00 TO   30.00  0.19126E+01              0.07197
  30.00 TO  100.00  0.40051E+01              0.15072
         >  100.00  0.19566E+02              0.73628
 TOTAL MASS AIRBORNE=  0.26574E+02     FRAC. INERT  AIRBORNE= 0.51902E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.513E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27130E+00              0.01020
   3.00 TO   10.00  0.81915E+00              0.03080
  10.00 TO   30.00  0.19129E+01              0.07193
  30.00 TO  100.00  0.40067E+01              0.15067
         >  100.00  0.19583E+02              0.73639
 TOTAL MASS AIRBORNE=  0.26593E+02     FRAC. INERT  AIRBORNE= 0.51838E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.514E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27124E+00              0.01019
   3.00 TO   10.00  0.81917E+00              0.03078
  10.00 TO   30.00  0.19133E+01              0.07190
  30.00 TO  100.00  0.40083E+01              0.15062
         >  100.00  0.19599E+02              0.73651
 TOTAL MASS AIRBORNE=  0.26611E+02     FRAC. INERT  AIRBORNE= 0.51773E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.515E+03 STD. DEV. = 8 00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     00   0.27117E+00              0.01018
   3.00 TO   10.00  0.81918E+00              0.03076
  10.00 TO   30.00  0.19136E+01              0.07186
  30.00 TO  100.00  0.40099E+01              0.15058
         >  100.00  0.19616E+02              0.73662
 TOTAL MASS AIRBORNE=  0.26630E+02     FRAC. INERT  AIRBORNE= 0.51709E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.516E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27110E+00              0.01017
   3.00 TO   10.00  0.81921E+00              0.03074
  10.00 TO   30.00  0.19140E+01              0.07182
  30.00 TO  100.00  0.40114E+01              0.15053
         >  100.00  0.19633E+02              0.73673
 TOTAL MASS AIRBORNE=  0.26649E+02     FRAC. INERT  AIRBORNE= 0.51645E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.517E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27104E+00              0.01016
   3.00 TO   10.00  0.81922E+00              0.03072
  10.00 TO   30.00  0.19144E+01              0.07179
  30.00 TO  100.00  0.40130E+01              0.15048
         >  100.00  0.19650E+02              0.73685
 TOTAL MASS AIRBORNE=  0.26668E+02     FRAC. INERT  AIRBORNE= 0.51581E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.518E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27097E+00              0.01015
   3.00 TO   10.00  0.81924E+00              0.03070
  10.00 TO   30.00  0.19147E+01              0.07175
  30.00 TO  100.00  0.40146E+01              0.15044
         >  100.00  0.19667E+02              0.73696
 TOTAL MASS AIRBORNE=  0.26686E+02     FRAC. INERT  AIRBORNE= 0.51518E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.519E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27090E+00              0.01014
   3.00 TO   10.00  0.81926E+00              0.03068
  10.00 TO   30.00  0.19151E+01              0.07171
  30.00 TO  100.00  0.40161E+01              0.15039
         >  100.00  0.19683E+02              0.73707
 TOTAL MA.( AIRBORNE=  0.26705E+02     FRAC. INERT  AIRBORNE= 0.51454E-01

EXPLOSIO   DIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.520E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27084E+00              0.01013
   3.00 TO   10.00  C.81928E+00              0.03036
  10.00 TO   30.00  0.19155E+01              0.07168
  30.00 TO  100.00  0.40177E+01              0.15034
         >  100.00  0.19700E+02              0.73719
 TOTAL MASS AIRBORNE=  0.26723E+02     FRAC. INERT  AIRBORNE= 0.51391E-01
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.521E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27077E+00              0.01013
   3.00 TO   10.00  0.81929E+00              0.03064
  10.00 TO   30.00  0.19168E+01              0.07164
  30.00 TO  100.00  0.40192E+01              0.15030
          >  100.00  0.19717E+02              0.73730
 TOTAL MASS AIRBORNE=  0.26742E+02      FRAC. INERT  AIRBORNE= 0.51328E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.522E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27071E+00              0.01012
   3.00 TO   10.00  0.81931E+00              0.03062
  10.00 TO   30.00  0.19162E+01              0.07160
  30.00 TO  100.00  0.40208E+01              0.15025
          >  100.00  0.19734E+02              0.73741
 TOTAL MASS AIRBORNE=  0.26761E+02      FRAC. INERT  AIRBORNE= 0.51265E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.523E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27064E+00              0.01011
   3.00 TO   10.00  0.81933E+00              0.03060
  10.00 TO   30.00  0.19165E+01              0.07157
  30.00 TO  100.00  0.40223E+01              0.15020
          >  100.00  0.19750E+02              0.73752
 TOTAL MASS AIRBORNE=  0.26779E+02      FRAC. INERT  AIRBORNE= 0.51203E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.524E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27058E+00              0.01010
   3.00 TO   10.00  0.81935E+00              0.03058
  10.00 TO   30.00  0.19169E+01              0.07153
  30.00 TO  100.00  0.40239E+01              0.15016
          >  100.00  0.19767E+02              0.73764
 TOTAL MASS AIRBORNE=  0.26798E+02      FRAC. INERT  AIRBORNE= 0.51140E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.525E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27051E+00              0.01009
   3.00 TO   10.00  0.81936E+00              0.03055
  10.00 TO   30.00  0.19172E+01              0.07150
  30.00 TO  100.00  0.40254E+01              0.15011
          >  100.00  0.19783E+02              0.73776
 TOTAL MASS AIRBORNE=  0.26816E+02      FRAC. INERT  AIRBORNE= 0.61078E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.526E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27044E+00              0.01008
   3.00 TO   10.00  0.81938E+00              0.03053
  10.00 TO   30.00  0.19176E+01              0.07146
  30.00 TO  100.00  0.40270E+01              0.15007
          >  100.00  0.19800E+02              0.73786
 TOTAL MASS AIRBORNE=  0.26835E+02      FRAC. INERT  AIRBORNE= 0.51016E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.527E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27038E+00              0.01007
   3.00 TO   10.00  0.81940E+00              0.03051
  10.00 TO   30.00  0.19179E+01              0.07142
  30.00 TO  100.00  0.40285E+01              0.15002
          >  100.00  0.19817E+02              0.73797
 TOTAL MASS AIRBORNE=  0.26853E+02      FRAC. INERT  AIRBORNE= 0.50954E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.528E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27032E+00              0.01006
   3.00 TO   10.00  0.81941E+00              0.03049
  10.00 TO   30.00  0.19183E+01              0.07139
  30.00 TO  100.00  0.40301E+01              0.14998
          >  100.00  0.19833E+02              0.73808
 TOTAL MASS AIRBORNE=  0.26871E+02      FRAC. INERT  AIRBORNE= 0.50893E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.529E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27025E+00              0.01005
   3.00 TO   10.00  0.81943E+00              0.03047
  10.00 TO   30.00  0.19187E+01              0.07135
  30.00 TO  100.00  0.40316E+01              0.14993
          >  100.00  0.19850E+02              0.73819
 TOTAL MASS AIRBORNE=  0.26890E+02      FRAC. INERT  AIRBORNE= 0.50831E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.530E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27018E+00              0.01004
   3.00 TO   10.00  0.81945E+00              0.03045
  10.00 TO   30.00  0.19190E+01              0.07132
  30.00 TO  100.00  0.40331E+01              0.14988
          >  100.00  0.19866E+02              0.73830
 TOTAL MASS AIRBORNE=  0.26908E+02      FRAC. INERT  AIRBORNE= 0.50770E-01

EXPLOS ON RADIOACTIVE SOURCE TERM
TNT WT G) =     1.00 INERT WT(G) = 0.531E+03 STD. DEV. = 8.00 # BINS = 4
SIZE R NGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.0  TO    3.00  0.27012E+00              0.01003
   3.0  TO   10.00  0.81946E+00              0.03043
  10.00 TO   30.00  0.19194E+01              0.07128
  30.00 TO  100.00  0.40347E+01              0.14984
          >  100.00  0.19883E+02              0.73841
 TOTAL MASS AIRBORNE=  0.26927E+02      FRAC. INERT  AIRBORNE= 0.50709E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.532E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.27006E+00              0.01002
   3.00 TO   10.00  0.81948E+00              0.03041
  10.00 TO   30.00  0.19197E+01              0.07125
  30.00 TO  100.00  0.40362E+01              0.14979
          >  100.00  0.19899E+02              0.73852
 TOTAL MASS AIRBORNE=  0.26945E+02      FRAC. INERT  AIRBORNE= 0.50648E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.533E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26999E+00              0.01001
   3.00 TO   10.00  0.81950E+00              0.03039
  10.00 TO   30.00  0.[illegible]9201E+01              0.07121
  30.00 TO  100.00  0.40377E+01              0.14975
          >  100.00  0.19916E+02              0.73863
 TOTAL MASS AIRBORNE=  0.26963E+02      FRAC. INERT  AIRBORNE= 0.50588E-01
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.534E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26993E+00            0.01006
   3.00 TO   10.00  0.81951E+00            0.03037
  10.00 TO   30.00  0.19204E+01            0.07117
  30.00 TO  100.00  0.40392E+01            0.14970
          >  100.00  0.19932E+02            0.73874
 TOTAL MASS AIRBORNE=  0.26981E+02     FRAC. INERT  AIRBORNE= 0.50527E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.535E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26986E+00            0.01000
   3.00 TO   10.00  0.81953E+00            0.03035
  10.00 TO   30.00  0.19207E+01            0.07114
  30.00 TO  100.00  0.40407E+01            0.14966
          >  100.00  0.19949E+02            0.73885
 TOTAL MASS AIRBORNE=  0.27000E+02     FRAC. INERT  AIRBORNE= 0.50467E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.536E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26980E+00            0.00999
   3.00 TO   10.00  0.81954E+00            0.03033
  10.00 TO   30.00  0.19211E+01            0.07110
  30.00 TO  100.00  0.40423E+01            0.14961
          >  100.00  0.19965E+02            0.73896
 TOTAL MASS AIRBORNE=  0.27018E+02     FRAC. INERT  AIRBORNE= 0.50407E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.537E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26973E+00            0.00998
   3.00 TO   10.00  0.81956E+00            0.03031
  10.00 TO   30.00  0.19214E+01            0.07107
  30.00 TO  100.00  0.40438E+01            0.14957
          >  100.00  0.19982E+02            0.73907
 TOTAL MASS AIRBORNE=  0.27036E+02     FRAC. INERT  AIRBORNE= 0.50347E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.538E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26967E+00            0.00997
   3.00 TO   10.00  0.81957E+00            0.03029
  10.00 TO   30.00  0.19218E+01            0.07103
  30.00 TO  100.00  0.40453E+01            0.14952
          >  100.00  0.19998E+02            0.73918
 TOTAL MASS AIRBORNE=  0.27054E+02     FRAC. INERT  AIRBORNE= 0.50287E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.539E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26961E+00            0.00996
   3.00 TO   10.00  0.81959E+00            0.03027
  10.00 TO   30.00  0.19221E+01            0.07100
  30.00 TO  100.00  0.40468E+01            0.14948
          >  100.00  0.20014E+02            0.73929
 TOTAL MASS AIRBORNE=  0.27073E+02     FRAC. INERT  AIRBORNE= 0.50227E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.540E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26954E+00            0.00995
   3.00 TO   10.00  0.81961E+00            0.03026
  10.00 TO   30.00  0.19225E+01            0.07096
  30.00 TO  100.00  0.40483E+01            0.14944
          >  100.00  0.20031E+02            0.73940
 TOTAL MASS AIRBORNE=  0.27091E+02     FRAC. INERT  AIRBORNE= 0.50168E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.541E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26948E+00            0.00994
   3.00 TO   10.00  0.81962E+00            0.03023
  10.00 TO   30.00  0.19228E+01            0.07093
  30.00 TO  100.00  0.40498E+01            0.14939
          >  100.00  0.20047E+02            0.73950
 TOTAL MASS AIRBORNE=  0.27109E+02     FRAC. INERT  AIRBORNE= 0.50109E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.542E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26942E+00            0.00993
   3.00 TO   10.00  0.81964E+00            0.03021
  10.00 TO   30.00  0.19232E+01            0.07089
  30.00 TO  100.00  0.40513E+01            0.14935
          >  100.00  0.20063E+02            0.73961
 TOTAL MASS AIRBORNE=  0.27127E+02     FRAC. INERT  AIRBORNE= 0.50050E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.543E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26935E+00            0.00992
   3.00 TO   10.00  0.81965E+00            0.03020
  10.00 TO   30.00  0.19235E+01            0.07086
  30.00 TO  100.00  0.40528E+01            0.14930
          >  100.00  0.20080E+02            0.73972
 TOTAL MASS AIRBORNE=  0.27145E+02     FRAC. INERT  AIRBORNE= 0.49991E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.544E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26929E+00            0.00991
   3.00 TO   10.00  0.81967E+00            0.03018
  10.00 TO   30.00  0.19238E+01            0.07083
  30.00 TO  100.00  0.40543E+01            0.14926
          >  100.00  0.20096E+02            0.73983
 TOTAL MASS AIRBORNE=  0.27163E+02     FRAC. INERT  AIRBORNE= 0.49932E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.545E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26923E+00            0.00990
   3.00 TO   10.00  0.81968E+00            0.03016
  10.00 TO   30.00  0.19242E+01            0.07079
  30.00 TO  100.00  0.40558E+01            0.14921
          >  100.00  0.20112E+02            0.73993
 TOTAL MASS AIRBORNE=  0.27181E+02     FRAC. INERT  AIRBORNE= 0.49874E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.546E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26916E+00            0.00990
   3.00 TO   10.00  0.81970E+00            0.03014
  10.00 TO   30.00  0.19245E+01            0.07076
  30.00 TO  100.00  0.40573E+01            0.14917
          >  100.00  0.20129E+02            0.74004
 TOTAL MASS AIRBORNE=  0.27199E+02     FRAC. INERT  AIRBORNE= 0.49815E-01
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.547E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26910E+00            0.00989
   3.00 TO   10.00  0.81971E+00            0.03012
  10.00 TO   30.00  0.19248E+01            0.07072
  30.00 TO  100.00  0.40588E+01            0.14912
         >  100.00  0.20145E+02            0.74015
 TOTAL MASS AIRBORNE=  0.27217E+02      FRAC. INERT  AIRBORNE= 0.49757E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.548E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26904E+00            0.00988
   3.00 TO   10.00  0.81972E+00            0.03010
  10.00 TO   30.00  0.19252E+01            0.07069
  30.00 TO  100.00  0.40602E+01            0.14908
         >  100.00  0.20161E+02            0.74026
 TOTAL MASS AIRBORNE=  0.27235E+02      FRAC. INERT  AIRBORNE= 0.49699E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.549E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26897E+00            0.00987
   3.00 TO   10.00  0.81974E+00            0.03008
  10.00 TO   30.00  0.19255E+01            0.07065
  30.00 TO  100.00  0.40617E+01            0.14904
         >  100.00  0.20177E+02            0.74036
 TOTAL MASS AIRBORNE=  0.27253E+02      FRAC. INERT  AIRBORNE= 0.49641E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.550E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26891E+00            0.00986
   3.00 TO   10.00  0.81975E+00            0.03006
  10.00 TO   30.00  0.19259E+01            0.07062
  30.00 TO  100.00  0.40632E+01            0.14899
         >  100.00  0.20193E+02            0.74047
 TOTAL MASS AIRBORNE=  0.27271E+02      FRAC. INERT  AIRBORNE= 0.49584E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.551E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26885E+00            0.00985
   3.00 TO   10.00  0.81977E+00            0.03004
  10.00 TO   30.00  0.19262E+01            0.07058
  30.00 TO  100.00  0.40647E+01            0.14895
         >  100.00  0.20210E+02            0.74057
 TOTAL MASS AIRBORNE=  0.27289E+02      FRAC. INERT  AIRBORNE= 0.49526E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.552E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26878E+00            0.00984
   3.00 TO   10.00  0.81978E+00            0.03002
  10.00 TO   30.00  0.19265E+01            0.07055
  30.00 TO  100.00  0.40662E+01            0.14891
         >  100.00  0.20226E-02            0.74068
 TOTAL MASS AIRBORNE=  0.27307E+02      FRAC. INERT  AIRBORNE= 0.49469E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.553E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26872E+00            0.00983
   3.00 TO   10.00  0.81980E+00            0.03000
  10.00 TO   30.00  0.19269E+01            0.07052
  30.00 TO  100.00  0.40676E+01            0.14886
         >  100.00  0.20242E+02            0.74078
 TOTAL MASS AIRBORNE=  0.27325E+02      FRAC. INERT  AIRBORNE= 0.49412E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.554E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26866E+00            0.00983
   3.00 TO   10.00  0.81981E+00            0.02998
  10.00 TO   30.00  0.19272E+01            0.07048
  30.00 TO  100.00  0.40691E+01            0.14882
         >  100.00  0.20258E+02            0.74089
 TOTAL MASS AIRBORNE=  0.27343E+02      FRAC. INERT  AIRBORNE= 0.49355E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.555E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    2.00  0.26865E+00            0.00982
   3.00 TO   10.00  0.81982E+00            0.02996
  10.00 TO   30.00  0.19275E+01            0.07045
  30.00 TO  100.00  0.40706E+01            0.14878
         >  100.00  0.20274E+02            0.74100
 TOTAL MASS AIRBORNE=  0.27360E+02      FRAC. INERT  AIRBORNE= 0.49298E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.556E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26854E+00            0.00981
   3.00 TO   10.00  0.81984E+00            0.02994
  10.00 TO   30.00  0.19279E+01            0.07042
  30.00 TO  100.00  0.40720E+01            0.14873
         >  100.00  0.20290E+02            0.74110
 TOTAL MASS AIRBORNE=  0.27378E+02      FRAC. INERT  AIRBORNE= 0.49242E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.557E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26847E+00            0.00980
   3.00 TO   10.00  0.81985E+00            0.02993
  10.00 TO   30.00  0.19282E+01            0.07038
  30.00 TO  100.00  0.40735E+01            0.14869
         >  100.00  0.20306E+02            0.74120
 TOTAL MASS AIRBORNE=  0.27396E+02      FRAC. INERT  AIRBORNE= 0.49185E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.558E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26841E+00            0.00979
   3.00 TO   10.00  0.81986E+00            0.02991
  10.00 TO   30.00  0.19285E+01            0.07035
  30.00 TO  100.00  0.40749E+01            0.14865
         >  100.00  0.20322E+02            0.74131
 TOTAL MASS AIRBORNE=  0.27414E+02      FRAC. INERT  AIRBORNE= 0.49129E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.559E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26835E+00            0.00978
   3.00 TO   10.00  0.81988E+00            0.02989
  10.00 TO   30.00  0.19288E+01            0.07031
  30.00 TO  100.00  0.40764E+01            0.14860
         >  100.00  0.20338E+02            0.74141
 TOTAL MASS AIRBORNE=  0.27432E+02      FRAC. INERT  AIRBORNE= 0.49073E-01
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.560E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
  0.00 TO     3.00  0.26829E+00             0.00977
  3.00 TO    10.00  0.81989E+00             0.02987
 10.00 TO    30.00  0.19292E+01             0.07028
 30.00 TO   100.00  0.40779E+01             0.14856
          > 100.00  0.20354E+02             0.74152
 TOTAL MASS AIRBORNE=  0.27449E+02     FRAC. INERT  AIRBORNE= 0.49017E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.561E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
  0.00 TO     3.00  0.26823E+00             0.00977
  3.00 TO    10.00  0.81991E+00             0.02985
 10.00 TO    30.00  0.19295E+01             0.07025
 30.00 TO   100.00  0.40793E+01             0.14852
          > 100.00  0.20370E+02             0.74162
 TOTAL MASS AIRBORNE=  0.27467E+02     FRAC. INERT  AIRBORNE= 0.48961E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.562E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
  0.00 TO     3.00  0.26816E+00             0.00976
  3.00 TO    10.00  0.81992E+00             0.02983
 10.00 TO    30.00  0.19298E+01             0.07021
 30.00 TO   100.00  0.40807E+01             0.14847
          > 100.00  0.20386E+02             0.74172
 TOTAL MASS AIRBORNE=  0.27485E+02     FRAC. INERT  AIRBORNE= 0.48905E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.563E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
  0.00 TO     3.00  0.26810E+00             0.00975
  3.00 TO    10.00  0.81993E+00             0.02981
 10.00 TO    30.00  0.19301E+01             0.07018
 30.00 TO   100.00  0.40822E+01             0.14843
          > 100.00  0.20402E+02             0.74183
 TOTAL MASS AIRBORNE=  0.27502E+02     FRAC. INERT  AIRBORNE= 0.48850E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.564E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
  0.00 TO     3.00  0.26804E+00             0.00974
  3.00 TO    10.00  0.81994E+00             0.02979
 10.00 TO    30.00  0.19305E+01             0.07015
 30.00 TO   100.00  0.40836E+01             0.14839
          > 100.00  0.20418E+02             0.74193
 TOTAL MASS AIRBORNE=  0.27520E+02     FRAC. INERT  AIRBORNE= 0.48795E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.565E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
  0.00 TO     3.00  0.26798E+00             0.00973
  3.00 TO    10.00  0.81996E+00             0.02978
 10.00 TO    30.00  0.19308E+01             0.07011
 30.00 TO   100.00  0.40851E+01             0.14834
          > 100.00  0.20434E+02             0.74203
 TOTAL MASS AIRBORNE=  0.27538E+02     FRAC. INERT  AIRBORNE= 0.48739E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.566E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
  0.00 TO     3.00  0.26792E+00             0.00972
  3.00 TO    10.00  0.81997E+00             0.02976
 10.00 TO    30.00  0.19311E+01             0.07008
 30.00 TO   100.00  0.40865E+01             0.14830
          > 100.00  0.20450E+02             0.74214
 TOTAL MASS AIRBORNE=  0.27555E+02     FRAC. INERT  AIRBORNE= 0.48684E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.567E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
  0.00 TO     3.00  0.26786E+00             0.00971
  3.00 TO    10.00  0.81998E+00             0.02974
 10.00 TO    30.00  0.19314E+01             0.07005
 30.00 TO   100.00  0.40880E+01             0.14826
          > 100.00  0.20466E+02             0.74224
 TOTAL MASS AIRBORNE=  0.27573E+02     FRAC. INERT  AIRBORNE= 0.48630E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.568E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
  0.00 TO     3.00  0.26780E+00             0.00971
  3.00 TO    10.00  0.81999E+00             0.02972
 10.00 TO    30.00  0.19318E+01             0.07002
 30.00 TO   100.00  0.40894E+01             0.14822
          > 100.00  0.20482E+02             0.74234
 TOTAL MASS AIRBORNE=  0.27591E+02     FRAC. INERT  AIRBORNE= 0.48575E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.569E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
  0.00 TO     3.00  0.26773E+00             0.00970
  3.00 TO    10.00  0.82001E+00             0.02970
 10.00 TO    30.00  0.19321E+01             0.06998
 30.00 TO   100.00  0.40908E+01             0.14817
          > 100.00  0.20497E+02             0.74244
 TOTAL MASS AIRBORNE=  0.27608E+02     FRAC. INERT  AIRBORNE= 0.48520E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.570E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
  0.00 TO     3.00  0.26767E+00             0.00969
  3.00 TO    10.00  0.82002E+00             0.02968
 10.00 TO    30.00  0.19324E+01             0.06995
 30.00 TO   100.00  0.40923E+01             0.14813
          > 100.00  0.20513E+02             0.74255
 TOTAL MASS AIRBORNE=  0.27626E+02     FRAC. INERT  AIRBORNE= 0.48466E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.571E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
  0.00 TO     3.00  0.26761E+00             0.00968
  3.00 TO    10.00  0.82003E+00             0.02966
 10.00 TO    30.00  0.19327E+01             0.06992
 30.00 TO   100.00  0.40937E+01             0.14809
          > 100.00  0.20529E+02             0.74265
 TOTAL MASS AIRBORNE=  0.27643E+02     FRAC. INERT  AIRBORNE= 0.48412E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.572E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
  0.00 TO     3.00  0.26755E+00             0.00967
  3.00 TO    10.00  0.82004E+00             0.02965
 10.00 TO    30.00  0.19331E+01             0.06988
 30.00 TO   100.00  0.40951E+01             0.14805
          > 100.00  0.20545E+02             0.74275
 TOTAL MASS AIRBORNE=  0.27661E+02     FRAC. INERT  AIRBORNE= 0.48358E-01
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.573E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.26749E+00            0.00966
   3.00 TO    10.00  0.82005E+00            0.02963
  10.00 TO    30.00  0.19334E+01            0.06985
  30.00 TO   100.00  0.40965E+01            0.14801
         >   100.00  0.20561E+02            0.74285
 TOTAL MASS AIRBORNE=  0.27678E+02     FRAC. INERT  AIRBORNE= 0.48304E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.574E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.26743E+00            0.00966
   3.00 TO    10.00  0.82007E+00            0.02961
  10.00 TO    30.00  0.19337E+01            0.06982
  30.00 TO   100.00  0.40979E+01            0.14796
         >   100.00  0.20577E+02            0.74295
 TOTAL MASS AIRBORNE=  0.27696E+02     FRAC. INERT  AIRBORNE= 0.48250E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.575E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.26737E+00            0.00965
   3.00 TO    10.00  0.82008E+00            0.02959
  10.00 TO    30.00  0.19340E+01            0.06979
  30.00 TO   100.00  0.40994E+01            0.14792
         >   100.00  0.20592E+02            0.74305
 TOTAL MASS AIRBORNE=  0.27713E+02     FRAC. INERT  AIRBORNE= 0.48197E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.576E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.26731E+00            0.00964
   3.00 TO    10.00  0.82009E+00            0.02957
  10.00 TO    30.00  0.19343E+01            0.06975
  30.00 TO   100.00  0.41008E+01            0.14788
         >   100.00  0.20608E+02            0.74315
 TOTAL MASS AIRBORNE=  0.27731E+02     FRAC. INERT  AIRBORNE= 0.48143E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.577E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.26725E+00            0.00963
   3.00 TO    10.00  0.82010E+00            0.02956
  10.00 TO    30.00  0.19346E+01            0.06972
  30.00 TO   100.00  0.41022E+01            0.14784
         >   100.00  0.20624E+02            0.74325
 TOTAL MASS AIRBORNE=  0.27748E+02     FRAC. INERT  AIRBORNE= 0.48090E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.578E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.26719E+00            0.00962
   3.00 TO    10.00  0.82011E+00            0.02954
  10.00 TO    30.00  0.19350E+01            0.06969
  30.00 TO   100.00  0.41036E+01            0.14780
         >   100.00  0.20639E+02            0.74335
 TOTAL MASS AIRBORNE=  0.27765E+02     FRAC. INERT  AIRBORNE= 0.48037E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.579E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.26713E+00            0.00962
   3.00 TO    10.00  0.82013E+00            0.02952
  10.00 TO    30.00  0.19353E+01            0.06966
  30.00 TO   100.00  0.41050E+01            0.14775
         >   100.00  0.20655E+02            0.74345
 TOTAL MASS AIRBORNE=  0.27783E+02     FRAC. INERT  AIRBORNE= 0.47984E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.580E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.26707E+00            0.00961
   3.00 TO    10.00  0.82014E+00            0.02950
  10.00 TO    30.00  0.19356E+01            0.06963
  30.00 TO   100.00  0.41064E+01            0.14771
         >   100.00  0.20671E+02            0.74355
 TOTAL MASS AIRBORNE=  0.27800E+02     FRAC. INERT  AIRBORNE= 0.47931E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.581E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.26701E+00            0.00960
   3.00 TO    10.00  0.82015E+00            0.02948
  10.00 TO    30.00  0.19359E+01            0.06959
  30.00 TO   100.00  0.41078E+01            0.14767
         >   100.00  0.20686E+02            0.74365
 TOTAL MASS AIRBORNE=  0.27817E+02     FRAC. INERT  AIRBORNE= 0.47878E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.582E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.26695E+00            0.00959
   3.00 TO    10.00  0.82016E+00            0.02947
  10.00 TO    30.00  0.19362E+01            0.06956
  30.00 TO   100.00  0.41092E+01            0.14763
         >   100.00  0.20702E+02            0.74375
 TOTAL MASS AIRBORNE=  0.27835E+02     FRAC. INERT  AIRBORNE= 0.47826E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.583E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.26689E+00            0.00958
   3.00 TO    10.00  0.82017E+00            0.02945
  10.00 TO    30.00  0.19365E+01            0.06953
  30.00 TO   100.00  0.41106E+01            0.14759
         >   100.00  0.20718E+02            0.74385
 TOTAL MASS AIRBORNE=  0.27852E+02     FRAC. INERT  AIRBORNE= 0.47773E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.584E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.26683E+00            0.00957
   3.00 TO    10.00  0.82018E+00            0.02943
  10.00 TO    30.00  0.19368E+01            0.06950
  30.00 TO   100.00  0.41120E+01            0.14755
         >   100.00  0.20733E+02            0.74395
 TOTAL MASS AIRBORNE=  0.27869E+02     FRAC. INERT  AIRBORNE= 0.47721E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.585E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.26677E+00            0.00957
   3.00 TO    10.00  0.82019E+00            0.02941
  10.00 TO    30.00  0.19371E+01            0.06947
  30.00 TO   100.00  0.41134E+01            0.14751
         >   100.00  0.20749E+02            0.74405
 TOTAL MASS AIRBORNE=  0.27886E+02     FRAC. INERT  AIRBORNE= 0.47669E-01
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.586E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.26671E+00            0.00956
   3.00 TO    10.00  0.82020E+00            0.02939
  10.00 TO    30.00  0.19374E+01            0.06943
  30.00 TO   100.00  0.41148E+01            0.14746
         >   100.00  0.20765E+02            0.74416
 TOTAL MASS AIRBORNE=  0.27904E+02      FRAC. INERT  AIRBORNE= 0.47617E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.587E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.26665E+00            0.00955
   3.00 TO    10.00  0.82021E+00            0.02938
  10.00 TO    30.00  0.19378E+01            0.06940
  30.00 TO   100.00  0.41162E+01            0.14742
         >   100.00  0.20780E+02            0.74426
 TOTAL MASS AIRBORNE=  0.27921E+02      FRAC. INERT  AIRBORNE= 0.47565E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.588E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.26660E+00            0.00954
   3.00 TO    10.00  0.82022E+00            0.02936
  10.00 TO    30.00  0.19381E+01            0.06937
  30.00 TO   100.0[illegible]  0.41176E+01            0.14738
         >   100.00  0.20796E+02            0.74435
 TOTAL MASS AIRBORNE=  0.27938E+02      FRAC. INERT  AIRBORNE= 0.47514E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.589E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.26654E+00            0.00953
   3.00 TO    10.00  0.82023E+00            0.02934
  10.00 TO    30.00  0.19384E+01            0.06934
  30.00 TO   100.00  0.41190E+01            0.14734
         >   100.00  0.20811E+02            0.74445
 TOTAL MASS AIRBORNE=  0.27955E+02      FRAC. INERT  AIRBORNE= 0.47462E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.590E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.26648E+00            0.00953
   3.00 TO    10.00  0.82024E+00            0.62932
  10.00 TO    30.00  0.19387E+01            0.06931
  30.00 TO   100.00  0.41203E+01            0.14730
         >   100.00  0.20827E+02            0.74454
 TOTAL MASS AIRBORNE=  0.27972E+02      FRAC. INERT  AIRBORNE= 0.47411E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.591E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.26642E+00            0.00952
   3.00 TO    10.00  0.82025E+00            0.02931
  10.00 TO    30.00  0.19390E+01            0.06928
  30.00 TO   100.00  0.41217E+01            0.14726
         >   100.00  0.20842E+02            0.74464
 TOTAL MASS AIRBORNE=  0.27990E+02      FRAC. INERT  AIRBORNE= 0.47360E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.592E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.26636E+00            0.00951
   3.00 TO    10.00  0.82027E+00            0.02929
  10.00 TO    30.00  0.19393E+01            0.06924
  30.00 TO   100.00  0.41231E+01            0.14722
         >   100.00  0.20858E+02            0.74474
 TOTAL MASS AIRBORNE=  0.28007E+02      FRAC. INERT  AIRBORNE= 0.47309E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.593E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.26630E+00            0.00950
   3.00 TO    10.00  0.82027E+00            0.02927
  10.00 TO    30.00  0.19396E+01            0.06921
  30.00 TO   100.00  0.41245E+01            0.14718
         >   100.00  0.20873E+02            0.74484
 TOTAL MASS AIRBORNE=  0.28024E+02      FRAC. INERT  AIRBORNE= 0.47258E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.594E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.26624E+00            0.00949
   3.00 TO    10.00  0.82029E+00            0.02925
  10.00 TO    30.00  0.19399E+01            0.06918
  30.00 TO   100.00  0.41259E+01            0.14714
         >   100.00  0.20889E+02            0.74493
 TOTAL MASS AIRBORNE=  0.28041E+02      FRAC. INERT  AIRBORNE= 0.47207E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.595E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.26618E+00            0.00949
   3.00 TO    10.00  0.82030E+00            0.02924
  10.00 TO    30.00  0.19402E+01            0.06915
  30.00 TO   100.00  0.41272E+01            0.14710
         >   100.00  0.20904E+02            0.74503
 TOTAL MASS AIRBORNE=  0.28058E+02      FRAC. INERT  AIRBORNE= 0.47156E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.596E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.26612E+00            0.00948
   3.00 TO    10.00  0.82031E+00            0.02922
  10.00 TO    30.00  0.19405E+01            0.06912
  30.00 TO   100.00  0.41286E+01            0.14706
         >   100.00  0.20919E+02            0.74513
 TOTAL MASS AIRBORNE=  0.28075E+02      FRAC. INERT  AIRBORNE= 0.47106E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.597E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.26606E+00            0.00947
   3.00 TO    10.00  0.82032E+00            0.02920
  10.00 TO    30.00  0.19408E+01            0.06909
  30.00 TO   100.00  0.41300E+01            0.14702
         >   100.00  0.20935E+02            0.74522
 TOTAL MASS AIRBORNE=  0.28092E+02      FRAC. INERT  AIRBORNE= 0.47055E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.598E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.26601E+00            0.00946
   3.00 TO    10.00  0.82032E+00            0.02918
  10.00 TO    30.00  0.19411E+01            0.06906
  30.00 TO   100.00  0.41313E+01            0.14697
         >   100.00  0.20950E+02            0.74532
 TOTAL MASS AIRBORNE=  0.28109E+02      FRAC. INERT  AIRBORNE= 0.47065E-01
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.599E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26595E+00             0.00946
   3.00 TO   10.00  0.82033E+00             0.02917
  10.00 TO   30.00  0.19414E+01             0.06903
  30.00 TO  100.00  0.41327E+01             0.14693
         >  100.00  0.20966E+02             0.74542
 TOTAL MASS AIRBORNE=  0.28126E+02     FRAC. INERT  AIRBORNE= 0.46955E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.600E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26589E+00             0.00945
   3.00 TO   10.00  0.82034E+00             0.02915
  10.00 TO   30.00  0.19417E+01             0.06899
  30.00 TO  100.00  0.41340E+01             0.14689
         >  100.00  0.20981E+02             0.74551
 TOTAL MASS AIRBORNE=  0.28143E+02     FRAC. INERT  AIRBORNE= 0.46905E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.601E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26583E+00             0.0094[illegible]
   3.00 TO   10.00  0.82035E+00             0.02913
  10.00 TO   30.00  0.19420E+01             0.06896
  30.00 TO  100.00  0.41354E+01             0.14685
         >  100.00  0.20996E+02             0.74561
 TOTAL MASS AIRBORNE=  0.28160E+02     FRAC. INERT  AIRBORNE= 0.46855E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.602E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26577E+00             0.00943
   3.00 TO   10.00  0.82036E+00             0.02911
  10.00 TO   30.00  0.19423E+01             0.06893
  30.00 TO  100.00  0.41368E+01             0.14681
         >  100.00  0.21012E+02             0.74571
 TOTAL MASS AIRBORNE=  0.28177E+02     FRAC. INERT  AIRBORNE= 0.46805E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.603E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26572E+00             0.00942
   3.00 TO   10.00  0.82037E+00             0.02910
  10.00 TO   30.00  0.19426E+01             0.06890
  30.00 TO  100.00  0.41381E+01             0.14677
         >  100.00  0.21027E+02             0.74580
 TOTAL MASS AIRBORNE=  0.28194E+02     FRAC. INERT  AIRBORNE= 0.46756E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.604E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26566E+00             0.00942
   3.00 TO   10.00  0.82038E+00             0.02908
  10.00 TO   30.00  0.19429E+01             0.06887
  30.00 TO  100.00  0.41395E+01             0.14673
         >  100.00  0.21042E+02             0.74590
 TOTAL MASS AIRBORNE=  0.28211E+02     FRAC. INERT  AIRBORNE= 0.46706E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.605E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26560E+00             0.00941
   3.00 TO   10.00  0.82039E+00             0.02906
  10.00 TO   30.00  0.19432E+01             0.06884
  30.00 TO  100.00  0.41408E+01             0.14669
         >  100.00  0.21058E+02             0.74599
 TOTAL MASS AIRBORNE=  0.28228E+02     FRAC. INERT  AIRBORNE= 0.46657E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.606E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26554E+00             0.00940
   3.00 TO   10.00  0.82040E+00             0.02905
  10.00 TO   30.00  0.19435E+01             0.06881
  30.00 TO  100.00  0.41422E+01             0.14665
         >  100.00  0.21073E+02             0.74609
 TOTAL MASS AIRBORNE=  0.28244E+02     FRAC. INERT  AIRBORNE= 0.46608E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.607E+03 STD. DEV = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26548E+00             0.00939
   3.00 TO   10.00  0.82041E+00             0.0290[illegible]
  10.00 TO   30.00  0.19438E+01             0.06878
  30.00 TO  100.00  0.41435E+01             0.14661
         >  100.00  0.21088E+02             0.74618
 TOTAL MASS AIRBORNE=  0.28261E+02     FRAC. INERT  AIRBORNE= 0.46559E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.608E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26543E+00             0.00939
   3.00 TO   10.00  0.82042E+00             0.02901
  10.00 TO   30.00  0.19441E+01             0.06875
  30.00 TO  100.00  0.41449E+01             0.14657
         >  100.00  0.21103E+02             0.74628
 TOTAL MASS AIRBORNE=  0.28278E+02     FRAC. INERT  AIRBORNE= 0.46510E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.609E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26537E+00             0.00938
   3.00 TO   10.00  0.82043E+00             0.02900
  10.00 TO   30.00  0.19441E+01             0.06872
  30.00 TO  100.00  0.41462E+01             0.14653
         >  100.00  0.21119E+02             0.74637
 TOTAL MASS AIRBORNE=  0.28295E+02     FRAC. INERT  AIRBORNE= 0.46461E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.610E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26531E+00             0.00937
   3.00 TO   10.00  0.82044E+00             0.02898
  10.00 TO   30.00  0.19447E+01             0.06869
  30.00 TO  100.00  0.41475E+01             0.14649
         >  100.00  0.21134E+02             0.74647
 TOTAL MASS AIRBORNE=  0.28312E+02     FRAC. INERT  AIRBORNE= 0.46413E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.611E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26526E+00             0.00936
   3.00 TO   10.00  0.82044E+00             0.02896
  10.00 TO   30.00  0.19450E+01             0.06866
  30.00 TO  100.00  0.41489E+01             0.14646
         >  100.00  0.21149E+02             0.74656
 TOTAL MASS AIRBORNE=  0.28329E+02     FRAC. INERT  AIRBORNE= 0.46364E-01
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.612E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.26520E+00             0.00936
   3.00 TO    10.00  0.82045E+00             0.02894
  10.00 TO    30.00  0.19453E+01             0.06863
  30.00 TO   100.00  0.41502E+01             0.14642
         >   100.00  0.21164E+02             0.74666
 TOTAL MASS AIRBORNE=  0.28345E+02     FRAC. INERT  AIRBORNE= 0.46316E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.613E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.26514E+00             0.00935
   3.00 TO    10.00  0.82046E+00             0.02893
  10.00 TO    30.00  0.19456E+01             0.06860
  30.00 TO   100.00  0.41515E+01             0.14638
         >   100.00  0.21179E+02             0.74675
 TOTAL MASS AIRBORNE=  0.28362E+02     FRAC. INERT  AIRBORNE= 0.46268E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.614E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.26508E+00             0.00934
   3.00 TO    10.00  0.82047E+00             0.02891
  10.00 TO    30.00  0.19459E+01             0.06857
  30.00 TO   100.00  0.41529E+01             0.14634
         >   100.00  0.21194E+02             0.74684
 TOTAL MASS AIRBORNE=  0.28379E+02     FRAC. INERT  AIRBORNE= 0.46220E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.615E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.26503E+00             0.00933
   3.00 TO    10.00  0.82048E+00             0.02889
  10.00 TO    30.00  0.19462E+01             0.06854
  30.00 TO   100.00  0.41542E+01             0.14630
         >   100.00  0.21210E+02             0.74694
 TOTAL MASS AIRBORNE=  0.28395E+02     FRAC. INERT  AIRBORNE= 0.46172E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.616E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.26497E+00             0.00933
   3.00 TO    10.00  0.82048E+00             0.02888
  10.00 TO    30.00  0.19465E+01             0.06851
  30.00 TO   100.00  0.41555E+01             0.14626
         >   100.00  0.21225E+02             0.74703
 TOTAL MASS AIRBORNE=  0.28412E+02     FRAC. INERT  AIRBORNE= 0.46124E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.617E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.26491E+00             0.00932
   3.00 TO    10.00  0.82049E+00             0.02886
  10.00 TO    30.00  0.19467E+01             0.06848
  30.00 TO   100.00  0.41568E+01             0.14622
         >   100.00  0.21240E+02             0.74712
 TOTAL MASS AIRBORNE=  0.28429E+02     FRAC. INERT  AIRBORNE= 0.46076E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.618E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.26486E+00             0.00931
   3.00 TO    10.00  0.82050E+00             0.02884
  10.00 TO    30.00  0.19470E+01             0.06845
  30.00 TO   100.00  0.41582E+01             0.14618
         >   100.00  0.21255E+02             0.74722
 TOTAL MASS AIRBORNE=  0.28446E+02     FRAC. INERT  AIRBORNE= 0.46028E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.619E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.26480E+00             0.00930
   3.00 TO    10.00  0.82051E+00             0.02883
  10.00 TO    30.00  0.19473E+01             0.06842
  30.00 TO   100.00  0.41595E+01             0.14614
         >   100.00  0.21270E+02             0.74731
 TOTAL MASS AIRBORNE=  0.28462E+02     FRAC. INERT  AIRBORNE= 0.45981E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.620E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.26474E+00             0.00930
   3.00 TO    10.00  0.82052E+00             0.02881
  10.00 TO    30.00  0.19476E+01             0.06839
  30.00 TO   100.00  0.41608E+01             0.14610
         >   100.00  0.21285E+02             0.74740
 TOTAL MASS AIRBORNE=  0.28479E+02     FRAC. INERT  AIRBORNE= 0.45934E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.621E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.26469E+00             0.00929
   3.00 TO    10.00  0.82053E+00             0.02880
  10.00 TO    30.00  0.19479E+01             0.06836
  30.00 TO   100.00  0.41621E+01             0.14606
         >   100.00  0.21300E+02             0.74749
 TOTAL MASS AIRBORNE=  0.28495E+02     FRAC. INERT  AIRBORNE= 0.45886E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.622E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.26463E+00             0.00928
   3.00 TO    10.00  0.82053E+00             0.02878
  10.00 TO    30.00  0.19482E+01             0.06833
  30.00 TO   100.00  0.41634E+01             0.14602
         >   100.00  0.21315E+02             0.74759
 TOTAL MASS AIRBORNE=  0.28512E+02     FRAC. INERT  AIRBORNE= 0.45839E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.623E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.26457E+00             0.00927
   3.00 TO    10.00  0.82054E+00             0.02876
  10.00 TO    30.00  0.19485E+01             0.06830
  30.00 TO   100.00  0.41648E+01             0.14599
         >   100.00  0.21330E+02             0.74768
 TOTAL MASS AIRBORNE=  0.28529E+02     FRAC. INERT  AIRBORNE= 0.45792E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.624E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.26452E+00             0.00927
   3.00 TO    10.00  0.82055E+00             0.02875
  10.00 TO    30.00  0.19488E+01             0.06827
  30.00 TO   100.00  0.41661E+01             0.14595
         >   100.00  0.21345E+02             0.74777
 TOTAL MASS AIRBORNE=  0.28545E+02     FRAC. INERT  AIRBORNE= 0.45745E-01
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.ØØ INERT WT(G) = Ø.625E+Ø3 STD. DEV. = 8.ØØ # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   Ø.ØØ TO    3.ØØ  Ø.26446E+ØØ            Ø.ØØ926
   3.ØØ TO   1Ø.ØØ  Ø.82Ø56E+ØØ            Ø.Ø2873
  1Ø.ØØ TO   3Ø.ØØ  Ø.1949ØE+Ø1            Ø.Ø6824
  3Ø.ØØ TO  1ØØ.ØØ  Ø.41674E+Ø1            Ø.14591
          > 1ØØ.ØØ  Ø.2136ØE+Ø2            Ø.74786
 TOTAL MASS AIRBORNE=  Ø.28562E+Ø2     FRAC. INERT  AIRBORNE= Ø.45699E-Ø1

