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April 24, 2000

Mr. George M. McCann
Senior Radiation Specialist
U.S. Nuclear Regulatory Commission
Region III
801 Warrensville Road
Lisle, IL 60532-4351

Dear Mr. McCann:

Transmittal of Copy of Battelle's NRC-Approved Decommissioning Plan

During last week's conference call between Battelle, Ohio Department of Health (ODH), and U.S. Nuclear Regulatory Commission (NRC), Region III, Mr. Jorgensen (NRC) requested that a copy of Battelle's NRC-approved Decommissioning Plan be sent to you. As Battelle agreed, an uncontrolled copy of the "Decommissioning Plan for the Battelle Memorial Institute Columbus Operations to U.S. Nuclear Regulatory Commission" is enclosed. In accordance with Amendment 22 of SNM-7, Battelle will submit an update to this plan on May 12, 2000. It is Battelle's understanding from the April 13, 2000, conference call that ODH and NRC will coordinate all changes to this license application.

If you have any questions, please do not hesitate to call me at (614) 424-5170 or April Chance at (614) 424-3883.

Sincerely,

Craig Jensen

Craig E. Jensen, CHP
Radiation Safety Officer
Battelle Columbus Operations

CEJ/ACC
Enclosure

DD-93-19
Revision 0

DECOMMISSIONING PLAN FOR THE BATTELLE MEMORIAL INSTITUTE COLUMBUS OPERATIONS

to

U.S. NUCLEAR REGULATORY COMMISSION

MAY 1993

UNCONTROLLED COPY

Prepared by

BATTELLE
505 King Avneue
Columbus, Ohio 43201

Contents

Page

1. General Information 1-1
   1.1 Introduction 1-1

2. Description of Planned Decommissioning Activities 2-1
   2.1 Decommissioning Objective, Activities, Tasks, and Schedules 2-1
      2.1.1 Need for Action 2-1
      2.1.2 Objective 2-1
      2.1.3 Description 2-6
      2.1.4 Procedures 2-19
      2.1.5 Schedules 2-21
   2.2 Decommissioning Organization and Responsibilities 2-23
      2.2.1 Department of Energy - Chicago Operations (CH) 2-23
      2.2.2 Decommissioning Operations 2-23
      2.2.3 Organization Communications 2-29
   2.3 Training 2-29
      2.3.1 Training Requirements 2-29
      2.3.2 QA Training 2-30
   2.4 Contractor Assistance 2-30
   2.5 References 2-31

3. Description of Methods Used for Protection of Occupational and Public Health and Safety 3-1
   3.1 Facility Radiological History Information 3-1
      3.1.1 Overview 3-1
      3.1.2 Current Contamination Status 3-2
      3.1.3 Operational Occurrences 3-10
      3.1.4 Radiation Levels 3-13
   3.2 Ensuring Occupational Radiation Exposures Are As Low As Is Reasonably Achievable (ALARA) 3-13
   3.3 Health Physics Program 3-15
      3.3.1 Radiation Protection Program 3-15
      3.3.2 Field Operations Section 3-18
      3.3.3 Technical Support 3-20
      3.3.4 Programs 3-21
      3.3.5 External Support Organizations and Functions 3-28
   3.4 Contractor Personnel 3-29
   3.5 Radioactive Waste Management 3-29
      3.5.1 Waste Interim Storage 3-30
      3.5.2 Waste Characterization 3-30
      3.5.3 Liquid Waste 3-30
      3.5.4 Release for Unrestricted Use 3-31

Contents (Continued)

Page

3.5.5 Transportation and Disposal 3-31
3.6 References 3-32

4. Planned Final Radiation Survey 4-1
4.1 References 4-1

5. Funding 5-1
5.1 References 5-1

6. Physical Security Plan and Material Control and Accounting Plan Provisions in Place During Decommissioning 6-1

Tables

Table 2.1 Battelle Buildings to be Decommissioned 2-8
Table 3.1 Summary of Radiological Contamination in the Battelle Facilities 3-3
Table 3.2. Responsibilities and Reporting Requirements of Health Physics Operations 3-18
Table 3.3 Responsibilities for Health Physics Support 3-19
Table 3.4 Respirators in use at BCLDP 3-22
Table 3.5 Calibration Frequency 3-23
Table 3.6 Instruments 3-25

Figures

Figure 2.1 King Avenue Buildings 2-2
Figure 2.2 West Jefferson Buildings 2-3
Figure 2.3 Example of Category 1 Contaminated Building 2-10
Figure 2.4 Example of Category 2 Contaminated Building 2-11
Figure 2.5 Example of Category 3 Contaminated Building 2-12
Figure 2.6 Decommissioning Schedule for the Fifteen Buildings 2-22
Figure 2.7 DOE Organization Chart for the BCLDP 2-24
Figure 2.8 Battelle Organization Chart of Key Management Positions for the BCLDP Decommissioning Operations 2-27

Contents (Continued)

Page

Figure 3.1 Environmental Monitoring at the West Jefferson Nuclear Sciences Area Showed Evidence of Soil Contamination in the Proximity of the Abandoned Filter Beds and the Storm Sewer Outfall (Area 1) 3-11
Figure 3.2 Radiation Protection Organization 3-16
Figure 3.3 Health Physics Organization 3-17

List of Attachments

Attachment 1. Surface Release Criteria Technical Basis Document
Attachment 2. Volumetric Release Criteria Technical Basis Document
Attachment 3. Current Index for BCLDP Procedures and Plans
Attachment 4. Biographical Information
Attachment 5. Facility Post-Decontamination Final Status Survey

1. General Information

Licensee Name:	Battelle Memorial Institute
License Address:	505 King Avenue, Columbus, OH 43201-2693
License Number:	SNM-7

1.1 Introduction

On April 16, 1943, Battelle Memorial Institute (BMI), acting through what is now its Columbus Operations (BCO), entered into Contract No. W-7405-ENG-92 with the Manhattan Engineer District to perform atomic energy research and development (R&D) activities. From that time until 1988, BCO performed nuclear materials research and development work at these privately-owned facilities for the Manhattan Engineer District and its successor agencies — AEC, ERDA, and DOE. BCO also performed commercial nuclear operations, and work for other Federal agencies such as the Department of Defense (U.S. Air Force, U.S. Army, U.S. Navy), and NASA.

The BCO facilities, comprising 15 buildings and associated grounds located at BCO's King Avenue Site, Columbus, Ohio, and West Jefferson North and South Sites, West Jefferson, Ohio, became partially radiologically contaminated as a result of the performance of such work. These facilities now require decontamination to original status (i.e., unrestricted use).

It has been determined that DOE, as the successor to the AEC and the Government's earlier work, has predominant liability and responsibility for decontamination and decommissioning (D&D) of the BCO facilities. At the direction of the Assistant Secretary for Nuclear Energy (ASNE) (May 29, 1986 memorandum, Voight to Vaughan, approved by Vaughan, June 10, 1986), D&D of the BCO facilities described herein was accepted into DOE's Surplus Facilities Management Program as a Major Project, entitled Battelle Columbus Laboratories Decommissioning Project (BCLDP).

Battelle also holds U.S. Nuclear Regulatory Commission (NRC) license number SNM-7. Battelle has continually operated in full compliance with this NRC license and plans to perform this decommissioning in compliance with NRC regulations. Accordingly, this decommissioning plan is being submitted to the NRC for review and approval. It does not constitute a declaration to terminate license number SNM-7. Battelle plans to continue to operate under the license conditions and to request renewal at the appropriate time.

2. Description of Planned Decommissioning Activities

2.1 Decommissioning Objective, Activities, Tasks, and Schedules

2.1.1 Need for Action

This Decommissioning Plan describes the planned decontamination and decommissioning of 15 buildings or portions thereof and possibly underlying and/or adjacent soils, which became radioactively contaminated as a result of performance of work under the U.S. Government contract. The fifteen buildings were contaminated as a result of nuclear materials research and development activities conducted for the U.S. Government and commercial nuclear facility clients [2.1,2.2]. The Battelle-owned buildings are being decontaminated at this time to make them available for unrestricted use.

Nine of the buildings are located at Battelle's King Avenue site, Columbus, Ohio (Figure 2.1), and the remaining six buildings are located at Battelle's West Jefferson site, West Jefferson, Ohio (Figure 2.2). Portions of the King Avenue site have radioactively contaminated research facilities and equipment contained in buildings which range in age from 30 to 60 years old, across the street from The Ohio State University. A moderate density residential area, the Olentangy River, and several commercial and industrial areas are within 1/2 mile of this site. The West Jefferson site consists of radioactively contaminated facilities including a decommissioned reactor building, a chemical/nuclear laboratory, and a hot cell building which is highly contaminated. The D&D of the BCO facilities will enhance environmental quality and assure public health and safety [2.3]. Battelle will perform, manage, and/or integrate the necessary D&D activities in compliance with all applicable Federal, State, and local regulations [2.4]. The Chicago Operations Office of DOE shall maintain day-by-day operational cognizance of the D&D project [2.5,2.6]. The NRC has reserved three statutory responsibilities: (1) to conduct periodic inspections, (2) to approve the release criteria used, and (3) to certify the final releases. The NRC has all rights of surveillance as agreed with DOE and Battelle [2.7] and as set forth in the SNM-7 license.

2.1.2 Objective

The overall objective of this D&D project is to return the fifteen contaminated buildings and surrounding sites to Battelle, free from radiological restrictions, at or below levels consistent with U.S. NRC [2.8] and DOE applicable requirements [2.4], and in a timely manner. These facilities are an integral part of the Battelle's ongoing R&D operations in Columbus. Several D&D alternatives were evaluated:

- Close Facilities and Continue S&M. This option involves leaving the facilities intact while continuing surveillance and maintenance (S&M) [2.9], and activities which are directed at preventing radiation exposure to workers, the environment, and the public. Accordingly, closing the facilities and continuing S&M indefinitely does not remove radioactive material from the site, in a timely manner, it therefore is not considered a feasible alternative for meeting the D&D objective of Battelle.

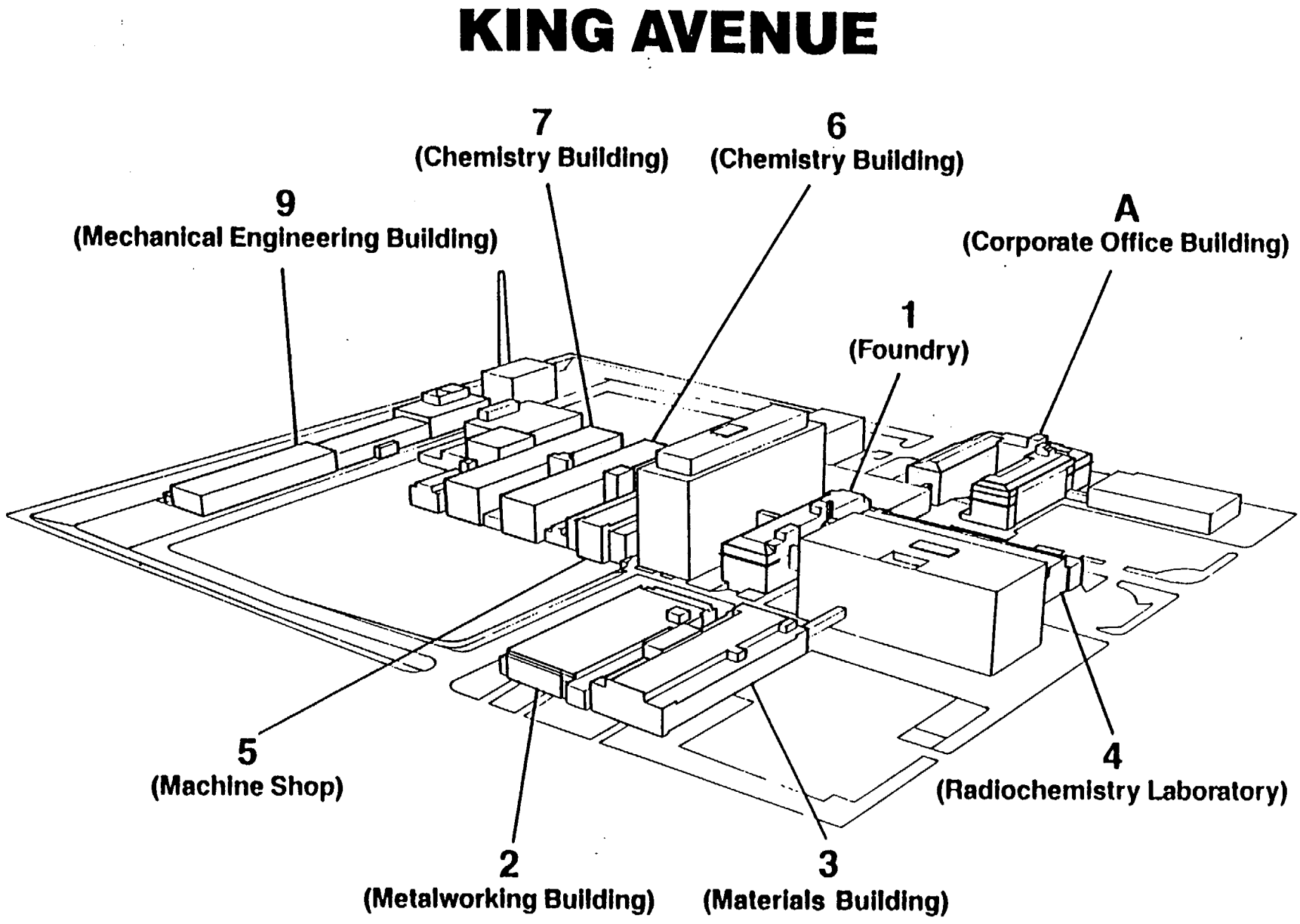
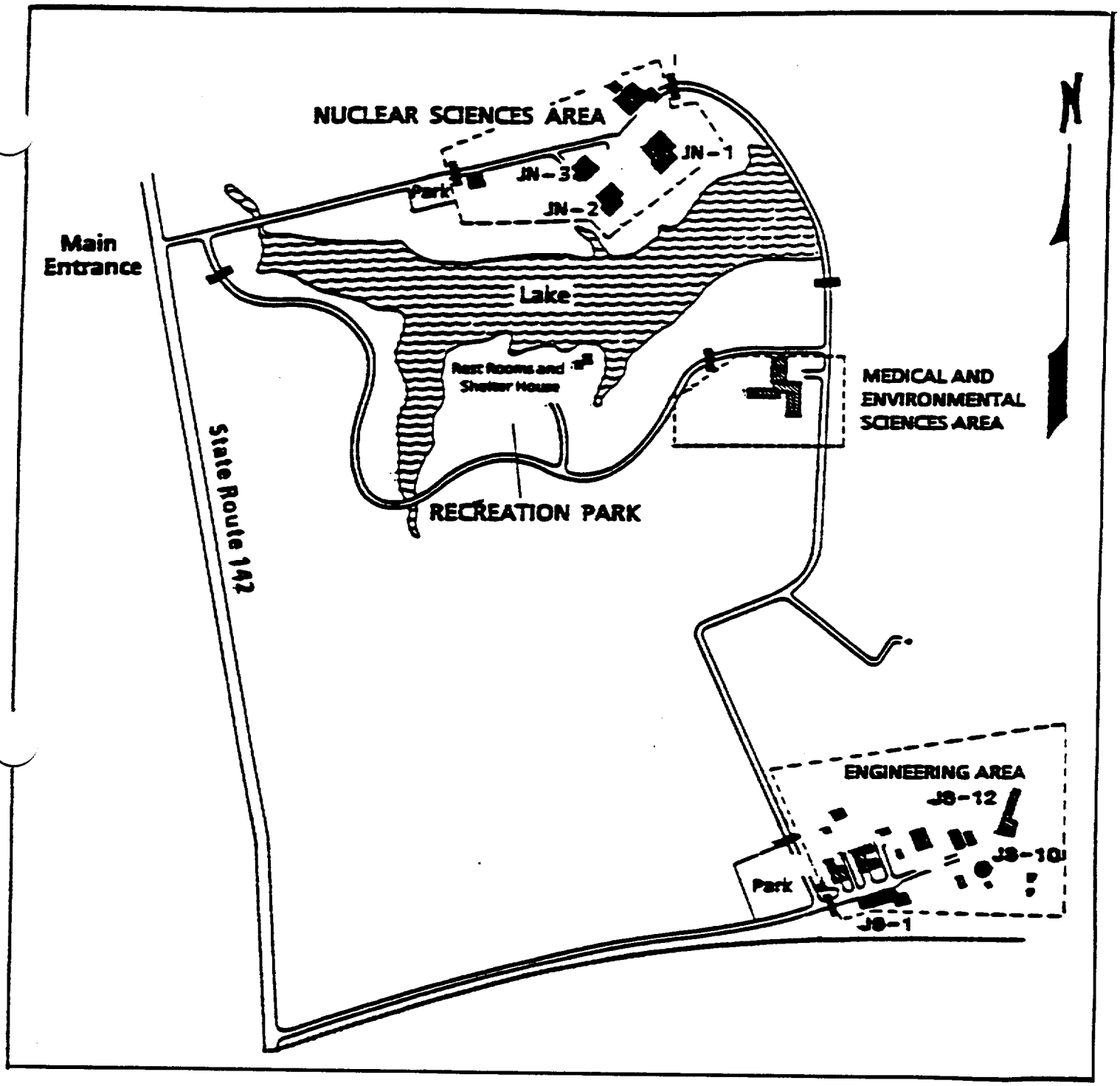