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.ØØ INERT WT(G) = Ø.626E+Ø3 STD. DEV. = 8.ØØ # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   Ø.ØØ TO    3.ØØ  Ø.26441E+ØØ            Ø.ØØ925
   3.ØØ TO   1Ø.ØØ  Ø.82Ø56E+ØØ            Ø.Ø2871
  1Ø.ØØ TO   3Ø.ØØ  Ø.19493E+Ø1            Ø.Ø6821
  3Ø.ØØ TO  1ØØ.ØØ  Ø.41687E+Ø1            Ø.14587
          > 1ØØ.ØØ  Ø.21375E+Ø2            Ø.74796
 TOTAL MASS AIRBORNE=  Ø.28578E+Ø2     FRAC. INERT  AIRBORNE= Ø.45652E-Ø1

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.ØØ INERT WT(G) = Ø.627E+Ø3 STD. DEV. = 8.ØØ # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   Ø.ØØ TO    3.ØØ  Ø.26435E+ØØ            Ø.ØØ924
   3.ØØ TO   1Ø.ØØ  Ø.82Ø57E+ØØ            Ø.Ø287Ø
  1Ø.ØØ TO   3Ø.ØØ  Ø.19496E+Ø1            Ø.Ø6818
  3Ø.ØØ TO  1ØØ.ØØ  Ø.417ØØE+Ø1            Ø.14583
          > 1ØØ.ØØ  Ø.2139ØE+Ø2            Ø.748ØØ
 TOTAL MASS AIRBORNE=  Ø.28595E+Ø2     FRAC. INERT  AIRBORNE= Ø.456Ø6E-Ø1

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.ØØ INERT WT(G) = Ø.628E+Ø3 STD. DEV. = 8.ØØ # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   Ø.ØØ TO    3.ØØ  Ø.26429E+ØØ            Ø.ØØ924
   3.ØØ TO   1Ø.ØØ  Ø.82Ø58E+ØØ            Ø.Ø2868
  1Ø.ØØ TO   3Ø.ØØ  Ø.19499E+Ø1            Ø.Ø6815
  3Ø.ØØ TO  1ØØ.ØØ  Ø.41713E+Ø1            Ø.14579
          > 1ØØ.ØØ  Ø.214Ø5E+Ø2            Ø.74814
 TOTAL MASS AIRBORNE=  Ø.28611E+Ø2     FRAC. INERT  AIRBORNE= Ø.45559E-Ø1

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.ØØ INERT WT(G) = Ø.629E+Ø3 STD. DEV. = 8.ØØ # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   Ø.ØØ TO    3.ØØ  Ø.26424E+ØØ            Ø.ØØ923
   3.ØØ TO   1Ø.ØØ  Ø.82Ø59E+ØØ            Ø.Ø2866
  1Ø.ØØ TO   3Ø.ØØ  Ø.195Ø2E+Ø1            Ø.Ø6812
  3Ø.ØØ TO  1ØØ.ØØ  Ø.41726E+Ø1            Ø.14575
          > 1ØØ.ØØ  Ø.2142ØE+Ø2            Ø.74823
 TOTAL MASS AIRBORNE=  Ø.28628E+Ø2     FRAC. INERT  AIRBORNE= Ø.45513E-Ø1

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.ØØ INERT WT(G) = Ø.63ØE+Ø3 STD. DEV. = 8.ØØ # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   Ø.ØØ TO    3.ØØ  Ø.26418E+ØØ            Ø.ØØ922
   3.ØØ TO   1Ø.ØØ  Ø.82Ø59E+ØØ            Ø.Ø2865
  1Ø.ØØ TO   3Ø.ØØ  Ø.195Ø5E+Ø1            Ø.Ø68Ø9
  3Ø.ØØ TO  1ØØ.ØØ  Ø.41739E+Ø1            Ø.14572
          > 1ØØ.ØØ  Ø.21435E+Ø2            Ø.74832
 TOTAL MASS AIRBORNE=  Ø.28644E+Ø2     FRAC. INERT  AIRBORNE= Ø.45467E-Ø1

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.ØØ INERT WT(G) = Ø.631E+Ø3 STD. DEV. = 8.ØØ # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   Ø.ØØ TO    3.ØØ  Ø.26413E+ØØ            Ø.ØØ922
   3.ØØ TO   1Ø.ØØ  Ø.82Ø6ØE+ØØ            Ø.Ø2863
  1Ø.ØØ TO   3Ø.ØØ  Ø.195Ø7E+Ø1            Ø.Ø68Ø6
  3Ø.ØØ TO  1ØØ.ØØ  Ø.41752E+Ø1            Ø.14568
          > 1ØØ.ØØ  Ø.2145ØE+Ø2            Ø.74841
 TOTAL MASS AIRBORNE=  Ø.28661E+Ø2     FRAC. INERT  AIRBORNE= Ø.45421E-Ø1

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.ØØ INERT WT(G) = Ø.632E+Ø3 STD. DEV. = 8.ØØ # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   Ø.ØØ TO    3.ØØ  Ø.264Ø7E+ØØ            Ø.ØØ921
   3.ØØ TO   1Ø.ØØ  Ø.82Ø61E+ØØ            Ø.Ø2862
  1Ø.ØØ TO   3Ø.ØØ  Ø.1951ØE+Ø1            Ø.Ø68Ø3
  3Ø.ØØ TO  1ØØ.ØØ  Ø.41765E+Ø1            Ø.14564
          > 1ØØ.ØØ  Ø.21465E+Ø2            Ø.7485Ø
 TOTAL MASS AIRBORNE=  Ø.28677E+Ø2     FRAC. INERT  AIRBORNE= Ø.45375E-Ø1

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.ØØ INERT WT(G) = Ø.633E+Ø3 STD. DEV. = 8.ØØ # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   Ø.ØØ TO    3.ØØ  Ø.264Ø2E+ØØ            Ø.ØØ92Ø
   3.ØØ TO   1Ø.ØØ  Ø.82Ø61E+ØØ            Ø.Ø286Ø
  1Ø.ØØ TO   3Ø.ØØ  Ø.19513E+Ø1            Ø.Ø68Ø1
  3Ø.ØØ TO  1ØØ.ØØ  Ø.41778E+Ø1            Ø.1456Ø
          > 1ØØ.ØØ  Ø.2148ØE+Ø2            Ø.74859
 TOTAL MASS AIRBORNE=  Ø.2869[illegible]E+Ø2     FRAC. INERT  AIRBORNE= Ø.45329E-Ø1

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.ØØ INERT WT(G) = Ø.634E+Ø3 STD. DEV. = 8.ØØ # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   Ø.ØØ TO    3.ØØ  Ø.26396E+ØØ            Ø.ØØ919
   3.ØØ TO   1Ø.ØØ  Ø.82Ø62E+ØØ            Ø.Ø2858
  1Ø.ØØ TO   3Ø.ØØ  Ø.19516E+Ø1            Ø.Ø6798
  3Ø.ØØ TO  1ØØ.ØØ  Ø.41791E+Ø1            Ø.14556
          > 1ØØ.ØØ  Ø.21494E+Ø2            Ø.74868
 TOTAL MASS AIRBORNE=  Ø.2871ØE+Ø2     FRAC. INERT  AIRBORNE= Ø.45283E-Ø1

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.ØØ INERT WT(G) = Ø.635E+Ø3 STD. DEV. = 8.ØØ # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   Ø.ØØ TO    3.ØØ  Ø.2639ØE+ØØ            Ø.ØØ919
   3.ØØ TO   1Ø.ØØ  Ø.82Ø63E+ØØ            Ø.Ø2857
  1Ø.ØØ TO   3Ø.ØØ  Ø.19519E+Ø1            Ø.Ø6795
  3Ø.ØØ TO  1ØØ.ØØ  Ø.418Ø3E+Ø1            Ø.14552
          > 1ØØ.ØØ  Ø.215Ø9E+Ø2            Ø.74877
 TOTAL MASS AIRBORNE=  Ø.28726E+Ø2     FRAC. INERT  AIRBORNE= Ø.45238E-Ø1

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.ØØ INERT WT(G) = Ø.636E+Ø3 STD. DEV. = 8.ØØ # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   Ø.ØØ TO    3.ØØ  Ø.26385E+ØØ            Ø.ØØ918
   3.ØØ TO   1Ø.ØØ  Ø.82Ø63E+ØØ            Ø.Ø2855
  1Ø.ØØ TO   3Ø.ØØ  Ø.19521E+Ø1            Ø.Ø6792
  3Ø.ØØ TO  1ØØ.ØØ  Ø.41816E+Ø1            Ø.14549
          > 1ØØ.ØØ  Ø.21524E+Ø2            Ø.74886
 TOTAL MASS AIRBORNE=  Ø.28742E+Ø2     FRAC. INERT  AIRBORNE= Ø.45193E-Ø1

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.ØØ INERT WT(G) = Ø.637E+Ø3 STD. DEV. = 8.ØØ # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   Ø.ØØ TO    3.ØØ  Ø.26379E+ØØ            Ø.ØØ917
   3.ØØ TO   1Ø.ØØ  Ø.82Ø64E+ØØ            Ø.Ø2854
  1Ø.ØØ TO   3Ø.ØØ  Ø.19524E+Ø1            Ø.Ø6789
  3Ø.ØØ TO  1ØØ.ØØ  Ø.41829E+Ø1            Ø.14545
          > 1ØØ.ØØ  Ø.21539E+Ø2            Ø.74895
 TOTAL MASS AIRBORNE=  Ø.28759E+Ø2     FRAC. INERT  AIRBORNE= Ø.45147E-Ø1
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.638E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26374E+00            0.00917
   3.00 TO   10.00  0.82065E+00            0.02852
  10.00 TO   30.00  0.19527E+01            0.06786
  30.00 TO  100.00  0.41842E+01            0.14541
         >  100.00  0.21554E+02            0.74904
 TOTAL MASS AIRBORNE=  0.28776E+02     FRAC. INERT  AIRBORNE= 0.45102E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.639E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26368E+00            0.00916
   3.00 TO   10.00  0.82066E+00            0.02850
  10.00 TO   30.00  0.19530E+01            0.06783
  30.00 TO  100.00  0.41855E+01            0.14537
         >  100.00  0.21569E+02            0.74913
 TOTAL MASS AIRBORNE=  0.28791E+02     FRAC. INERT  AIRBORNE= 0.45057E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.640E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26363E+00            0.00916
   3.00 TO   10.00  0.82066E+00            0.02849
  10.00 TO   30.00  0.19533E+01            0.06780
  30.00 TO  100.00  0.41867E+01            0.14533
         >  100.00  0.21583E+02            0.74922
 TOTAL MASS AIRBORNE=  0.28808E+02     FRAC. INERT  AIRBORNE= 0.45012E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.641E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26357E+00            0.00914
   3.00 TO   10.00  0.82067E+00            0.02847
  10.00 TO   30.00  0.19535E+01            0.06777
  30.00 TO  100.00  0.41880E+01            0.14530
         >  100.00  0.21598E+02            0.74931
 TOTAL MASS AIRBORNE=  0.28824E+02     FRAC. INERT  AIRBORNE= 0.44967E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.642E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26352E+00            0.00914
   3.00 TO   10.00  0.82067E+00            0.02846
  10.00 TO   30.00  0.19538E+01            0.06776
  30.00 TO  100.00  0.41893E+01            0.14526
         >  100.00  0.21613E+02            0.74940
 TOTAL MASS AIRBORNE=  0.28840E+02     FRAC. INERT  AIRBORNE= 0.44922E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.643E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26346E+00            0.00913
   3.00 TO   10.00  0.82068E+00            0.02844
  10.00 TO   30.00  0.19541E+01            0.06772
  30.00 TO  100.00  0.41906E+01            0.14522
         >  100.00  0.21628E+02            0.74949
 TOTAL MASS AIRBORNE=  0.28856E+02     FRAC. INERT  AIRBORNE= 0.44878E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.644E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26341E+00            0.00912
   3.00 TO   10.00  0.82069E+00            0.02842
  10.00 TO   30.00  0.19544E+01            0.06769
  30.00 TO  100.00  0.41918E+01            0.14518
         >  100.00  0.21642E+02            0.74958
 TOTAL MASS AIRBORNE=  0.28873E+02     FRAC. INERT  AIRBORNE= 0.44833E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.645E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26335E+00            0.00912
   3.00 TO   10.00  0.82069E+00            0.02841
  10.00 TO   30.00  0.19546E+01            0.06766
  30.00 TO  100.00  0.41931E+01            0.14516
         >  100.00  0.21657E+02            0.74967
 TOTAL MASS AIRBORNE=  0.28889E+02     FRAC. INERT  AIRBORNE= 0.44789E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.646E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26330E+00            0.00911
   3.00 TO   10.00  0.82070E+00            0.02839
  10.00 TO   30.00  0.19549E+01            0.06763
  30.00 TO  100.00  0.41944E+01            0.14511
         >  100.00  0.21672E+02            0.74976
 TOTAL MASS AIRBORNE=  0.28905E+02     FRAC. INERT  AIRBORNE= 0.44745E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.647E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26325E+00            0.00910
   3.00 TO   10.00  0.82070E+00            0.02838
  10.00 TO   30.00  0.19552E+01            0.06760
  30.00 TO  100.00  0.41957E+01            0.14507
         >  100.00  0.21686E+02            0.74[illegible]
 TOTAL MASS AIRBORNE=  0.28921E+02     FRAC. INERT  AIRBORNE= 0.44701E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.648E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26319E+00            0.00910
   3.00 TO   10.00  0.82071E+00            0.02836
  10.00 TO   30.00  0.19555E+01            0.06758
  30.00 TO  100.00  0.41969E+01            0.14503
         >  100.00  0.21701E+02            0.74993
 TOTAL MASS AIRBORNE=  0.28937E+02     FRAC. INERT  AIRBORNE= 0.44657E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.649E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26314E+00            0.00909
   3.00 TO   10.00  0.82071E+00            0.02835
  10.00 TO   30.00  0.19557E+01            0.06755
  30.00 TO  100.00  0.41982E+01            0.14500
         >  100.00  0.21716E+02            0.75002
 TOTAL MASS AIRBORNE=  0.28954E+02     FRAC. INERT  AIRBORNE= 0.44613E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.650E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26308E+00            0.00908
   3.00 TO   10.00  0.82072E+00            0.02833
  10.00 TO   30.00  0.19560E+01            0.06752
  30.00 TO  100.00  0.41994E+01            0.14496
         >  100.00  0.21730E+02            0.75011
 TOTAL MASS AIRBORNE=  0.28970E+02     FRAC. INERT  AIRBORNE= 0.44569E-01
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.651E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26303E+00          0.00907
   3.00 TO   10.00  0.82072E+00          0.02831
  10.00 TO   30.00  0.19563E+01          0.06749
  30.00 TO  100.00  0.42007E+01          0.14492
          > 100.00  0.21746E+02          0.75020
 TOTAL MASS AIRBORNE=  0.28986E+02     FRAC. INERT  AIRBORNE= 0.44526E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.652E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26297E+00          0.00907
   3.00 TO   10.00  0.82072E+00          0.02830
  10.00 TO   30.00  0.19565E+01          0.06746
  30.00 TO  100.00  0.42019E+01          0.14489
          > 100.00  0.21760E+02          0.75029
 TOTAL MASS AIRBORNE=  0.29002E+02     FRAC. INERT  AIRBORNE= 0.44481E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.653E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26292E+00          0.00906
   3.00 TO   10.00  0.82074E+00          0.02828
  10.00 TO   30.00  0.19568E+01          0.06743
  30.00 TO  100.00  0.42032E+01          0.14485
          > 100.00  0.21774E+02          0.75037
 TOTAL MASS AIRBORNE=  0.29018E+02     FRAC. INERT  AIRBORNE= 0.44438E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.654E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26287E+00          0.00906
   3.00 TO   10.00  0.82074E+00          0.02827
  10.00 TO   30.00  0.19571E+01          0.06741
  30.00 TO  100.00  0.42044E+01          0.14481
          > 100.00  0.21789E+02          0.75046
 TOTAL MASS AIRBORNE=  0.29034E+02     FRAC. INERT  AIRBORNE= 0.44395E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.655E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26281E+00          0.00905
   3.00 TO   10.00  0.82075E+00          0.02825
  10.00 TO   30.00  0.19574E+01          0.06738
  30.00 TO  100.00  0.42057E+01          0.14477
          > 100.00  0.21803E+02          0.75055
 TOTAL MASS AIRBORNE=  0.29050E+02     FRAC. INERT  AIRBORNE= 0.44351E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.656E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26276E+00          0.00904
   3.00 TO   10.00  0.82075E+00          0.02824
  10.00 TO   30.00  0.19576E+01          0.06735
  30.00 TO  100.00  0.42070E+01          0.14474
          > 100.00  0.21818E+02          0.75063
 TOTAL MASS AIRBORNE=  0.29066E+02     FRAC. INERT  AIRBORNE= 0.44308E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.657E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26271E+00          0.00903
   3.00 TO   10.00  0.82076E+00          0.02822
  10.00 TO   30.00  0.19579E+01          0.06732
  30.00 TO  100.00  0.42082E+01          0.14470
          > 100.00  0.21833E+02          0.75072
 TOTAL MASS AIRBORNE=  0.29082E+02     FRAC. INERT  AIRBORNE= 0.44265E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.658E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26265E+00          0.00903
   3.00 TO   10.00  0.82076E+00          0.02821
  10.00 TO   30.00  0.19582E+01          0.06730
  30.00 TO  100.00  0.42094E+01          0.14466
          > 100.00  0.21847E+02          0.75081
 TOTAL MASS AIRBORNE=  0.29098E+02     FRAC. INERT  AIRBORNE= 0.44222E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.659E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26260E+00          0.00902
   3.00 TO   10.00  0.82077E+00          0.02819
  10.00 TO   30.00  0.19584E+01          0.06727
  30.00 TO  100.00  0.42107E+01          0.14463
          > 100.00  0.21862E+02          0.75090
 TOTAL MASS AIRBORNE=  0.29114E+02     FRAC. INERT  AIRBORNE= 0.44179E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.660E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26254E+00          0.00901
   3.00 TO   10.00  0.82078E+00          0.02818
  10.00 TO   30.00  0.19587E+01          0.06724
  30.00 TO  100.00  0.42119E+01          0.14459
          > 100.00  0.21876E+02          0.75098
 TOTAL MASS AIRBORNE=  0.29130E+02     FRAC. INERT  AIRBORNE= 0.44137E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.661E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26249E+00          0.00901
   3.00 TO   10.00  0.82078E+00          0.02816
  10.00 TO   30.00  0.19590E+01          0.06721
  30.00 TO  100.00  0.42132E+01          0.14455
          > 100.00  0.21891E+02          0.75107
 TOTAL MASS AIRBORNE=  0.29146E+02     FRAC. INERT  AIRBORNE= 0.44094E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.662E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26244E+00          0.00900
   3.00 TO   10.00  0.82078E+00          0.02815
  10.00 TO   30.00  0.19592E+01          0.06718
  30.00 TO  100.00  0.42144E+01          0.14452
          > 100.00  0.21905E+02          0.75115
 TOTAL MASS AIRBORNE=  0.29162E+02     FRAC. INERT  AIRBORNE= 0.44051E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.663E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26238E+00          0.00899
   3.00 TO   10.00  0.82079E+00          0.02813
  10.00 TO   30.00  0.19595E+01          0.06716
  30.00 TO  100.00  0.42156E+01          0.14448
          > 100.00  0.21920E+02          0.75124
 TOTAL MASS AIRBORNE=  0.29178E+02     FRAC. INERT  AIRBORNE= 0.44009E-01
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.664E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
    0.00 TO    3.00  0.26233E+00            0.00899
    3.00 TO   10.00  0.82079E+00            0.02812
   10.00 TO   30.00  0.19598E+01            0.06713
   30.00 TO  100.00  0.42169E+01            0.14444
           > 100.00  0.21934E+02            0.75133
 TOTAL MASS AIRBORNE=  0.29194E+02     FRAC. INERT  AIRBORNE= 0.43967E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.665E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
    0.00 TO    3.00  0.26228E+00            0.00898
    3.00 TO   10.00  0.82080E+00            0.02810
   10.00 TO   30.00  0.19600E+01            0.06710
   30.00 TO  100.00  0.42181E+01            0.14441
           > 100.00  0.21949E+02            0.75141
 TOTAL MASS AIRBORNE=  0.29210E+02     FRAC. INERT  AIRBORNE= 0.43924E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.666E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
    0.00 TO    3.00  0.26222E+00            0.00897
    3.00 TO   10.00  0.82080E+00            0.02809
   10.00 TO   30.00  0.19603E+01            0.06707
   30.00 TO  100.00  0.42193E+01            0.14437
           > 100.00  0.21963E+02            0.75150
 TOTAL MASS AIRBORNE=  0.29226E+02     FRAC. INERT  AIRBORNE= 0.43882E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.667E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
    0.00 TO    3.00  0.26217E+00            0.00897
    3.00 TO   10.00  0.82061E+00            0.02807
   10.00 TO   30.00  0.19606E+01            0.06705
   30.00 TO  100.00  0.42206E+01            0.14433
           > 100.00  0.21977E+02            0.75158
 TOTAL MASS AIRBORNE=  0.29241E+02     FRAC. INERT  AIRBORNE= 0.43840E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.668E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
    0.00 TO    3.00  0.26212E+00            0.00896
    3.00 TO   10.00  0.82081E+00            0.02805
   10.00 TO   30.00  0.19608E+01            0.06702
   30.00 TO  100.00  0.42218E+01            0.14430
           > 100.00  0.21992E+02            0.75167
 TOTAL MASS AIRBORNE=  0.29257E+02     FRAC. INERT  AIRBORNE= 0.43798E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.669E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
    0.00 TO    3.00  0.26206E+00            0.00895
    3.00 TO   10.00  0.82082E+00            0.02804
   10.00 TO   30.00  0.19611E+01            0.06699
   30.00 TO  100.00  0.42230E+01            0.14426
           > 100.00  0.22006E+02            0.75175
 TOTAL MASS AIRBORNE=  0.29273E+02     FRAC. INERT  AIRBORNE= 0.43757E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.670E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
    0.00 TO    3.00  0.26201E+00            0.00895
    3.00 TO   10.00  0.82082E+00            0.02802
   10.00 TO   30.00  0.19613E+01            0.06697
   30.00 TO  100.00  0.42242E+01            0.14423
           > 100.00  0.22021E+02            0.75184
 TOTAL MASS AIRBORNE=  0.29289E+02     FRAC. INERT  AIRBORNE= 0.43715E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.671E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
    0.00 TO    3.00  0.26196E+00            0.00894
    3.00 TO   10.00  0.82083E+00            0.02801
   10.00 TO   30.00  0.19616E+01            0.06694
   30.00 TO  100.00  0.42255E+01            0.14419
           > 100.00  0.22035E+02            0.75192
 TOTAL MASS AIRBORNE=  0.29305E+02     FRAC. INERT  AIRBORNE= 0.43673E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.672E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
    0.00 TO    3.00  0.26191E+00            0.00893
    3.00 TO   10.00  0.82083E+00            0.02799
   10.00 TO   30.00  0.19619E+01            0.06691
   30.00 TO  100.00  0.42267E+01            0.14415
           > 100.00  0.22049E+02            0.75201
 TOTAL MASS AIRBORNE=  0.29321E+02     FRAC. INERT  AIRBORNE= 0.43632E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.673E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
    0.00 TO    3.00  0.26185E+00            0.00893
    3.00 TO   10.00  0.82084E+00            0.02798
   10.00 TO   30.00  0.19621E+01            0.06688
   30.00 TO  100.00  0.42279E+01            0.14412
           > 100.00  0.22064E+02            0.75209
 TOTAL MASS AIRBORNE=  0.29336E+02     FRAC. INERT  AIRBORNE= 0.43590E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.674E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
    0.00 TO    3.00  0.26180E+00            0.00892
    3.00 TO   10.00  0.82084E+00            0.02797
   10.00 TO   30.00  0.19624E+01            0.06686
   30.00 TO  100.00  0.42291E+01            0.14408
           > 100.00  0.22078E+02            0.75218
 TOTAL MASS AIRBORNE=  0.29352E+02     FRAC. INERT  AIRBORNE= 0.43549E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.675E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
    0.00 TO    3.00  0.26175E+00            0.00891
    3.00 TO   10.00  0.82084E+00            0.02795
   10.00 TO   30.00  0.19626E+01            0.06683
   30.00 TO  100.00  0.42303E+01            0.14405
           > 100.00  0.22092E+02            0.75226
 TOTAL MASS AIRBORNE=  0.29368E+02     FRAC. INERT  AIRBORNE= 0.43508E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.676E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
    0.00 TO    3.00  0.26170E+00            0.00891
    3.00 TO   10.00  0.82085E+00            0.02794
   10.00 TO   30.00  0.19629E+01            0.06680
   30.00 TO  100.00  0.42315E+01            0.14401
           > 100.00  0.22107E+02            0.75235
 TOTAL MASS AIRBORNE=  0.29384E+02     FRAC. INERT  AIRBORNE= 0.43467E-01
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.677E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26164E+00           0.00890
   3.00 TO   10.00  0.82086E+00           0.02792
  10.00 TO   30.00  0.19632E+01           0.06678
  30.00 TO  100.00  0.42327E+01           0.14397
          >  100.00  0.22121E+02           0.75243
 TOTAL MASS AIRBORNE=  0.29399E+02     FRAC. INERT  AIRBORNE= 0.43426E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.678E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26159E+00           0.00889
   3.00 TO   10.00  0.82086E+00           0.02791
  10.00 TO   30.00  0.19634E+01           0.06675
  30.00 TO  100.00  0.42340E+01           0.14394
          >  100.00  0.22135E+02           0.75251
 TOTAL MASS AIRBORNE=  0.29415E+02     FRAC. INERT  AIRBORNE= 0.43385E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.679E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26154E+00           0.00889
   3.00 TO   10.00  0.82086E+00           0.02789
  10.00 TO   30.00  0.19637E+01           0.06672
  30.00 TO  100.00  0.42352E+01           0.14390
          >  100.00  0.22149E+02           0.75260
 TOTAL MASS AIRBORNE=  0.29431E+02     FRAC. INERT  AIRBORNE= 0.43344E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.680E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26149E+00           0.00888
   3.00 TO   10.00  0.82086E+00           0.02788
  10.00 TO   30.00  0.19639E+01           0.06670
  30.00 TO  100.00  0.42364E+01           0.14387
          >  100.00  0.22164E+02           0.75268
 TOTAL MASS AIRBORNE=  0.29446E+02     FRAC. INERT  AIRBORNE= 0.43303E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.681E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26144E+00           0.00887
   3.00 TO   10.00  0.82087E+00           0.02786
  10.00 TO   30.00  0.19642E+01           0.06667
  30.00 TO  100.00  0.42376E+01           0.14383
          >  100.00  0.22178E+02           0.75276
 TOTAL MASS AIRBORNE=  0.29462E+02     FRAC. INERT  AIRBORNE= 0.43263E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.682E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26138E+00           0.00887
   3.00 TO   10.00  0.82087E+00           0.02785
  10.00 TO   30.00  0.19644E+01           0.06664
  30.00 TO  100.00  0.42388E+01           0.14380
          >  100.00  0.22192E+02           0.75285
 TOTAL MASS AIRBORNE=  0.29478E+02     FRAC. INERT  AIRBORNE= 0.43222E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.683E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26133E+00           0.00886
   3.00 TO   10.00  0.82087E+00           0.02783
  10.00 TO   30.00  0.19647E+01           0.06662
  30.00 TO  100.00  0.42400E+01           0.14376
          >  100.00  0.22206E+02           0.75293
 TOTAL MASS AIRBORNE=  0.29493E+02     FRAC. INERT  AIRBORNE= 0.43182E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.684E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26128E+00           0.00885
   3.00 TO   10.00  0.82088E+00           0.02782
  10.00 TO   30.00  0.19650E+01           0.06659
  30.00 TO  100.00  0.42412E+01           0.14373
          >  100.00  0.22221E+02           0.75301
 TOTAL MASS AIRBORNE=  0.29509E+02     FRAC. INERT  AIRBORNE= 0.43142E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.685E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26123E+00           0.00885
   3.00 TO   10.00  0.82088E+00           0.02780
  10.00 TO   30.00  0.19652E+01           0.06656
  30.00 TO  100.00  0.42424E+01           0.14369
          >  100.00  0.22235E+02           0.75310
 TOTAL MASS AIRBORNE=  0.29524E+02     FRAC. INERT  AIRBORNE= 0.43101E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.686E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26118E+00           0.00884
   3.00 TO   10.00  0.82089E+00           0.02779
  10.00 TO   30.00  0.19655E+01           0.06654
  30.00 TO  100.00  0.42436E+01           0.14365
          >  100.00  0.22249E+02           0.75318
 TOTAL MASS AIRBORNE=  0.29540E+02     FRAC. INERT  AIRBORNE= 0.43061E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.687E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26112E+00           0.00884
   3.00 TO   10.00  0.82089E+00           0.02777
  10.00 TO   30.00  0.19657E+01           0.06651
  30.00 TO  100.00  0.42448E+01           0.14362
          >  100.00  0.22263E+02           0.75326
 TOTAL MASS AIRBORNE=  0.29556E+02     FRAC. INERT  AIRBORNE= 0.43021E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.688E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26107E+00           0.00883
   3.00 TO   10.00  0.82089E+00           0.02776
  10.00 TO   30.00  0.19660E+01           0.06648
  30.00 TO  100.00  0.42459E+01           0.14358
          >  100.00  0.22277E+02           0.75335
 TOTAL MASS AIRBORNE=  0.29571E+02     FRAC. INERT  AIRBORNE= 0.42981E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.689E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26102E+00           0.00882
   3.00 TO   10.00  0.82089E+00           0.02775
  10.00 TO   30.00  0.19662E+01           0.06646
  30.00 TO  100.00  0.42471E+01           0.14355
          >  100.00  0.22291E+02           0.75343
 TOTAL MASS AIRBORNE=  0.29587E+02     FRAC. INERT  AIRBORNE= 0.42942E-01
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.690E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26097E+00          0.00882
   3.00 TO   10.00  0.82090E+00          0.02773
  10.00 TO   30.00  0.19665E+01          0.06643
  30.00 TO  100.00  0.42483E+01          0.14351
          >  100.00  0.22306E+02          0.75351
 TOTAL MASS AIRBORNE=  0.29602E+02     FRAC. INERT  AIRBORNE= 0.42902E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.691E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26092E+00          0.00881
   3.00 TO   10.00  0.82090E+00          0.02772
  10.00 TO   30.00  0.19667E+01          0.06340
  30.00 TO  100.00  0.42496E+01          0.14348
          >  100.00  0.22320E+02          0.75359
 TOTAL MASS AIRBORNE=  0.29618E+02     FRAC. INERT  AIRBORNE= 0.42862E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.692E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26087E+00          0.00880
   3.00 TO   10.00  0.82090E+00          0.02770
  10.00 TO   30.00  0.19670E+01          0.06638
  30.00 TO  100.00  0.42507E+01          0.14344
          >  100.00  0.22334E+02          0.75367
 TOTAL MASS AIRBORNE=  0.29633E+02     FRAC. INERT  AIRBORNE= 0.42823E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.693E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26082E+00          0.00880
   3.00 TO   10.00  0.82091E+00          0.02769
  10.00 TO   30.00  0.19672E+01          0.06635
  30.00 TO  100.00  0.42519E+01          0.14341
          >  100.00  0.22348E+02          0.75376
 TOTAL MASS AIRBORNE=  0.29649E+02     FRAC. INERT  AIRBORNE= 0.42783E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.694E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26076E+00          0.00879
   3.00 TO   10.00  0.82091E+00          0.02767
  10.00 TO   30.00  0.19675E+01          0.06633
  30.00 TO  100.00  0.42531E+01          0.14337
          >  100.00  0.22362E+02          0.75384
 TOTAL MASS AIRBORNE=  0.29664E+02     FRAC. INERT  AIRBORNE= 0.42744E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.695E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26071E+00          0.00878
   3.00 TO   10.00  0.82091E+00          0.02766
  10.00 TO   30.00  0.19677E+01          0.06630
  30.00 TO  100.00  0.42542E+01          0.14334
          >  100.00  0.22376E+02          0.75392
 TOTAL MASS AIRBORNE=  0.29680E+02     FRAC. INERT  AIRBORNE= 0.42705E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.696E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26066E+00          0.00873
   3.00 TO   10.00  0.82092E+00          0.02764
  10.00 TO   30.00  0.19680E+01          0.06627
  30.00 TO  100.00  0.42554E+01          0.14330
          >  100.00  0.22390E+02          0.75400
 TOTAL MASS AIRBORNE=  0.29695E+02     FRAC. INERT  AIRBORNE= 0.42665E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.697E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26061E+00          0.00877
   3.00 TO   10.00  0.82092E+00          0.02763
  10.00 TO   30.00  0.19682E+01          0.06625
  30.00 TO  100.00  0.42566E+01          0.14327
          >  100.00  0.22404E+02          0.75408
 TOTAL MASS AIRBORNE=  0.29711E+02     FRAC. INERT  AIRBORNE= 0.42626E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.698E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26056E+00          0.00877
   3.00 TO   10.00  0.82092E+00          0.02762
  10.00 TO   30.00  0.19685E+01          0.06622
  30.00 TO  100.00  0.42578E+01          0.14323
          >  100.00  0.22418E+02          0.75416
 TOTAL MASS AIRBORNE=  0.29726E+02     FRAC. INERT  AIRBORNE= 0.42587E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.699E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26051E+00          0.00876
   3.00 TO   10.00  0.82092E+00          0.02760
  10.00 TO   30.00  0.19687E+01          0.06619
  30.00 TO  100.00  0.42590E+01          0.14320
          >  100.00  0.22432E+02          0.75424
 TOTAL MASS AIRBORNE=  0.29741E+02     FRAC. INERT  AIRBORNE= 0.42548E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.700E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26046E+00          0.00875
   3.00 TO   10.00  0.82093E+00          0.02759
  10.00 TO   30.00  0.19690E+01          0.06617
  30.00 TO  100.00  0.42601E+01          0.14317
          >  100.00  0.22446E+02          0.75433
 TOTAL MASS AIRBORNE=  0.29757E+02     FRAC. INERT  AIRBORNE= 0.42510E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.701E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26041E+00          0.00875
   3.00 TO   10.00  0.82093E+00          0.02757
  10.00 TO   30.00  0.19692E+01          0.06614
  30.00 TO  100.00  0.42613E+01          0.14313
          >  100.00  0.22460E+02          0.75441
 TOTAL MASS AIRBORNE=  0.29772E+02     FRAC. INERT  AIRBORNE= 0.42471E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.702E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.26036E+00          0.00874
   3.00 TO   10.00  0.82093E+00          0.02756
  10.00 TO   30.00  0.19695E+01          0.06612
  30.00 TO  100.00  0.42625E+01          0.14310
          >  100.00  0.22474E+02          0.75449
 TOTAL MASS AIRBORNE=  0.29787E+02     FRAC. INERT  AIRBORNE= 0.42432E-01
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.703E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
    0.00 TO     3.00  0.26031E+00            0.00873
    3.00 TO    10.00  0.82093E+00            0.02755
   10.00 TO    30.00  0.19697E+01            0.06609
   30.00 TO   100.00  0.42636E+01            0.14306
           >  100.00  0.22488E+02            0.75457
 TOTAL MASS AIRBORNE=  0.29803E+02      FRAC. INERT  AIRBORNE= 0.42394E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.704E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
    0.00 TO     3.00  0.26026E+00            0.00873
    3.00 TO    10.00  0.82094E+00            0.02753
   10.00 TO    30.00  0.19700E+01            0.06607
   30.00 TO   100.00  0.42648E+01            0.14303
           >  100.00  0.22502E+02            0.75465
 TOTAL MASS AIRBORNE=  0.29818E+02      FRAC. INERT  AIRBORNE= 0.42355E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.705E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
    0.00 TO     3.00  0.26021E+00            0.00872
    3.00 TO    10.00  0.82094E+00            0.02752
   10.00 TO    30.00  0.19702E+01            0.06604
   30.00 TO   100.00  0.42660E+01            0.14299
           >  100.00  0.22516E+02            0.75473
 TOTAL MASS AIRBORNE=  0.29833E+02      FRAC. INERT  AIRBORNE= 0.42317E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.706E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
    0.00 TO     3.00  0.26016E+00            0.00872
    3.00 TO    10.00  0.82094E+00            0.02750
   10.00 TO    30.00  0.19704E+01            0.06601
   30.00 TO   100.00  0.42671E+01            0.14296
           >  100.00  0.22530E+02            0.75481
 TOTAL MASS AIRBORNE=  0.29849E+02      FRAC. INERT  AIRBORNE= 0.42279E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.707E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
    0.00 TO     3.00  0.26011E+00            0.00871
    3.00 TO    10.00  0.82094E+00            0.02749
   10.00 TO    30.00  0.19707E+01            0.06599
   30.00 TO   100.00  0.42683E+01            0.14292
           >  100.00  0.22544E+02            0.75489
 TOTAL MASS AIRBORNE=  0.29864E+02      FRAC. INERT  AIRBORNE= 0.42240E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.708E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
    0.00 TO     3.00  0.26006E+00            0.00870
    3.00 TO    10.00  0.82095E+00            0.02748
   10.00 TO    30.00  0.19709E+01            0.06596
   30.00 TO   100.00  0.42694E+01            0.14289
           >  100.00  0.22558E+02            0.75497
 TOTAL MASS AIRBORNE=  0.29879E+02      FRAC. INERT  AIRBORNE= 0.42202E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.709E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
    0.00 TO     3.00  0.26000E+00            0.00870
    3.00 TO    10.00  0.82095E+00            0.02746
   10.00 TO    30.00  0.19712E+01            0.06594
   30.00 TO   100.00  0.42706E+01            0.14286
           >  100.00  0.22572E+02            0.75505
 TOTAL MASS AIRBORNE=  0.29895E+02      FRAC. INERT  AIRBORNE= 0.42164E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.710E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
    0.00 TO     3.00  0.25996E+00            0.00869
    3.00 TO    10.00  0.82095E+00            0.02745
   10.00 TO    30.00  0.19714E+01            0.06591
   30.00 TO   100.00  0.42718E+01            0.14282
           >  100.00  0.22586E+02            0.75513
 TOTAL MASS AIRBORNE=  0.29910E+02      FRAC. INERT  AIRBORNE= 0.42126E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.711E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
    0.00 TO     3.00  0.25990E+00            0.00869
    3.00 TO    10.00  0.82095E+00            0.02743
   10.00 TO    30.00  0.19717E+01            0.06589
   30.00 TO   100.00  0.42729E+01            0.14279
           >  100.00  0.22600E+02            0.75521
 TOTAL MASS AIRBORNE=  0.29925E+02      FRAC. INERT  AIRBORNE= 0.42089E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.712E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
    0.00 TO     3.00  0.25985E+00            0.00868
    3.00 TO    10.00  0.82095E+00            0.02742
   10.00 TO    30.00  0.19719E+01            0.06586
   30.00 TO   100.00  0.42741E+01            0.14275
           >  100.00  0.22613E+02            0.75529
 TOTAL MASS AIRBORNE=  0.29940E+02      FRAC. INERT  AIRBORNE= 0.42051E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.713E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
    0.00 TO     3.00  0.25980E+00            0.00867
    3.00 TO    10.00  0.82096E+00            0.02741
   10.00 TO    30.00  0.19722E+01            0.06584
   30.00 TO   100.00  0.42752E+01            0.14272
           >  100.00  0.22627E+02            0.75537
 TOTAL MASS AIRBORNE=  0.29955E+02      FRAC. INERT  AIRBORNE= 0.42013E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.714E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
    0.00 TO     3.00  0.25976E+00            0.00867
    3.00 TO    10.00  0.82096E+00            0.02739
   10.00 TO    30.00  0.19724E+01            0.06581
   30.00 TO   100.00  0.42764E+01            0.14269
           >  100.00  0.22641E+02            0.75544
 TOTAL MASS AIRBORNE=  0.29971E+02      FRAC. INERT  AIRBORNE= 0.41970E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.6? INERT WT(G) = 0.715E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
    0.00 TO     3.00  0.25970E+00            0.00866
    3.00 TO    10.00  0.82096E+00            0.02738
   10.00 TO    30.00  0.19726E+01            0.06579
   30.00 TO   100.00  0.42775E+01            0.14265
           >  100.00  0.22655E+02            0.75552
 TOTAL MASS AIRBORNE=  0.29986E+02      FRAC. INERT  AIRBORNE= 0.41938E-01
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.716E+03 STD. DEV  = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25966E+00           0.00865
   3.00 TO   10.00  0.82095E+00           0.02736
  10.00 TO   30.00  0.19729E+01           0.06576
  30.00 TO  100.00  0.42787E+01           0.14262
          > 100.00  0.22669E+02           0.75560
 TOTAL MASS AIRBORNE=  0.30001E+02     FRAC. INERT  AIRBORNE= 0.41901E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.717E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25961E+00           0.00865
   3.00 TO   10.00  0.82096E+00           0.02735
  10.00 TO   30.00  0.19731E+01           0.06574
  30.00 TO  100.00  0.42798E+01           0.14258
          > 100.00  0.22683E+02           0.75568
 TOTAL MASS AIRBORNE=  0.30016E+02     FRAC. INERT  AIRBORNE= 0.41863E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.718E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25956E+00           0.00864
   3.00 TO   10.00  0.82096E+00           0.02734
  10.00 TO   30.00  0.19734E+01           0.06571
  30.00 TO  100.00  0.42809E+01           0.14255
          > 100.00  0.22696E+02           0.75576
 TOTAL MASS AIRBORNE=  0.30031E+02     FRAC. INERT  AIRBORNE= 0.41826E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.719E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25951E+00           0.00864
   3.00 TO   10.00  0.82097E+00           0.02732
  10.00 TO   30.00  0.19736E+01           0.06568
  30.00 TO  100.00  0.42821E+01           0.14252
          > 100.00  0.22710E+02           0.75584
 TOTAL MASS AIRBORNE=  0.30046E+02     FRAC. INERT  AIRBORNE= 0.41789E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.720E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25946E+00           0.00863
   3.00 TO   10.00  0.82097E+00           0.02731
  10.00 TO   30.00  0.19738E+01           0.06566
  30.00 TO  100.00  0.42832E+01           0.14248
          > 100.00  0.22724E+02           0.75592
 TOTAL MASS AIRBORNE=  0.30061E+02     FRAC. INERT  AIRBORNE= 0.41752E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.721E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25941E+00           0.00862
   3.00 TO   10.00  0.82097E+00           0.02730
  10.00 TO   30.00  0.19741E+01           0.06563
  30.00 TO  100.00  0.42844E+01           0.14245
          > 100.00  0.22738E+02           0.75600
 TOTAL MASS AIRBORNE=  0.30077E+02     FRAC. INERT  AIRBORNE= 0.41715E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.722E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25936E+00           0.00862
   3.00 TO   10.00  0.82097E+00           0.02728
  10.00 TO   30.00  0.19743E+01           0.06561
  30.00 TO  100.00  0.42855E+01           0.14242
          > 100.00  0.22752E+02           0.75607
 TOTAL MASS AIRBORNE=  0.30092E+02     FRAC. INERT  AIRBORNE= 0.41678E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.723E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25931E+00           0.00861
   3.00 TO   10.00  0.82097E+00           0.02727
  10.00 TO   30.00  0.19745E+01           0.06558
  30.00 TO  100.00  0.42866E+01           0.14238
          > 100.00  0.22765E+02           0.75615
 TOTAL MASS AIRBORNE=  0.30107E+02     FRAC. INERT  AIRBORNE= 0.41641E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.724E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25926E+00           0.00861
   3.00 TO   10.00  0.82097E+00           0.02726
  10.00 TO   30.00  0.19748E+01           0.06556
  30.00 TO  100.00  0.42878E+01           0.14235
          > 100.00  0.22779E+02           0.75623
 TOTAL MASS AIRBORNE=  0.30122E+02     FRAC. INERT  AIRBORNE= 0.41605E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.725E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25921E+00           0.00860
   3.00 TO   10.00  0.82098E+00           0.02724
  10.00 TO   30.00  0.19750E+01           0.06554
  30.00 TO  100.00  0.42889E+01           0.14231
          > 100.00  0.22793E+02           0.75631
 TOTAL MASS AIRBORNE=  0.30137E+02     FRAC. INERT  AIRBORNE= 0.41568E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.726E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25916E+00           0.00860
   3.00 TO   10.00  0.82098E+00           0.02723
  10.00 TO   30.00  0.19753E+01           0.06551
  30.00 TO  100.00  0.42900E+01           0.14228
          > 100.00  0.22806E+02           0.75639
 TOTAL MASS AIRBORNE=  0.30152E+02     FRAC. INERT  AIRBORNE= 0.41531E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.727E+03 STD. DEV. = [illegible] # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.2591[illegible]           0.00859
   3.00 TO   10.00  [illegible]           0.02721
  10.00 TO   30.00  [illegible]           0.06549
  30.00 TO  100.00  [illegible]           0.14225
          > 100.00  0.22820E+02           0.75646
 TOTAL MASS AIRBORNE=  0.30167E+02     FRAC. INERT  AIRBORNE= 0.41495E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.728E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25906E+00           0.00858
   3.00 TO   10.00  0.82098E+00           0.02720
  10.00 TO   30.00  0.19757E+01           0.06546
  30.00 TO  100.00  0.42923E+01           0.14221
          > 100.00  0.22834E+02           0.75654
 TOTAL MASS AIRBORNE=  0.30182E+02     FRAC. INERT  AIRBORNE= 0.41459E-01
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.729E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25901E+00             0.00858
   3.00 TO   10.00  0.82098E+00             0.02719
  10.00 TO   30.00  0.19760E+01             0.06544
  30.00 TO  100.00  0.42934E+01             0.14218
         >  100.00  0.22847E+02             0.75662
 TOTAL MASS AIRBORNE=  0.30197E+02     FRAC. INERT  AIRBORNE= 0.41422E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.730E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25896E+00             0.00857
   3.00 TO   10.00  0.82098E+00             0.02717
  10.00 TO   30.00  0.19762E+01             0.06541
  30.00 TO  100.00  0.42946E+01             0.14216
         >  100.00  0.22861E+02             0.75669
 TOTAL MASS AIRBORNE=  0.30212E+02     FRAC. INERT  AIRBORNE= 0.41386E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.731E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25892E+00             0.00857
   3.00 TO   10.00  0.82098E+00             0.02 16
  10.00 TO   30.00  0.19764E+01             0.06539
  30.00 TO  100.00  0.42957E+01             0.14211
         >  100.00  0.22876E+02             0.75677
 TOTAL MASS AIRBORNE=  0.30227E+02     FRAC. INERT  AIRBORNE= 0.41350E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.732E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25887E+00             0.00856
   3.00 TO   10.00  0.82098E+00             0.02716
  10.00 TO   30.00  0.19767E+01             0.06536
  30.00 TO  100.00  0.42968E+01             0.14208
         >  100.00  0.22888E+02             0.75686
 TOTAL MASS AIRBORNE=  0.30242E+02     FRAC. INERT  AIRBORNE= 0.41314E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.733E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25882E+00             0.00855
   3.00 TO   10.00  0.82098E+00             0.02713
  10.00 TO   30.00  0.19769E+01             0.06534
  30.00 TO  100.00  0.42979E+01             0.14205
         >  100.00  0.22902E+02             0.75693
 TOTAL MASS AIRBORNE=  0.30257E+02     FRAC. INERT  AIRBORNE= 0.41278E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.734E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25877E+00             0.00855
   3.00 TO   10.00  0.82098E+00             0.02712
  10.00 TO   30.00  0.19771E+01             0.06531
  30.00 TO  100.00  0.42990E+01             0.14202
         >  100.00  0.22916E+02             0.75700
 TOTAL MASS AIRBORNE=  0.30272E+02     FRAC. INERT  AIRBORNE= 0.41242E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.735E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25872E+00             0.00854
   3.00 TO   10.00  0.82099E+00             0.02711
  10.00 TO   30.00  0.19774E+01             0.06529
  30.00 TO  100.00  0.43002E+01             0.14198
         >  100.00  0.22929E+02             0.75708
 TOTAL MASS AIRBORNE=  0.30287E+02     FRAC. INERT  AIRBORNE= 0.41206E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.736E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25867E+00             0.00854
   3.00 TO   10.00  0.82099E+00             0.02709
  10.00 TO   30.00  0.19776E+01             0.06526
  30.00 TO  100.00  0.43013E+01             0.14195
         >  100.00  0.22943E+02             0.75716
 TOTAL MASS AIRBORNE=  0.30301E+02     FRAC. INERT  AIRBORNE= 0.41170E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.737E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25862E+00             0.00853
   3.00 TO   10.00  0.82099E+00             0.02708
  10.00 TO   30.00  0.19778E+01             0.06524
  30.00 TO  100.00  0.43024E+01             0.14192
         >  100.00  0.22956E+02             0.75723
 TOTAL MASS AIRBORNE=  0.30316E+02     FRAC. INERT  AIRBORNE= 0.41135E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.738E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25858E+00             0.00853
   3.00 TO   10.00  0.82099E+00             0.02707
  10.00 TO   30.00  0.19781E+01             0.06522
  30.00 TO  100.00  0.43035E+01             0.14188
         >  100.00  0.22970E+02             0.75731
 TOTAL MASS AIRBORNE=  0.30331E+02     FRAC. INERT  AIRBORNE= 0.41099E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.739E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25853E+00             0.00852
   3.00 TO   10.00  0.82099E+00             0.02705
  10.00 TO   30.00  0.19783E+01             0.06519
  30.00 TO  100.00  0.43046E+01             0.14185
         >  100.00  0.22984E+02             0.75738
 TOTAL MASS AIRBORNE=  0.30346E+02     FRAC. INERT  AIRBORNE= 0.41064E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.740E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25848E+00             0.00851
   3.00 TO   10.00  0.82099E+00             0.02704
  10.00 TO   30.00  0.19785E+01             0.06517
  30.00 TO  100.00  0.43057E+01             0.14182
         >  100.00  0.22997E+02             0.75746
 TOTAL MASS AIRBORNE=  0.30361E+02     FRAC. INERT  AIRBORNE= 0.41028E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.741E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25843E+00             0.00851
   3.00 TO   10.00  0.82099E+00             0.02703
  10.00 TO   30.00  0.19788E+01             0.06514
  30.00 TO  100.00  0.43068E+01             0.14179
         >  100.00  0.23011E+02             0.75764
 TOTAL MASS AIRBORNE=  0.30376E+02     FRAC. INERT  AIRBORNE= 0.40993E-01
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.742E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25838E+00           0.00850
   3.00 TO   10.00  0.82099E+00           0.02701
  10.00 TO   30.00  0.19790E+01           0.06512
  30.00 TO  100.00  0.43079E+01           0.14176
         >  100.00  0.23024E+02           0.75761
 TOTAL MASS AIRBORNE=  0.30391E+02     FRAC. INERT  AIRBORNE= 0.40958E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.743E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25833E+00           0.00850
   3.00 TO   10.00  0.82099E+00           0.02700
  10.00 TO   30.00  0.19792E+01           0.06509
  30.00 TO  100.00  0.43090E+01           0.14172
         >  100.00  0.23038E+02           0.75769
 TOTAL MASS AIRBORNE=  0.30405E+02     FRAC. INERT  AIRBORNE= 0.40922E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.744E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25829E+00           0.00849
   3.00 TO   10.00  0.82099E+00           0.02699
  10.00 TO   30.00  0.19794E+01           0.06507
  30.00 TO  100.00  0.43101E+01           0.14169