Figure 2.1 King Avenue Buildings



<u>Ongoing</u>	
JN-1	Hot Cell Laboratory
JN-2	Administrative Building
JN-3	Decommissioned Research Reactor
<u>Completed</u>	
JS-1	Hot Isostatic Processing Facility and Site Facilities
JS-10	High-Energy Containment Building
JS-12	High-Energy Ballistics Research Building

Figure 2.2 West Jefferson Buildings

- Close Facilities and No Further Action. The option of closing the facilities and doing nothing further is not appropriate for two reasons. First, it does not meet the objective of returning the facilities free from radiological restrictions, nor does it remove radiological material from the site. Second, the radioactive contamination remaining on site cannot be left unattended.

- Entombment. Entombment is the encasement of radioactive materials and components in a structure of concrete and steel. The structure must be sufficiently strong and long-lived to ensure retention of the radioactivity until it has decayed to levels that permit unrestricted use of the site. The entombment alternative is technically feasible but it permanently precludes Battelle from using the affected facilities for alternative activities in pursuit of its business objectives. As these facilities are an integral part of Battelle's R&D operations in Columbus, entombment is not considered to be a feasible alternative.

- Safe Storage Followed by Deferred Dismantlement. Safe storage involves activities required to place and maintain facilities in a condition such that risk to public safety is within acceptable bounds and the facilities can be safely stored for as long as desired. This involves some facility and site preparation followed by a period of continuing care that includes security and S&M. Following the storage period, deferred dismantlement is initiated. Safe storage with deferred dismantlement is not the preferred decommissioning alternative for the BCO facilities, because it involves long-term, i.e., higher total, radiation exposures (estimated to be 6 man-rem per year deriving from S&M activities during the safe storage period) and higher cost than immediate dismantlement. In addition, it delays returning the facilities to unrestricted use in a timely manner.

- Immediate Dismantlement/Decontamination. This decommissioning alternative involves D&D of all the facilities designated for decommissioning operations. This includes decontamination or removal from the involved facilities of all fluids, piping, equipment, components, structures, and waste having radioactivity levels greater than those permitted for unrestricted use of the property. This is the only alternative to meet the overall objective of the project to return the facilities to Battelle's use free from radiological restrictions, in a timely manner.

Based on an evaluation of alternatives, within the overall objective of returning the affected facilities to unrestricted use, immediate dismantlement was selected with the following technical objectives:

- Meet the requirements of the NRC regulations.
- Decontaminate or remove and dispose of all contaminated equipment and the contaminated portions of the buildings and grounds at minimum costs consistent with safety, health, security, and environmental considerations in accordance with all applicable Federal, State, and local regulations.

- Perform the decommissioning operations in accordance with ALARA (as low as reasonably achievable) principles.
- Perform the technical decommissioning operations within the budget and time allocations.

To accomplish the overall objective, the proposed activities and tasks of the D&D project will include the following:

(1) Conduct pre and post D&D radiological characterization surveys of each building and the surrounding areas [2.10,2.11].

(2) Remove spent fuel fragments or fines, special nuclear and source material, low level waste (LLW), transuranic (TRU) waste, by-product material, and hazardous material required to prepare buildings for D&D.

(3) Plan, engineer, and procure equipment for the D&D tasks.

(4) Continue surveillance and maintenance of the buildings and site during D&D.

(5) Perform and/or manage D&D of 15 buildings and surrounding grounds, as necessary.

(6) Perform the necessary environmental, safety and health support functions in compliance with applicable Federal, State, and local regulations.

(7) Develop appropriate release criteria for NRC approval.

(8) Package and transport all D&D waste to an appropriate storage or disposal facility.

(9) Contract for independent radiological release surveys by an independent verification contractor (IVC).

(10) Complete restoration, as required, of buildings for structural integrity or safety.

The type of operations required to achieve the above listed objectives will vary among the buildings and the areas surrounding the buildings involved, depending on the nature of the previous radioactive material operations. The concept of ALARA dose rates for the workers is an important part of this technical objective. The details of the ALARA program are described in section 3.2. The objectives will be achieved by utilizing a suitable mix of experienced Battelle staff and subcontractors. Subcontractor assistance is described in section 2.4. Battelle has a core of staff experienced in nuclear facility operations, D&D operations, waste management, radiation protection, occupational safety and health, health physics, and environmental protection. When subcontractors are required, they will be selected based on applicable prior experience using competitive cost considerations. The number and type of subcontractors utilized will be based on the type of workers required. All workers will be

trained to carry out the decommissioning operations in a safe and cost effective manner. Training is further described in section 2.3.

2.1.2.1 Release Criteria for Unrestricted Use

The objective of the decommissioning project is to decontaminate areas such that they are available for unrestricted use (i.e., without radiological restrictions). In order to clearly define the objective, the BCLDP has prepared two technical basis documents.

- Surface Release Criteria Technical Basis Document, and
- Volumetric Release Criteria Technical Basis Document.

These two documents provide the quantitative values for decommissioning objectives and discuss their technical basis. The documents also address how the project objectives meet the applicable NRC criteria, as well as DOE criteria for unrestricted release. The documents are presented in Attachments 1 and 2. Implementation of the release process consistent with these technical basis documents is governed by procedures also presented in Attachments 1 and 2.

2.1.3 Description

This section provides a brief historical perspective, the contamination categories of buildings, and a description of the overall plan to accomplish the activities and tasks proposed for D&D of the fifteen BCO facilities.

2.1.3.1 Brief History of Battelle's Nuclear Activities

Nine of the buildings involved in the D&D project are located at the King Avenue site. The nuclear research performed in the nine buildings included processing and machining of enriched, natural, and depleted uranium and thorium for fuel element fabrication and other uses. Radio-tracer studies, radiochemical analyses, and powder metallurgy studies were also performed. In addition, secure vault storage for accountable nuclear material was provided in one of the buildings.

The remaining six buildings are located at the West Jefferson research site in two areas: (1) the Engineering Area in the southeastern portion, (2) the Nuclear Sciences Area in the northern portion.

The oldest and most contaminated building in the Nuclear Sciences Area is the Hot Cell Building (JN-1). This building began operation in 1955 and was used until 1988 for nuclear research studies. Work conducted there included evaluations of both power and research reactor fuels; post-irradiation examination of fissile, control rod, source, and structural materials and components; and examination of irradiation surveillance capsules. In addition, the facility has been the site of radiation source encapsulation, and physical and mechanical property studies of irradiated materials and structures.

The two other buildings at the Nuclear Sciences Area are the former Critical Assembly Laboratory (JN-2) and the partially dismantled Research Reactor Building (JN-3). Both of these buildings are significantly less contaminated than the Hot Cell Building. The former Critical Assembly Laboratory was originally used for reactor critical assembly experiments, direct energy conversion experiments, experiment assembly, special nuclear materials handling, and plutonium research activities. Active nuclear experimentation in this building was terminated in 1970. A small Plutonium Laboratory previously located in this building was decontaminated and converted into the current Radioanalytical Laboratory. This building also contains administration offices and a special nuclear materials vault.

The Battelle Research Reactor (BRR) was actively used from 1956 until 1974. It was then partially dismantled. The pool liner and core hardware were removed and most of the building was decontaminated. The BRR license was then changed to a possession only under SNM-7. Since then it has been used for short term waste storage (approximately one truck load of low level waste).

The three buildings (JS-1, JS-10, and JS-12) at the Engineering Area, (the D&D was completed in 1990) were used for fuel element fabrication and ballistics studies. The Hot Isostatic Pressure Bonding Facility (JS-1) was used to fabricate military reactor fuel elements using the hot isostatic pressure (HIP) fabrication technique. The other two buildings (JS-10, JS-12) were used for studies involving explosive forming and bonding techniques, and for ballistic studies using nuclear materials. These three facilities were never operated under the NRC license. They were independently verified, and returned to BCO for unrestricted use.

Section 3.1 provides more detailed radiological history information.

2.1.3.2 Assessment of Contamination Levels

The facilities undergoing D&D can be placed in three categories based on the history of operations and the levels of contamination present: Category 1 - widely contaminated with low radioactivity levels; Category 2 - high radiation fields and extensive contamination in hot cell areas and lower levels of contamination in operating areas; Category 3 - low level contamination of isolated sections in otherwise uncontaminated facilities. The building categories are shown in Table 2.1. Contamination levels and isotopes are shown in Table 3.1. Note that all fissile material has been removed from the Battelle sites other than small laboratory samples or standards.

Category 1. Category 1 defines contamination levels which vary from low to moderately high and which are widespread throughout the building; the buildings in this category are contaminated above background levels over wide areas of floors, walls, and ceilings, and contain contaminated equipment. Four buildings (KA-1, KA-2, KA-3, and JN-3) have this level of contamination. A typical example of such a contaminated building is shown in Figure 2.3. Decontaminating this category building will potentially require isolation of the building prior to initiation of operations. Only limited and controlled non-nuclear operations are now conducted in these buildings. All of the operations unrelated to decommissioning will be relocated, and uncontaminated equipment will be surveyed and removed from the facility prior to decommissioning.

Table 2.1 Battelle Buildings to be Decommissioned Listed by Category of Contamination

Building Number	Category*
King Avenue Site	
Building KA-A	3
Building KA-1	1
Building KA-2	1
Building KA-3	1
Building KA-4	3
Building KA-5	3
Building KA-6	3
Building KA-7	3
Building KA-9**	3
West Jefferson Site	
Building JN-1	2
Building JN-2	3
Building JN-3	1
Building JS-1**	3
Building JS-10**	3
Building JS-12**	3

* Category 1: Contamination level varies from low to moderately high and is widespread throughout the building.

* Category 2: Highly contaminated in hot cells; low to moderate contamination in other work areas.

* Category 3: Generally low contamination levels in small number of rooms.

** Buildings KA-9, JS-1, JS-10, and JS-12 have been completed.

Category 2. Category 2 is the Hot Cell Facility, Building JN-1. This is the only Category 2 building to be decommissioned. The operating cells of this building have high radiation fields and extensive contamination on the ceilings, walls, and floors. The equipment inside the cell is also highly contaminated. Other areas in the building have low levels of contamination. Decommissioning of this building's hot cells will require some remote operations, and extensive radiation protection precautions. Figure 2.4 shows the floor plan of this building.

Category 3. Category 3 includes buildings KA-A, KA-4, KA-5, KA-6, KA-7, KA-9, JS-1, JS-10, JS-12, and JN-2 which are only partially contaminated and most of the contamination is fixed. Buildings JS-1, JS-10, JS-12, and KA-9 have been completed. Only controlled, non-nuclear research programs are currently being conducted in some areas of the Category 3 buildings adjacent to areas scheduled for decommissioning. Proposed decommissioning activities within or for these buildings include isolation of the areas to be decommissioned, and establishment of access control and administrative procedures to prevent the spread of contamination during decommissioning. A typical example of a Category 3 building is shown in Figure 2.5.

2.1.3.3 Planning and Assessment

Planning includes the preparation of project planning documents which will control and guide the decommissioning operations, preparation of documents to meet regulatory and institutional requirements, preparation of cost schedule and technical baseline estimates for the decommissioning operations, site characterization, and performance of operations in preparation for decontamination.

Decommissioning of each facility or major part thereof will be conducted as a separate campaign. Therefore, a planned Readiness Review [2.12] will be performed prior to decontamination operations of each campaign. The campaign-specific Readiness Review package will include, but is not limited to, the following subjects:

- Decommissioning Operations Plan
- Organization of the Project
- Decommissioning Operations Objectives
- Radiological and Chemical Characterization Report
- Safety and Environmental Risk Assessment
- Decommissioning Operations Release Criteria
- Work Breakdown Structure
- Decommissioning Operations Schedule
- Waste Management Plan
- Support Functions (QA, Health Physics, Radiological Safety Training)
- Work Instructions
- Radiation Work Permits