         >  100.00  0.23051E+02           0.75776
 TOTAL MASS AIRBORNE=  0.30420E+02     FRAC. INERT  AIRBORNE= 0.40887E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.745E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25824E+00           0.00848
   3.00 TO   10.00  0.82099E+00           0.02698
  10.00 TO   30.00  0.19797E+01           0.06505
  30.00 TO  100.00  0.43112E+01           0.14165
         >  100.00  0.23065E+02           0.75784
 TOTAL MASS AIRBORNE=  0.30435E+02     FRAC. INERT  AIRBORNE= 0.40852E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.746E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25819E+00           0.00848
   3.00 TO   10.00  0.82099E+00           0.02696
  10.00 TO   30.00  0.19799E+01           0.06502
  30.00 TO  100.00  0.43123E+01           0.14162
         >  100.00  0.23078E+02           0.75791
 TOTAL MASS AIRBORNE=  0.30450E+02     FRAC. INERT  AIRBORNE= 0.40817E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.747E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25814E+00           0.00847
   3.00 TO   10.00  0.82099E+00           0.02695
  10.00 TO   30.00  0.19801E+01           0.06500
  30.00 TO  100.00  0.43135E+01           0.14159
         >  100.00  0.23092E+02           0.75799
 TOTAL MASS AIRBORNE=  0.30464E+02     FRAC. INERT  AIRBORNE= 0.40782E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.748E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25809E+00           0.00847
   3.00 TO   10.00  0.82099E+00           0.02694
  10.00 TO   30.00  0.19804E+01           0.06497
  30.00 TO  100.00  0.43145E+01           0.14156
         >  100.00  0.23105E+02           0.75806
 TOTAL MASS AIRBORNE=  0.30479E+02     FRAC. INERT  AIRBORNE= 0.40748E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.749E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25805E+00           0.00846
   3.00 TO   10.00  0.82099E+00           0.02692
  10.00 TO   30.00  0.19806E+01           0.06495
  30.00 TO  100.00  0.43156E+01           0.14152
         >  100.00  0.23119E+02           0.75814
 TOTAL MASS AIRBORNE=  0.30494E+02     FRAC. INERT  AIRBORNE= 0.40713E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.750E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25800E+00           0.00846
   3.00 TO   10.00  0.82099E+00           0.02691
  10.00 TO   30.00  0.19808E+01           0.06493
  30.00 TO  100.00  0.43167E+01           0.14149
         >  100.00  0.23132E+02           0.75821
 TOTAL MASS AIRBORNE=  0.30509E+02     FRAC. INERT  AIRBORNE= 0.40678E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.751E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25795E+00           0.00845
   3.00 TO   10.00  0.82099E+00           0.02690
  10.00 TO   30.00  0.19810E+01           0.06490
  30.00 TO  100.00  0.43178E+01           0.14146
         >  100.00  0.23146E+02           0.75829
 TOTAL MASS AIRBORNE=  0.30523E+02     FRAC. INERT  AIRBORNE= 0.40644E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.752E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25790E+00           0.00845
   3.00 TO   10.00  0.82099E+00           0.02688
  10.00 TO   30.00  0.19813E+01           0.06488
  30.00 TO  100.00  0.43189E+01           0.14143
         >  100.00  0.23159E+02           0.75836
 TOTAL MASS AIRBORNE=  0.30538E+02     FRAC. INERT  AIRBORNE= 0.40609E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.753E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25786E+00           0.00844
   3.00 TO   10.00  0.82099E+00           0.02687
  10.00 TO   30.00  0.19815E+01           0.06485
  30.00 TO  100.00  0.43200E+01           0.14140
         >  100.00  0.23172E+02           0.75844
 TOTAL MASS AIRBORNE=  0.30553E+02     FRAC. INERT  AIRBORNE= 0.40575E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.754E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25781E+00           0.00843
   3.00 TO   10.00  0.82099E+00           0.02686
  10.00 TO   30.00  0.19817E+01           0.06483
  30.00 TO  100.00  0.43211E+01           0.14136
         >  100.00  0.23186E+02           0.75851
 TOTAL MASS AIRBORNE=  0.30567E+02     FRAC. INERT  AIRBORNE= 0.40540E-01
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.755E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25776E+00            0.00843
   3.00 TO    10.00  0.82099E+00            0.02686
  10.00 TO    30.00  0.19819E+01            0.06481
  30.00 TO   100.00  0.43222E+01            0.14133
          >  100.00  0.23199E+02            0.75859
 TOTAL MASS AIRBORNE=  0.30582E+02     FRAC. INERT  AIRBORNE= 0.40506E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.756E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25771E+00            0.00842
   3.00 TO    10.00  0.82099E+00            0.02683
  10.00 TO    30.00  0.19822E+01            0.06478
  30.00 TO   100.00  0.43233E+01            0.14130
          >  100.00  0.23213E+02            0./5866
 TOTAL MASS AIRBORNE=  0.30597E+02     FRAC. INERT  AIRBORNE= 0.40472E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.757E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25766E+00            0.00842
   3.00 TO    10.00  0.82099E+00            0.02682
  10.00 TO    30.00  0.19824E+01            0.06476
  30.00 TO   100.00  0.43244E+01            0.14127
          >  100.00  0.23226E+02            0.75874
 TOTAL MASS AIRBORNE=  0.30611E+02     FRAC. INERT  AIRBORNE= 0.40438E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.758E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25762E+00            0.00841
   3.00 TO    10.00  0.82099E+00            0.02681
  10.00 TO    30.00  0.19826E+01            0.06474
  30.00 TO   100.00  0.43255E+01            0.14124
          >  100.00  0.23239E+02            0.75881
 TOTAL MASS AIRBORNE=  0.30626E+02     FRAC. INERT  AIRBORNE= 0.40404E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.759E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25757E+00            0.00841
   3.00 TO    10.00  0.82099E+00            0.02679
  10.00 TO    30.00  0.19828E+01            0.06471
  30.00 TO   100.00  0.43265E+01            0.14120
          >  100.00  0.23253E+02            0.75888
 TOTAL MASS AIRBORNE=  0.30641E+02     FRAC. INERT  AIRBORNE= 0.40370E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.760E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25752E+00            0.00840
   3.00 TO    10.00  0.82099E+00            0.02678
  10.00 TO    30.00  0.19831E+01            0.06469
  30.00 TO   100.00  0.43276E+01            0.14117
          >  100.00  0.23266E+02            0.75896
 TOTAL MASS AIRBORNE=  0.30655E+02     FRAC. INERT  AIRBORNE= 0.40336E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.761E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25748E+00            0.00840
   3.00 TO    10.00  0.82099E+00            0.02677
  10.00 TO    30.00  0.19833E+01            0.06467
  30.00 TO   100.00  0.43287E+01            0.14114
          >  100.00  0.23279E+02            0.75903
 TOTAL MASS AIRBORNE=  0.30670E+02     FRAC. INERT  AIRBORNE= 0.40302E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.762E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25743E+00            0.00839
   3.00 TO    10.00  0.82099E+00            0.02676
  10.00 TO    30.00  0.19835E+01            0.06464
  30.00 TO   100.00  0.43298E+01            0.14111
          >  100.00  0.23293E+02            0.75910
 TOTAL MASS AIRBORNE=  0.30684E+02     FRAC. INERT  AIRBORNE= 0.40268E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.763E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25738E+00            0.00838
   3.00 TO    10.00  0.82099E+00            0.02674
  10.00 TO    30.00  0.19837E+01            0.06462
  30.00 TO   100.00  0.43309E+01            0.14108
          >  100.00  0.23306E+02            0.75918
 TOTAL MASS AIRBORNE=  0.30699E+02     FRAC. INERT  AIRBORNE= 0.40234E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.764E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25734E+00            0.00838
   3.00 TO    10.00  0.82099E+00            0.02673
  10.00 TO    30.00  0.19840E+01            0.06460
  30.00 TO   100.00  0.43319E+01            0.14104
          >  100.00  0.23319E+02            0.75925
 TOTAL MASS AIRBORNE=  0.30713E+02     FRAC. INERT  AIRBORNE= 0.40201E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.765E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25729E+00            0.00837
   3.00 TO    10.00  0.82099E+00            0.02672
  10.00 TO    30.00  0.19842E+01            0.06457
  30.00 TO   100.00  0.43330E+01            0.14101
          >  100.00  0.23332E+02            0.75932
 TOTAL MASS AIRBORNE=  0.30728E+02     FRAC. INERT  AIRBORNE= 0.40167E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.766E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25724E+00            0.00837
   3.00 TO    10.00  0.82099E+00            0.02671
  10.00 TO    30.00  0.19844E+01            0.06455
  30.00 TO   100.00  0.43341E+01            0.14098
          >  100.00  0.23346E+02            0.75940
 TOTAL MASS AIRBORNE=  0.30742E+02     FRAC. INERT  AIRBORNE= 0.40134E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.767E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25720E+00            0.00836
   3.00 TO    10.00  0.82099E+00            0.02669
  10.00 TO    30.00  0.19846E+01            0.06453
  30.00 TO   100.00  0.43352E+01            0.14095
          >  100.00  0.23359E+02            0.75947
 TOTAL MASS AIRBORNE=  0.30757E+02     FRAC. INERT  AIRBORNE= 0.40100E-01
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.768E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25715E+00           0.00836
   3.00 TO   10.00  0.82099E+00           0.02668
  10.00 TO   30.00  0.19848E+01           0.06450
  30.00 TO  100.00  0.43362E+01           0.14092
          >  100.00  0.23372E+02           0.75954
 TOTAL MASS AIRBORNE=  0.30771E+02     FRAC. INERT  AIRBORNE= 0.40067E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.769E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25710E+00           0.00835
   3.00 TO   10.00  0.82099E+00           0.02667
  10.00 TO   30.00  0.19851E+01           0.06448
  30.00 TO  100.00  0.43373E+01           0.14089
          >  100.00  0.23386E+02           0.75962
 TOTAL MASS AIRBORNE=  0.30786E+02     FRAC. INERT  AIRBORNE= 0.40034E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.770E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25706E+00           0.00836
   3.00 TO   10.00  0.82098E+00           0.02665
  10.00 TO   30.00  0.19853E+01           0.06446
  30.00 TO  100.00  0.43384E+01           0.14085
          >  100.00  0.23399E+02           0.75969
 TOTAL MASS AIRBORNE=  0.30800E+02     FRAC. INERT  AIRBORNE= 0.40001E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.771E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25701E+00           0.00834
   3.00 TO   10.00  0.82098E+00           0.02664
  10.00 TO   30.00  0.19855E+01           0.06443
  30.00 TO  100.00  0.43394E+01           0.14082
          >  100.00  0.23412E+02           0.75976
 TOTAL MASS AIRBORNE=  0.30815E+02     FRAC. INERT  AIRBORNE= 0.39967E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.772E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25696E+00           0.00833
   3.00 TO   10.00  0.82098E+00           0.02663
  10.00 TO   30.00  0.19857E+01           0.06441
  30.00 TO  100.00  0.43405E+01           0.14079
          >  100.00  0.23425E+02           0.75983
 TOTAL MASS AIRBORNE=  0.30829E+02     FRAC. INERT  AIRBORNE= 0.39934E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.773E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25692E+00           0.00833
   3.00 TO   10.00  0.82098E+00           0.02662
  10.00 TO   30.00  0.19859E+01           0.06439
  30.00 TO  100.00  0.43416E+01           0.14076
          >  100.00  0.23438E+02           0.75991
 TOTAL MASS AIRBORNE=  0.30844E+02     FRAC. INERT  AIRBORNE= 0.39901E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.774E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25687E+00           0.00832
   3.00 TO   10.00  0.820[illegible]E+00           0.02660
  10.00 TO   30.00  0.19861E+01           0.06436
  30.00 TO  100.00  0.43426E+01           0.14073
          >  100.00  0.23452E+02           0.75998
 TOTAL MASS AIRBORNE=  0.30858E+02     FRAC. INERT  AIRBORNE= 0.39868E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.775E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25682E+00           0.00832
   3.00 TO   10.00  0.82098E+00           0.02659
  10.00 TO   30.00  0.19864E+01           0.06434
  30.00 TO  100.00  0.43437E+01           0.14070
          >  100.00  0.23465E+02           0.76005
 TOTAL MASS AIRBORNE=  0.30873E+02     FRAC. INERT  AIRBORNE= 0.39836E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.776E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25678E+00           0.00831
   3.00 TO   10.00  0.82098E+00           0.02658
  10.00 TO   30.00  0.19866E+01           0.06432
  30.00 TO  100.00  0.43447E+01           0.14067
          >  100.00  0.23478E+02           0.76012
 TOTAL MASS AIRBORNE=  0.30887E+02     FRAC. INERT  AIRBORNE= 0.39803E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.777E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25673E+00           0.00831
   3.00 TO   10.00  0.82098E+00           0.02657
  10.00 TO   30.00  0.19868E+01           0.06429
  30.00 TO  100.00  0.43458E+01           0.14063
          >  100.00  0.23491E+02           0.76020
 TOTAL MASS AIRBORNE=  0.30901E+02     FRAC. INERT  AIRBORNE= 0.39770E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.778E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25668E+00           0.00830
   3.00 TO   10.00  0.82098E+00           0.02656
  10.00 TO   30.00  0.19870E+01           0.06427
  30.00 TO  100.00  0.43469E+01           0.14060
          >  100.00  0.23504E+02           0.76027
 TOTAL MASS AIRBORNE=  0.30916E+02     FRAC. INERT  AIRBORNE= 0.39738E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.779E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25664E+00           0.00830
   3.00 TO   10.00  0.82098E+00           0.02654
  10.00 TO   30.00  0.19872E+01           0.06425
  30.00 TO  100.00  0.43479E+01           0.14057
          >  100.00  0.23517E+02           0.76034
 TOTAL MASS AIRBORNE=  0.30930E+02     FRAC. INERT  AIRBORNE= 0.39705E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.780E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25659E+00           0.00829
   3.00 TO   10.00  0.82097E+00           0.02653
  10.00 TO   30.00  0.19874E+01           0.06423
  30.00 TO  100.00  0.43490E+01           0.14054
          >  100.00  0.23531E+02           0.76041
 TOTAL MASS AIRBORNE=  0.30945E+02     FRAC. INERT  AIRBORNE= 0.39672E-01
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.781E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25655E+00            0.00829
   3.00 TO    10.00  0.82097E+00            0.02652
  10.00 TO    30.00  0.19877E+01            0.06420
  30.00 TO   100.00  0.43500E+01            0.14051
          >  100.00  0.23544E+02            0.76048
 TOTAL MASS AIRBORNE=  0.30959E+02     FRAC. INERT  AIRBORNE= 0.39640E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.782E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25650E+00            0.00828
   3.00 TO    10.00  0.82097E+00            0.02651
  10.00 TO    30.00  0.19872E+01            0.06418
  30.00 TO   100.00  0.43511E+01            0.14048
          >  100.00  0.23557E+02            0.76056
 TOTAL MASS AIRBORNE=  0.30973E+02     FRAC. INERT  AIRBORNE= 0.39608E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.783E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25645E+00            0.00828
   3.00 TO    10.00  0.82097E+00            0.02649
  10.00 TO    30.00  0.19881E+01            0.06416
  30.00 TO   100.00  0.43521E+01            0.14045
          >  100.00  0.23570E+02            0.76062
 TOTAL MASS AIRBORNE=  0.30988E+02     FRAC. INERT  AIRBORNE= 0.39576E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.784E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25641E+00            0.00827
   3.00 TO    10.00  0.82097E+00            0.02648
  10.00 TO    30.00  0.19883E+01            0.06414
  30.00 TO   100.00  0.43532E+01            0.14042
          >  100.00  0.23583E+02            0.76070
 TOTAL MASS AIRBORNE=  0.31002E+02     FRAC. INERT  AIRBORNE= 0.39543E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.785E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25636E+00            0.00827
   3.00 TO    10.00  0.82097E+00            0.02647
  10.00 TO    30.00  0.19885E+01            0.06411
  30.00 TO   100.00  0.43542E+01            0.14039
          >  100.00  0.23596E+02            0.76077
 TOTAL MASS AIRBORNE=  0.31016E+02     FRAC. INERT  AIRBORNE= 0.39511E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.786E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25632E+00            0.00826
   3.00 TO    10.00  0.82097E+00            0.02646
  10.00 TO    30.00  0.19887E+01            0.06409
  30.00 TO   100.00  0.43553E+01            0.14035
          >  100.00  0.23609E+02            0.76084
 TOTAL MASS AIRBORNE=  0.31030E+02     FRAC. INERT  AIRBORNE= 0.39479E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.787E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25627E+00            0.00825
   3.00 TO    10.00  0.82096E+00            0.02644
  10.00 TO    30.00  0.19889E+01            0.06407
  30.00 TO   100.00  0.43563E+01            0.14032
          >  100.00  0.23622E+02            0.76091
 TOTAL MASS AIRBORNE=  0.31045E+02     FRAC. INERT  AIRBORNE= 0.39447E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.788E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25623E+00            0.00825
   3.00 TO    10.00  0.82096E+00            0.02643
  10.00 TO    30.00  0.19892E+01            0.06404
  30.00 TO   100.00  0.43574E+01            0.14029
          >  100.00  0.23635E+02            0.76098
 TOTAL MASS AIRBORNE=  0.31059E+02     FRAC. INERT  AIRBORNE= 0.39415E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.789E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25618E+00            0.00824
   3.00 TO    10.00  0.82096E+00            0.02642
  10.00 TO    30.00  0.19894E+01            0.06402
  30.00 TO   100.00  0.43584E+01            0.14026
          >  100.00  0.23648E+02            0.76105
 TOTAL MASS AIRBORNE=  0.31073E+02     FRAC. INERT  AIRBORNE= 0.39383E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.790E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25613E+00            0.00824
   3.00 TO    10.00  0.82096E+00            0.02641
  10.00 TO    30.00  0.19896E+01            0.06400
  30.00 TO   100.00  0.43594E+01            0.14023
          >  100.00  0.23661E+02            0.76112
 TOTAL MASS AIRBORNE=  0.31087E+02     FRAC. INERT  AIRBORNE= 0.39351E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.791E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25609E+00            0.00823
   3.00 TO    10.00  0.82096E+00            0.02640
  10.00 TO    30.00  0.19898E+01            0.06398
  30.00 TO   100.00  0.43605E+01            0.14020
          >  100.00  0.23674E+02            0.76119
 TOTAL MASS AIRBORNE=  0.31102E+02     FRAC. INERT  AIRBORNE= 0.39319E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.792E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25604E+00            0.00823
   3.00 TO    10.00  0.82096E+00            0.02638
  10.00 TO    30.00  0.19900E+01            0.06395
  30.00 TO   100.00  0.43615E+01            0.14017
          >  100.00  0.23687E+02            0.76126
 TOTAL MASS AIRBORNE=  0.31116E+02     FRAC. INERT  AIRBORNE= 0.39288E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.793E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25600E+00            0.00822
   3.00 TO    10.00  0.82096E+00            0.02637
  10.00 TO    30.00  0.19902E+01            0.06393
  30.00 TO   100.00  0.43626E+01            0.14014
          >  100.00  0.23700E+02            0.76133
 TOTAL MASS AIRBORNE=  0.31130E+02     FRAC. INERT  AIRBORNE= 0.39256E-01
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.794E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25595E+00            0.00822
   3.00 TO   10.00  0.82095E+00            0.02636
  10.00 TO   30.00  0.19904E+01            0.06391
  30.00 TO  100.00  0.43636E+01            0.14011
          >  100.00  0.23713E+02            0.76140
 TOTAL MASS AIRBORNE=  0.31144E+02     FRAC. INERT  AIRBORNE= 0.39225E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.795E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25591E+00            0.00821
   3.00 TO   10.00  0.82095E+00            0.02635
  1'.00 TO   30.00  0.19906E+01            0.06389
  30.00 TO  100.00  0.43646E+01            0.14008
          >  100.00  0.23726E+02            0.76147
 TOTAL MASS AIRBORNE=  0.31158E+02     FRAC. INERT  AIRBORNE= 0.39193E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.796E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25586E+00            0.00821
   3.00 TO   10.00  0.82095E+00            0.02634
  1?.00 TO   30.00  0.19908E+01            0.06387
  30.00 TO  100.00  0.43657E+01            0.14005
          >  100.00  0.23739E+02            0.76154
 TOTAL MASS AIRBORNE=  0.31173E+02     FRAC. INERT  AIRBORNE= 0.39162E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.797E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TCTAL AIRBORNE
   0.00 TO    3.00  0.25582E+00            0.00820
   3.00 TO   10.00  0.82095E+00            0.02632
  10.00 TO   30.00  0.19911E+01            0.06384
  30.00 TO  100.00  0.43667E+01            0.14002
          >  100.00  0.23752E+02            0.76161
 TOTAL MASS AIRBCRNE=  0.31187E+02     FRAC. INERT  AIRBORNE= 0.39130E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.798E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25577E+00            0.00820
   3.00 TO   10.00  0.82095E+00            0.02631
  10.00 TO   30.00  0.19913E+01            0.06382
  30.00 TO  100.00  0.43677E+01            0.13999
          >  100.00  0.23765E+02            0.76168
 TOTAL MASS AIRBORNE=  0.31201E+02     FRAC. INERT  AIRBORNE= 0.39099E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.799E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25573E+00            0.00819
   3.00 TO   10.00  0.82094E+00            0.02630
  10.00 TO   30.00  0.19915E+01            0.06380
  30.00 TO  100.00  0.43688E+01            0.13996
          >  100.00  0.23778E+02            0.76175
 TOTAL MASS AIRBORNE=  0.31215E+02     FRAC. INERT  AIRBORNE= 0.39068E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.800E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25568E+00            0.00819
   3.00 TO   10.00  0.82094E+00            0.02629
  10.00 TO   30.00  0.19917E+01            0.06378
  30.00 TO  100.00  0.43698E+01            0.13993
          >  100.00  0.23791E+02            0.76182
 TOTAL MASS AIRBORNE=  0.31229E+02     FRAC. INERT  AIRBORNE= 0.39[illegible]-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.801E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS, MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25564E+00            0.00818
   3.00 TO   10.00  0.82094E+00            0.02628
  10.00 TO   30.00  0.19919E+01            0.06376
  30.00 TO  100.00  0.43708E+01            0.13990
          >  100.00  0.23804E+02            0.76189
 TOTAL MASS AIRBORNE=  0.31243E+02     FRAC. INERT  AIRBORNE= 0.39005E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.802E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25559E+00            0.00818
   3.00 TO   10.00  0.82094E+00            0.02626
  10.00 TO   30.00  0.19921E+01            0.06373
  30.00 TO  100.00  0.43718E+01            0.13987
          >  100.00  0.23817E+02            0.76196
 TOTAL MASS AIRBORNE=  0.31257E+02     FRAC. INERT  AIRBORNE= 0.38974E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.803E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25555E+00            0.00817
   3.00 TO   10.00  0.82094E+00            0.02625
  10.00 TO   30.00  0.19923E+01            0.06371
  30.00 TO  100.00  0.43729E+01            0.13984
          >  100.00  0.23830E+02            0.76203
 TOTAL MASS AIRBORNE=  0.31272E+02     FRAC. INERT  AIRBORNE= 0.38943E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.804E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25550E+00            0.00817
   3.00 TO   10.00  0.82093E+00            0.02624
  10.00 TO   30.00  0.19925E+01            0.06369
  30.00 TO  100.00  0.43739E+01            0.13981
          >  100.00  0.23843E+02            0.76210
 TOTAL MASS AIRBORNE=  0.31286E+02     FRAC. INERT  AIRBORNE= 0.38912E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.805E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25546E+00            0.00816
   3.00 TO   10.00  0.82093E+00            0.02623
  10.00 TO   30.00  0.19927E+01            0.06367
  30.00 TO  100.00  0.43749E+01            0.13977
          >  100.00  0.23856E+02            0.76217
 TOTAL MASS AIRBORNE=  0.31300E+02     FRAC. INERT  AIRBORNE= 0.38882E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.806E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25541E+00            0.00816
   3.00 TO   10.00  0.82093E+00            0.02622
  10.00 TO   30.00  0.19929E+01            0.06364
  30.00 TO  100.00  0.43759E+01            0.13974
          >  100.00  0.23869E+02            0.76224
 TOTAL MASS AIRBORNE=  0.31314E+02     FRAC. INERT  AIRBORNE= 0.38851E-01
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.807E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25537E+00           0.00815
   3.00 TO   10.00  0.82093E+00           0.02620
  10.00 TO   30.00  0.19931E+01           0.06362
  30.00 TO  100.00  0.43770E+01           0.13971
         >  100.00  0.23881E+02           0.76231
 TOTAL MASS AIRBORNE=  0.31328E+02     FRAC. INERT  AIRBORNE= 0.38820E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.808E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25532E+00           0.00815
   3.00 TO   10.00  0.82093E+00           0.02619
  10.00 TO   30.00  0.19933E+01           0.06360
  30.00 TO  100.00  0.43780E+01           0.13968
         >  100.00  0.23894E+02           0.76238
 TOTAL MASS AIRBORNE=  0.31342E+02     FRAC. INERT  AIRBORNE= 0.38789E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.809E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25528E+00           0.00814
   3.00 TO   10.00  0.82092E+00           0.02618
  10.00 TO   30.00  0.19936E+01           0.06358
  30.00 TO  100.00  0.43790E+01           0.13965
         >  100.00  0.23907E+02           0.76244
 TOTAL MASS AIRBORNE=  0.31356E+02     FRAC. INERT  AIRBORNE= 0.38759E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.810E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25523E+00           0.00814
   3.00 TO   10.00  0.82092E+00           0.02617
  10.00 TO   30.00  0.19938E+01           0.06356
  30.00 TO  100.00  0.43800E+01           0.13962
         >  100.00  0.23920E+02           0.76251
 TOTAL MASS AIRBORNE=  0.31370E+02     FRAC. INERT  AIRBORNE= 0.38728E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.811E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25519E+00           0.00813
   3.00 TO   10.00  0.82092E+00           0.02616
  10.00 TO   30.00  0.19940E+01           0.06353
  30.00 TO  100.00  0.43810E+01           0.13959
         >  100.00  0.23933E+02           0.76258
 TOTAL MASS AIRBORNE=  0.31384E+02     FRAC. INERT  AIRBORNE= 0.38698E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.812E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25515E+00           0.00813
   3.00 TO   10.00  0.82092E+00           0.02615
  10.00 TO   30.00  0.19942E+01           0.06351
  30.00 TO  100.00  0.43820E+01           0.13956
         >  100.00  0.23946E+02           0.76265
 TOTAL MASS AIRBORNE=  0.31398E+02     FRAC. INERT  AIRBORNE= 0.38667E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.813E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25510E+00           0.00812
   3.00 TO   10.00  0.82091E+00           0.02613
  10.00 TO   30.00  0.19944E+01           0.06349
  30.00 TO  100.00  0.43830E+01           0.13953
         >  100.00  0.23958E+02           0.76272
 TOTAL MASS AIRBORNE=  0.31412E+02     FRAC. INERT  AIRBORNE= 0.38637E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.814E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25506E+00           0.00812
   3.00 TO   10.00  0.82091E+00           0.02612
  10.00 TO   30.00  0.19946E+01           0.06347
  30.00 TO  100.00  0.43841E+01           0.13951
         >  100.00  0.23971E+02           0.76279
 TOTAL MASS AIRBORNE=  0.31426E+02     FRAC. INERT  AIRBORNE= 0.38607E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.815E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25501E+00           0.00811
   3.00 TO   10.00  0.8209.E+00           0.02611
  10.00 TO   30.00  0.19948E+01           0.06345
  30.00 TO  100.00  0.43851E+01           0.1394P
         >  100.00  0.23984E+02           0.76286
 TOTAL MASS AIRBORNE=  0.31440E+02     FRAC. INERT  AIRBORNE= 0.38576E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.816E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICR^NS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25497E+00           0.00811
   3.00 TO   10.00  0.82090E+00           0.02610
  10.00 TO   30.00  0.19950E+01           0.06343
  30.00 TO  100.00  0.43861E+01           0.13945
         >  100.00  0.23997E+02           0.76292
 TOTAL MASS AIRBORNE=  0.31454E+02     FRAC. INERT  AIRBORNE= 0.38546E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.817E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25492E+00           0.00810
   3.00 TO   10.00  0.82090E+00           0.02609
  10.00 TO   30.00  0.19952E+01           0.06340
  30.00 TO  100.00  0.43871E+01           0.13942
         >  100.00  0.24010E+02           0.76299
 TOTAL MASS AIRBORNE=  0.31468E+02     FRAC. INERT  AIRBORNE= 0.38516E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.818E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25488E+00           0.00810
   3.00 TO   10.00  0.82090E+00           0.02608
  10.00 TO   30.00  0.19954E+01           0.06338
  30.00 TO  100.00  0.43881E+01           0.13939
         >  100.00  0.24022E+02           0.76306
 TOTAL MASS AIRBORNE=  0.31482E+02     FRAC. INERT  AIRBORNE= 0.38486E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.819E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25484E+00           0.00809
   3.00 TO   10.00  0.82090E+00           0.02606
  10.00 TO   30.00  0.19956E+01           0.06336
  30.00 TO  100.00  0.43891E+01           0.13936
         >  100.00  0.24035E+02           0.76313
 TOTAL MASS AIRBORNE=  0.31495E+02     FRAC. INERT  AIRBORNE= 0.38456E-01
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.820E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25479E+00          0.00809
   3.00 TO   10.00  0.82090E+00          0.02605
  10.00 TO   30.00  0.19958E+01          0.06334
  30.00 TO  100.00  0.43901E+01          0.13933
          >  100.00  0.24048E+02          0.76319
 TOTAL MASS AIRBORNE=  0.31509E+02     FRAC. INERT  AIRBORNE= 0.38426E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.821E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25476E+00          0.00808
   3.00 TO   10.00  0.82089E+00          0.02604
  10.00 TO   30.00  0.19960E+01          0.06332
  30.00 TO  100.00  0.43911E+01          0.13930
          >  100.00  0.24061E+02          0.76326
 TOTAL MASS AIRBORNE=  0.31523E+02     FRAC. INERT  AIRBORNE= 0.38396E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.822E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25470E+00          0.00808
   3.00 TO   10.00  0.82089E+00          0.02603
  10.00 TO   30.00  0.19962E+01          0.06330
  30.00 TO  100.00  0.43921E+01          0.13927
          >  100.00  0.24073E+02          0.76333
 TOTAL MASS AIRBORNE=  0.31537E+02     FRAC. INERT  AIRBORNE= 0.38366E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.823E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25466E+00          0.00807
   3.00 TO   10.00  0.82089E+00          0.02602
  10.00 TO   30.00  0.19964E+01          0.06328
  30.00 TO  100.00  0.43931E+01          0.13924
          >  100.00  0.24086E+02          0.76340
 TOTAL MASS AIRBORNE=  0.31551E+02     FRAC. INERT  AIRBORNE= 0.38337E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.824E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25462E+00          0.00807
   3.00 TO   10.00  0.82088E+00          0.02601
  10.00 TO   30.00  0.19966E+01          0.06325
  30.00 TO  100.00  0.43941E+01          0.13921
          >  100.00  0.24099E+02          0.76346
 TOTAL MASS AIRBORNE=  0.31565E+02     FRAC. INERT  AIRBORNE= 0.38307E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.825E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25457E+00          0.00806
   3.00 TO   10.00  0.82088E+00          0.02599
  10.00 TO   30.00  0.19968E+01          0.06323
  30.00 TO  100.00  0.43951E+01          0.13918
          >  100.00  0.24111E+02          0.76353
 TOTAL MASS AIRBORNE=  0.31579E+02     FRAC. INERT  AIRBORNE= 0.38277E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.826E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25453E+00          0.00806
   3.00 TO   10.00  0.82088E+00          0.02598
  10.00 TO   30.00  0.19970E+01          0.06321
  30.00 TO  100.00  0.43961E+01          0.13915
          >  100.00  0.24124E+02          0.76360
 TOTAL MASS AIRBORNE=  0.31593E+02     FRAC. INERT  AIRBORNE= 0.38248E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.827E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25449E+00          0.00805
   3.00 TO   10.00  0.82087E+00          0.02597
  10.00 TO   30.00  0.19972E+01          0.06319
  30.00 TO  100.00  0.43971E+01          0.13912
          >  100.00  0.24137E+02          0.76367
 TOTAL MASS AIRBORNE=  0.31606E+02     FRAC. INERT  AIRBORNE= 0.38218E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.828E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25444E+00          0.00805
   3.00 TO   10.00  0.82087E+00          0.02596
  10.00 TO   30.00  0.19974E+01          0.06317
  30.00 TO  100.00  0.43981E+01          0.13909
          >  100.00  0.24149E+02          0.76373
 TOTAL MASS AIRBORNE=  0.31620E+02     FRAC. INERT  AIRBORNE= 0.38189E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.829E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25440E+00          0.00804
   3.00 TO   10.00  0.82087E+00          0.02595
  10.00 TO   30.00  0.19976E+01          0.06315
  30.00 TO  100.00  0.43991E+01          0.13906
          >  100.00  0.24162E+02          0.76380
 TOTAL MASS AIRBORNE=  0.31634E+02     FRAC. INERT  AIRBORNE= 0.38159E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.830E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25435E+00          0.00804
   3.00 TO   10.00  0.82087E+00          0.02594
  10.00 TO   30.00  0.19978E+01          0.06313
  30.00 TO  100.00  0.44001E+01          0.13903
          >  100.00  0.24175E+02          0.76387
 TOTAL MASS AIRBORNE=  0.31648E+02     FRAC. INERT  AIRBORNE= 0.38130E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.831E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25431E+00          0.00803
   3.00 TO   10.00  0.82086E+00          0.02593
  10.00 TO   30.00  0.19980E+01          0.06310
  30.00 TO  100.00  0.44011E+01          0.13900
          >  100.00  0.24187E+02          0.76393
 TOTAL MASS AIRBORNE=  0.31662E+02     FRAC. INERT  AIRBORNE= 0.38101E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.832E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25427E+00          0.00803
   3.00 TO   10.00  0.82086E+00          0.02591
  10.00 TO   30.00  0.19982E+01          0.06308
  30.00 TO  100.00  0.44021E+01          0.13897
          >  100.00  0.24200E+02          0.76400
 TOTAL MASS AIRBORNE=  0.31675E+02     FRAC. INERT  AIRBORNE= 0.38071E-01
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.833E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25422E+00           0.00802
   3.00 TO   10.00  0.82065E+00           0.02590
  10.00 TO   30.00  0.19984E+01           0.06306
  30.00 TO  100.00  0.44030E+01           0.13894
          >  100.00  0.24213E+02           0.76407
 TOTAL MASS AIRBORNE=  0.31689E+02     FRAC. INERT  AIRBORNE= 0.38042E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.834E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25416E+00           0.00802
   3.00 TO   10.00  0.82085E+00           0.02589
  10.00 TO   30.00  0.19986E+01           0.06304
  30.00 TO  100.00  0.44040E+01           0.13892
          >  100.00  0.24225E+02           0.76413
 TOTAL MASS AIRBORNE=  0.31703E+02     FRAC. INERT  AIRBORNE= 0.38013E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.835E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25414E+00           0.00801
   3.00 TO   10.00  0.82085E+00           0.02588
  10.00 TO   30.00  0.19988E+01           0.06302
  30.00 TO  100.00  0.44050E+01           0.13889
          >  100.00  0.24238E+02           0.76420
 TOTAL MASS AIRBORNE=  0.31717E+02     FRAC. INERT  AIRBORNE= 0.37984E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.836E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25409E+00           0.00801
   3.00 TO   10.00  0.82085E+00           0.02587
  10.00 TO   30.00  0.19990E+01           0.06300
  30.00 TO  100.00  0.44060E+01           0.13886
          >  100.00  0.24250E+02           0.76427
 TOTAL MASS AIRBORNE=  0.31730E+02     FRAC. INERT  AIRBORNE= 0.37955E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.837E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25405E+00           0.00800
   3.00 TO   10.00  0.82084E+00           0.02586
  10.00 TO   30.00  0.19992E+01           0.06298
  30.00 TO  100.00  0.44070E+01           0.13883
          >  100.00  0.24263E+02           0.76433
 TOTAL MASS AIRBORNE=  0.31744E+02     FRAC. INERT  AIRBORNE= 0.37926E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.838E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25401E+00           0.00800
   3.00 TO   10.00  0.82084E+00           0.02585
  10.00 TO   30.00  0.19994E+01           0.06296
  30.00 TO  100.00  0.44080E+01           0.13880
          >  100.00  0.24276E+02           0.76440
 TOTAL MASS AIRBORNE=  0.31758E+02     FRAC. INERT  AIRBORNE= 0.37897E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.839E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25396E+00           0.00799
   3.00 TO   10.00  0.82084E+00           0.02584
  10.00 TO   30.00  0.19996E+01           0.06294
  30.00 TO  100.00  0.44089E+01           0.13877
          >  100.00  0.24288E+02           0.76446
 TOTAL MASS AIRBORNE=  0.31772E+02     FRAC. INERT  AIRBORNE= 0.37868E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.840E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25392E+00           0.00799
   3.00 TO   10.00  0.82083E+00           0.02582
  10.00 TO   30.00  0.19998E+01           0.06292
  30.00 TO  100.00  0.44099E+01           0.13874
          >  100.00  0.24301E+02           0.76453
 TOTAL MASS AIRBORNE=  0.31785E+02     FRAC. INERT  AIRBORNE= 0.37840E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.841E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25388E+00           0.00798
   3.00 TO   10.00  0.82083E+00           0.02581
  10.00 TO   30.00  0.20000E+01           0.06289
  30.00 TO  100.00  0.44109E+01           0.13871
          >  100.00  0.24313E+02           0.76460
 TOTAL MASS AIRBORNE=  0.31799E+02     FRAC. INERT  AIRBORNE= 0.37811E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.842E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25384E+00           0.00798
   3.00 TO   10.00  0.82082E+00           0.02580
  10.00 TO   30.00  0.20002E+01           0.06287
  30.00 TO  100.00  0.44119E+01           0.13868
          >  100.00  0.24326E+02           0.76466
 TOTAL MASS AIRBORNE=  0.31813E+02     FRAC. INERT  AIRBORNE= 0.37782E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.843E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25379E+00           0.00797
   3.00 TO   10.00  0.82082E+00           0.02579
  10.00 TO   30.00  0.20004E+01           0.06285
  30.00 TO  100.00  0.44129E+01           0.13865
          >  100.00  0.24338E+02           0.76473
 TOTAL MASS AIRBORNE=  0.31826E+02     FRAC. INERT  AIRBORNE= 0.37754E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.844E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25375E+00           0.00797
   3.00 TO   10.00  0.82082E+00           0.02578
  10.00 TO   30.00  0.20006E+01           0.06283
  30.00 TO  100.00  0.44138E+01           0.13863
          >  100.00  0.24351E+02           0.76479
 TOTAL MASS AIRBORNE=  0.31840E+02     FRAC. INERT  AIRBORNE= 0.37725E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.845E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25371E+00           0.00796
   3.00 TO   10.00  0.82081E+00           0.02577
  10.00 TO   30.00  0.20008E+01           0.06281
  30.00 TO  100.00  0.44148E+01           0.13860
          >  100.00  0.24363E+02           0.76486
 TOTAL MASS AIRBORNE=  0.31854E+02     FRAC. INERT  AIRBORNE= 0.37696E-01
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.846E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25366E+00           0.00796
   3.00 TO   10.00  0.82081E+00           0.02576
  10.00 TO   30.00  0.20009E+01           0.06279
  30.00 TO  100.00  0.44158E+01           0.13857
         >  100.00  0.24376E+02           0.76492
 TOTAL MASS AIRBORNE=  0.31867E+02     FRAC. INERT  AIRBORNE= 0.37668E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.847E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25362E+00           0.00796
   3.00 TO   10.00  0.82081E+00           0.02575
  10.00 TO   30.00  0.20011E+01           0.06277
  30.00 TO  100.00  0.44168E+01           0.13854
         >  100.00  0.24388E+02           0.76499
 TOTAL MASS AIRBORNE=  0.31881E+02     FRAC. INERT  AIRBORNE= 0.37640E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.848E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25358E+00           0.00795
   3.00 TO   10.00  0.82080E+00           0.02574
  10.00 TO   30.00  0.20013E+01           0.06275
  30.00 TO  100.00  0.44177E+01           0.13851
         >  100.00  0.24401E+02           0.76505
 TOTAL MASS AIRBORNE=  0.31894E+02     FRAC. INERT  AIRBORNE= 0.37611E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.849E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25354E+00           0.00795
   3.00 TO   10.00  0.82080E+00           0.02572
  10.00 TO   30.00  0.20015E+01           0.06272
  30.00 TO  100.00  0.44187E+01           0.13848
         >  100.00  0.24413E+02           0.76512
 TOTAL MASS AIRBORNE=  0.31908E+02     FRAC. INERT  AIRBORNE= 0.37583E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.850E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25349E+00           0.00794
   3.00 TO   10.00  0.820[illegible]E+00           0.02571
  10.00 TO   30.00  0.20017E+01           0.06271
  30.00 TO  100.00  0.44197E+01           0.13845
         >  100.00  0.24426E+02           0.76518
 TOTAL MASS AIRBORNE=  0.31921E+02     FRAC. INERT  AIRBORNE= 0.37555E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.851E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25345E+00           0.00794
   3.00 TO   10.00  0.82079E+00           0.02570
  10.00 TO   30.00  0.20019E+01           0.06269
  30.00 TO  100.00  0.44206E+01           0.13843
         >  100.00  0.24438E+02           0.76525
 TOTAL MASS AIRBORNE=  0.3193[illegible]E+02     FRAC. INERT  AIRBORNE= 0.37527E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.852E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25341E+00           0.00793
   3.00 TO   10.00  0.82079E+00           0.02569
  10.00 TO   30.00  0.20021E+01           0.06267
  30.00 TO  100.00  0.44216E+01           0.13840
         >  100.00  0.24451E+02           0.76531
 TOTAL MASS AIRBORNE=  0.31949E+02     FRAC. INERT  AIRBORNE= 0.37498E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.853E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25336E+00           0.00793
   3.00 TO   10.00  0.82079E+00           0.02568
  10.00 TO   30.00  0.20023E+01           0.06265
  30.00 TO  100.00  0.44226E+01           0.13837
         >  100.00  0.2[illegible]           0.76538
 TOTAL MASS AIRBORNE=  [illegible]     FRAC. INERT  AIRBORNE= 0.37470E-01

EXPLOSION RADIOACTIVE SO[illegible]
TNT WT(G) =     1.00 INER[illegible]54E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AI[illegible]SS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25332E+00           0.00792
   3.00 TO   10.00  0.82078E+00           0.02567
  10.00 TO   30.00  0.20025E+01           0.06263
  30.00 TO  100.00  0.44235E+01           0.13834
         >  100.00  0.24476E+02           0.76544
 TOTAL MASS AIRBORNE=  0.31976E+02     FRAC. INERT  AIRBORNE= 0.37442E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.855E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25328E+00           0.00792
   3.00 TO   10.00  0.82075E+00           0.02566
  10.00 TO   30.00  0.20027E+01           0.06260
  30.00 TO  100.00  0.44245E+01           0.13831
         >  100.00  0.24488E+02           0.76551
 TOTAL MASS AIRBORNE=  0.31989E+02     FRAC. INERT  AIRBORNE= 0.37414E-01

EXPLOS[illegible]IOACTIVE SOURCE TERM
TNT W[illegible]     1.00 INERT WT(G) = 0.856E-03 STD. DEV. = 8.00 # BINS = 4
SIZE [illegible]CRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0[illegible]    3.00  0.25324E+00           0.00791
   3.[illegible]   10.00  0.82077E+00           0.02565
  10.[illegible]   30.00  0.20029E+01           0.06258
  30.00 TO  100.00  0.44255E+01           0.13828
         >  100.00  0.24501E+02           0.76557
 TOTAL MASS AIRBORNE=  0.32003E+02     FRAC. INERT  AIRBORNE= 0.37387E-01