BUILDING 3
Materials Building

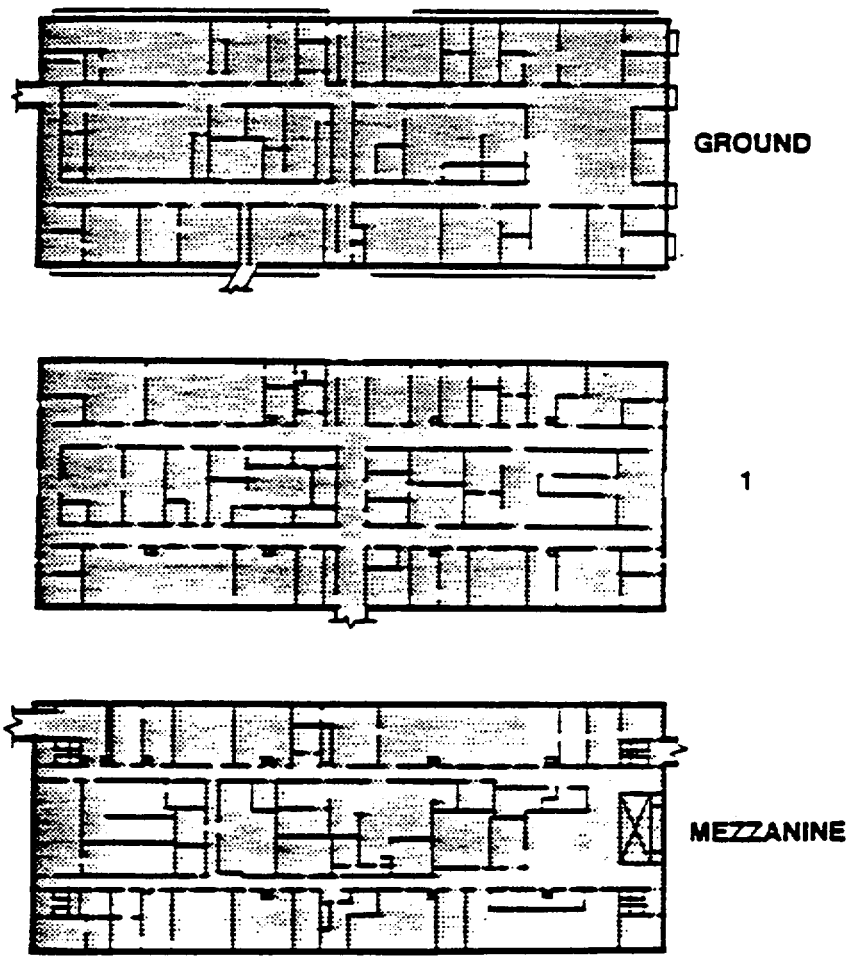


Figure 2.3 Example of Category 1 Contaminated Building

BUILDING JN-1
Floor Plan of the BCD Hot Cell Facility

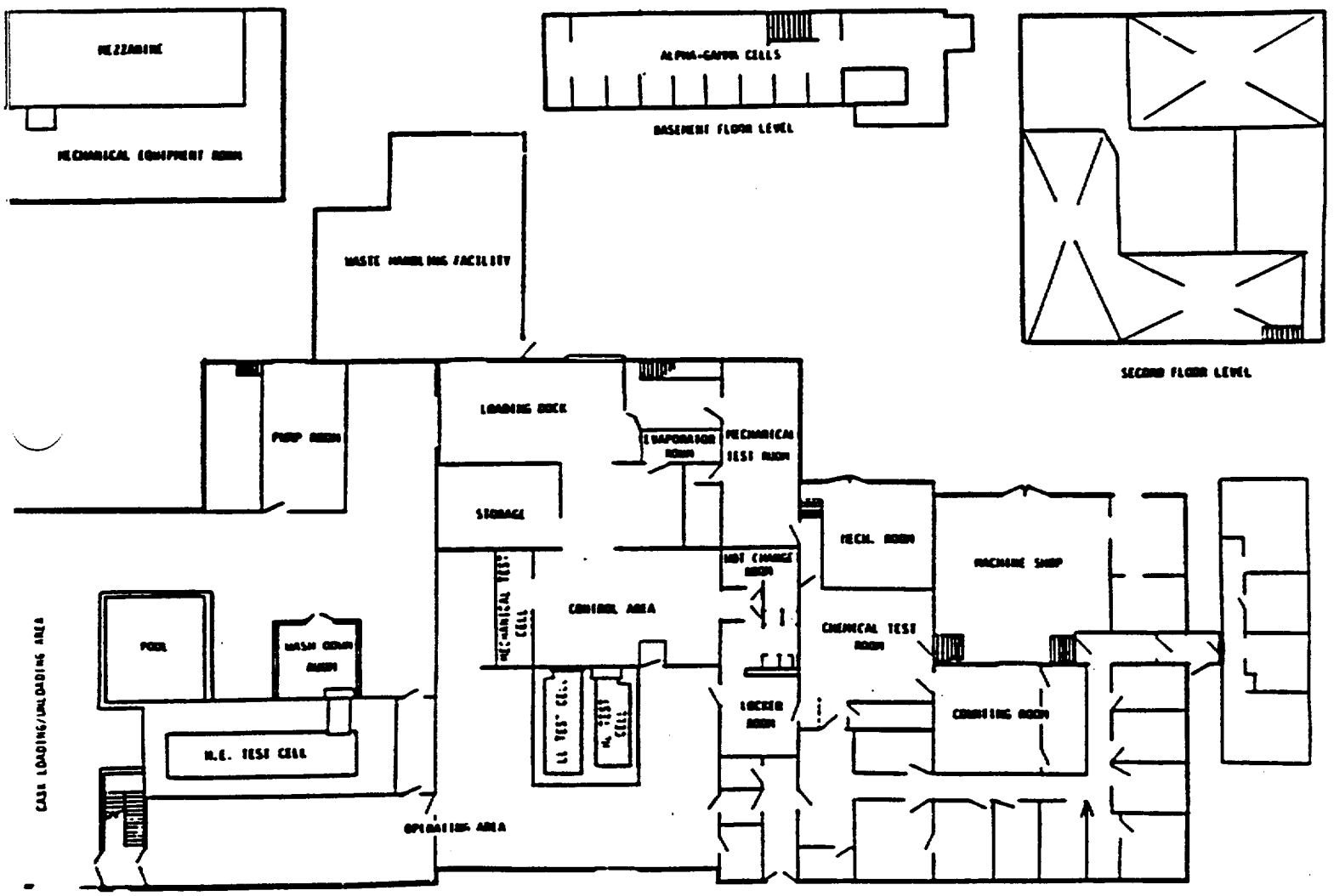
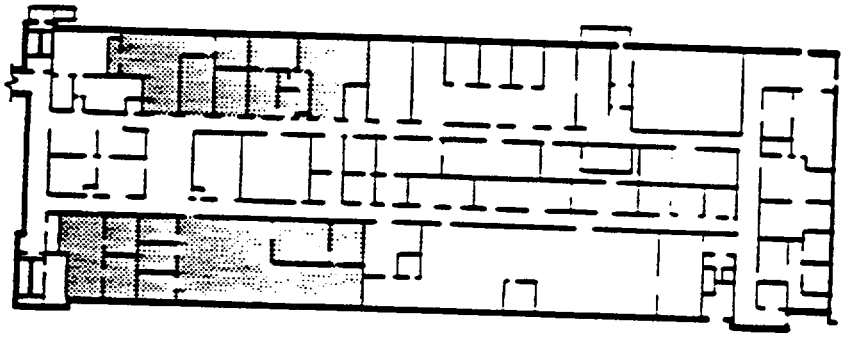


Figure 2.4 Example of Category 2 Contaminated Building

BUILDING 4
Radiochemistry Laboratory



GROUND

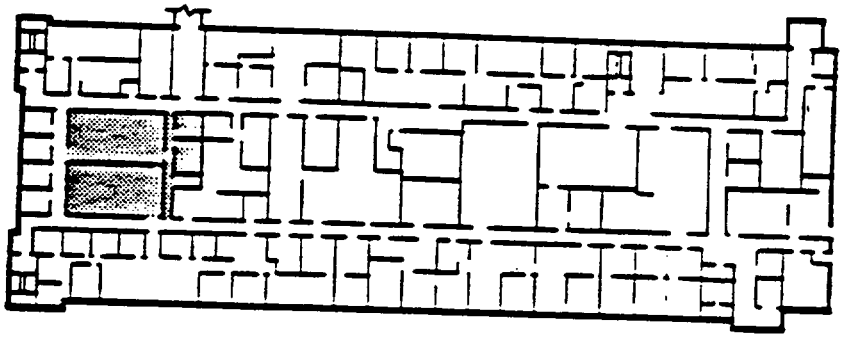


Figure 2.5 Example of Category 3 Contaminated Building

The **Site Characterization Plan** (SCP) [2.13] provides guidance for radiological characterization of locations surrounding the buildings to be decommissioned. The SCP sets forth the procedures for a detailed characterization. It includes the following subjects:

- Site Sampling Plan
  - * Sampling approach for areas within, under and around buildings
  - * Sample analyses
  - * Reporting procedures
- Responsibility for Site Characterization.

The **Site or Building Characterization Report** [2.14] includes radiological and chemical survey data. It will be prepared for each building or area to be decontaminated. Upon completion, each area or building including areas not D&Ded will have an independent verification survey to confirm release criteria have been met.

Surveillance and Maintenance (S&M) operations are performed prior to, during, and after decontamination to assure that the contamination in the fifteen buildings remains controlled and is not inadvertently spread. S&M activities include:

- Environmental Monitoring -- An environmental monitoring program is required to assure that radioactive contamination has not escaped to the surrounding environment. The environmental monitoring includes collection and analysis of water, air, soil, vegetation, agricultural crop, and sedimentation samples from areas surrounding the Battelle facilities [2.15].

- Facility Surveillance and Maintenance -- This includes regularly scheduled inspection and maintenance of health, safety, and radiation protection equipment and instrumentation. A detailed schedule of inspection and maintenance is followed. All S&M activities are conducted under an established nuclear quality assurance program. Emergency planning, training, and drills are also conducted as part of S&M [2.16]. Repair and replacement of equipment, air and water filtration and clean-up equipment performed as required.

- Operational Health Physics -- A program of health physics radiation monitoring is conducted, including training of site personnel, posting of contaminated areas, a detailed schedule of health physics surveillance monitoring and personnel dosimetry. This health physics program is described in section 3.3.

2.1.3.4 Decommissioning Operations

The sequence of D&D operations described in the following sections is based on the radiological survey information obtained at termination of research activities. This general sequence will be defined specifically in the individual building D&D plans [2.17] as detailed radiological characterization information becomes available for each building. Each plan will describe the sequence of operations in predecessor-successor logic. The actual decontamination methods to be used and the rationale for selection, waste management and other support functions will be described, and schedules for completion of the work will be provided. More specific procedures and work instructions are developed for each task within the buildings (see Attachment 3). All of these documents are prepared and controlled according to QA-AP-5.1 (Preparation of Procedures), QA-AP-5.2 (Work Instructions), and QA-AP-6.1 (Document Control) which conform to NRC requirements for preparation, management, approval (signatures), and quality independent activity assessments (see also paragraph 2.1.4).

2.1.3.4.1 Category 1 Sequence of D&D Operations. The proposed general sequence of operations for decommissioning Category 1 buildings is as follows:

1. Relocate the staff and non-nuclear operations from the building.

2. Survey and remove uncontaminated items including office furniture and laboratory equipment from the building.

3. Perform a detailed radiological and chemical survey of the building and the equipment in the building to identify contaminated areas and equipment. This information will be used to select the appropriate decontamination procedures for specific areas.

4. Prepare a staging area for handling and packaging contaminated equipment and waste removed during the decommissioning operations. A King Avenue staging area will be set up in building KA-3 and a West Jefferson staging area will be set up in Building JN-3.

5. Remove contaminated furniture and equipment. Decontamination will be performed or the equipment will be disposed of as radioactive waste.

6. Design and install access control areas including change rooms and showers as required.

7. Seal all drains, vents, and other openings from the contaminated rooms to prevent the release of radioactive material during these decommissioning operations.

8. Remove exposed and contaminated plumbing, hoods, ducts, and electric equipment (including surface conduits and hanging lights) and dispose as radioactive waste.

9. Decontaminate the ceilings, floors, and walls using detailed decontamination procedures as prepared based on information from the radiological characterization surveys. The principal decontamination method will be wiping and vacuuming and/or removal of surface layers from the ceilings, walls and floors. Isolation will be provided to control the spread of contamination, as well as the use of dust and liquid collection equipment.

10. Characterize and clean or remove all sumps, vertical and horizontal drain lines, and sewer lines.

11. Perform interim radiological and chemical surveys to determine the depth to which material must be removed to achieve complete decontamination consistent with the release criteria and the release procedure.

12. Perform a Planned Final Radiation Survey, including any building areas not covered in the D&D plan, and then notify DOE that the building is ready for an independent verification survey when the radiological survey indicates that the building has been successfully decontaminated and the waste removed. The independent verification contractor (IVC) who will perform an independent confirmatory survey is Oak Ridge Institute of Science and Education (ORISE).

13. Restore the building when the building is certified as releasable free from radiological restriction. The restoration operations do not constitute a radiological hazard to the workers or the public.

2.1.3.4.2 Category 2: Sequence of D&D Operations. The Hot Cell Building (JN-1) has been operated as a "closed system" with respect to release to the environment. Thus, all radioactive materials handled and processed in the building, and the associated waste generated were retained in the building. The "closed system" feature will be maintained during the decommissioning operations. The following is the general sequence of decommissioning operations:

1. Continue throughout the decommissioning operations the current, complete environmental monitoring procedures including sampling of air, water, and soil.

2. Prepare a staging area at JN-3 for handling and packaging low level contaminated equipment and waste removed during the decommissioning operations. High level waste and transuranic waste will be packaged in the hot cell.

3. Remove all storage racks and other underwater equipment in the fuel storage pool. Volume reduce the racks and equipment and dispose as waste.

4. Clean the pool wall and floor surfaces with underwater vacuum cleaners.

5. Reduce the volume of water in the pool using a water evaporation system. Dispose of the sludge residue by solidification.

6. Remove all equipment and fixtures in the cells and in other contamination control areas of the building. Dispose of all waste generated.

7. Remotely remove surface contamination from the inner walls of the hot cells to reduce the radiation field to a level that will permit entry by workers using the principles of ALARA.

8. Dispose of all waste generated by the remote cleaning operations in the cells.

9. Dismantle the hot cell rooms using methods which may include cutting, concrete breakers, core drilling, and other appropriate demolition methods. For these operations a separate exhaust system from the building may be installed. It will use HEPA filters to restrict the release of radioactive material to within regulatory limits.

10. Remediate sumps, vertical and horizontal drain lines, and sewer lines.

11. Dispose of the waste from the cell dismantling operations.

12. Clean the remaining rooms in the building using vacuum cleaning, wiping, and scabbling methods as required.

13. Perform a Planned Final Radiation Survey of the entire facility and then notify DOE that the building is ready for an IVC survey when the radiological survey indicates that the building has been successfully decontaminated and the waste removed.

14. Restore the building as required when a building is certified as releasable for use without radiological restriction. The restoration operations do not constitute a radiological hazard to the workers or the public.

2.1.3.4.3 Category 3: Sequence of D&D Operations. The primary concern during decommissioning operations in Category 3 buildings will be to initially isolate the contaminated areas and prevent the spread of contamination to clean areas. The following is the general sequence of operations proposed for decommissioning Category 3 buildings:

1. Relocate any staff and/or non-nuclear operations from the areas to be decontaminated.

2. Relocate or isolate all activities from the clean areas adjacent or near the contaminated areas.

3. Establish access control areas near the contaminated areas. The access control areas will provide for change rooms and showers as required.

4. Survey and remove uncontaminated items including office furniture and laboratory equipment.

5. Perform detailed radiological surveys of the contaminated areas and the equipment in those areas. This will assist in preparing the specific decontamination procedures for specific areas.

6. Prepare a staging area for handling and packaging contaminated equipment and waste removed during the decommissioning operations.

7. Remove contaminated furniture and equipment. Decontaminate at a suitable location or dispose as radioactive waste as deemed appropriate.

8. Seal all drains, vents, and other openings from the contaminated areas to prevent the release of radioactive material during these decommissioning operations.

9. Remove exposed and contaminated plumbing, hoods, ducts, and electric equipment (including surface conduits and hanging lights) and dispose as radioactive waste.

10. Decontaminate the ceilings, floors, walls, and using detailed procedures as prepared using information obtained from the radiological surveys. The principal decontamination method will be vacuum cleaning, wiping, and removal of the surface layers from the ceilings, walls and floors. Care will be taken to control the spread of contamination by isolation and use of dust and liquid collection equipment.

11. Remediate sumps, vertical and horizontal drain lines, and sewer lines by decontamination or removal.

12. Perform interim radiological surveys to determine the progress and depth to which material must be removed to achieve complete decontamination.

13. Perform a Planned Final Radiation Survey, including areas of the building not covered in the D&D plan, and then notify DOE that the building is ready for an IVC survey when the radiological survey indicates that the area has been successfully decontaminated and the waste has been removed.

14. Restore the building as required when the area is certified as releasable free from radiological restrictions. The restoration operations do not constitute a radiological hazard to the workers or the public.

2.1.3.4.4 Soil Remediation. The soil near or under the buildings may be contaminated. The ground near and under the buildings, especially along buried sewer lines, will be surveyed to determine the presence of radioactive contamination greater than naturally occurring for the vicinity. All soil found to be contaminated above background will be evaluated to determine the appropriate remedial action consistent with the NRC-approved release criteria as presented in Attachments 1 and 2 of this plan. Such action could include leaving it undisturbed, in situ remediation, providing appropriate cover, or removal and shipment to a burial site. The areas affected by the soil removal will be restored as appropriate.