EXPLOS[illegible] RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.857E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25320E+00           0.00791
   3.00 TO   10.00  0.82077E+00           0.02564
  10.00 TO   30.00  0.20031E+01           0.06256
  30.00 TO  100.00  0.44264E+01           0.13825
         >  100.00  0.24513E+02           0.76564
 TOTAL MASS AIRBORNE=  0.32016E+[illegible]     FRAC. INERT  AIRBORNE= 0.37359E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.858E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25315E+00           0.00790
   3.00 TO   10.00  0.82076E+00           0.02562
  10.00 TO   30.00  0.20033E+01           0.06254
  30.00 TO  100.00  0.44274E+01           0.13823
         >  100.00  0.24525E+02           0.76570
 TOTAL MASS AIRBORNE=  0.32030E+02     FRAC. INERT  AIRBORNE= 0.37331E-01
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.859E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25311E+00              0.00790
   3.00 TO    10.00  0.82076E+00              0.02561
  10.00 TO    30.00  0.20034E+01              0.06252
  30.00 TO   100.00  0.44283E+01              0.13820
         >   100.00  0.24538E+02              0.76577
 TOTAL MASS AIRBORNE=  0.32043E+02      FRAC. INERT  AIRBORNE= 0.37303E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.860E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25307E+00              0.00789
   3.00 TO    10.00  0.82076E+00              0.02560
  10.00 TO    30.00  0.20036E+01              0.06250
  30.00 TO   100.00  0.44293E+01              0.13817
         >   100.00  0.24550E+02              0.76583
 TOTAL MASS AIRBORNE=  0.32057E+02      FRAC. INERT  AIRBORNE= 0.37275E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.861E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25303E+00              0.00789
   3.00 TO    10.00  0.82075E+00              0.02559
  10.00 TO    30.00  0.20038E+01              0.06248
  30.00 TO   100.00  0.44303E+01              0.13814
         >   100.00  0.24562E+02              0.76589
 TOTAL MASS AIRBORNE=  0.32070E+02      FRAC. INERT  AIRBORNE= 0.37248E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.862E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25299E+00              0.00789
   3.00 TO    10.00  0.82075E+00              0.02558
  10.00 TO    30.00  0.20040E+01              0.06246
  30.00 TO   100.00  0.44312E+01              0.13811
         >   100.00  0.24575E+02              0.76596
 TOTAL MASS AIRBORNE=  0.32084E+02      FRAC. INERT  AIRBORNE= 0.37220E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.863E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25294E+00              0.00788
   3.00 TO    10.00  0.82075E+00              0.02557
  10.00 TO    30.00  0.20042E+01              0.06244
  30.00 TO   100.00  0.44322E+01              0.13809
         >   100.00  0.24587E+02              0.76602
 TOTAL MASS AIRBORNE=  0.32097E+02      FRAC. INERT  AIRBORNE= 0.37193E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.864E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25290E+00              0.00788
   3.00 TO    10.00  0.82074E+00              0.02556
  10.00 TO    30.00  0.20044E+01              0.06242
  30.00 TO   100.00  0.44331E+01              0.13806
         >   100.00  0.24600E+02              0.76609
 TOTAL MASS AIRBORNE=  0.32111E+02      FRAC. INERT  AIRBORNE= 0.37165E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.865E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25286E+00              0.00787
   3.00 TO    10.00  0.82074E+00              0.02555
  10.00 TO    30.00  0.20046E+01              0.06240
  30.00 TO   100.00  0.44341E+01              0.13803
         >   100.00  0.24612E+02              0.76615
 TOTAL MASS AIRBORNE=  0.32124E+02      FRAC. INERT  AIRBORNE= 0.37138E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.866E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25282E+00              0.00787
   3.00 TO    10.00  0.82073E+00              0.02554
  10.00 TO    30.00  0.20048E+01              0.06238
  30.00 TO   100.00  0.44350E+01              0.13800
         >   100.00  0.24624E+02              0.76621
 TOTAL MASS AIRBORNE=  0.32138E+02      FRAC. INERT  AIRBORNE= 0.37110E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.867E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25278E+00              0.00786
   3.00 TO    10.00  0.82073E+00              0.02553
  10.00 TO    30.00  0.20050E+01              0.06236
  30.00 TO   100.00  0.44360E+01              0.13797
         >   100.00  0.24637E+02              0.76628
 TOTAL MASS AIRBORNE=  0.32151E+02      FRAC. INERT  AIRBORNE= 0.37083E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.868E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25273E+00              0.00786
   3.00 TO    10.00  0.82072E+00              0.02552
  10.00 TO    30.00  0.20051E+01              0.06234
  30.00 TO   100.00  0.44369E+01              0.13795
         >   100.00  0.24649E+02              0.76634
 TOTAL MASS AIRBORNE=  0.32164E+02      FRAC. INERT  AIRBORNE= 0.37056E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.869E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25269E+00              0.00785
   3.00 TO    10.00  0.82072E+00              0.02551
  10.00 TO    30.00  0.20053E+01              0.06232
  30.00 TO   100.00  0.44379E+01              0.13792
         >   100.00  0.24661E+02              0.76640
 TOTAL MASS AIRBORNE=  0.32178E+02      FRAC. INERT  AIRBORNE= 0.37029E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.870E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25265E+00              0.00785
   3.00 TO    10.00  0.82071E+00              0.02549
  10.00 TO    30.00  0.20055E+01              0.06230
  30.00 TO   100.00  0.44388E+01              0.13789
         >   100.00  0.24674E+02              0.76647
 TOTAL MASS AIRBORNE=  0.32191E+02      FRAC. INERT  AIRBORNE= 0.37001E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.871E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25261E+00              0.00784
   3.00 TO    10.00  0.82071E+00              0.02548
  10.00 TO    30.00  0.20057E+01              0.06228
  30.00 TO   100.00  0.44398E+01              0.13786
         >   100.00  0.24686E+02              0.76653
 TOTAL MASS AIRBORNE=  0.32205E+02      FRAC. INERT  AIRBORNE= 0.36974E-01
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.872E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25257E+00          0.00784
   3.00 TO   10.00  0.82071E+00          0.02547
  10.00 TO   30.00  0.20059E+01          0.06226
  30.00 TO  100.00  0.44407E+01          0.13783
         >  100.00  0.24698E+02          0.76659
 TOTAL MASS AIRBORNE=  0.32218E+02     FRAC. INERT  AIRBORNE= 0.36947E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.873E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25253E+00          0.00783
   3.00 TO   10.00  0.82070E+00          0.02546
  10.00 TO   30.00  0.20061E+01          0.06224
  30.00 TO  100.00  0.44417E+01          0.13781
         >  100.00  0.24710E+02          0.76666
 TOTAL MASS AIRBORNE=  0.32231E+02     FRAC. INERT  AIRBORNE= 0.36920E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.874E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25248E+00          0.00783
   3.00 TO   10.00  0.82070E+00          0.02545
  10.00 TO   30.00  0.20063E+01          0.06222
  30.00 TO  100.00  0.44426E+01          0.13778
         >  100.00  0.24723E+02          0.76672
 TOTAL MASS AIRBORNE=  0.32245E+02     FRAC. INERT  AIRBORNE= 0.36893E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.875E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25244E+00          0.00783
   3.00 TO   10.00  0.82069E+00          0.02544
  10.00 TO   30.00  0.20065E+01          0.06220
  30.00 TO  100.00  0.44435E+01          0.13775
         >  100.00  0.24735E+02          0.76678
 TOTAL MASS AIRBORNE=  0.32258E+02     FRAC. INERT  AIRBORNE= 0.36866E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.876E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25240E+00          0.00782
   3.00 TO   10.00  0.82069E+00          0.02543
  10.00 TO   30.00  0.20066E+01          0.06218
  30.00 TO  100.00  0.44445E+01          0.13772
         >  100.00  0.24747E+02          0.76685
 TOTAL MASS AIRBORNE=  0.32271E+02     FRAC. INERT  AIRBORNE= 0.36839E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.877E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25236E+00          0.00782
   3.00 TO   10.00  0.82068E+00          0.02542
  10.00 TO   30.00  0.20068E+01          0.06216
  30.00 TO  100.00  0.44454E+01          0.13769
         >  100.00  0.24759E+02          0.76691
 TOTAL MASS AIRBORNE=  0.32285E+02     FRAC. INERT  AIRBORNE= 0.36813E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.878E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25232E+00          0.00781
   3.00 TO   10.00  0.82068E+00          0.02541
  10.00 TO   30.00  0.20070E+01          0.06214
  30.00 TO  100.00  0.44464E+01          0.13767
         >  100.00  0.24772E+02          0.76697
 TOTAL MASS AIRBORNE=  0.32298E+02     FRAC. INERT  AIRBORNE= 0.36786E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.879E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25228E+00          0.00781
   3.00 TO   10.00  0.82067E+00          0.02540
  10.00 TO   30.00  0.20072E+01          0.06212
  30.00 TO  100.00  0.44473E+01          0.13764
         >  100.00  0.24784E+02          0.76703
 TOTAL MASS AIRBORNE=  0.32311E+02     FRAC. INERT  AIRBORNE= 0.36759E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.880E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25224E+00          0.00780
   3.00 TO   10.00  0.82067E+00          0.02539
  10.00 TO   30.00  0.20074E+01          0.06210
  30.00 TO  100.00  0.44482E+01          0.13761
         >  100.00  0.24796E+02          0.76710
 TOTAL MASS AIRBORNE=  0.32325E+02     FRAC. INERT  AIRBORNE= 0.36732E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.881E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25219E+00          0.00780
   3.00 TO   10.00  0.82067E+00          0.02538
  10.00 TO   30.00  0.20076E+01          0.06208
  30.00 TO  100.00  0.44492E+01          0.13758
         >  100.00  0.24808E+02          0.76716
 TOTAL MASS AIRBORNE=  0.32338E+02     FRAC. INERT  AIRBORNE= 0.36706E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.882E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25215E+00          0.00779
   3.00 TO   10.00  0.82066E+00          0.02537
  10.00 TO   30.00  0.20078E+01          0.06206
  30.00 TO  100.00  0.44501E+01          0.13756
         >  100.00  0.24820E+02          0.76722
 TOTAL MASS AIRBORNE=  0.32351E+02     FRAC. INERT  AIRBORNE= 0.36679E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.883E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25211E+00          0.00779
   3.00 TO   10.00  0.82066E+00          0.02536
  10.00 TO   30.00  0.20079E+01          0.06204
  30.00 TO  100.00  0.44510E+01          0.13753
         >  100.00  0.24833E+02          0.76728
 TOTAL MASS AIRBORNE=  0.32364E+02     FRAC. INERT  AIRBORNE= 0.36653E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.884E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25207E+00          0.00779
   3.00 TO   10.00  0.82065E+00          0.02535
  10.00 TO   30.00  0.20081E+01          0.06202
  30.00 TO  100.00  0.44520E+01          0.13750
         >  100.00  0.24845E+02          0.76735
 TOTAL MASS AIRBORNE=  0.32378E+02     FRAC. INERT  AIRBORNE= 0.36626E-01
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.885E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25203E+00             0.00778
   3.00 TO    10.00  0.82064E+00             0.02534
  10.00 TO    30.00  0.20083E+01             0.06200
  30.00 TO   100.00  0.44529E+01             0.13747
         >   100.00  0.24857E+02             0.76741
 TOTAL MASS AIRBORNE=  0.32391E+02     FRAC. INERT  AIRBORNE= 0.36600E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.886E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25199E+00             0.00778
   3.00 TO    10.00  0.82064E+00             0.02533
  10.00 TO    30.00  0.20085E+01             0.06198
  30.00 TO   100.00  0.44538E+01             0.13745
         >   100.00  0.24869E+02             0.76747
 TOTAL MASS AIRBORNE=  0.32404E+02     FRAC. INERT  AIRBORNE= 0.36573E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.887E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25195E+00             0.00777
   3.00 TO    10.00  0.82063E+00             0.02531
  10.00 TO    30.00  0.20087E+01             0.06196
  30.00 TO   100.00  0.44548E+01             0.13742
         >   100.00  0.24881E+02             0.76753
 TOTAL MASS AIRBORNE=  0.32417E+02     FRAC. INERT  AIRBORNE= 0.36547E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.888E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25191E+00             0.00777
   3.00 TO    10.00  0.82063E+00             0.02530
  10.00 TO    30.00  0.20089E+01             0.06194
  30.00 TO   100.00  0.44557E+01             0.13739
         >   100.00  0.24893E+02             0.76759
 TOTAL MASS AIRBORNE=  0.32431E+02     FRAC. INERT  AIRBORNE= 0.36521E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.889E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25187E+00             0.00776
   3.00 TO    10.00  0.82062E+00             0.02529
  10.00 TO    30.00  0.20090E+01             0.06192
  30.00 TO   100.00  0.44566E+01             0.13736
         >   100.00  0.24906E+02             0.76766
 TOTAL MASS AIRBORNE=  0.32444E+02     FRAC. INERT  AIRBORNE= 0.36495E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.890E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25182E+00             0.00776
   3.00 TO    10.00  0.82062E+00             0.02528
  10.00 TO    30.00  0.20092E+01             0.06190
  30.00 TO   100.00  0.44575E+01             0.13734
         >   100.00  0.24918E+02             0.76772
 TOTAL MASS AIRBORNE=  0.32457E+02     FRAC. INERT  AIRBORNE= 0.36468E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.891E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25179E+00             0.00775
   3.00 TO    10.00  0.82061E+00             0.02527
  10.00 TO    30.00  0.20094E+01             0.06188
  30.00 TO   100.00  0.44585E+01             0.13731
         >   100.00  0.24930E+02             0.76778
 TOTAL MASS AIRBORNE=  0.32470E+02     FRAC. INERT  AIRBORNE= 0.36442E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.892E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25174E+00             0.00775
   3.00 TO    10.00  0.82061E+00             0.02526
  10.00 TO    30.00  0.20096E+01             0.06187
  30.00 TO   100.00  0.44594E+01             0.13728
         >   100.00  0.24942E+02             0.76784
 TOTAL MASS AIRBORNE=  0.32483E+02     FRAC. INERT  AIRBORNE= 0.36416E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.893E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25170E+00             0.00775
   3.00 TO    10.00  0.82061E+00             0.02525
  10.00 TO    30.00  0.20098E+01             0.06185
  30.00 TO   100.00  0.44603E+01             0.13726
         >   100.00  0.24954E+02             0.76790
 TOTAL MASS AIRBORNE=  0.32496E+02     FRAC. INERT  AIRBORNE= 0.36390E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.894E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25166E+00             0.00774
   3.00 TO    10.00  0.82060E+00             0.02524
  10.00 TO    30.00  0.20099E+01             0.06183
  30.00 TO   100.00  0.44612E+01             0.13723
         >   100.00  0.24966E+02             0.76796
 TOTAL MASS AIRBORNE=  0.32510E+02     FRAC. INERT  AIRBORNE= 0.36364E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.895E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25162E+00             0.00774
   3.00 TO    10.00  0.82060E+00             0.02523
  10.00 TO    30.00  0.20101E+01             0.06181
  30.00 TO   100.00  0.44622E+01             0.13720
         >   100.00  0.24978E+02             0.76802
 TOTAL MASS AIRBORNE=  0.32523E+02     FRAC. INERT  AIRBORNE= 0.36338E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.896E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25158E+00             0.00773
   3.00 TO    10.00  0.82059E+00             0.02522
  10.00 TO    30.00  0.20103E+01             0.06179
  30.00 TO   100.00  0.44631E+01             0.13717
         >   100.00  0.24990E+02             0.76809
 TOTAL MASS AIRBORNE=  0.32536E+02     FRAC. INERT  AIRBORNE= 0.36312E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.897E-03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25154E+00             0.00773
   3.00 TO    10.00  0.82059E+00             0.02521
  10.00 TO    30.00  0.20105E+01             0.06177
  30.00 TO   100.00  0.44640E+01             0.13715
         >   100.00  0.25002E+02             0.76815
 TOTAL MASS AIRBORNE=  0.32549E+02     FRAC. INERT  AIRBORNE= 0.36287E-01
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.898E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25150E+00           0.00772
   3.00 TO   10.00  0.82058E+00           0.02520
  10.00 TO   30.00  0.20107E+01           0.06175
  30.00 TO  100.00  0.44649E+01           0.13712
         >  100.00  0.25015E+02           0.76821
 TOTAL MASS AIRBORNE=  0.32562E+02     FRAC. INERT  AIRBORNE= 0.36261E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.899E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25146E+00           0.00772
   3.00 TO   10.00  0.82057E+00           0.02519
  10.00 TO   30.00  0.20108E+01           0.06173
  30.00 TO  100.00  0.44658E+01           0.13709
         >  100.00  0.25027E+02           0.76827
 TOTAL MASS AIRBORNE=  0.32575E+02     FRAC. INERT  AIRBORNE= 0.36235E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.900E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25142E+00           0.00771
   3.00 TO   10.00  0.82057E+00           0.02518
  10.00 TO   30.00  0.20110E+01           0.06171
  30.00 TO  100.00  0.44667E+01           0.13707
         >  100.00  0.25039E+02           0.76833
 TOTAL MASS AIRBORNE=  0.32588E+02     FRAC. INERT  AIRBORNE= 0.36209E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.901E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25138E+00           0.00771
   3.00 TO   10.00  0.82056E+00           0.02517
  10.00 TO   30.00  0.20112E+01           0.06169
  30.00 TO  100.00  0.44677E+01           0.13704
         >  100.00  0.25051E+02           0.76839
 TOTAL MASS AIRBORNE=  0.32601E+02     FRAC. INERT  AIRBORNE= 0.36184E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.902E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25134E+00           0.00771
   3.00 TU   10.00  0.82056E+00           0.02516
  10.00 TO   30.00  0.20114E+01           0.06167
  30.00 TO  100.00  0.44686E+01           0.13701
         >  100.00  0.25063E+02           0.76845
 TOTAL MASS AIRBORNE=  0.32615E+02     FRAC. INERT  AIRBORNE= 0.36158E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.903E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25130E+00           0.00770
   3.00 TO   10.00  0.82055E+00           0.02515
  10.00 TO   30.00  0.20116E+01           0.06165
  30.00 TO  100.00  0.44695E+01           0.13698
         >  100.00  0.25075E+02           0.76851
 TOTAL MASS AIRBORNE=  0.32628E+02     FRAC. INERT  AIRBORNE= 0.36132E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.904E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25126E+00           0.00770
   3.00 TO   10.00  0.82055E+00           [illegible]
  10.00 TO   30.00  0.20117E+01           0.06163
  30.00 TO  100.00  0.44704E+01           0.13696
         >  100.00  0.25087E+02           0.76857
 TOTAL MASS AIRBORNE=  0.32641E+02     FRAC. INERT  AIRBORNE= 0.36107E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.905E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25122E+00           0.00769
   3.00 TO   10.00  0.82054E+00           0.02513
  10.00 TO   30.00  0.20119E+01           0.06161
  30.00 TO  100.00  0.44713E+01           0.13693
         >  100.00  0.25099E+02           0.76863
 TOTAL MASS AIRBORNE=  0.32654E-02     FRAC. INERT  AIRBORNE= 0.36081E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.906E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25118E+00           0.00769
   3.00 TO   10.00  0.82054E+00           0.02512
  10.00 TO   30.00  0.20121E+01           0.06159
  30.00 TO  100.00  0.44722E+01           0.13690
         >  100.00  0.25111E+02           0.76869
 TOTAL MASS AIRBORNE=  0.32667E+02     FRAC. INERT  AIRBORNE= 0.36056E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.907E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25114E+00           0.00768
   3.00 TO   10.00  0.82053E+00           0.02511
  10.00 TO   30.00  0.20123E+01           0.06158
  30.00 TO  100.00  0.44731E+01           0.13688
         >  100.00  0.25123E-02           0.76875
 TOTAL MASS AIRBORNE=  0.32680E+02     FRAC. INERT  AIRBORNE= 0.36031E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.908E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25110E+00           0.00768
   3.00 TO   10.00  0.82053E+00           0.02510
  10.00 TO   30.00  0.20124E+01           0.06156
  30.00 TO  100.00  0.44740E+01           0.13685
         >  100.00  0.25135E+02           0.76881
 TOTAL MASS AIRBORNE=  0.32693E+02     FRAC. INERT  AIRBORNE= 0.36005E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.909E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25106E+00           0.00768
   3.00 TO   10.00  0.82052E+00           0.02509
  10.00 TO   30.00  0.20126E+01           0.06154
  30.00 TO  100.00  0.44749E+01           0.13682
         >  100.00  0.25147E+02           0.76888
 TOTAL MASS AIRBORNE=  0.32706E+02     FRAC. INERT  AIRBORNE= 0.35980E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.910E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.25102E+00           0.00767
   3.00 TO   10.00  0.82052E+00           0.02508
  10.00 TO   30.00  0.20128E+01           0.06152
  30.00 TO  100.00  0.44758E+01           0.13680
         >  100.00  0.25159E+02           0.76894
 TOTAL MASS AIRBORNE=  0.32719E+02     FRAC. INERT  AIRBORNE= 0.35955E-01
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.911E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25098E+00            0.00767
   3.00 TO    10.00  0.82051E+00            0.02507
  10.00 TO    30.00  0.20130E+01            0.06150
  30.00 TO   100.00  0.44767E+01            0.13677
          >  100.00  0.25171E+02            0.76906
 TOTAL MASS AIRBORNE=  0.32732E+02     FRAC. INERT  AIRBORNE= 0.35930E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.912E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25094E+00            0.00766
   3.00 TO    10.00  0.82050E+00            0.02506
  10.00 TO    30.00  0.20132E+01            0.06148
  30.00 TO   100.00  0.44777E+01            0.13674
          >  100.00  0.25183E+02            0.76906
 TOTAL MASS AIRBORNE=  0.32745E+02     FRAC. INERT  AIRBORNE= 0.35904E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.913E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25090E+00            0.00766
   3.00 TO    10.00  0.82050E+00            0.02505
  10.00 TO    30.00  0.20133E+01            0.06146
  30.00 TO   100.00  0.44786E+01            0.13672
          >  100.00  0.25195E+02            0.76912
 TOTAL MASS AIRBORNE=  0.32758E+02     FRAC. INERT  AIRBORNE= 0.35879E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.914E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25086E+00            0.00765
   3.00 TO    10.00  0.82049E+00            0.02504
  10.00 TO    30.00  0.20135E+01            0.06144
  30.00 TO   100.00  0.44795E+01            0.13669
          >  100.00  0.25207E+02            0.76918
 TOTAL MASS AIRBORNE=  0.32771E+02     FRAC. INERT  AIRBORNE= 0.35854E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.915E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25082E+00            0.00765
   3.00 TO    10.00  0.82049E+00            0.02503
  10.00 TO    30.00  0.20137E+01            0.06142
  30.00 TO   100.00  0.44804E+01            0.13666
          >  100.00  0.25218E+02            0.76924
 TOTAL MASS AIRBORNE=  0.32784E+02     FRAC. INERT  AIRBORNE= 0.35829E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.916E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25078E+00            0.00765
   3.00 TO    10.00  0.82048E+00            0.02502
  10.00 TO    30.00  0.20139E+01            0.06140
  30.00 TO   100.00  0.44813E+01            0.13664
          >  100.00  0.25230E+02            0.76929
 TOTAL MASS AIRBORNE=  0.32797E+02     FRAC. INERT  AIRBORNE= 0.35804E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.917E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25074E+00            0.00764
   3.00 TO    10.00  0.82048E+00            0.02501
  10.00 TO    30.00  0.20140E+01            0.06139
  30.00 TO   100.00  0.44822E+01            0.13661
          >  100.00  0.25242E+02            0.76935
 TOTAL MASS AIRBORNE=  0.32810E+02     FRAC. INERT  AIRBORNE= 0.35779E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.918E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25070E+00            0.00764
   3.00 TO    10.00  0.82047E+00            0.02500
  10.00 TO    30.00  0.20142E+01            0.06137
  30.00 TO   100.00  0.44831E+01            0.13658
          >  100.00  0.25254E+02            0.76941
 TOTAL MASS AIRBORNE=  0.32823E+02     FRAC. INERT  AIRBORNE= 0.35755E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.919E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25066E+00            0.00763
   3.00 TO    10.00  0.82046E+00            0.02499
  10.00 TO    30.00  0.20144E+01            0.06135
  30.00 TO   100.00  0.44840E+01            0.13656
          >  100.00  0.25266E+02            0.76947
 TOTAL MASS AIRBORNE=  0.32836E+02     FRAC. INERT  AIRBORNE= 0.35730E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.920E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25062E+00            0.00763
   3.00 TO    10.00  0.82046E+00            0.02498
  10.00 TO    30.00  0.20146E+01            0.06133
  30.00 TO   100.00  0.44848E+01            0.13653
          >  100.00  0.25278E+02            0.76953
 TOTAL MASS AIRBORNE=  0.32848E+02     FRAC. INERT  AIRBORNE= 0.35705E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.921E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25058E+00            0.00763
   3.00 TO    10.00  0.82045E+00            0.02497
  10.00 TO    30.00  0.20147E+01            0.06131
  30.00 TO   100.00  0.44857E+01            0.13650
          >  100.00  0.25290E+02            0.76959
 TOTAL MASS AIRBORNE=  0.32861E+02     FRAC. INERT  AIRBORNE= 0.35680E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.922E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25054E+00            0.00762
   3.00 TO    10.00  0.82045E+00            0.02496
  10.00 TO    30.00  0.20149E+01            0.06129
  30.00 TO   100.00  0.44866E+01            0.13648
          >  100.00  0.25302E+02            0.76965
 TOTAL MASS AIRBORNE=  0.32874E+02     FRAC. INERT  AIRBORNE= 0.35655E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.923E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.25050E+00            0.00762
   3.00 TO    10.00  0.82044E+00            0.02495
  10.00 TO    30.00  0.20151E+01            0.06127
  30.00 TO   100.00  0.44875E+01            0.13645
          >  100.00  0.25314E+02            0.76971
 TOTAL MASS AIRBORNE=  0.32887E+02     FRAC. INERT  AIRBORNE= 0.35631E-01
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.924E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
  0.00 TO    3.00  0.25046E+00            0.00761
  3.00 TO   10.00  0.82044E+00            0.02494
 10.00 TO   30.00  0.20153E+01            0.06125
 30.00 TO  100.00  0.44884E+01            0.13643
        >  100.00  0.25325E+02            0.76977
 TOTAL MASS AIRBORNE=  0.32900E+02     FRAC. INERT  AIRBORNE= 0.35606E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.925E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
  0.00 TO    3.00  0.25042E+00            0.00761
  3.00 TO   10.00  0.82043E+00            0.02493
 10.00 TO   30.00  0.20154E+01            0.06124
 30.00 TO  100.00  0.44893E+01            0.13640
        >  100.00  0.25337E+02            0.76983
 TOTAL MASS AIRBORNE=  0.32913E+02     FRAC. INERT  AIRBORNE= 0.35582E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.926E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
  0.00 TO    3.00  0.25038E+00            0.00760
  3.00 TO   10.00  0.82042E+00            0.02492
 10.00 TO   30.00  0.20156E+01            0.06122
 30.00 TO  100.00  0.44902E+01            0.13637
        >  100.00  0.25349E+02            0.76989
 TOTAL MASS AIRBORNE=  0.32926E+02     FRAC. INERT  AIRBORNE= 0.35557E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.927E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
  0.00 TO    3.00  0.25034E+00            0.00760
  3.00 TO   10.00  0.82042E+00            0.02491
 10.00 TO   30.00  0.20158E+01            0.06120
 30.00 TO  100.00  0.44911E+01            0.13635
        >  100.00  0.25361E+02            0.76995
 TOTAL MASS AIRBORNE=  0.32939E+02     FRAC. INERT  AIRBORNE= 0.75533E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.928E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
  0.00 TO    3.00  0.25030E+00            0.00760
  3.00 TO   10.00  0.82041E+00            0.02490
 10.00 TO   30.00  0.20159E+01            0.06118
 30.00 TO  100.00  0.44920E+01            0.13632
        >  100.00  0.25373E+02            0.77001
 TOTAL MASS AIRBORNE=  0.32952E+02     FRAC. INERT  AIRBORNE= 0.35508E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.929E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
  0.00 TO    3.00  0.25027E+00            0.00759
  3.00 TO   10.00  0.82041E+00            0.02489
 10.00 TO   30.00  0.20161E+01            0.06116
 30.00 TO  100.00  0.44929E+01            0.13629
        >  100.00  0.25385E+02            0.77007
 TOTAL MASS AIRBORNE=  0.32964E+02     FRAC. INERT  AIRBORNE= 0.35484E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.930E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
  0.00 TO    3.00  0.25023E+00            0.00759
  3.00 TO   10.00  0.82040E+00            0.02488
 10.00 TO   30.00  0.20163E+01            0.06114
 30.00 TO  100.00  0.44938E+01            0.13627
        >  100.00  0.25397E+02            0.77012
 TOTAL MASS AIRBORNE=  0.32977E+02     FRAC. INERT  AIRBORNE= 0.35459E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.931E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
  0.00 TO    3.00  0.25019E+00            0.00758
  3.00 TO   10.00  0.82039E+00            0.02487
 10.00 TO   30.00  0.20165E+01            0.06112
 30.00 TO  100.00  0.44946E+01            0.13624
        >  100.00  0.25408E+02            0.77018
 TOTAL MASS AIRBORNE=  0.32990E+02     FRAC. INERT  AIRBORNE= 0.35435E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.932E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
  0.00 TO    3.00  0.25015E+00            0.00758
  3.00 TO   10.00  0.82039E+00            0.02486
 10.00 TO   30.00  0.20166E+01            0.06110
 30.00 TO  100.00  0.44955E+01            0.13622
        >  100.00  0.25420E+02            0.77024
 TOTAL MASS AIRBORNE=  0.33003E+02     FRAC. INERT  AIRBORNE= 0.35411E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.933E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
  0.00 TO    3.00  0.25011E+00            0.00758
  3.00 TO   10.00  0.82038E+00            0.02485
 10.00 TO   30.00  0.20168E+01            0.06109
 30.00 TO  100.00  0.44964E+01            0.13619
        >  100.00  0.25432E+02            0.77030
 TOTAL MASS AIRBORNE=  0.33016E+02     FRAC. INERT  AIRBORNE= 0.35387E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.934E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
  0.00 TO    3.00  0.25007E+00            0.00757
  3.00 TO   10.00  0.82038E+00            0.02484
 10.00 TO   30.00  0.20170E+01            0.06107
 30.00 TO  100.00  0.44973E+01            0.13616
        >  100.00  0.25444E+02            0.77036
 TOTAL MASS AIRBORNE=  0.33028E+02     FRAC. INERT  AIRBORNE= 0.35362E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.935E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
  0.00 TO    3.00  0.25003E+00            0.00757
  3.00 TO   10.00  0.82037E+00            0.02483
 10.00 TO   30.00  0.20171E+01            0.06105
 30.00 TO  100.00  0.44982E+01            0.13614
        >  100.00  0.25455E+02            0.77042
 TOTAL MASS AIRBORNE=  0.33041E+02     FRAC. INERT  AIRBORNE= 0.35338E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.936E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
  0.00 TO    3.00  0.24999E+00            0.00756
  3.00 TO   10.00  0.82037E+00            0.02482
 10.00 TO   30.00  0.20173E+01            0.06103
 30.00 TO  100.00  0.44991E+01            0.13611
        >  100.00  0.25467E+02            0.77047
 TOTAL MASS AIRBORNE=  0.33054E+02     FRAC. INERT  AIRBORNE= 0.35314E-01
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) = 1.00 INERT WT(G) = 0.937E+03 STD. DEV. = 8.00 # BINS = 4

SIZE RANGE(MICRONS)	MASS AIRBORNE	MASS AIRBORNE/TOTAL AIRBORNE
0.00 TO 3.00	0.24995E+00	0.00756
3.00 TO 10.00	0.82036E+00	0.02481
10.00 TO 30.00	0.20175E+01	0.06101
30.00 TO 100.00	0.44999E+01	0.13609
> 100.00	0.25479E+02	0.77053

TOTAL MASS AIRBORNE= 0.33067E+02 FRAC. INERT AIRBORNE= 0.35290E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) = 1.00 INERT WT(G) = 0.938E+03 STD. DEV. = 8.00 # BINS = 4

SIZE RANGE(MICRONS)	MASS AIRBORNE	MASS AIRBORNE/TOTAL AIRBORNE
0.00 TO 3.00	0.24991E+00	0.00755
3.00 TO 10.00	0.82035E+00	0.02480
10.00 TO 30.00	0.20177E+01	0.06099
30.00 TO 100.00	0.45008E+01	0.13606
> 100.00	0.25491E+02	0.77059

TOTAL MASS AIRBORNE= 0.33080E+02 FRAC. INERT AIRBORNE= 0.35266E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) = 1.00 INERT WT(G) = 0.939E+03 STD. DEV. = 8.00 # BINS = 4

SIZE RANGE(MICRONS)	MASS AIRBORNE	MASS AIRBORNE/TOTAL AIRBORNE
0.00 TO 3.00	0.24987E+00	0.00755
3.00 TO 10.00	0.82034E+00	0.02479
10.00 TO 30.00	0.20178E+01	0.06098
30.00 TO 100.00	0.45017E+01	0.13603
> 100.00	0.25503E+02	0.77065

TOTAL MASS AIRBORNE= 0.33092E+02 FRAC. INERT AIRBORNE= 0.35242E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) = 1.00 INERT WT(G) = 0.940E+03 STD. DEV. = 8.00 # BINS = 4

SIZE RANGE(MICRONS)	MASS AIRBORNE	MASS AIRBORNE/TOTAL AIRBORNE
0.00 TO 3.00	0.24984E+00	0.00755
3.00 TO 10.00	0.82034E+00	0.02478
10.00 TO 30.00	0.20180E+01	0.06096
30.00 TO 100.00	0.45026E+01	0.13601
> 100.00	0.25514E+02	0.77071

TOTAL MASS AIRBORNE= 0.33105E+02 FRAC. INERT AIRBORNE= 0.35218E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) = 1.00 INERT WT(G) = 0.941E+03 STD. DEV. = 8.00 # BINS = 4

SIZE RANGE(MICRONS)	MASS AIRBORNE	MASS AIRBORNE/TOTAL AIRBORNE
0.00 TO 3.00	0.24980E+00	0.00754
3.00 TO 10.00	0.82033E+00	0.02477
10.00 TO 30.00	0.20182E+01	0.06094
30.00 TO 100.00	0.45034E+01	0.13598
> 100.00	0.25526E+02	0.77077