2.1.3.5 Environmental Safety and Assessment

Key environmental safety and health aspects of the D&D project have been assessed in the Environmental Assessment and Finding of No Significant Impact (06/14/90). In this assessment, the potential for radiological exposure and impacts on human health and the environment, non-radiological impacts such as chemical, physical, and biological, and socioeconomic impacts focusing on transportation and employment have been considered in detail.

Estimates of potential exposures which may be experienced by D&D workers, Battelle staff, or the public were derived based on information available about the source term. The results showed that under normal operations, the exposure rates in all D&D areas will be well below the appropriate guidelines [2.18-2.20]. Even under accident conditions where all mitigative measures become inoperable, the estimated exposure was three orders of magnitude and five orders of magnitude below these guidelines for West Jefferson and King Avenue, respectively.

Additionally, other "worst case" scenarios were considered for release of radionuclides to the environment. Again, the conclusion was that such releases were extremely unlikely and that the environmental consequences of any release were insignificant. An ALARA policy has been adopted by Battelle for this project. In order to maintain doses as low as reasonably achievable, all preventive, administrative, and protective measures will be employed to the maximum practical extent (see section 3.2). Additionally, monitoring of exposure rates,

airborne concentrations, and surface contamination will be maintained in the work area, adjacent areas, and peripheral areas to evaluate the effectiveness of contamination controls and to detect and map trends. Such preventive and mitigative measures will also prevent and control contamination transported by air movement as well as by other transfer vectors. Preventative measures to control airborne contamination include:

- Enclosure and isolation of the work areas.
- Control of traffic and movement of equipment and materials in and out of the work area enclosure.
- Ventilation of the work area to maintain the enclosed area a negative pressure with respect to surrounding areas and capture and remove from the exhausted air stream a major portion of the aerosols with standard high efficiency particulate air (HEPA) filters.
- Change areas for workers in the staging area.
- Continuous monitoring and sampling of the air in the D&D areas and in the exhaust stream.
- Use of personal dosimeters and breathing zone air samplers.
- Use of local exhaust pick up for decontamination procedures such as certain kinds of abrasive blasting, scabbling, drilling, and spalling.
- Use of a fine water spray to reduce the amount of dust which becomes airborne.
- Use of remote manipulators in the decontamination process in the Hot Cells Laboratory.
- Use of approved containers for waste transfers.

Decommissioning will be accomplished as described above to reduce risks and proceed in a safe manner.

2.1.4 Procedures

Battelle will conduct the decommissioning activities and tasks in accordance with approved procedures which are responsive to Quality Grading as outlined in QA-AP-5.1 (Preparation of Procedures), QA-AP-5.2 (Work Instructions), and QA-AP-6.1 (Document Control) and in the Quality Manual for the BCLDP. Second tier documents are prepared for each building for example, QAP-4.1 (Quality Assurance Plan for Decontamination and Decommissioning Operations in Building 6, 6G-NW Area), QAP-7.1 (Quality Assurance Plan for Decontamination and Decommissioning Operations in Building 3), QAP-11.0 (Quality Assurance Plan for Decontamination and Decommissioning Operations in Building A). A

quality plan may be incorporated into specific work plans as allowed by QA-AP-2.2 (Preparation and Control of Quality Assurance Plans). Third tier quality assurance is described in documents QA-AP-2.1 through QD-AP-19.2. Administrative procedures, operating procedures, detailed technical procedures, work instructions, and work permits are used to control activities in the conduct of D&D operations. Examples of processes to be controlled are:

- Welding, cutting, and brazing
- Non-destructive examinations
- Chemical cleaning
- Grit and sandblasting
- Chipping and scabbling
- Concrete cutting
- Demolition processes
- Packaging radioactive wastes
- Packaging other wastes (non-radioactive).

Individual procedures have been developed and approved for controlling each process and/or special process. They include:

- Applicable codes, standards, and specifications
- Definition of responsibility
- Prerequisites including qualification and certification requirements
- Sequence of operations
- Acceptance criteria
- Record keeping requirements.

The procedures needed have been identified for the project and developed by the designated project staff. Documents are prepared in accordance with the quality procedures noted above. Documents are prepared and revised by task members, task leaders, technical personnel, and Project Management. All documents will be approved by the Quality Manager and Project Management prior to release for use. The current index of project procedures/plans is included as Attachment 3.

2.1.4.1 Document Control

All procedures are controlled as described in QA-AP-6.1 (Document Control). The review, comment, revision, and approval process for the procedures is documented. The Project Technical Manager or the Project Quality Manager assigns the approvals needed for controlled documents. These documents require at least two approvals in addition to the originator before implementation. They also require a QA approval either by the Project Quality Manager or the Nuclear QA Manager.

The Project Quality Manager retains the original copy of the approval page, and is responsible for issuing copies of new and/or revised procedures to individuals designated by Project Management to receive them. The Project Quality Manager maintains logs of document distribution. He also publishes a monthly log of all active project procedures indicating their revision status and date of issue; this is distributed to predetermined,

responsible personnel. All project personnel are required to have an approved procedure before work is started and assure they have the proper version of the document. All project personnel working with a Work Instruction are required to read and document by signature that they understand the Work Instruction being performed. For more critical procedures, they must demonstrate proficiency.

Methods for document revision and accomplishing activities under approved, temporary procedures are specified in QA-AP-5.1. The life of a temporary procedure is limited to thirty days but may be extended to a maximum of sixty days. After sixty days, the temporary procedure expires or must be incorporated into an existing or new procedure. The Project Quality Manager is responsible for assuring that the temporary procedure is terminated or incorporated into an existing or new procedure.

2.1.5 Schedules

Decommissioning activities for the Battelle nuclear facilities began in June 1988 with the initiation of Planning and Assessment.

Figure 2.6 shows the baseline schedule for decommissioning each of the remaining eleven buildings and the associated soils. Development of more detailed building-specific milestones is part of the D&D planning and Readiness Review process for the individual building.

Buildings JS-1, JS-10, JS-12, and KA-9 have been decommissioned. Decommissioning of each of the remaining 11 buildings is generally independent of each other. As shown in the project schedule (Figure 2.6), the activities for each building will be parallel. Figure 2.6 indicates that the critical path for the decommissioning activities runs through completion of the building which will require the most time, Building JN-1. Specific activities and milestones for decommissioning this building as well as the other 10 buildings are being planned as part of the building-specific D&D/Readiness Review plans. Due to the nature of these buildings, and available funding, the D&D has been scheduled through 2000.

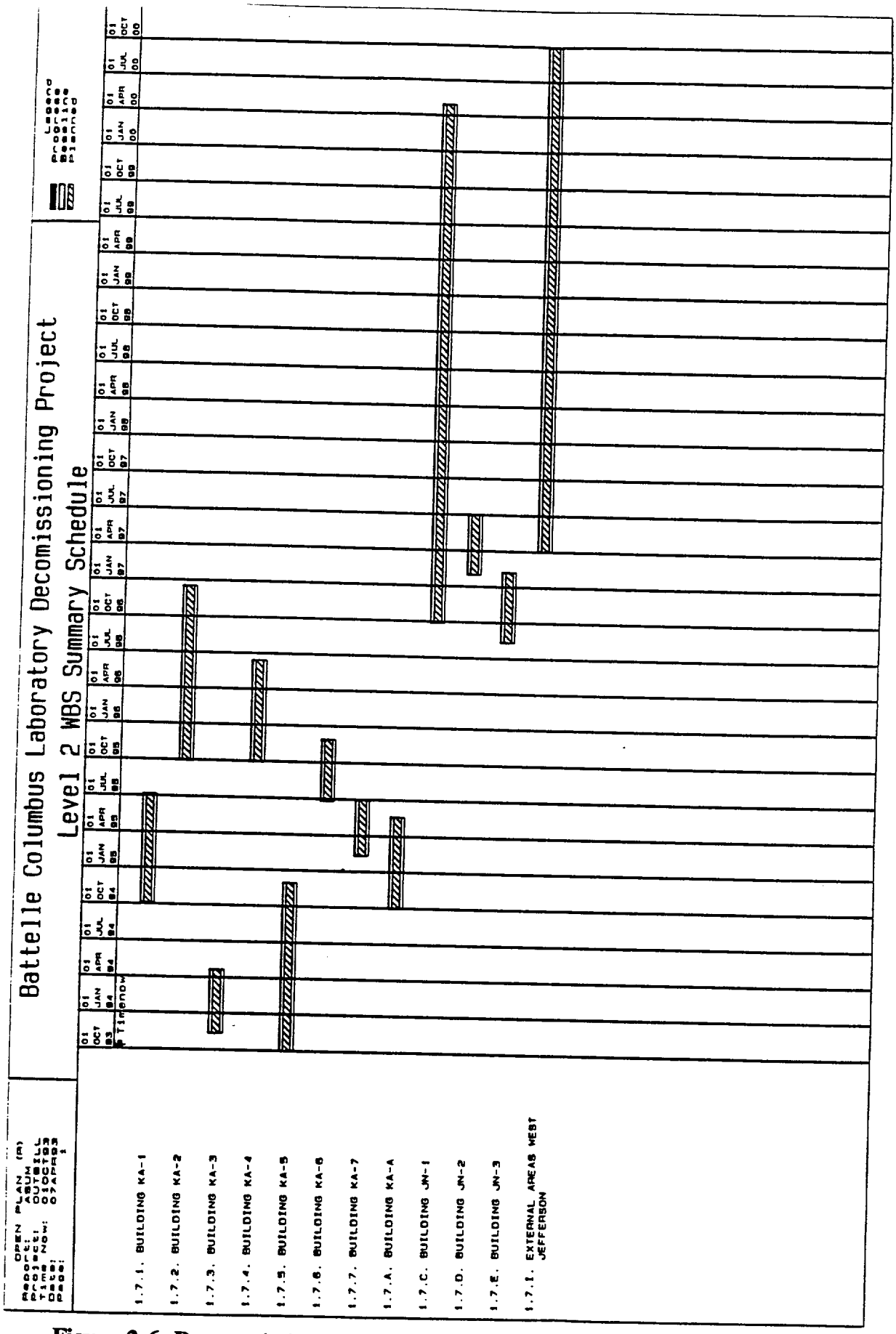


Figure 2.6 Decommissioning Schedule for the Fifteen Buildings

2.2 Decommissioning Organization and Responsibilities

The Department of Energy has the lead responsibility for day-to-day management of this Federally funded project. The NRC has responsibility for conducting periodic inspections; approving this Decommissioning Plan, the Financial/Assurance Plan, and the release criteria; and certifying the facilities for release. These D&D activities will be conducted and/or managed by Battelle under contract to DOE through its Chicago Operations Office. The D&D project is referred to as the Battelle Columbus Laboratories Decommissioning Project (BCLDP). Battelle will function as the decommissioning operations contractor (DOC) and will be responsible for all decommissioning operations, including procurement of appropriate subcontractors and integration of work performed. Battelle has the ultimate responsibility for complying with all the environmental, safety and health requirements of the U.S. NRC license SNM-7.

The DOE organization chart showing the lines of authority and responsibility for the project is presented in Figure 2.7.

2.2.1 Department of Energy - Chicago Operations (CH)

The DOE Project Manager, CH, (on site) is responsible for DOE oversight and field management of the BCLDP. As the DOE/CH Contracting Officer's Technical Representative, he has technical and programmatic authority for overall project implementation. The DOE/CH Contracting Officer is responsible for contract administration.

2.2.2 Decommissioning Operations

Battelle will manage, integrate, perform, and subcontract the decommissioning operations, as necessary, to ensure that all activities are performed within the requirements for occupational, radiological and industrial safety, environmental protection, site security, cost and schedule baselines, and the technical objectives of the project including the approved release criteria. Battelle activities will include preparation of detailed work procedures, engineering and design functions, decommissioning activities, property and waste disposal functions, and transportation of packaged waste material to a remote disposal site. In addition, Battelle will be responsible for all on-site work performance including that of subcontractors. After the completion of decommissioning activities, a planned final radiation survey of all areas will be conducted to verify that decontamination is complete and the facilities may be released without restriction. DOE will be notified and an independent verification survey will be performed by ORISE under a contract to DOE-HQ to verify that decommissioned facilities are suitable for release without radiological restrictions. A certification package will then be submitted to the NRC for its review and final certification of facility release.

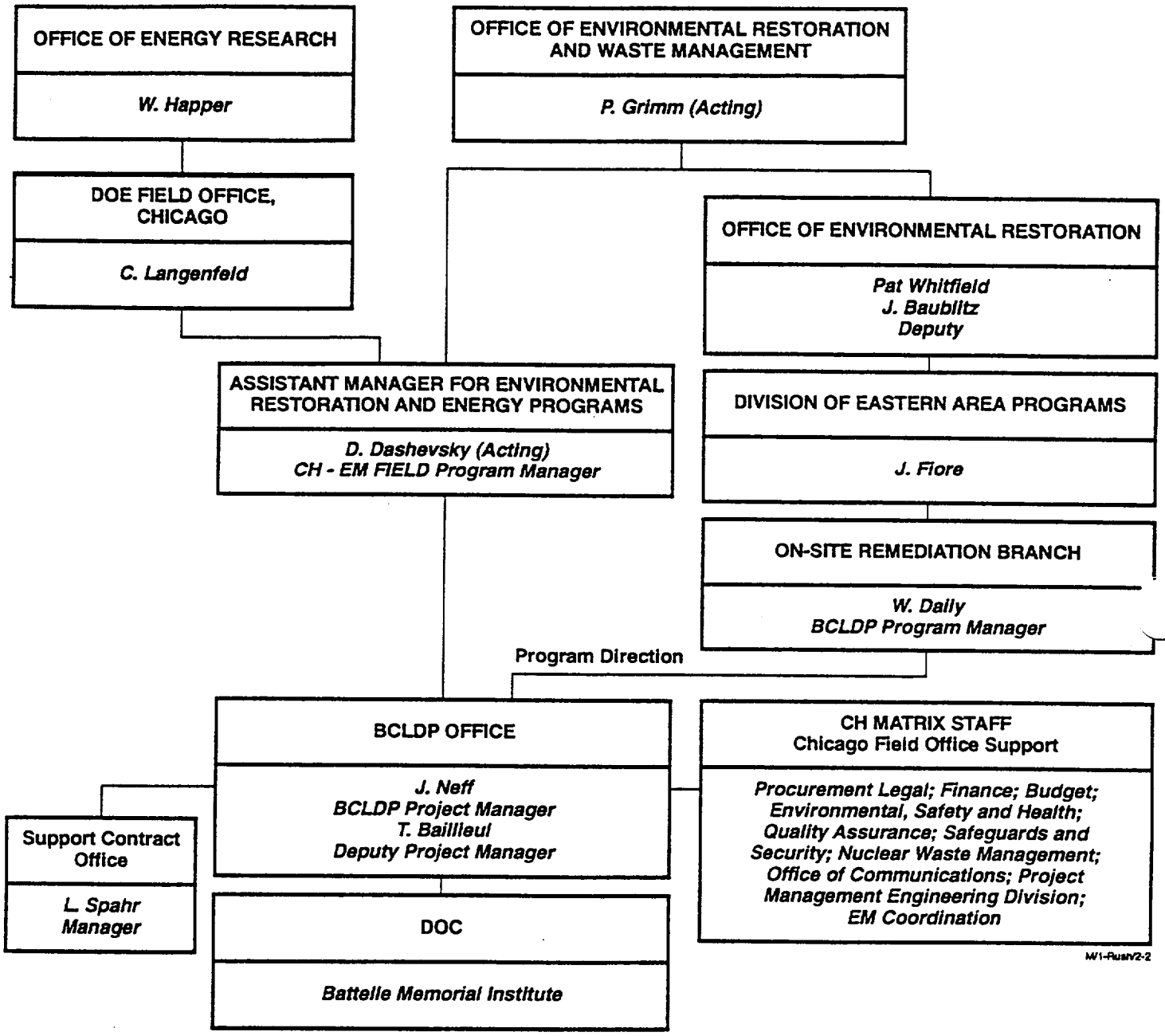


Figure 2.7 DOE Organization Chart for the BCLDP

The Battelle organization for the BCLDP is presented in Figure 2.8. The primary responsibilities for safety in decommissioning operations rests with this management team. The Program Manager is Dr. Kenneth C. Brog. Dr. Brog has 30 years experience in physics and nuclear technology at Battelle including 14 years in the planning and management of nuclear projects. He has been responsible for planning and/or management of a number of major projects and is currently responsible for managing all work in nuclear D&D at Battelle Columbus Operations.