TOTAL MASS AIRBORNE= 0.33118E+02 FRAC. INERT AIRBORNE= 0.35194E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) = 1.00 INERT WT(G) = 0.942E+03 STD. DEV. = 8.00 # BINS = 4

SIZE RANGE(MICRONS)	MASS AIRBORNE	MASS AIRBORNE/TOTAL AIRBORNE
0.00 TO 3.00	0.24976E+00	0.00754
3.00 TO 10.00	0.82033E+00	0.02476
10.00 TO 30.00	0.20183E+01	0.06092
30.00 TO 100.00	0.45043E+01	0.13596
> 100.00	0.25538E+02	0.77082

TOTAL MASS AIRBORNE= 0.33130E+02 FRAC. INERT AIRBORNE= 0.35170E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) = 1.00 INERT WT(G) = 0.943E+03 STD. DEV. = 8.00 # BINS = 4

SIZE RANGE(MICRONS)	MASS AIRBORNE	MASS AIRBORNE/TOTAL AIRBORNE
0.00 TO 3.00	0.24972E+00	0.00753
3.00 TO 10.00	0.82032E+00	0.02475
10.00 TO 30.00	0.20185E+01	0.06090
30.00 TO 100.00	0.45052E+01	0.13593
> 100.00	0.25549E+02	0.77088

TOTAL MASS AIRBORNE= 0.33143E+02 FRAC. INERT AIRBORNE= 0.35147E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) = 1.00 INERT WT(G) = 0.944E+03 STD. DEV. = 8.00 # BINS = 4

SIZE RANGE(MICRONS)	MASS AIRBORNE	MASS AIRBORNE/TOTAL AIRBORNE
0.00 TO 3.00	0.24968E+00	0.00753
3.00 TO 10.00	0.82031E+00	0.02474
10.00 TO 30.06	0.20187E+01	0.06088
30.00 TO 100.00	0.45061E+01	0.13591
> 100.00	0.25561E+02	0.77094

TOTAL MASS AIRBORNE= 0.33156E+02 FRAC. INERT AIRBORNE= 0.35123E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) = 1.00 INERT WT(G) = 0.945E+03 STD. DEV. = 8.00 # BINS = 4

SIZE RANGE(MICRONS)	MASS AIRBORNE	MASS AIRBORNE/TOTAL AIRBORNE
0.00 TO 3.00	0.24964E+00	0.00753
3.00 TO 10.00	0.82031E+00	0.02473
10.00 TO 30.00	0.20188E+01	0.06087
30.00 TO 100.00	0.45069E+01	0.13588
> 100.00	0.25573E+02	0.77100

TOTAL MASS AIRBORNE= 0.33169E+02 FRAC. INERT AIRBORNE= 0.35099E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) = 1.00 INERT WT(G) = 0.946E+03 STD. DEV. = 8.00 # BINS = 4

SIZE RANGE(MICRONS)	MASS AIRBORNE	MASS AIRBORNE/TOTAL AIRBORNE
0.00 TO 3.00	0.24960E+00	0.00752
3.00 TO 10.00	0.82030E+00	0.02472
10.00 TO 30.00	0.20190E+01	0.06085
30.00 TO 100.00	0.45078E+01	0.13585
> 100.00	0.25585E+02	0.77105

TOTAL MASS AIRBORNE= 0.33181E+02 FRAC. INERT AIRBORNE= 0.35075E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) = 1.00 INERT WT(G) = 0.947E+03 STD. DEV. = 8.00 # BINS = 4

SIZE RANGE(MICRONS)	MASS AIRBORNE	MASS AIRBORNE/TOTAL AIRBORNE
0.00 TO 3.00	0.24957E+00	0.00752
3.00 TO 10.00	0.82029E+00	0.02471
10.00 TO 30.00	0.20192E+01	0.06083
30.00 TO 100.00	0.45087E+01	0.13583
> 100.00	0.25596E+02	0.77111

TOTAL MASS AIRBORNE= 0.33194E+02 FRAC. INERT AIRBORNE= 0.35052E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) = 1.00 INERT WT(G) = 0.948E+03 STD. DEV. = 8.00 # BINS = 4

SIZE RANGE(MICRONS)	MASS AIRBORNE	MASS AIRBORNE/TOTAL AIRBORNE
0.00 TO 3.00	0.24953E+00	0.00751
3.00 TO 10.00	0.82029E+00	0.02470
10.00 TO 30.00	0.20193E+01	0.06081
30.00 TO 100.00	0.45096E+01	0.13580
> 100.00	0.25606E+02	0.77117

TOTAL MASS AIRBORNE= 0.33207E+02 FRAC. INERT AIRBORNE= 0.35028E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) = 1.00 INERT WT(G) = 0.949E+03 STD. DEV. = 8.00 # BINS = 4

SIZE RANGE(MICRONS)	MASS AIRBORNE	MASS AIRBORNE/TOTAL AIRBORNE
0.00 TO 3.00	0.24949E+00	0.00751
3.00 TO 10.00	0.82028E+00	0.02469
10.00 TO 30.00	0.20195E+01	0.06079
30.00 TO 100.00	0.45104E+01	0.13578
> 100.00	0.25620E+02	0.77123

TOTAL MASS AIRBORNE= 0.33219E+02 FRAC. INERT AIRBORNE= 0.35005E-01

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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.950E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
    0.00 TO     3.00  0.24945E+00              0.00751
    3.00 TO    10.00  0.82028E+00              0.02468
   10.00 TO    30.00  0.20197E+01              0.06078
   30.00 TO   100.00  0.45113E-01              0.13575
          >   100.00  0.25631E+02              0.77128
 TOTAL MASS AIRBORNE=  0.33232E+02      FRAC. INERT  AIRBORNE= 0.34981E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.951E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
    0.00 TO     3.00  0.24941E+00              0.00750
    3.00 TO    10.00  0.82027E+00              0.02467
   10.00 TO    30.00  0.20198E+01              0.06076
   30.00 TO   100.00  0.45122E+01              0.13573
          >   100.00  0.25643E+02              0.77134
 TOTAL MASS AIRBORNE=  0.33245E+02      FRAC. INERT  AIRBORNE= 0.34958E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.952E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
    0.00 TO     3.00  0.24937E+00              0.00750
    3.00 TO    10.00  0.82026E+00              0.02466
   10.00 TO    30.00  0.20200E+01              0.06074
   30.00 TO   100.00  0.45130E+01              0.13570
          >   100.00  0.25655E+02              0.77140
 TOTAL MASS AIRBORNE=  0.33257E+02      FRAC. INERT  AIRBORNE= 0.34934E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.953E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
    0.00 TO     3.00  0.24934E+00              0.00749
    3.00 TO    10.00  0.82025E+00              0.02465
   10.00 TO    30.00  0.20202E+01              0.06072
   30.00 TO   100.00  0.45139E+01              0.13567
          >   100.00  0.25666E+02              0.77146
 TOTAL MASS AIRBORNE=  0.33270E+02      FRAC. INERT  AIRBORNE= 0.34911E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.954E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
    0.00 TO     3.00  0.24930E+00              0.00749
    3.00 TO    10.00  0.82025E+00              0.02465
   10.00 TO    30.00  0.20203E+01              0.06070
   30.00 TO   100.00  0.45147E+01              0.13565
          >   100.00  0.25678E+02              0.77151
 TOTAL MASS AIRBORNE=  0.33282E+02      FRAC. INERT  AIRBORNE= 0.34887E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.955E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
    0.00 TO     3.00  0.24926E+00              0.00749
    3.00 TO    10.00  0.82024E+00              0.02464
   10.00 TO    30.00  0.20205E+01              0.06068
   30.00 TO   100.00  0.45156E+01              0.13562
          >   100.00  0.25689E+02              0.77157
 TOTAL MASS AIRBORNE=  0.33295E+02      FRAC. INERT  AIRBORNE= 0.34864E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.956E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
    0.00 TO     3.00  0.24922E+00              0.00748
    3.00 TO    10.00  0.82024E+00              0.02463
   10.00 TO    30.00  0.20207E+01              0.06067
   30.00 TO   100.00  0.45165E+01              0.13558
          >   100.00  0.25701E+02              0.77163
 TOTAL MASS AIRBORNE=  0.33308E+02      FRAC. INERT  AIRBORNE= 0.34841E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.957E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
    0.00 TO     3.00  0.24918E+00              0.00748
    3.00 TO    10.00  0.82023E+00              0.02462
   10.00 TO    30.00  0.20208E+01              0.06065
   30.00 TO   100.00  0.45173E+01              0.13557
          >   100.00  0.25713E+02              0.77168
 TOTAL MASS AIRBORNE=  0.33320E+02      FRAC. INERT  AIRBORNE= 0.34817E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.958E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
    0.00 TO     3.00  0.24914E+00              0.00747
    3.00 TO    10.00  0.82022E+00              0.02461
   10.00 TO    30.00  0.20210E+01              0.06063
   30.00 TO   100.00  0.45182E+01              0.13555
          >   100.00  0.25724E+02              0.77174
 TOTAL MASS AIRBORNE=  0.33333E+02      FRAC. INERT  AIRBORNE= 0.34794E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.959E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
    0.00 TO     3.00  0.24911E+00              0.00747
    3.00 TO    10.00  0.82022E+00              0.02460
   10.00 TO    30.00  0.20212E+01              0.06061
   30.00 TO   100.00  0.45191E+01              0.13552
          >   100.00  0.25736E+02              0.77180
 TOTAL MASS AIRBORNE=  0.33345E+02      FRAC. INERT  AIRBORNE= 0.34771E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.960E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
    0.00 TO     3.00  0.24907E+00              0.00747
    3.00 TO    10.00  0.82021E+00              0.02459
   10.00 TO    30.00  0.20213E+01              0.06060
   30.00 TO   100.00  0.45199E+01              0.13550
          >   100.00  0.25748E+02              0.77185
 TOTAL MASS AIRBORNE=  0.33358E+02      FRAC. INERT  AIRBORNE= 0.34748E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.961E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
    0.00 TO     3.00  0.24903E+00              0.00746
    3.00 TO    10.00  0.82020E+00              0.02458
   10.00 TO    30.00  0.20215E+01              0.06058
   30.00 TO   100.00  0.45208E+01              0.13547
          >   100.00  0.25759E+02              0.77191
 TOTAL MASS AIRBORNE=  0.33371E+02      FRAC. INERT  AIRBORNE= 0.34725E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.962E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
    0.00 TO     3.00  0.24899E+00              0.00746
    3.00 TO    10.00  0.82019E+00              0.02457
   10.00 TO    30.00  0.20217E+01              0.06056
   30.00 TO   100.00  0.45216E+01              0.13545
          >   100.00  0.25771E+02              0.77197
 TOTAL MASS AIRBORNE=  0.33383E+02      FRAC. INERT  AIRBORNE= 0.34702E-01
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.963E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.24895E+00             0.00745
   3.00 TO    10.00  0.82019E+00             0.02456
  10.00 TO    30.00  0.20218E+01             0.06054
  30.00 TO   100.00  0.45225E+01             0.13542
          >  100.00  0.25782E+02             0.77202
 TOTAL MASS AIRBORNE=  0.33396E+02     FRAC. INERT  AIRBORNE= 0.34679E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.964E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.24891E+00             0.00745
   3.00 TO    10.00  0.82018E+00             0.02455
  10.00 TO    30.00  0.20220E+01             0.06052
  30.00 TO   100.00  0.45233E+01             0.13540
          >  100.00  0.25794E+02             0.77208
 TOTAL MASS AIRBORNE=  0.33408E+02     FRAC. INERT  AIRBORNE= 0.34656E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.965E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.24888E+00             0.00745
   3.00 TO    10.00  0.82017E+00             0.02454
  10.00 TO    30.00  0.20222E+01             0.06051
  30.00 TO   100.00  0.45242E+01             0.13537
          >  100.00  0.25805E+02             0.77214
 TOTAL MASS AIRBORNE=  0.33421E+02     FRAC. INERT  AIRBORNE= 0.34633E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.966E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.24884E+00             0.00744
   3.00 TO    10.00  0.82017E+00             0.02453
  10.00 TO    30.00  0.20223E+01             0.06049
  30.00 TO   100.00  0.45251E+01             0.13535
          >  100.00  0.25817E+02             0.77219
 TOTAL MASS AIRBORNE=  0.33433E+02     FRAC. INERT  AIRBORNE= 0.34610E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.967E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.24880E+00             0.00744
   3.00 TO    10.00  0.82016E+00             0.02452
  10.00 TO    30.00  0.20225E+01             0.06047
  30.00 TO   100.00  0.45259E+01             0.13532
          >  100.00  0.25828E+02             0.77225
 TOTAL MASS AIRBORNE=  0.33446E+02     FRAC. INERT  AIRBORNE= 0.34587E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.968E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.24877E+00             0.00744
   3.00 TO    10.00  0.82015E+00             0.02451
  10.00 TO    30.00  0.20226E+01             0.06045
  30.00 TO   100.00  0.45268E+01             0.13530
          >  100.00  0.25840E+02             0.77230
 TOTAL MASS AIRBORNE=  0.33458E+02     FRAC. INERT  AIRBORNE= 0.34564E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.969E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.24873E+00             0.00743
   3.00 TO    10.00  0.82015E+00             0.02450
  10.00 TO    30.00  0.20228E+01             0.06043
  30.00 TO   100.00  0.45276E+01             0.13527
          >  100.00  0.25852E+02             0.77236
 TOTAL MASS AIRBORNE=  0.33471E+02     FRAC. INERT  AIRBORNE= 0.34542E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.970E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.24869E+00             0.00743
   3.00 TO    10.00  0.82014E+00             0.02449
  10.00 TO    30.00  0.20230E+01             0.06042
  30.00 TO   100.00  0.45285E+01             0.13525
          >  100.00  0.25863E+02             0.77242
 TOTAL MASS AIRBORNE=  0.33483E+02     FRAC. INERT  AIRBORNE= 0.34519E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.971E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.24865E+00             0.00742
   3.00 TO    10.00  0.82013E+00             0.02448
  10.00 TO    30.00  0.20231E+01             0.06040
  30.00 TO   100.00  0.45293E+01             0.13522
          >  100.00  0.25875E+02             0.77247
 TOTAL MASS AIRBORNE=  0.33496E+02     FRAC. INERT  AIRBORNE= 0.34496E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.972E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.24861E+00             0.00742
   3.00 TO    10.00  0.82013E+00             0.02448
  10.00 TO    30.00  0.20233E+01             0.06038
  30.00 TO   100.00  0.45302E+01             0.13520
          >  100.00  0.25886E+02             0.77253
 TOTAL MASS AIRBORNE=  0.33508E+02     FRAC. INERT  AIRBORNE= 0.34474E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.973E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.24858E+00             0.00742
   3.00 TO    10.00  0.82012E+00             0.02447
  10.00 TO    30.00  0.20235E+01             0.06036
  30.00 TO   100.00  0.45310E+01             0.13517
          >  100.00  0.25898E+02             0.77258
 TOTAL MASS AIRBORNE=  0.33521E+02     FRAC. INERT  AIRBORNE= 0.34451E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.974E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.24854E+00             0.00741
   3.00 TO    10.00  0.82011E+00             0.02446
  10.00 TO    30.00  0.20236E+01             0.06035
  30.00 TO   100.00  0.45318E+01             0.13515
          >  100.00  0.25909E+02             0.77264
 TOTAL MASS AIRBORNE=  0.33533E+02     FRAC. INERT  AIRBORNE= 0.34428E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.975E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.24850E+00             0.00741
   3.00 TO    10.00  0.82011E+00             0.02445
  10.00 TO    30.00  0.20238E+01             0.06033
  30.00 TO   100.00  0.45327E+01             0.13512
          >  100.00  0.25[illegible]21E+02       0.77270
 TOTAL MASS AIRBORNE=  0.33546E+02     FRAC. INERT  AIRBORNE= 0.34406E-01
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EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.976E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.24846E+00            0.00740
   3.00 TO   10.00  0.82010E+00            0.02444
  10.00 TO   30.00  0.20239E+01            0.06031
  30.00 TO  100.00  0.45335E+01            0.13510
        >   100.00  0.25932E+02            0.77275
 TOTAL MASS AIRBORNE=  0.33558E+02      FRAC. INERT  AIRBORNE= 0.34383E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.977E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.24843E+00            0.00740
   3.00 TO   10.00  0.82009E+00            0.02443
  10.00 TO   30.00  0.20241E+01            0.06029
  30.00 TO  100.00  0.45344E+01            0.13507
        >   100.00  0.25944E+02            0.77281
 TOTAL MASS AIRBORNE=  0.33571E+02      FRAC. INERT  AIRBORNE= 0.34361E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.978E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.24839E+00            0.00740
   3.00 TO   10.00  0.82008E+00            0.02442
  10.00 TO   30.00  0.20243E+01            0.06028
  30.00 TO  100.00  0.45352E+01            0.13505
        >   100.00  0.25955E+02            0.77286
 TOTAL MASS AIRBORNE=  0.33583E+02      FRAC. INERT  AIRBORNE= 0.34338E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.979E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.24835E+00            0.00739
   3.00 TO   10.00  0.82008E+00            0.02441
  10.00 TO   30.00  0.20244E+01            0.06026
  30.00 TO  100.00  0.45361E+01            0.13502
        >   100.00  0.25966E+02            0.77292
 TOTAL MASS AIRBORNE=  0.33595E+02      FRAC. INERT  AIRBORNE= 0.34316E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.980E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.24831E+00            0.00739
   3.00 TO   10.00  0.82007E+00            0.02440
  10.00 TO   30.00  0.20246E+01            0.06024
  30.00 TO  100.00  0.45369E+01            0.13500
        >   100.00  0.25978E+02            0.77297
 TOTAL MASS AIRBORNE=  0.33608E+02      FRAC. INERT  AIRBORNE= 0.34294E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.981E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.24828E+00            0.00738
   3.00 TO   10.00  0.82006E+00            0.02439
  10.00 TO   30.00  0.20247E+01            0.06022
  30.00 TO  100.00  0.45377E+01            0.13497
        >   100.00  0.25989E+02            0.77303
 TOTAL MASS AIRBORNE=  0.33620E+02      FRAC. INERT  AIRBORNE= 0.34271E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.982E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.24824E+00            0.00738
   3.00 TO   10.00  0.82005E+00            0.02438
  10.00 TO   30.00  0.20249E+01            0.06021
  30.00 TO  100.00  0.45386E+01            0.13495
        >   100.00  0.26001E+02            0.77308
 TOTAL MASS AIRBORNE=  0.33633E+02      FRAC. INERT  AIRBORNE= 0.34249E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.983E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.24820E+00            0.00738
   3.00 TO   10.00  0.82005E+00            0.02437
  10.00 TO   30.00  0.20251E+01            0.06019
  30.00 TO  100.00  0.45394E+01            0.13492
        >   100.00  0.26012E+02            0.77314
 TOTAL MASS AIRBORNE=  0.33645E+02      FRAC. INERT  AIRBORNE= 0.34227E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.984E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.24816E+00            0.00737
   3.00 TO   10.00  0.82004E+00            0.02436
  10.00 TO   30.00  0.20252E+01            0.06017
  30.00 TO  100.00  0.45403E+01            0.13490
        >   100.00  0.26024E+02            0.77319
 TOTAL MASS AIRBORNE=  0.33657E+02      FRAC. INERT  AIRBORNE= 0.34205E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.985E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.24813E+00            0.00737
   3.00 TO   10.00  0.82004E+00            0.02436
  10.00 TO   30.00  0.20254E+01            0.06015
  30.00 TO  100.00  0.45411E+01            0.13487
        >   100.00  0.26035E+02            0.77325
 TOTAL MASS AIRBORNE=  0.33670E+02      FRAC. INERT  AIRBORNE= 0.34182E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.986E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.24809E+00            0.00737
   3.00 TO   10.00  0.82003E+00            0.02435
  10.00 TO   30.00  0.20255E+01            0.06014
  30.00 TO  100.00  0.45419E+01            0.13485
        >   100.00  0.26046E+02            0.77330
 TOTAL MASS AIRBORNE=  0.33682E+02      FRAC. INERT  AIRBORNE= 0.34160E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.987E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.24805E+00            0.00736
   3.00 TO   10.00  0.82002E+00            0.02434
  10.00 TO   30.00  0.20257E+01            0.06012
  30.00 TO  100.00  0.45428E+01            0.13482
        >   100.00  0.26058E+02            0.77336
 TOTAL MASS AIRBORNE=  0.33694E+02      FRAC. INERT  AIRBORNE= 0.34138E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =      1.00 INERT WT(G) = 0.988E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO    3.00  0.24802E+00            0.00736
   3.00 TO   10.00  0.82001E+00            0.02433
  10.00 TO   30.00  0.20259E+01            0.06010
  30.00 TO  100.00  0.45436E+01            0.13480
        >   100.00  0.26069E+02            0.77341
 TOTAL MASS AIRBORNE=  0.33707E+02      FRAC. INERT  AIRBORNE= 0.34116E-01
```

```
EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.989E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.24798E+00            0.00735
   3.00 TO    10.00  0.82001E+00            0.02432
  10.00 TO    30.00  0.20260E+01            0.06009
  30.00 TO   100.00  0.45444E+01            0.13477
         >   100.00  0.26081E+02            0.77347
 TOTAL MASS AIRBORNE=  0.33719E+02     FRAC. INERT  AIRBORNE= 0.34094E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.990E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.24794E+00            0.00735
   3.00 TO    10.00  0.82000E+00            0.02431
  10.00 TO    30.00  0.20262E+01            0.06007
  30.00 TO   100.00  0.45453E+01            0.13475
         >   100.00  0.26092E+02            0.77352
 TOTAL MASS AIRBORNE=  0.33731E+02     FRAC. INERT  AIRBORNE= 0.34072E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.991E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.24791E+00            0.00735
   3.00 TO    10.00  0.81999E+00            0.02430
  10.00 TO    30.00  0.20263E+01            0.06005
  30.00 TO   100.00  0.45461E+01            0.13472
         >   100.00  0.26103E+02            0.77358
 TOTAL MASS AIRBORNE=  0.33744E+02     FRAC. INERT  AIRBORNE= 0.34050E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.992E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.24787E+00            0.00734
   3.00 TO    10.00  0.81998E+00            0.02429
  10.00 TO    30.00  0.20265E+01            0.06003
  30.00 TO   100.00  0.45469E+01            0.13470
         >   100.00  0.26115E+02            0.77363
 TOTAL MASS AIRBORNE=  0.33756E+02     FRAC. INERT  AIRBORNE= 0.34028E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.993E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.24783E+00            0.00734
   3.00 TO    10.00  0.81998E+00            0.02428
  10.00 TO    30.00  0.20267E+01            0.06002
  30.00 TO   100.00  0.45478E+01            0.13468
         >   100.00  0.26126E+02            0.77369
 TOTAL MASS AIRBORNE=  0.33768E+02     FRAC. INERT  AIRBORNE= 0.34006E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.994E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.24780E+00            0.00734
   3.00 TO    10.00  0.81997E+00            0.02427
  10.00 TO    30.00  0.20268E+01            0.06000
  30.00 TO   100.00  0.45486E+01            0.13465
         >   100.00  0.26137E+02            0.77374
 TOTAL MASS AIRBORNE=  0.33781E+02     FRAC. INERT  AIRBORNE= 0.33985E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.995E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.24776E+00            0.00733
   3.00 TO    10.00  0.81996E+00            0.02426
  10.00 TO    30.00  0.20270E+01            0.05998
  30.00 TO   100.00  0.45494E+01            0.13463
         >   100.00  0.26149E+02            0.77380
 TOTAL MASS AIRBORNE=  0.33793E+02     FRAC. INERT  AIRBORNE= 0.33963E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.996E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.24772E+00            0.00733
   3.00 TO    10.00  0.81995E+00            0.02426
  10.00 TO    30.00  0.20271E+01            0.05996
  30.00 TO   100.00  0.45503E+01            0.13460
         >   100.00  0.26160E+02            0.77385
 TOTAL MASS AIRBORNE=  0.33805E+02     FRAC. INERT  AIRBORNE= 0.33941E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.997E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.24768E+00            0.00732
   3.00 TO    10.00  0.81995E+00            0.02425
  10.00 TO    30.00  0.20273E+01            0.05995
  30.00 TO   100.00  0.45511E+01            0.13458
         >   100.00  0.26171E+02            0.77390
 TOTAL MASS AIRBORNE=  0.33817E+02     FRAC. INERT  AIRBORNE= 0.33919E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.998E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.24765E+00            0.00732
   3.00 TO    10.00  0.81994E+00            0.02424
  10.00 TO    30.00  0.20274E+01            0.05993
  30.00 TO   100.00  0.45519E+01            0.13455
         >   100.00  0.26183E+02            0.77396
 TOTAL MASS AIRBORNE=  0.33830E+02     FRAC. INERT  AIRBORNE= 0.33898E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.999E+03 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.24761E+00            0.00732
   3.00 TO    10.00  0.81993E+00            0.02423
  10.00 TO    30.00  0.20276E+01            0.05991
  30.00 TO   100.00  0.45527E+01            0.13453
         >   100.00  0.26194E+02            0.77401
 TOTAL MASS AIRBORNE=  0.33842E+02     FRAC. INERT  AIRBORNE= 0.33876E-01

EXPLOSION RADIOACTIVE SOURCE TERM
TNT WT(G) =     1.00 INERT WT(G) = 0.100E+04 STD. DEV. = 8.00 # BINS = 4
SIZE RANGE(MICRONS) MASS AIRBORNE MASS AIRBORNE/TOTAL AIRBORNE
   0.00 TO     3.00  0.24757E+00            0.00731
   3.00 TO    10.00  0.81992E+00            0.02422
  10.00 TO    30.00  0.20278E+01            0.05990
  30.00 TO   100.00  0.45536E+01            0.13450
         >   100.00  0.26205E+02            0.77407
 TOTAL MASS AIRBORNE=  0.33854E+02     FRAC. INERT  AIRBORNE= 0.33854E-01
```

APPENDIX D

FILE

DETIN COMPUTER CODE

```
      PROGRAM DETIN
C     THIS PROGRAM CALCULATES THE AMOUNT AND SIZE DISTRIBUTION
C     OF THE AEROSOL PRODUCED BY A DETONATION OF A GIVEN AMOUNT
C     OF TNT MIXED WITH A GIVEN AMOUNT OF INERT MATERIAL. FOR
C     EXPLOSI E MATERIALS OTHER THAN TNT, THE TNT EQUIVALENT
C     WEIGHT OF THE MATERIAL IS USED. GIVEN A USER SUPPLIED
C     STANDARD DEVIATION OF THE AIRBORNE MATERIAL, THE DISTRI-
C     BUTION OF THE AEROSOL IN UP TO 2Ø DISCRETE SIZE RANGES
C     MAY BE CALCULATED. THIS CODE IS BASED ON THE WORK OF
C     STEINDLER AND SEEFELDT AS DESCRIBED IN THE DETIN USER'S
C     MANUAL.
      DIMENSION D(2Ø),T(2Ø),DELTA(2Ø),B(6),X(2Ø),P(2Ø),XMASS(2Ø)
     +,A(5),Y(2Ø),Z(2Ø)
      DATA A/Ø.31938153,-Ø.356563782,1.781477937,-1.821255978,
     +1.33Ø274429/
      DATA B/2.5Ø52367,1.28312Ø4,Ø.2264718,Ø.13Ø6469,-Ø.Ø2Ø249Ø,
     +Ø.ØØ39132/
      OPEN(UNIT=5,NAME='READ.DAT',TYPE='OLD',READONLY)
      OPEN(UNIT=6,NAME='EXPLO.DAT',TYPE='NEW',FORM='FORMATTED')
      READ(5,1Ø)TNTWT,WTIN,STDEV,N,(D(I),I=1,N)
   1Ø FORMAT(F8.2,E1Ø.3,F5.2,I2,2Ø(F7.2))
      WRITE(6,2Ø)TNTWT,WTIN,STDEV,N
   2Ø FORMAT(1HØ,'EXPLOSION RADIOACTIVE SOURCE TERM',/,' TNT WT ='
     +,F8.2,' INERT WT=',E1Ø.3,' STD. DEV. =',F5.2,' # BINS =',I2)
      TXMASS=Ø.Ø
      XMR=WTIN/TNTWT
C     THE CALCULATIONS OF XMED ARE BASED ON VISUAL ESTIMATION
C     OF THE CURVE PRESENTED IN STEINDLER AND SEEFELDT.
      IF(XMR.LE.1.)XMED=Ø.5
      IF(XMR.LE.2.AND.XMR.GT.1.)XMED=(XMR-1.)*21.8+3.3
      IF(XMR.LE.3.AND.XMR.GT.2.)XMED=(XMR-2.)*16.Ø+25.1
      IF(XMR.LE.4.AND.XMR.GT.3.)XMED=(XMR-3.)*11.1+41.1
      IF(XMR.LE.5.AND.XMR.GT.4.)XMED=(XMR-4.)*8.9+52.2
      IF(XMR.LE.6.AND.XMR.GT.5.)XMED=(XMR-5.)*7.Ø+61.1
      IF(XMR.GT.6.)XMED=35.78*(XMR)**Ø.3753
C     THE CALCULATION OF RATIO IS BASED ON AN EXPONENTIAL
C     FIT OF THE RESULTS PRESENTED IN STEINDLER AND SEEFELDT.
      RATIO=1.Ø235*(XMR)**Ø.3617
      TMASS=RATIO*TNTWT
      IF(N.EQ.Ø)GO TO 99
      DO 7 I=1,N
      X(I)=(ALOG(D(I))-ALOG(XMED))/ALOG(STDEV)
C     THE CALCULATION OF Z(I),P(I),AND T(I) ARE BASED ON
C     APPROXIMATIONS OF THE NORMAL DISTRIBUTION AND THE
C     CUMULATIVE NORMAL DISTRIBUTION FUNCTIONS AS GIVEN
C     BY ABRAMOWITZ.
      Z(I)=(B(1)+B(2)*X(I)**2+B(3)*X(I)**4+B(4)*X(I)**6
     Q+B(5)*X(I)**8+B(6)*X(I)**1Ø)**-1.Ø
      IF(X(I))1,2,3
    1 Y(I)=ABS(X(I))
      GO TO 4
    2 P(I)=Ø.5
      GO TO 5
    3 Y(I)=X(I)
    4 CONTINUE
      T(I)=(1.Ø+Ø.2316419*Y(I))**-1.Ø
      P(I)=1.Ø-Z(I)*(A(1)*T(I)+A(2)*T(I)**2+A(3)*T(I)**3
     Q+A(4)*T(I)**4+A(5)*T(I)**5)
      IF(X(I).LE.Ø.)P(I)=1.Ø-P(I)
    5 CONTINUE
      IF(I.EQ.1)THEN
      DELTA(I)=P(I)
      GO TO 6
      END IF
      DELTA(I)=P(I)-P(I-1)
```

```
  6 XMASS(I)=DELTA(I)*TMASS
  7 TXMASS=TXMASS+XMASS(I)
    ENDMASS=TMASS-TXMASS
    ENDELT=ENDMASS/TMASS
    WRITE(6,40)
 40 FORMAT(1H ,4X,'SIZE RANGE',5X,'MASS AIRBORNE',
   +' MASS AIRBORNE/TOTAL AIRBORNE')
    DI=0.0
    WRITE(6,50)DI,D(1),XMASS(1),DELTA(1)
 50 FORMAT(1H ,F7.2,' TO ',F7.2,1X,E12.5,11X,F7.5)
    DO 8 I=1,N-1
    WRITE(6,50)D(I),D(I+1),XMASS(I+1),DELTA(I+1)
  8 CONTINUE
    WRITE(6,60)D(N),ENDMASS,ENDELT
 60 FORMAT(1H ,7X,'  > ',F7.2,1X,E12.5,11X,F7.5)
 99 WRITE(6,30)TMASS
 30 FORMAT(1H ,' TOTAL MASS AIRBORNE= ',E12.5)
    END
```

APPENDIX E

LETTER FROM G. W. MCNAIR TO J. MISHIMA ON CRITICALITY EXCURSION MODELS

Battelle
Pacific Northwest Laboratories

Project Number__________

Internal Distribution

CL Brown
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File/LB

Date March 26, 1980

To J. Mishima

From G. W. McNair

Subject A Review of Criticality Excursion Models

A criticality accident is an event that results in the uncontrolled release of energy and radioactive by-products from an assemblage of fissile material. In a fuel reprocessing plant, MOX Fuel Fabrication Plant, or Waste Management Facilities conditions that might lead to criticalities are carefully avoided because of the potential for adverse physical and radiological effects. However, experience with these and related facilities has demonstrated that criticality accidents can occur.

A criticality accident might be initiated[1] by (1) inadvertant transfer or leakage of a solution of fissile material (or powder) from a geometrically safe vessel into an area or vessel not so designed, (2) introduction of excess fissile material to a vessel, (3) introduction of excess fissile material to a solution, (4) overconcentration, (5) failure to maintain sufficient neutron absorbing materials in a vessel, (6) precipitation of fissile solids from a solution and their retention in a vessel, (7) introduction of neutron moderators or reflectors, (8) deformation of or failure to maintain safe storage arrays, or (9) similar actions that can lead to increases in the reactivity of fissile systems.

This report reviews the models currently available that can be used to estimate the mass and/or energy generated by criticality accidents involving liquid or powder systems. The adequacy of the various methods and suggested areas where improvements need to be developed are discussed.

Three sets of data are available on criticalities that have occured in liquid systems. There is currently no benchmark data available for criticality accidents involving powder systems. Data for solution criticalities are obtained from the following:

- Kinetics Experiments on Water Boilers[2]
- French Criticality Excursion Experiments[3]
- Various accidents involving U or Pu Solutions[4]

The Kinetic Experiments on Water Boilers (KEWB) program was initiated by Atomics International under contract to the Atomic Energy Commission in October, 1954. The objective of the program was to establish a firm basis for the evaluation of the safety of aqueous homogeneous reactor designs with regards to an accidental release of large amounts of reactivity. Approximately 900 power excursions were initiated during the testing of a small spherical aqueous homogeneous reactor core. The reactor was fueled with a highly enriched (93% U^{235}) uranyl sulfate solution.

In November, 1968, the Service d'Etudes de Criticite of the French Commissariate a l'Energie Atomique initiated a program designed to provide data on the consequences of exceeding delayed criticality with various aqueous solutions of uranyl nitrate. In this program a series of experiments were performed in which aqueous uranyl nitrate solutions at various concentrations were injected into a large diameter cylinder to heights in excess of the critical height. The uranium was 93% enriched in U^{235}.

In addition to these two sets of experimental data, criticality incidents have occurred in approximately one dozen facilities that involved aqueous solutions of uranium or plutonium. A summary of the data concerning these accidents is presented in Table 1.

The methods utilized to estimate the energy generated in various criticality accidents have ranged from the work done by Woodcock(5) (in which he suggested that a maximum of 3×10^{18} and 3×10^{19} fissions could occur in solution systems of 100 gallons or less and more than 100 gallons, respectively), to the work done by Peterson and others(6-9) (in which complex computer codes have been developed to couple kinetics with thermodynamics and hydrodynamics).

Woodcock's values for the total fission yield for solution systems are largely subjective. The estimates are based on reviewing the energy released from previous solution criticalities. It is noted that the suggested yields are not intended to describe the maximum yield possible, but are an attempt to describe a yield that should be assumed in making plans to deal with possible emergencies. Woodcock assumed that it would be unrealistic to plan on the basis of the maximum yield possible since this might be very high and would require elaborate plans for an emergency that has a negligible probability of occurring.

Another attempt to describe the total number of fissions from accidental criticalities occurring in uranium or plutonium systems was developed by Olsen et.al. at Battelle Northwest Laboratories[10]. The Battelle model was an empirical fit to the French critical solutions experiments. The model makes no attempt to model the actual physical phenomena occurring within a criticality accident and relies solely on the user's discretion as to the length of time the excursion will continue. The model requires only the volume of the critical solution and an estimate of the duration of the event to predict the total amount of fissions that will occur. The model was developed for predicting the number of fissions for criticalities in highly enriched uranium solutions. The model may be used for plutonium and slightly enriched uranium systems, though the energy release will be conservatively high because of the presence of isotopes that undergo spontaneous fissions. A comparison of the total energy release predicted by the model with the actual energy releases of five accidental excursions (Table 2) shows the model predicts a higher energy release by a factor of 2 to 30 for four of five cases. In the fifth case (Separations plant criticality accident at the Idaho Falls Reactor Test Site) the model underpredicted the total energy by a factor of 10. In modeling excursions for plutonium systems, the model predicts a 3 to 20 times higher energy release and in one instance, 1600 times higher. In all cases, the model's predicted energy release lies between 1.4×10^{18} and 2.8×10^{18} fissions which compares very closely to the estimate of total fissions made by Woodcock.

An additional empirical model has been developed by Tuck[11] that describes (1) the maximum number of fissions occurring during any 5-second interval, (2) the total number of fissions from an excursion, and (3) the maximum fission rate and associated pressures generated. The Tuck model was developed for both plutonium and uranium solution excursions. The information required as input to this model is the tank geometry, fill rate, and a source initiating parameter (taken from a table). The model was developed using the information obtained from the French Criticality Excursion Experiments and the Kinetics Experiments on Water Boilers. A series of curve fits were used to describe reactivity addition rates and shutdown coefficients that were used to develop the final equations. The estimates calculated by the Tuck model for the total number of fissions generated from a solution excursion show a very close comparison with those estimated by the Battelle model. The Tuck model is applicable only to solution systems that can be described within the following restrictions: (1) the volume must be represented by a cylinder with vertical sides, (2) the cylinder bottom must be 30 cm or more above a good reflecting material such as concrete, (3) the tank diameter must be between 28 and 152 cm, (4) the tank must be in a typical process area where the heat transfer from the tank to the environment is no greater than a bare tank cooled by room air, (5) the vent pipes must be designed such that little venting steam will condense and drain back into the tank, (6) the fill rate must be between 0.47 and 0.006 liter/sec, and (7) the fissile solutions must not have concentrations greater than 500 g/liter.

A more rigorous treatment of criticality excursions is found in the computer programs developed for modeling LMFBR disassembly accidents. These models couple together neutron kinetics, thermodynamics, and hydrodynamics to describe the phenomena occurring within molten solutions of sodium, steel, and mixed-oxide fuel. The main focus of these programs is directed towards predicting recriticalities during disruptive accidents rather than mass releases. The characteristics of three of these codes are listed below.

The FX2-POOL[6,7,12] computer program couples the FX2 neutronics code (space-dependent kinetics treatment based on diffusion theory) with the POOL Thermodynamic-Hydrodynamic computer code. Both of these codes utilize two dimensional cylindrical (R-Z) geometry and have fixed spatial (Eulerian) grids. Reactivity feedback due to both Doppler broadening of the cross sections and displacement (material motion) is treated explicitly. FX2 calculates temperature adjusted cross sections for each mesh cell based on material and temperature-dependent nine-group cross sections. Explicit K-calculations are then performed for determining changes in the state of criticality due to temperature and material motion effects. The thermodynamics and hydrodynamics were developed specifically to analyze boiling pools of fuel and steel.

The PAD[8,12] computer code is a coupled neutronic-hydrodynamic program that evolved from computer models developed to analyze weapons explosions, burst reactor transients, and later, the KIWI-TNT reactor-destruction experiment. Three one-dimensional geometries (spherical, cylindrical, and rectangular) are available, and the calculation is performed on a Lagrangian grid. Doppler reactivity feedback is determined at each time step for each mass point. The Doppler feedback is mass point weighted as in FX2-POOL, but not weighted spatially according to a neutron importance function. Energy deposition and displacement reactivity feedback are provided in a manner similar to FX2-POOL with the state of criticality, fluxes, powers, etc. being determined by explicit neutron transport calculations.

The VENUS-II[9,12] neutronic hydrodynamic code was developed to analyze postulated LMFBR disassembly accidents. The code utilizes two dimensional R-Z geometry with Lagrangian hydrodynamics. Doppler reactivity feedback is calculated via an equation similar to that in the PAD code. The difference is that the change in reactivity due to a temperature rise is calculated for zone (mass) averaged temperatures with a weighting coefficient input to each core zone. Reactivity changes due to material motion are calculated from an input tabulation of spatially dependent reactivity worths. Both reactivity worths and spatial power distributions must be predetermined by a R-Z diffusion theory or transport theory calculation.

These three programs are typical of the programs that have been used to describe and analyze LMFBR disassembly accidents. Although they require modifications before they may be considered adequate to analyze solution or powder criticalities, they offer the best starting point from which future programs could be developed. The PAD computer program (without modifications) has been used to analyze powder criticalities[13]. The analysis was done for uranium oxide and mixed oxide powders with low water content, and high reactivity insertion rates. The analysis was performed for initial fission spikes only with no recriticality mechanisms considered. The shutdown mechanism was due to the expansion of the water vapor that initiated disassembly.

In addition to the coupled models listed above, a code is currently under development at Battelle's Pacific Northwest Laboratories to describe criticality excursions within spent fuel storage basins. This code couples together neutronics and thermohydraulics in such a manner as to describe excursions within fuel storage basins including shutdown mechanisms. With the development and implementation of additional shutdown models in the code it is expected that a full range of criticality excursions for various material compositions and configurations could be analyzed.

The review of the models that have been used in the past shows the empirical models, as a group, are very limited in their range of applicability and do not guarantee any more than a first-cut estimate of the energy releases to be expected during solution excursions. The empirical models in "actual practice" generate an estimated total fission yield of the same magnitude as suggested by Woodcock. The number for the total fission yields estimated by Woodcock will give the same accuracy as the empirical models.

The review of the coupled models show these methods offer the best estimate of energy and mass balance available. These codes have not been developed within the framework of solution or powder excursions and therefore require modifications. The coupled computer codes are now capable of providing models for shutdown mechanisms such as density changes, voiding, doppler feedback, and convection. They, at present, do not adequately address the areas of radiolytic gas formation, volatile separation, evaporative boiling loss, neutron precursor changes with density, or significant boiling and mass separation. It is felt that the proper analysis for solution or powder criticalities should contain models to represent these mechanisms.

A starting point to begin development of a model could be provided by the coupled computer code presently under development at the Pacific Northwest Laboratories. This model incorporates the presently available shutdown mechanisms and provides a framework for future additions. The anticipated cost to develop and implement the improvements that are needed to adequately answer questions concerning solution or powder excursions is $100,000 to $200,000. This range of funding would provide a model that could be used industry-wide for environmental and criticality safety analysis for all ranges of criticality excursions.

TABLE 2.[10] Comparison of Total Energy Release Predicted by Battelle Model and Actual Energy Release of Past Criticality Accidents

No.	Location	Characteristics of Fissile Material System: Form	Mass, Kg Fissile	Volume, ℓ	Duration of Excursion Min.	Number of Fissions (x 10^{17}): Actual Excursion, Initial Burst	Actual Excursion, Total	Predicted By BNW Model, Initial Burst	Predicted By BNW Model, Total
P-1	Y12	$UO_2(NO_3)_2$ (a)	2.5	56	13	∼ 0.1	13.0	0.8	21.0
P-2	LASL	Pu/Organic	3.3	168	< 1	1.5	1.5	2.0	16.7
P-3	IF	$UO_2(NO_3)_2$ (a)	34.5	800	20	1.0	400.	7.1	28.1
P-4	IF	$UO_2(NO_3)_2$ (a)	8.0	40	< 1	∼ 0.6	6.0	0.6	15.3
P-5	Hanford	Pu Complex	1.5	∼ 60	2220	∼ 0.1	8.0	0.9	27.4
P-6	Wood River	$UO_2(NO_3)_2$ (a)	2.6	∼ 70	< 1	1.1	1.3	1.0	15.7
P-7	Windscale	Pu/Organic	2.5	∼ 100	< 1	0.01	0.01	1.3	16.0
SE-2	ORNL	$Pu(NO_3)_4$	1.15	64	< 1	∼ 0.8	0.8	0.9	15.6
SE-3	ORNL	UO_2F_2	18.3	55	< 1	0.5	0.5	0.8	15.5
SE-5	ORNL	$^{233}UO_2(NO_3)_2$	∼ 1.0	5.8	< 1	0.11	0.11	0.1	14.8

(a) Uranium Enrichment ∼ 93 wt% ^{235}U

TABLE 1[4]

A Review of Solution Criticality Excursions

Date	Location	Fissionable Material	Arrangement	Cause	Physical Damage
December 1949	LASL. New Mexico	$U(93)O_2(NO_3)_2$ (~ 1 kg ^{235}U; 136 ℓ)	Sphere, graphite-reflected	Control rods withdrawn too fast	None
November 16, 1951	Hanford Works Richland, Washington	$PuO_2(NO_3)_2$ (1.15 kg Pu; 63.8 ℓ)	Sphere, 93% full reflected	Too high fuel addition	None
May 26, 1954	ORNL, Tennessee	UO_2F_2 (18.3 kg ^{235}U; 55.4 ℓ)	Cylindrical annulus unreflected	Shift of poison	None
February 1, 1956	ORNL, Tennessee	UO_2F_2 (27.7 kg ^{235}U; 58.9 ℓ)	Cylinder unreflected	Geometry change	Warping of bottom of cylinder (geyser).
January 30, 1968	ORNL, Tennessee	$UO_2(NO_3)_2$ (~1 kg ^{233}U; 5.8 ℓ)	Sphere water-reflected	Air in line	None
June 16, 1958	ORNL, Tennessee Y-12 Processing Plant	$UO_2(NO_3)_2$ (2.5 kg ^{235}U; 56 ℓ)	Cylinder concrete reflected below	Valve leaked or left open	None (loss: $1,000)
December 30, 1958	LASL New Mexico Pu Processing Plant	$PuO_2(NO_3)_2$ (3.27 kg Pu; 168 ℓ)	Cylinder water reflected below	Procedure not followed	None
October 16, 1959	Idaho Reactor Testing Area, Chemical Processing Plant	$UO_2(NO_3)_2$ (34.5 kg ^{235}U; ~800 ℓ)	Cylinder concrete reflected below	Sparge gauge plugged	None (loss: $62,000)
January 25, 1961	Idaho Reactor Testing Area, Chemical Processing Plant	$UO_2(NO_3)_2$ (8 kg ^{235}U; 40 ℓ)	Cylinder	Instructions misinterpreted	None (loss: $6,000)
April 7, 1962	Hanford Works Richland Washington	Pu complex (1.5 kg Pu)	Cylinder unreflected	Valve leaked or opened	None (loss: $1,000)
July 24, 1964	Wood River Junction, R.I., scrap recovery facility	$UO_2(NO_3)_2$ (2.64 kg ^{235}U)	Cylinder unreflected	Procedure not followed	None
August 24, 1970	Windscale Works, England	Pu complex (~2.5 kg Pu; ~100 ℓ)	Cylinder	Pu accumulated in organic	None

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APPENDIX F

ACRONYMS AND ABBREVIATIONS

APPENDIX F

ACRONYMS AND ABBREVIATIONS

AAH	Accident Analysis Handbook
ADU	Ammonium Diuranate
AED	Aerodynamic Equivalent Diameter (see GLOSSARY)
AFRP	Advanced Fuel Reprocessing Plant
AGNS	Allied General Nuclear Services
AMMD	Aerodynamic Mass Median Diameter (see GLOSSARY)
ANS	American Nuclear Society
ANSI	American National Standards Institute
Arch	Archimedes Number (see GLOSSARY)
BWR	Boiling Water Reactor
CFR	Code of Federal Regulations
COG	Cell Off-Gas
CUP	Cask Unloading Pool
DETIN	A preliminary computer code to estimate the airborne release of fragments from the effects of detonations on solids and liquids (not suggested for estimating airborne releases of powders from the effects of detonation)
DF	Decontamination Factor
DOG	Dissolver Off-Gas
DRM	Deterministic Burning Model
DUO	Depleted Uranium Dioxide
ED_e	Effective Energy Density
EXPAC	Explosion Analysis Code
FIRAC	Fire Analysis Code
FIRIN	Fire Source Term Code
FMRC	Factory Mutual Research Corporation
Fr	Froude Number (see Glossary)
Ga	Galileo Number (see Glossary)
GB	Glove Box
GD	Geome[illegible] Diameter (see GLOSSARY)
GPC	General Purpose Concentrator
HAF	The feed for the HA column in the PUREX process
HAP	The HA column product in the PUREX process
HEPA	High Efficiency Particulate Air (Filter) (see GLOSSARY)
HLLW	High Level Liquid Waste
HLW	High Level Waste
HT	Hydrogen Tritium
HVAC	Heating Ventilation and Air-Conditioning
ILW	Intermediate Level (liquid) Waste
IRM	Idealized Reference Burning Model
ISFSI	Independent Spent Fuel Storage Installation
LANL	Los Alamos National Laboratory
LFCM	Liquid Fed Ceramic Melter

LMFBR	Liquid Metal Fast Breeder Reactor
LWR	Light Water Reactor
MMD	Mass Median Diameter (see GLOSSARY)
MOX	Mixed Oxides of Uranium and Plutonium Used for Nuclear Fuel
MR	Effective Mass Ratio
MRS	Monitored Retrievable Storage
MTHM	Metric Ton Heavy Metal
MTU	Metric Ton Uranium
MWD	Megawatt Day
NFS	Nuclear Fuel Services
NPH	Normal Paraffin Hydrocarbon
NRC	Nuclear Regulatory Commission
PBM	Probabilistic Burning Model
PMMA	Polymethylmethacrylate
PNL	Pacific Northwest Laboratory
PP	Polypropylene
PREL	Powder Pressurized Release Code
PS	Polystyrene
PSPILL	Powder Spill Code
PVC	Polyvinyl chloride
PWR	Pressurized Water Reactor
Re	Reynolds Number (see Glossary)
SRP	Savannah River Plant
SX	Solvent Extraction
TBP	Tributyl Phosphate
TORAC	Tornado Accident Code
UNH	Uranyl Nitrate Hexahydrate
VOG	Vessel Off-Gas
We	Weber Number (see Glossary)
1AU	The Uranium Stream From the 1A column in the PUREX process
2SU	The uranium stream from the 2S column in the PUREX process

APPENDIX G

GLOSSARY

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GLOSSARY

Aerodynamic Entrainment:	The suspension of material lying on an exposed surface due to the action of air passing over the powder parallel to the surface.
Aerodynamic Equivalent Diameter (AED):	A sphere of density 1.0 g/cm^3 with the aerodynamic behavior equivalent to the particle measured.
Aerodynamic (Equivalent) Mass Median Diameter (AMMD):	The AED of particles in a given size distribution for which half the mass is associated with particles greater than and half the mass associated with particles less than the stated size.
Agglomeration:	The adherence of a particle to another upon collision to produce a particle of larger size and, for solids, less dense.
Archimedes Number:	Dimensionless number used in fluidization; gravitational force/viscous force
Branches:	A connecting member between upstream and downstream nodal points. A branch contains one component. (Ducts, dampers, filters, and blowers are components that can exist in a branch).
Bulk Flow:	The assumption that the flow of air through a space proceeds in a given direction at a uniform fashion in all areas of the space.
Canyon:	A series of interconnected containments.
Catastrophic Failure:	The sudden and essentially complete loss of containment of a structure or piece of equipment.
Cellulosics:	Materials that are primarily cellulose in various forms (e.g., paper, cardboard, cloth).
Combustible:	Materials which can burn. A relative term - many materials will burn under one set of conditions and will not burn under another set of conditions. Does not indicate ignition, burning intensity, or rate of burning unless modified by adjectives such as highly (from Appendix E, <u>Fire</u>

Protection Handbook, 14th Edition, G. P. McKinnon and K. Tower, Ed., National Fire Protection Association, Boston, Massachusetts, 1976).

Consequence Assessment: Determination of emissions of radioactive materials to the environment and within the facility resulting from an accident in the facility.

Conservative: An assumption that maximizes the adverse effect or condition in the face of uncertainties in the parameters.

Crush-Impact: The forces/energies imposed upon a material by masses compressing the material (crush) or upon striking a harder, essentially unyielding surface.

Decanter: Equipment used in the PUREX process to remove organic materials that have separated from acidic solution.

Decontamination Factor (DF): The ratio of the initial concentration to the final concentration resulting from a process.

Descriptors: Structural and process parameters essential to source term calculations.

Detonation: A rapid (the energy is released in microseconds) explosion where the source of energy is a chemical reaction. Generally, a detonation involves condensed phase materials, but vapor phase chemical reactions can accelerate to detonations.

Engineered Control Devices/Systems: Devices or systems designed to control the emission of radionuclides during processing (e.g., scrubbers, filters, off-gas systems).

Evaporator-denitrator: Equipment used in the PUREX process to reduce volume and decrease the amount of nitrate present.

Exponential Dilution: The assumption that air entering a volume will be immediately well mixed with the entire volume and air extracted from the volume will have the same concentration of material as found in the volume.

Froude Number: Dimensionless number used in wave and surface behavior; inertial force/gravitational force.

Flammable: Combustible materials that ignite readily, burn intensely and have a rapid rate of flame spread. Flammable in the general sense does not refer to any specific numerical limits such as ignition temperature, rate of burning or other properties. When specific numerical limits are necessary, categories such as Class I or Class II Flammable Liquids are used. (Fire Protection Handbook).

Galileo Number:	Dimensionless Number important in circulation of viscous liquid; Reynolds Number x gravity force/viscous force.
Geometric Diameter (GD):	The diameter of a sphere equivalent in cross-section to the particle measured.
Geometric Standard Deviation (GSD):	The slope of a size distribution plotted on log-normal scale. The standard deviation of the logarithm of the diameters of particles in a size distribution.
Geometrically Unsafe:	A vessel or container whose dimensions do not provide adequate safety for use with relatively pure/high concentrations of fissile materials.
Grout:	A cement-like material used to incorporate small quantities of radionuclides (added as dilute solutions or slurries) in its matrix or contain the radionuclides.
Hardened Area:	The area within a nuclear-grade facility that will remain functional under all credible accident conditions.
HEPA:	Filters designed to remove submicron particles with a high (>99.97%) collection efficiency.
In-can Melting:	High level liquid waste vitrification process in which the waste and glass frit are fed to a can, then heated to form glass.
Inventory-at-risk:	Amount of radionuclides present that could potentially be subjected to the suspension mechanisms postulated.
Mass Median Diameter (MMD):	The diameter of particles in a given size distribution for which half the mass is associated with particles greater than and half the mass associated with particles less than the stated size.

Material-at-risk: The amount of material that could potentially be exposed to the event conditions that would result in adverse consequences.

Node: A connection point or junction for one or more branches. Volume elements such as rooms, gloveboxes, and plenums are defined as capacitance nodes. The compressibility of the system fluid is taken into account at these capacitance nodes. Boundary points (inlets and exhaust) are defined at nodes. System pressure and material concentration also are defined at nodes.

Nonfissile Uranium: Primarily ^{238}U.

Nuclear Criticality Excursion: An inadvertent nuclear chain reaction which is terminated after a finite period.

Nuclear-grade Facility: A facility designed to contain large inventories of radionuclides in a safe manner. The structures and critical systems for the safe operation of the facility will withstand all maximum credible events postulated for the facility at a specific locale. Most are substantial structures with directional air systems (air is directed by pressure gradient from uncontaminated to more contaminated areas in the facility). The facilities generally include systems to safely handle the hazardous materials used in processing and many essential systems have separate back-up or parallel systems.

Particulate Matter: Matter (solid or liquid) that is subdivided into discrete particles.

Primary Sample Problems (Illustrative Examples): Sample problems which are carried through all the chapters in the AAH.

PUREX: Process using solvent extraction and ion exchange for separating plutonium and uranium from irradiated nuclear fuel.

Radiolysis: Dissociation of molecules by radiation.

Radiolytic: Material generated by radiolysis.

Red Oil: A product of solvent degradation in Pu concentrators. It consists of various forms of tributyl phosphate and degraded TBP compounds.

Release Factor:	Ratio of the amount airborne to the amount in a source.
Representative System:	A large (37 branches, 22 nodes) ventilation system that features natural bypass around rooms, recirculation, combinations of series and parallel component arrangements, rooms with multiple inlets and outlets, and duct friction.
Respirable Size Range:	The diameter of particles that will be inhaled by humans and be deposited in the deep lung. For the purposes of this report, the respirable size range is "conservatively" assumed to be particles 10 micrometers AED and less.
Reynolds Number:	Dimensionless number used in fluid flow; Inertia force/viscous force.
Secondary Sample Problems:	Sample problems chosen to illustrate a particular analysis technique, and not carried through the entire AAH.
Secondary Wastes:	Wastes that result from applying waste treatment technology to primary wastes.
Self-heating, decay energy:	Materials that are heated due to the energy imparted from the decay of radionuclides present.
Semi-volatiles:	Elemental material and chemical compound that could be converted into vapors at elevated temperatures, reduced pressures, or by a readily available chemical reaction at elevated temperature or reduced pressures.
Simple System:	Basic once through ventilation system consisting of a blower, cell, filter, plenum, and associated duct work.
Skimmer:	Equipment used in the PUREX process for removal of organics.
Slug Press:	A press used in fuel fabrication facilities to provide the initial compaction of powder into aggregates of higher bulk density and improve the final density of fuel pellets.
Source Term:	Initial amount of material and energy injected into the air during an accident or event.

Specific Radioactivity (specific activity):	The disintegration rate per gram of a radionuclide.
Spray Calcine:	Conversion of soluble metal salts and solids to a powder.
System:	A network of components (branches) joined together at points called nodes.
Transuranics:	Elements of greater atomic number than uranium (e.g., plutonium, neptunium, americium).
Vitrification:	A process to convert waste into a glass form.
Volatiles:	Elemental material and chemical compounds that have high vapor pressures under ambient temperature and pressure conditions in the chemical matrix in which they are found (e.g., iodine, ruthenium).
Voloxidize:	A process to drive off noble gases before dilution.
Volume/Surface Diameter:	A size distribution based upon the volume or surface area of the particles represented.
Weber Number:	Dimensionless number used in bubble formation; inertial force/viscous force.

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The Nuclear Regulatory Commission (NRC) has sponsored a research program to develop improved methods for realistically evaluating the consequences of major accidents in nuclear fuel cycle facilities. These methods, along with supporting information and illustrative examples are provided in this handbook. Four types of facilities: fuel manufacturing, fuel reprocessing, waste storage and solidification, and spent fuel storage; and six accident types: fires, explosions, spills, tornadoes, nuclear criticalities, and equipment failures, are covered. Both computer and hand calculations are presented to estimate the source term from potential accidents. This source term information is used as input to computer codes which calculate the transport and release of mass, energy, and material throughout the facility and to the environment.

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