The Manager of Decontamination Operations is Virgil E. Castleberry. Mr. Castleberry has over 15 years of engineering management and project management experience at a major DOE facility. He was responsible for planning and managing decommissioning of a large plutonium processing and a tritium-contaminated laboratory just prior to joining the BCLDP.

The Manager of Regulatory Compliance, Environmental Safety and Health Oversight is Mark E. Jackson. Mr. Jackson has over 17 years experience in nuclear licensing and regulatory compliance, both from the perspective of the applicant (nuclear utilities and DOE) and the regulator (NRC). He has performed and supervised every aspect of licensing commercial nuclear power plants, including preparation of license applications, interpretation of regulatory requirements, development of technical guidance, technical specifications, review and closure of licensing issues, and review of design change packages for operating reactors.

The Quality Manager is Scott Brown. Mr. Brown has 9 years of experience with Battelle in quality programs and technical activities. The majority of Mr. Brown's experience has been quality program development, facilitation, and verification for various environmental and radioactive waste management programs. He spent three and a half years performing quality program responsibilities for the nations high-level radioactive waste repository program and various low-level waste projects. For the last three and a half years, he has been responsible for the development, performance, facilitation, and management of a compliant and effective Quality Program for all activities in the Battelle Columbus Laboratories Decommissioning Project (BCLDP).

The Manager of Safety, Health, and Environmental Support is Stephen Layendecker. Mr. Layendecker has over 11 years experience in radiation protection and regulatory compliance at major DOE facilities and commercial nuclear power plants. He is a certified health physicist.

The Manager, Remedial Action is Ronald S. Carlson. Mr. Carlson has over 25 years of experience in the construction industry including 15 years as Carpenter, Foreman, and/or Superintendent in the building trades; 6 years as Lead Construction Engineer in Construction Management at the DOE Idaho National Engineering Laboratory (including remedial action and experimental waste reduction facilities); 2 years in remedial action as Project Manager on the UMTRA project; 4 years experience as Site Manger on the Denver Radium EPA Superfund Site; and 1 year experience as Project Manager on the BCLDP Project prior to being promoted to Manager, Remedial Action.

The Manager for Decommissioning Engineering functions are being handled by Samuel Basham, PE, with technical support from Battelle corporate staff on an as-needed basis. Mr. Basham has over 35 years experience in nuclear reactor research and

development, and hot cell operations. He was the manager for operations of the research reactor and its decommissioning. He has provided engineering management for preparation of the configuration control and "as-built" drawings of the Hot Cell Laboratory. He is the Building Group 3 Decommissioning Manager.

The positions shown in the chart are filled by Battelle staff or with subcontractor support, as needed, to ensure safe decontamination and decommissioning operations. Battelle currently has dedicated staff assigned to the BCLDP who have a wide breadth of knowledge of nuclear and non-nuclear safety and well-tested abilities to identify and solve safety problems.

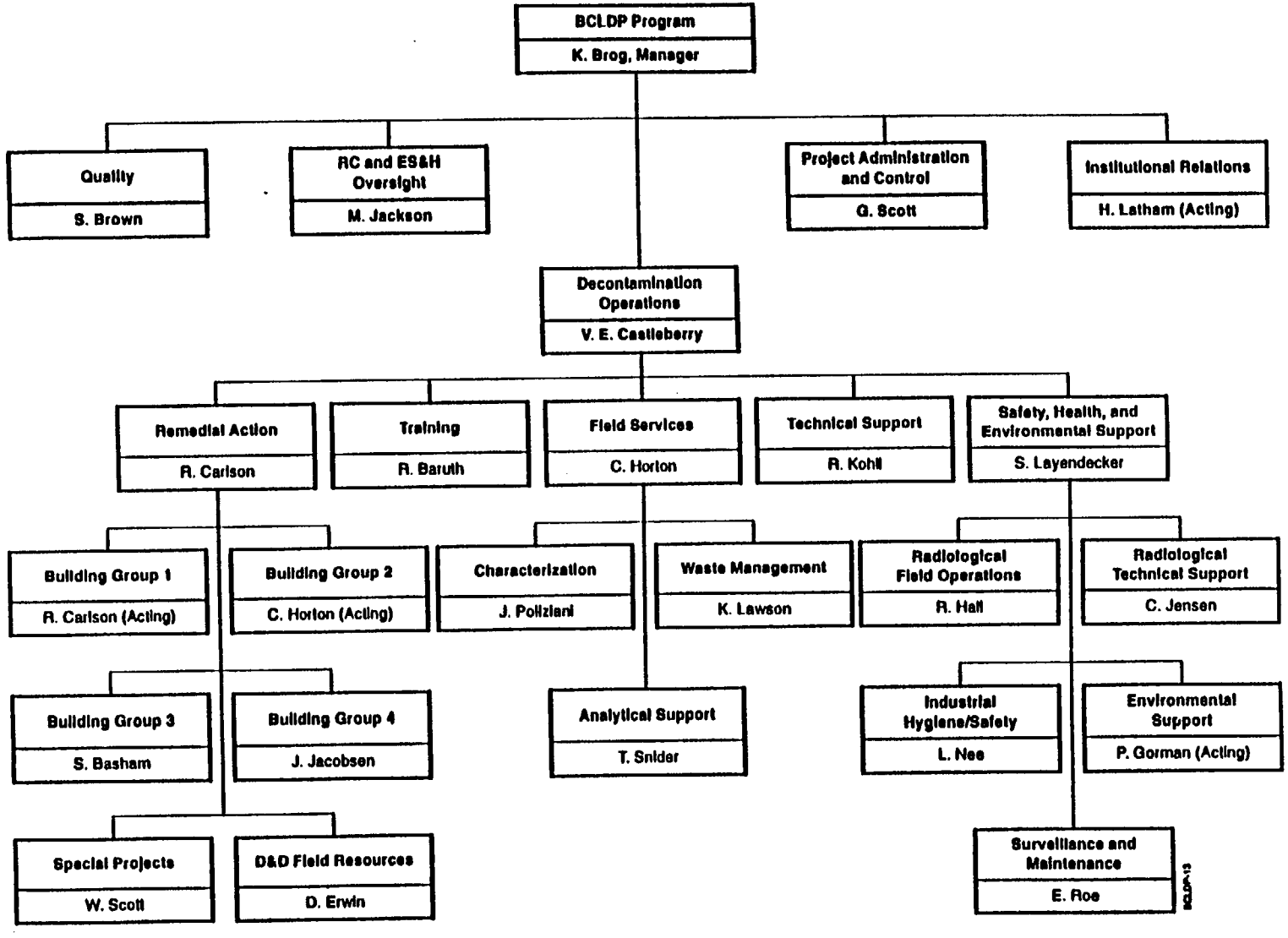


Figure 2.8 Battelle Organization Chart of Key Management Positions for the BCLDP Decommissioning Operations

2/93

BCO also maintains an independent Health and Safety Services Department which shares the responsibility for safe operation throughout Battelle by consulting, reviewing, providing surveillance, and training in safety matters. The BCO Radiological Safety Office has the authority and responsibility to interdict any activities deemed to constitute an unacceptable environmental, radiological, or human health and safety hazard.

The Health and Safety Department shares a part of its responsibility for the control of potential radiological hazards with the Radiological Safety Committee (RSC). Review of decommissioning operations will be a primary function of the RSC. The RSC provides technical information and a broad experience base for the evaluation of radiological safety in proposed and ongoing BCO operations, including the BCLDP. Like the Health and Safety Services Department, the RSC has the responsibility and authority to interdict any decommissioning operation believed to constitute an unacceptable potential for radiological hazard [2.21]. The RSC is responsible directly to the Office of the Chief Executive Officer (OCEO), and the responsibilities and duties incumbent upon each member of the RSC shall be dispatched promptly and shall take priority over usual responsibilities. Specific responsibilities of the RSC are to:

- Advise the OCEO in matters of radiological hazards.
- Determine the types of work which must be reviewed.
- Evaluate the hazard analysis of proposed work to assure the CEO that the hazards associated with work reviewed and recommended for approval will be maintained at the lowest practicable level when conducted as approved.
- Assure the CEO that the potential for radiological incidents have been reduced to acceptable levels when operations are conducted as approved.

The Radiological Safety Officer (RSO) is the health physicist appointed by the CEO to represent him and the RSC in matters of radiological safety. This applies to all BCO operations including the BCLDP. The RSO has the responsibility and authority for:

- Initial review of proposed operations to determine if RSC review is necessary or advisable.
- Approval of proposed operations which do not require RSC review and which are judged consistent with Battelle policy and radiological standards.
- Surveillance and auditing of Battelle operations with respect to radiological safety matters.

In summary, the RSO has the responsibility and authority to order the cessation or modification of any activities believed to constitute a substantial safety hazard or involve an unacceptable potential for such hazard.

2.2.3 Organization Communications

The BCLDP will require effective communications between participants for routine matters and emergency conditions. The Project Plan (Rev. 1, dated July 1991) describes the organization and communicates responsibilities for DOE-HQ and the DOE Chicago Field Office, including the onsite Project Manager. The Project Management Plan (Rev. 1, dated October 1992) describes project administration and control. It provides more specific details of the daily operations of the project.

The Battelle emergency plan and procedures for King Avenue and West Jefferson North [2.16] identifies the types of emergencies that might occur and the immediate responses to be taken. The plan also presents the emergency communications procedures to be followed. This plan is being updated. Communications with local fire, police, hospitals, and ambulance services are being formally re-established. Letters have been sent to these agencies and site visits have taken place. An emergency training drill with their participation is expected to take place in the third quarter of FY93 at the King Avenue and West Jefferson sites. This will be well before decontamination begins in FY94.

2.3 Training

2.3.1 Training Requirements

The BCLDP has adopted a policy that all personnel working on the project are required to have appropriate and verified training for the task assigned to them. The BCLDP Training Program Plan (DD-93-04) outlines the training program requirements for employees, subcontractors, consultants, visitors, and others engaged in the D&D operations [2.22]. This training program addresses health, safety, and environmental concerns for these workers and the public. It meets Environmental Protection Agency (EPA), Occupational Safety and Health Administration (OSHA), Department of Energy (DOE), and Nuclear Regulatory Commission (NRC) requirements for handling D&D tasks in a safe and environmentally-sound manner.

The Training Program is overseen and implemented by the Training Manager, Ms. Ruth Baruth, with required input from the managers responsible for the qualification and safety of their staff. This training program meets the requirements outlined in the following procedures: QA-AP-2.3, Indoctrination, Training, and Qualification; RS-AP-3.0, Radiation Protection Training; RS-AP-4.0, Health Physics Technician Training and Qualification; QA-AP-17.1, Project Records Management System for S&M and D&D Activities; and TD-AP-1.1, The Personnel Training and Qualification Records System.

This Training Plan details the minimum training requirements, the employee/visitor/subcontractor/consultant groups addressed, and the staff responsible for the successful implementation of the program. Finally, the plan discusses the training schedule, course evaluation process, and Training Information Management System (TIMS), the system used to archive and track trainees' needs and accomplishments. Further details are provided in the Training Program Plan.

2.3.2 QA Training

All BCLDP personnel are given a quality indoctrination and training by the Quality Manager. The training is administered by means of class room instruction, readings, and bulletins. The instructions are given to ensure adequate knowledge of the project requirements, familiarization with quality procedures, and documentation requirements. Project quality training and annual retraining are conducted as described in the Quality Manual, D&D Operations and its revised segments [2.23]. Records of project personnel indoctrination and training are kept in the DDO Project Records file.

The quality requirements comply with DOE Order 5700.6C; Title 10 CFR, Part 50, Appendix B; Title 10 CFR, Part 71, Subpart H; ANSI/ASME NQA-1; Quality Assurance Specifications for Battelle Columbus Division dated 02/12/92; and DOE/EM's Quality Assurance Requirements and Description (QARD), Revision 0, dated 10/31/91.

2.4 Contractor Assistance

It is expected that Battelle will accomplish some of the decommissioning activities by using subcontractors. As discussed in Section 2.3, administrative controls are in place to ensure adequate health and safety protection during D&D activities employing subcontractor personnel. Placement of a contract is based on objective evidence of the subcontractors' capability and quality program, and/or successful past performance, documented evidence of qualifications and certifications of the subcontractor employees, and successful completion of the radiological safety training program. The evaluation is made jointly by the Project Management requestor and the Project Quality Manager.

The subcontractor's suppliers of goods and services are subject to the Quality group surveys to assure performance to project standards, as well as audits and surveillance of subcontractor's work on site. Records of audits and surveillances will be kept in the Quality Manager's file.

The scope of the D&D effort requiring subcontractor assistance has been defined in the Subcontracting Plan dated 10/29/92 [2.24]. A list of qualified bidders has been developed.

2.5 References

2.1 "Battelle-Columbus. 40 Years of Energy Research for the U.S. Government", Internal Report, Battelle Columbus Division, June 1984.

2.2 "The U.S. Government and Battelle--Partners in Nuclear Research. 1943 - Present", Report prepared by Battelle for the U.S. Department of Energy, October 1985.

2.3 "Environmental Assessment and Finding of No Significant Impact for the Battelle Columbus Laboratories Decommissioning Project", June 1990. DOE document.

2.4 Applicable Requirements List, latest revision. DOE document.

2.5 "Battelle Columbus Laboratories Decommissioning Project, Project Plan, Revision 1", July 1991.

2.6 "Battelle Columbus Laboratories Decommissioning Project, Project Management Plan, Revision 1", October 1992.

2.7 U.S. NRC, Letter Pertaining to Oversight Responsibilities and Authority on BCLDP, Charles J. Haughey, US NRC to Martin A. Langsam, DOE-CH, December 18, 1990.

2.8 "Termination of Operating Licenses for Nuclear Reactors", USAEC Regulatory Guide 1.86, June 1974.

2.9 "Battelle Columbus Surplus Facilities Surveillance and Maintenance Program Plan, Revision 1", Prepared by Battelle Nuclear Services, October 1989.

2.10 "Inventory and Radiological Survey Procedure", DD-CP-005, April 1991.

2.11 "Facility Post Decontamination Resurvey/Remonitor", DD-CP-002, May 1990.

2.12 "Decontamination and Decommissioning Operations Readiness Reviews", DD-92-04, October 1992.

2.13 "Site Characterization Plan", draft

2.14 "Radiological Characterization Plan/Equipment Survey and Identification Plan for 6G-NW".

2.15 "Environmental Monitoring Plan for the BCLDP Project", EM-QAP-1.0, Revision 1, March 1991.

2.16 "Emergency Plan and Procedures, West Jefferson North", Battelle Columbus Division Document, Revised October 1989.

2.17 "Decontamination Work Plan for Building KA-7A", DD-WP-002, January 1993 (example).

2.18 "Radionuclide Release into the Environment: Assessment of Doses to Man", ICRP Publication 29, International Commission on Radiological Protection, 1978.

2.19 "Limits for Intakes of Radionuclides by Workers", ICRP Publication 30, International Commission on Radiological Protection, 1979-1982.

2.20 "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings", 40 CFR Part 192, Code of Federal Regulations, July 1988.

2.21 "Charter of the Radiological Safety Committee (RSC)", Battelle Columbus Division Document, March 1989.

2.22 "BCLDP Training Program Plan (DD-93-04)", December 1992

2.23 "Quality Manual for D&D Operations", Revision 1, November 1992.

2.24 "Subcontracting Plan", October 1992

3. Description of Methods Used for Protection of Occupational and Public Health and Safety

This chapter provides a description of the methods that will be used to ensure protection of workers, the public and the environment against radiation hazards during decommissioning.

3.1 Facility Radiological History Information

Battelle has completed nearly 1000 government and commercially sponsored research projects involving nuclear materials since April 1943. A description of these projects is compiled in the first reference [2.1,2.2]. The following section of this chapter is intended to provide an overview of Battelle's involvement in this nuclear work. More detailed information is presented of the current contamination status of the King Avenue and West Jefferson sites in paragraph 3.1.2 below.

3.1.1 Overview

Battelle's first studies with atomic energy development began in 1942, on the fabrication of uranium, a metal whose properties had yet to be characterized. The scope of atomic energy research rapidly increased after 1954, when the Atomic Energy Commission (AEC) lifted restrictions on atomic energy research/development. Battelle's accomplishments during the war years helped to make it possible to build and operate plutonium producing reactors, not long after the feasibility of the chain reaction had been demonstrated. Several different types of reactor systems were being assessed by the early 1950s.

Nuclear-related research was greatly expanded at Battelle in the decade after World War II. Development work on extractive metallurgy and plant corrosion resulted in an ion-exchange process which is the basis for recovery of most of the world's uranium. Extensive work was performed on alloy and fabrication process development, corrosion chemistry studies, and engineering analyses for the Naval Reactor Branch via the Naval Reactor Program, beginning in the early 1950s. Reactor development was the main research theme throughout the first 20 years, and dominated Battelle's research and development program.

The very nature of research being performed made it mandatory that a remote handling facility be built. Thus in 1955, Battelle expanded the existing nuclear facilities by building the first privately-owned nuclear research center in the world. This facility -- the Nuclear Sciences Area, located at the north end of the West Jefferson site, included a research reactor, critical assembly facility, hot cells, and later a plutonium laboratory which has since been fully decommissioned. At the south end of the West Jefferson site, several autoclaves were constructed, for use in hot isostatic pressing, a Battelle-developed technique for fabricating nuclear reactor fuel elements. Experiments connected with the radiation stability of materials were conducted in the Hot Cell Facility. Evaluation of these experiments has formed the basis for developing better nuclear fuels, control rod materials, and reactor

structural materials. An additional capability was added to the Hot Cell Facility by adding a mechanical test cell to study the mechanical properties of irradiated materials. Typical areas of research have included:

- Postirradiation examination of commercial PWR & BWR fuel and control rod materials
- Nuclear fuel failure inspection
- Spent fuel shipping and storage container development
- Nuclear plant reliability analysis and qualification for NRC licensing
- Commercial reactor hardware testing and refurbishment

The above overview gives an indication of the scope of Battelle's government and commercially sponsored nuclear energy research programs.

3.1.2 Current Contamination Status

The basis of the current assessment of the radiological contamination in the facilities at King Avenue and West Jefferson sites is a preliminary radiological survey performed in 1984. The survey results are summarized in Table 3.1. It lists known or suspected locations of contamination within each building, the types of operations performed, the estimated contamination inventory, and the types of isotopes involved. Detailed radiological surveys, decontamination and IVC surveys have been performed on buildings JS-1, JS-10, JS-12, and KA-9. Detailed radiological surveys are on-going in buildings KA-A, KA-1, KA-2, KA-3, KA-4, KA-5, KA-6G, KA-7, JN-2, JN-3, and JN-4.

Results indicate contamination in facilities/buildings which had been associated with handling nuclear material, with some contamination found in contiguous areas. Radioactive contaminants detected include transuranics (TRU), mixed fission products (MFP), activation products, uranium, thorium, carbon-14, and cobalt-60. Most of the contamination at the King Avenue sites is due to uranium, thorium, associated daughter products, and carbon-14. This status also applied to the South Area of the West Jefferson Site which has been decontaminated. The bulk of TRU, MFP, and activation product contamination is confined to the Nuclear Sciences (North) Area of the West Jefferson Site.

The contamination status of each building is described in more detail below.

TABLE 3.1. SUMMARY OF RADIOLOGICAL CONTAMINATION IN THE BATTELLE FACILITIES

Building	Type of Activity/Areas	Use	Survey Instrument Reading (dpm/100 cm^2)	Estimated Contamination Inventory (Year of Inventory)	Radioisotopes	Location*/ Type of Contamination
A	Misc R&D/ First, fourth floors	Encapsulation of highly enriched U for ATR fuel elements; pilot plant operation	1.5 K - 200 K	10^{-6} Ci ('73)	U, Th, daughters	Drain system
1	Misc R&D/ First floor	Uranium ore processing; ore beneficiation studies	0.5 K - 10 K	0.3 Ci ('84)	U, Th, daughters	Drain system, equipment, exhaust stack and ducts, piping (sludge)
1	Foundry	Processing of ore (tons)	1 K - 15 K	2.0 Ci ('84)	U, Th, daughters	
2	Metal Working Lab	Ore processing (tons); metal working	1 K - 4 K	< 1 Ci ('84)	U-238, daughters; U, Th, daughters	Trenches (debris), piping (sludge), equipment, debris, sludge
2	Welding Lab	Natural, enriched, depleted U welding and fabrication	3 K - 15 K	10^{-3} Ci ('84)	U, Th, daughters	Piping (sludge), trench (debris), equipment, stacks

TABLE 3.1. (Continued)

Building	Type of Activity/Areas	Use	Survey Instrument Reading (dpm/100 cm^2)	Estimated Contamination Inventory (Year of Inventory)	Radioisotopes	Location*/ Type of Contamination
2	Misc R&D/ Second floor	Heat treatment; electroplating	3.5 K - 5 K	10^{-3} Ci ('84)	U, Th, daughters	Debris/sludge, pipes (sludge)
3	U-235 Area	Receiving and distribution point for all unirradiated source & U-235 material	ND	< 1 Ci ('84)	U, Th, daughters	Pipes (sludge), floors and hoods
3	Melt Lab.	U-235 materials (1954-1975) metallographic research; tons of source material	5 K - 50 K	< 1 Ci ('83)	U, Th, daughters	Sludge; hoods, drain lines, trench (debris), equipment, stacks
3	Powder Metallurgy Lab	Natural U storage source processing	5 K - 30 K	< 1 Ci ('83)	U, Th, daughters	Pipes (sludge); trench (debris), equipment, stacks
3	Misc R&D	Ceramics research; metallographic research using tons of source material	8 K - 200 K (localized)	< 1 Ci ('83)	U, Th, daughters	Pipes (sludge) trench (debris), stacks

TABLE 3.1. (Continued)

Building	Type of Activity/Areas	Use	Survey Instrument Reading (dpm/100 cm^2)	Estimated Contamination Inventory (Year of Inventory)	Radioisotopes	Location*/ Type of Contamination
4	Radiochemistry Laboratory	Radiochemical analyses	ND	< 1 Ci ('84)	U, MFP, daughters	Residual activity in remaining sections of drain system
4	Misc Labs/ Second, fourth floors	Metallography; encapsulation facility	50 K (localized)	0.1 Ci ('84)	U, Th, daughters; MFP	Piping (sludge), trench (debris), equipment
5	Machine Shop	Machining and grinding of natural, enriched, depleted U; beryllium machining	1 K - 30 K	< 1 Ci ('84)	U, Th, daughters; MFP	Trench (debris); drain lines, equipment
5	Coating Lab	Coating	6 K - 10 K	< 0.1 Ci ('84)	U, Th, daughters; MFP	Piping (sludge); equipment, exhaust ducts, stacks
5	Misc R&D/ First, second floors	Americium processing; corrosion	2 K - 40 K	< 1 Ci ('84)	U, Th, daughters	Piping (sludge)

TABLE 3.1. (Continued)

Building	Type of Activity/Areas	Use	Survey Instrument Reading (dpm/100 cm^2)	Estimated Contamination Inventory (Year of Inventory)	Radioisotopes	Location*/ Type of Contamination
6	Misc R&D/ Ground, first floors	Alloy studies; chemical analyses; Co-60 irradiation	1 K - 14 K	< 1 Ci ('93)	U, Th, daughters Pu (TRU), Ce	Floor drains (sludge); drain lines, equipment, ducts
7	Misc R&D	Analytical chemistry on source materials; corrosion	1 K - 100 K	< 1 Ci ('84)	U, Th, daughters	Drain lines (sludge), trench (debris), equipment, exhaust ducts
9	Misc R&D/ Ground floor	Handling of natural and depleted U; krypton studies	ND	< 1 Ci ('84)	U, Th, daughters	Drain lines (sludge); trench (debris), equipment

TABLE 3.1. (Continued)

Building	Type of Activity/Areas	Use	Survey Instrument Reading (dpm/100 cm^2)	Estimated Contamination Inventory (Year of Inventory)	Radioisotopes	Location*/ Type of Contamination
JN-1	Hot cells	Fuel element development; examination of irradiated fuel; criticality experiments	ND	6,000 Ci ('89)	MFP; U, Th, activation products (AP); Co-60	Drain lines (sludge), closed tank (water), equipment
JN-2	Former critical assembly lab; Accountability Lab; Radio-analytical lab	Fuel element development; U-235, plutonium storage; radio-chemical analyses	ND	<1 Ci ('84)	TRU, MFP, AP	Tanks (closed); stored water; drain lines (sludge); trench (debris)
JN-3	Retired research reactor	Reactor studies; material irradiations	ND	ND	TRU, MFP, AP	Piping, trench base of containment), external hold-up tank (water); external drain system; drainage system (sludge)

* Building surface contamination is common to all buildings.

ND = not determined.

3.1.2.1 King Avenue Site

Building A (Corporate Office Building). Previous operations in this building included the encapsulation of highly enriched uranium for advance test reactor fuel elements. The building was substantially contaminated with uranium. Some areas of the building have now been decontaminated, several rooms are under evaluation, and approximately 200 linear feet of drain line, four floor drains and about 100 square feet of concrete are known to be contaminated. Contamination is due to uranium, thorium and associated decay products.

Building 1 (Foundry). Uranium ore processing and ore beneficiation studies were performed in this facility, in support of feed material processing centers operated by other contractors for the AEC. A foundry and melting, cutting, and grinding facilities are located within this building. The second floor of this building was substantially contaminated but most of the contamination now has been removed. Approximately 75 square feet on the second floor are still contaminated, together with the drain system. Other parts of this building which are contaminated include the foundry area, and both ground and third floors. Contamination is due to uranium, thorium and associated decay products.

Building 2 (Metalworking Building). Building 2 was used for AEC research including the electroplating of Hanford reactor slugs, heat treatment and fabrication of uranium and thorium alloys, rolling studies, alloy development and fuel element fabrication. Most of the area contaminated by the electroplating activities has been cleaned. Radioactivity has been detected at several locations on floors and in trenches on one side of the building. A major portion of work in this building consists of decontaminating and/or removing 12 large metal working machines that include hydraulic presses, rolling mills, furnaces, and a power transformer. Contamination is due to uranium, thorium, and daughter products.

Building 3 (Materials Building). This building housed powder metallurgy, melting, metallographic, and ceramics research facilities using enriched, natural, and depleted uranium. Contaminated areas (uranium, thorium, and daughter products) are spread throughout this building, from the ground to the second floor, and include equipment, building surfaces, and drains. In addition, survey data indicated a relatively high concentration of uranium (10^{-3} μg/g) in sludge from a Building 3 sump.

Building 4 (Radiochemistry Laboratory). Building 4 contained a radiochemistry laboratory and an encapsulation facility for highly enriched uranium. The radiochemistry laboratory -- floors, walls, ventilation system, and floor drains and drain lines -- has been decontaminated. Areas of contamination still exist in the building ventilation system and parts of the drain system. They are contaminated with a mixture of uranium and mixed fission products (MFP).

Building 5 (Machine Shop). This machine shop produced substantial work for AEC/ERDA/DOE programs. The work involved machining, grinding and milling operations on depleted, natural, and enriched uranium. Part of the floor of the grinding room was replaced to remove contamination. Small areas of contamination also remain in the mezzanine and second floors. Areas of contamination also exist in the exhaust ventilation system, and drain system sumps.

Buildings 6 and 7 (Chemistry Buildings). Analytical chemistry activities in support of the DOE/Navy program took place in these buildings. The work involved alloy studies, corrosion research, chemical and instrumental analyses. Low levels of contamination exist in the ground and first floors of Building 6, and in the first through fourth floors of Building 7. Contamination also has been detected in the drain system for these buildings. The contamination in both buildings is due to uranium and thorium.

Building 9 (Mechanical Engineering Building). Research programs were conducted in Building 9 for AEC/ERDA/DOE involving natural and depleted uranium. Minimal surface contamination remained in one area of the ground floor and drain lines were slightly contaminated with uranium and thorium. A laboratory area on the mezzanine contained contaminated hoods and duct work which were removed. This building has been decontaminated and released.

3.1.2.2 West Jefferson Site

Building JN-1 (Hot Cells). JN-1 was constructed to support fuel development research for the AEC. The facility was initially used for hot cell examination of fuel specimens which had been irradiated in the Battelle Research Reactor. Subsequent work involved examination of fuel from commercial power reactors in support of DOE programs. Due to the nature and extent of contamination within the hot cell area, a formal radiological survey has not been performed. Extensive contamination from transuranics, fission products, activation products, uranium and decay products, and Co-60 exists throughout the hot cell laboratories.

Building JN-2 (Former Critical Assembly Laboratory). This building was used for a zero power organic-moderated critical assembly and other criticality experiments. Subsequently, JN-2 housed a small plutonium laboratory, an instrument laboratory, and currently a radioanalytical laboratory for the D&D program. The building also contains a storage vault formerly used for storage of plutonium and highly-enriched uranium. Contamination exists in those areas and in an underground storage tank and its associated hot drain system. The plutonium laboratory was decontaminated and converted into the radioanalytical laboratory.

Building JN-3 (Reactor Building). Building JN-3 housed a research reactor which was operated in support of fuel development programs for the AEC. This reactor was partially decommissioned in the mid seventies and retired. Subsequently, the building was used to store waste generated from previous D&D activities in the JN-2 Plutonium Laboratory and another Plutonium Laboratory (JN-4) at the same site. TRU, MFP, and activation products are present, either as surface contamination, or in sludge/water/soil media in drain lines and around the containment building itself as a result of former reactor operations.

3.1.2.3 Site Soil at the West Jefferson Nuclear Sciences Area

Data presented in the Battelle annual environmental reports [3.1] indicate that there have been no significant radionuclide releases to the environment from site activities. Furthermore, the ongoing environmental monitoring program indicates no significant site releases or migration of contamination.

Radionuclide activities of soil/sediment samples collected by Battelle and Argonne National Laboratory during limited characterization studies, show that there are four small areas on the West Jefferson north site which have elevated activities of Cs-137 and Am-241. One area is in two abandoned filter beds (Figure 3.1) which has been remediated. The residual contamination is confined to a small area within the remediated region. The second area is located near the storm sewer outfall (Location #1 in Figure 3.1) which serves buildings JN-1 and JN-4 (the former plutonium laboratory). Low levels of mixed fission products, and transuranic contamination have been identified along a narrow band that originates from this outfall. These areas will require remediation in the form of soil excavation. The extent of the remediation effort will be determined from the site characterization and excavation work.

3.1.3 Operational Occurrences

3.1.3.1 Procedure

In response to NRC Regulation 10 CFR Part 21 of 1977 [3.2], Battelle developed a procedure for reporting of defects and noncompliance [3.3]. A careful evaluation of the revised NRC regulation issued in November 1988 [3.4] showed that Battelle's original procedure for reporting would not have to be changed to comply with the revised regulation.

This Battelle procedure requires the staff member recognizing a "deviation" that has radiological implications to immediately notify his Manager, who documents the deviation by initiating a Form D-21, "Part 21 Initial Deviation Report", and forwards it to the Battelle Radiological Safety Officer (RSO), or in his absence the NRC Compliance Coordinator. This document serves as the official record for all identified deviations. The Form D-21 remains open until the evaluation is resolved. This log report, along with the final evaluation report, is maintained by the RSO for inspection purposes by NRC. The appropriate Manager, together with the RSO and the NRC Compliance Coordinator, arranges for evaluation of the deviation to determine present or potential radiological safety hazards. The evaluation must reflect a thorough and comprehensive investigation to determine if a substantial radiological safety hazard resulted or could have resulted from the deviation.

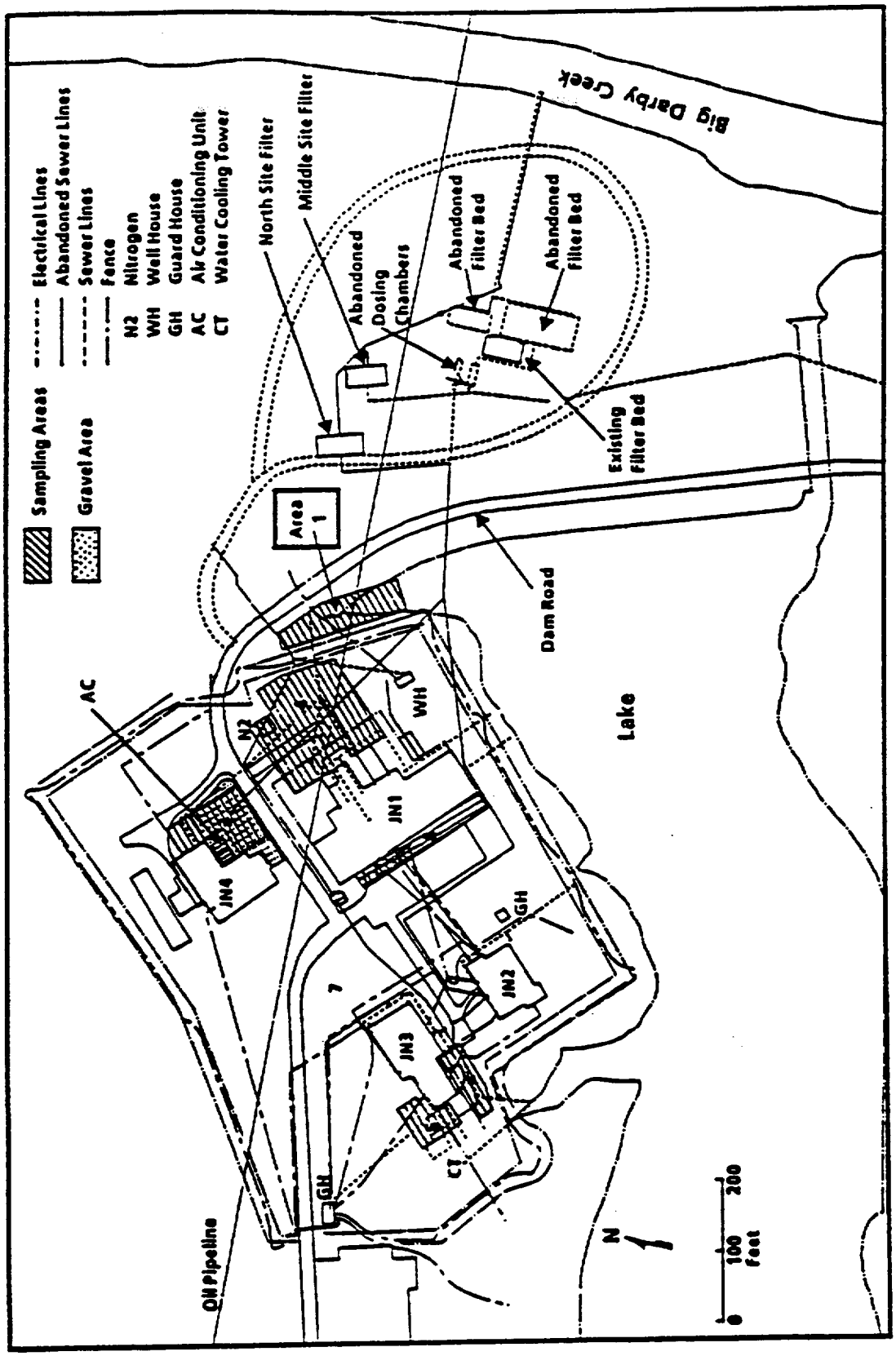


Figure 3.1 Environmental Monitoring at the West Jefferson Nuclear Sciences Area Showed Evidence of Soil Contamination in the Proximity of the Abandoned Filter Beds and the Storm Sewer Outfall (Area 1)

If in the evaluation of a deviation or an item of noncompliance it is determined that a substantial safety hazard did result or could have resulted, the Manager immediately notifies the Battelle Radiation Safety Officer in a written report which must include the following information:

- Identification of the facility, the activity, or the basic component which "fails to comply" or contains a defect
- Nature of the defect or "failure to comply" and the safety hazard which was or could be created
- The date on which the information of such defect or "failure to comply" was obtained
- Any advice related to the defect or failure.

The Battelle Radiation Safety Officer and the NRC Licensing Coordinator must initially notify NRC of a defect or noncompliance within two days after he is notified.

3.1.3.2 Previous NRC Reportable Occurrences

Previous operational occurrences such as spills, releases, or other accidents, were evaluated according to the above procedure. Except for two incidents, the RSO found that the deviation did not constitute a substantial safety hazard and was not reportable to the NRC under 10 CFR Part 21 and Battelle's license conditions. For each nonreportable incident, the RSO filed an internal memorandum. The memorandum serves as the formal documentation of the evaluation and the final determination. All these memoranda are maintained in the Battelle RSO files.

None of these non-reportable incidents resulted in significant residual contamination since the contamination was largely removed following the occurrence.

In one of the two incidents reported to the NRC, the Security Access Control Center (SACC) alarm panel at the West Jefferson Nuclear Science Area became inoperative at 5:00 p.m. October 17, 1977, and was not restored to operation until 8:00 p.m. on October 21, 1977. As a result of this outage, facility alarms at the Hot Cell Laboratory (JN-1), the former plutonium laboratory (JN-4), Vault Area (JN-2), and Retired Battelle Research Reactor (JN-3) were not continuously monitored during nonworking hours. The evaluation concluded that this outage could have constituted a substantial safety hazard since a condition such as fire, stack release, or criticality could have gone undetected for approximately one hour during nonworking hours. A security guard makes hourly clock rounds at each of the above facilities.

As required, the Battelle Responsible Officer notified the NRC on November 11, 1977 [3.5] within two days after receiving the results of the evaluation. Since no radioactivity was released during this occurrence, there is no residual contamination due to this specific incident.

The other noncompliance incident reported to NRC involved a release of airborne radioactive material within the Hot Cell facility and subsequent surface contamination. This occurred at the Hot Cell facility on May 3, 1980, during unloading operations of a failed spent fuel assembly received from the Connecticut Yankee Atomic Power Company. There was no release of radioactive material from the building. The data from bioassay procedures, including in-vivo counting, have established that resultant radiation exposures were well within prescribed standards as set forth in 10 CFR Part 20. Pulmonary depositions were a fraction of a percent of the permissible body burden.

An evaluation of this deviation in accordance with 10 CFR Part 21 procedures determined that this incident was reportable to the NRC as a defect in that it could have created a substantial safety hazard to staff in the area and the environment. Accordingly, the Battelle Responsible Officer notified the NRC on July 18, 1980 [3.6] within two days of the evaluation. However, the surface contamination was largely removed following the occurrence and subsequent monitoring has shown no significant residual contamination.

3.1.4 Radiation Levels

The 1984 radiological survey of the facilities showed that with the exception of the Hot Cell (Building JN-1), the contamination was widespread but that the radiation levels were low, in the range of 0.1-0.2 mR/hr (beta-gamma). Although no measurements were made in the hot cells as part of the 1984 survey, the presence of radioactive materials currently stored in the cells and contamination from past operations indicates high radiation fields within the cells and in the controlled-access areas. The operating areas outside the cells have average radiation levels of less than 0.5 mR/hr. Table 3.1 shows radiation levels reported in the 1984 survey of the building. Radiation levels will be continuously monitored and all operations will be performed in keeping with the ALARA considerations described in the next section during decommissioning operations in the hot cells and other buildings.

3.2 Ensuring Occupational Radiation Exposures Are As Low As Is Reasonably Achievable (ALARA)

Ensuring occupational radiation exposures, both internal and external, are as low as reasonably achievable is accomplished through an integrated radiation protection program at BCLDP [3.7]. Project management, with a mandate and commitment from the Battelle Chief Executive Officer and senior management, aggressively promotes a policy of ALARA among project staff [3.8]. A thorough approach to ALARA is accomplished through a formal procedure-based program administered and implemented through the Safety, Health and Environmental Support (SH&ES) department [3.9]. Project staff is encouraged to actively participate in the ALARA process through suggestions, review and feedback

networks of a formal and informal nature. Senior project management encourages an "open door policy" where an environment of self-appraisal is highly desired.

The goal of minimizing radiation exposure is based on the assumption that even small exposures involve some health risk. It is therefore incumbent upon staff and management to maintain individual and collective dose as low as reasonably achievable.

Reducing individual and collective radiation exposures to as low as reasonably achievable levels is a fundamental objective of a radiological protection program [3.10-3.12]. Reducing collective exposures (man-rem) is desirable because of the inferred connection between collective dose and the health and safety of the workers and the public. This connection has been presumed repeatedly in the guidance provided by such organizations as the National Council on Radiological Protection and Measurements (NCRP), the International Commission on Radiological Protection (ICRP), and the National Academy of Sciences Committee on the Biological Effects of Ionizing Radiation (NAS-BEIR).

Reducing individual and collective radiation exposures also improves other parts of a radiological protection program through better planning of work, training of workers, and tracking of exposures. Ultimately, these efforts benefit the safety and reliability of the project by improving the quality of work performed; they also are cost-effective because they often save time and money by reducing lost time incidents.

Minimizing radiation exposure is accomplished by preliminary planning and scheduling, by using proven and innovative engineering techniques, and by establishing and achieving radiation exposure goals. Preliminary planning and scheduling identifies those jobs that should be reviewed for radiation exposure reduction and allows time to develop methods, write procedures, and train personnel. Radiological engineering provides methods to reduce dose rates or the time spent in radiation areas. Radiation exposure goals are used as a management tool for involving all project groups in actively reducing radiation exposures and also providing a means of assessing the effectiveness of radiation exposure reduction actions.

The project has established a formal ALARA program administered by the ALARA coordinator. This program requires ALARA goals and objectives, pre-job and post-job reviews, and performance tracking. Formal reports are issued to management to ensure proper review. These formal reports are implemented through the following procedures:

HP-AP-12.0, "Radiological Performance Reports", November 1992 [3.13]
HP-AP-21.0, "Radiological Awareness Reports", January 1993 [3.14]
HP-AP-31.0, "ALARA Reports", December 1992 [3.15].

The SH&ES manager reviews and approves all procedures, work plans and work instructions. The SH&ES manager also administers the Radiation Work Permit program which applies specific ALARA requirements to each task [3.16].

During jobs involving exposure to radioactive material, supervisors make regular observations of work in progress to ensure the planned exposure reduction techniques are implemented and to identify other ways to further reduce exposures.

It is the policy of the BCLDP that ALARA is an individual as well as a collective philosophy in which training equips the staff with the tools to have a successful program and management commitment promotes the use of those tools. Training is described in section 2.3.

Supplemental implementation is accomplished through other administrative and operating procedures, training, oversight activities and management direction.

3.3 Health Physics Program

3.3.1 Radiation Protection Program

The BCLDP Radiation Protection program is an element of the BCLDP Safety, Health and Environmental Support Staff (see Figure 3.2). The SH&ES manager is the functional Radiation Protection Manager reporting to the BCLDP Decontamination Operations Manager. The Battelle Radiation Safety Officer, representing the Battelle Chief Executive Office, provides oversight in matters concerning license conditions.

Reporting to the SH&ES manager are the managers of the two sections of Health Physics; the Radiological Field Operations Manager and the Radiological Technical Support Manager. The section represented by the Field Operations Manager consists of Operational Health Physics and Health Physics Support. The section represented by the Technical Support Manager consists of Dosimetry, ALARA programs, and Technical Support. The biographical information for the SH&ES Manager, Field Operations Manager, and Technical Support Manager is shown in Attachment 4.

Within each of the two sections of Health Physics, further division of authority and responsibility is provided through the HP Shift Supervisors, Dosimetry Administrator, ALARA Coordinator, and Lead Technicians (see Figure 3.3).

Detailed discussions of each area of the Health Physics program are in the document "Radiation Protection Program for the Battelle Columbus Laboratories Decommissioning Project".

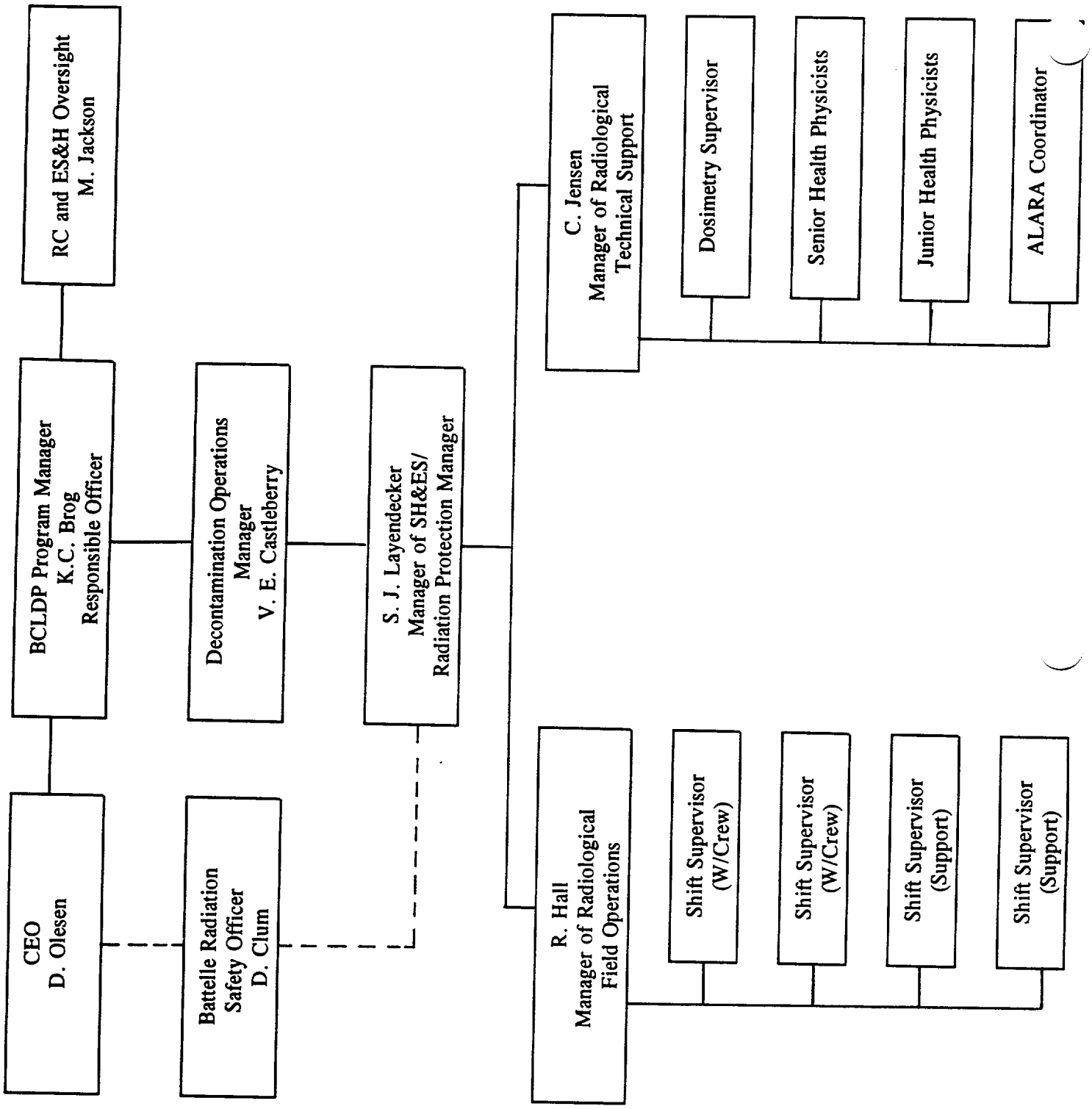


Figure 3.2 Radiation Protection Organization

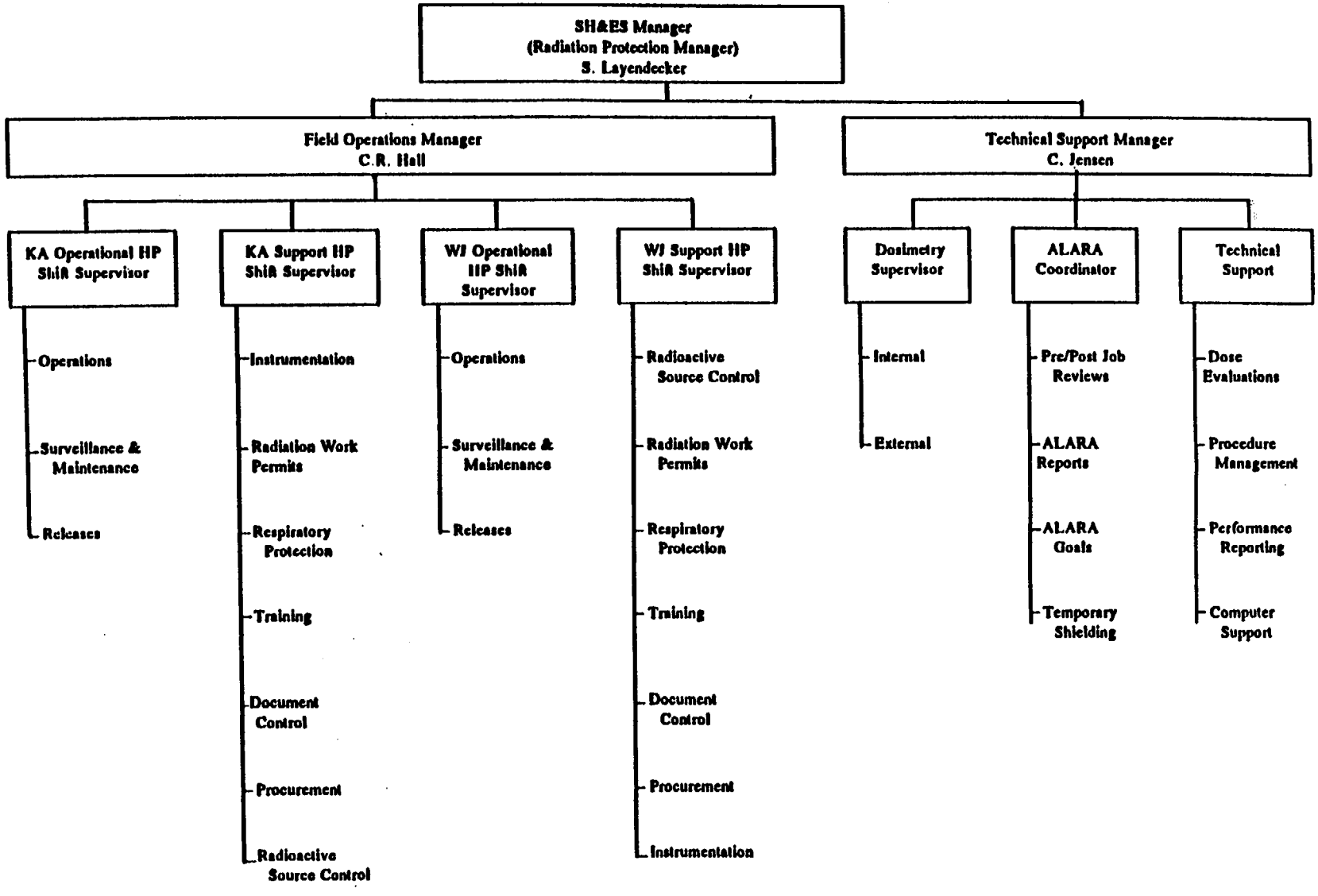


Figure 3.3 Health Physics Organization

3.3.2 Field Operations Section

3.3.2.1 Health Physics Operations

HP Operations at each site is comprised of three sections and each section is supervised by a lead technician responsible to the HP Operations Shift Supervisor.:

- Operations
- Surveillance and Maintenance
- Releases

The following chart (Table 3.2) describes the responsibilities and reporting requirements of each section.

Table 3.2. Responsibilities and Reporting Requirements of Health Physics Operations

	OPERATIONS	SURVEILLANCE AND MAINTENANCE	RELEASES
RESPONSIBILITIES	1. Provides all field radiation protection job coverage 2. Provides, on an as needed basis, supplemental support to the S&M and Release Sections	1. Performs all scheduled surveillance activities 2. Submits the monthly and annual performance reports	1. Supports the Building Manager and Decontamination Operations Department in the area of releases of materials from the controlled areas
REPORTING REQUIREMENTS	Reports to Operations Shift Supervisor	Reports to Operations Shift Supervisor	Reports to Operations Shift Supervisor in the area of Health Physics and the Task Manager in the area of work coordination

3.3.2.2 Health Physics Support

HP Support at each site is comprised of several sections and each section is supervised by a Lead Technician who reports to the Support Shift Supervisor:

- Instrumentation
- Radiation Work Permits
- Respiratory Protection
- Training
- Radioactive Source Control
- Document Control
- Procurement

Table 3.3 describes the responsibilities and reporting requirements of each section.

Table 3.3 Responsibilities and Reporting Requirements for Health Physics Support

	Instrumentation	RWP	Respiratory Protection	Training	Source Control	Document Control	Procurement
Responsibilities	Calibration, issue, use, repair, records and recall of all Health Physics Instrumentation	Generation, maintenance and use of all Radiation Work Permits	Storage, selection, issue, and maintenance of all respirators and breathing air systems and Fit Testing	Scheduling of personnel training and maintenance of personnel training records	Inventory, issue, leak testing and accountability of all project radioactive sources	Management of all Health Physics records	Ordering, inventory and maintenance of minimum quantity levels of all HP equipment and consumables
Reporting Requirements	Reports to Support Shift Supervisor	Reports to Support Shift Supervisor and Operations Shift Supervisor	Reports to Support Shift Supervisor	Reports to Support Shift Supervisor and works closely with the Project Training Coordinator	Reports to Support Shift Supervisor and works with RSO Group	Reports to Support Shift Supervisor and works with Project Records Management Group	Reports to Support Shift Supervisor and works closely with Battelle Purchasing Department

3.3.3 Technical Support

3.3.3.1 Dosimetry Section

Project Dosimetry is currently managed by the acting Dosimetry Supervisor who reports to the Technical Support Manager. The Dosimetry Supervisor and support staff operate from the King Avenue site with dosimetry technician support at both sites. Supplemental support of dosimetry functions is provided from the Field Operations Section as necessary.

Currently, Dosimetry uses the services of Landauer Inc., for thermoluminescent dosimetry (TLD) processing. Landauer Inc. is National Voluntary Laboratory Accreditation Program (NVLAP) accredited and Department of Energy Laboratory Accreditation Program (DOELAP) accreditable. TMA Eberline is the bioassay contractor for the project, and the whole body counting contractor is Helgesen Scientific. They each provide a high quality, reliable service to the project.

Dosimetry is responsible for:

- Routine dosimetric monitoring,
- Special dosimetric monitoring,
- Exposure records management,
- Internal and external dose tracking,
- Bioassay program, and
- Dosimeter quality control program.

The dosimetry functions are controlled by procedures such as the External Personnel Dosimetry Program [3.17], Administering the Personnel Bioassay Program [3.18] and others listed in Attachment 3.

3.3.3.2 ALARA

Project ALARA is supervised by the ALARA coordinator who reports to the Technical Support Manager. ALARA staffing is composed of one technician with supplemental staffing provided by the Field Operations Section and Decontamination Operations as necessary.

The ALARA coordinator is responsible for:

- Annual ALARA goals,
- Pre-job ALARA reviews and reports,
- Post-job ALARA reviews and reports,
- Providing guidance to staff concerning maintaining exposures ALARA,
- Monthly and quarterly ALARA status reports,
- ALARA audits,
- Temporary shielding.

The ALARA coordinator, in addition to his/her formal responsibilities promotes the ALARA philosophy to the project staff and management. Further details of the ALARA program are described in section 3.2.

3.3.3.3 Technical Support

The responsibility for technical support in the areas of dose evaluations, program and equipment evaluations, and technical basis documents is managed by the Technical Support Manager (Figure 2.8). Resources are provided by the staff and management of the SH&ES department on an as needed basis. Subject expertise is provided, when necessary, from outside consulting firms.

Performance tracking and awareness reporting are also provided to the project by the Technical Support Manager.

3.3.4 Programs

3.3.4.1 Respiratory Protection

The BCLDP respiratory protection program [3.19] is based upon the guidance provided in NUREG 0041 [3.20]. Strict compliance to NIOSH and NRC requirements provides the project with a reliable, high quality program of respiratory protection.

The respiratory protection program provides training, equipment, and fit testing to all project personnel. Also, ventilation and engineering controls are provided by procedural requirements [3.21] based upon a strong admonition by project management to use these systems prior to the use of respirators.

Controlling airborne radioactivity at its source is the goal of the respiratory protection program [3.22]. Through the application of engineered controls, decontamination, ventilation systems and personnel training, the use of respirators can be minimized.

Each type of respiratory protection device used by BCLDP is controlled by its own use and maintenance procedure [3.23-3.26]. Selection of the devices for specific purposes is also procedure governed [3.27].

The Respiratory Protection section issues respirators to individuals for one time use. Each respirator issued is sealed in a clear plastic bag with a "Cleaned and Inspected" certification provided.

It is the procedurally mandated policy of BCLDP that personnel wearing respirators will have line-of-sight supervision by a qualified health physics technician in all cases.

Dedicated breathing air systems supplying Grade D air are also in use [3.28]. Use of breathing air is based upon strict compliance with NUREG 0041 and the device's NIOSH certification requirements. Normally, air supplied bubble hoods with continuous flow are the only type of supplied air respirators in use at BCLDP.

Table 3.4 lists the respirators in use at BCLDP:

Table 3.4 Respirators in use at BCLDP

BRAND	TYPE
MSA Ultratwin	FFNP
North 7600-8A	FFNP
MSA PAPR	Powered, Air Purifying
Survivair HIP PAC w/Escape Bottle	FF Continuous Flow Airline
Survivair Mark II	SCBA - Pressure Demand
MSA Ultra Lite	SCBA - Pressure Demand
FRHAM	Bubble Hood - Continuous Flow

3.3.4.2 Instrumentation

The instrumentation program is based upon the requirements of DOE Order 5480.11 and 10 CFR 20 with guidance from ANSI N323-1978 [3.29] and Regulatory Guide Division 8 OP-032-5 [3.30].

The following table (Table 3.5) describes the selection criteria, purpose, calibration specification and frequency, performance testing and sensitivities of all Health Physics instrumentation.

Other instruments used by BCLDP are listed below in Table 3.6. Each has its own operation, calibration and performance testing procedure [3.31]. See Attachment 3, procedure numbers HP-OP-101 through HP-OP-145.

Table 3.5 Calibration Frequency

	SELECTION CRITERIA	PURPOSE	CALIBRATION SPECIFICATION	PERFORMANCE TESTING CRITERION	SENSITIVITIES
Bicron & RSO-50 Eberline RO-20 Bicron RSO-5 and RSO-5 Eberline RO-20	1. Tissue Equivalent Air Ion Chambers 2. Proven dependability 3. Energy independence 4. Linear response 5. Beta/Gamma measurement capability 6. Portable	Performance of exposure rate measurements to comply with DOE Order 5480.11 and 10 CFR 20	HP-OP-101 Frequency - Every 6 months Calibrated to NIST traceable sources (CS-137 and depleted U-238) to 2 points on each scale	- Daily or prior to use - One point on each scale ± 10%	Beta and gamma radiation R50-5 - 0.2 to 5,000 mR/h R50-50 -0.2 to 50,000 mR/h RO-20 - 0.2 to 50,000 mr/h Linear response from 70 kev to 10 Mev
PAC-4G W/AC21B	1. Gas proportional 2. Response to alpha and beta 3. Good gamma rejection 4. Good response to very low energy beta (C-14) 5. Audible response 6. Portable	Performance of direct measurements of alpha and beta emitting isotopes on equipment and building surfaces	HP-OP-103 Frequency - every 6 months Calibrated to NIST traceable Pu-239 standards. Beta response is verified but not quantified	- Daily or prior to use - One point on each decade ± 20%	Quantitative alpha-response over full energy range Qualitative beta response from energies of C-14 to SrY-90
NE Technologies Delta & Electra	1. Phoswich detector 2. Integrate/scaler modes 3. Audible response 4. Two channel (alpha & beta) 5. Good gamma rejection 6. Good response to Th & U beta energies	Performance of direct measurements of alpha and beta emitting isotopes on equipment and building surfaces Replaces the PAC-4G	HP-OP-131 Frequency - every 6 months Calibrated to NIST traceable Pu-239 and Tc-99 standards	- Daily or prior to use - Qualitative hourly when performing release surveys - One point on each channel ± 10%	TC-99 - 10%, 4 π Pu-239 - 15%, 4 π
Ludlum 2929	1. Phoswich detector 2. 2 channel (alpha & beta) scaler 3. Low minimum detectable activity values 4. Threshold and window variable setting capability 5. Reliability 6. Ease of calibration	Performance of smear and air sample counting	HP-OP-105 Frequency - Every 6 months Calibrated to NIST traceable sources (Pu-239 and Tc-99)	- Daily or prior to use - MDA daily - Background frequently each day	Tc-99 15%, 4π Pu-239 35%, 4π

Table 3.5 Calibration Frequency (Continued)

	SELECTION CRITERIA	PURPOSE	CALIBRATION SPECIFICATION	PERFORMANCE TESTING CRITERION	SENSITIVITIES
Bicron & RSO-50 Eberline RO-20 Bicron RSO-5 and RSO-5 Eberline RO-20	1. Tissue Equivalent Air Ion Chambers 2. Proven dependability 3. Energy independence 4. Linear response 5. Beta/Gamma measurement capability 6. Portable	Performance of exposure rate measurements to comply with DOE Order 5480.11 and 10 CFR 20	HP-OP-101 Frequency - Every 6 months Calibrated to NIST traceable sources (CS-137 and depleted U-238) to 2 points on each scale	- Daily or prior to use - One point on each scale ± 10%	Beta and gamma radiation R50-5 - 0.2 to 5,000 mR/h R50-50 -0.2 to 50,000 mR/h RO-20 - 0.2 to 50,000 mr/h Linear response from 70 kev to 10 Mev
Eberline PCM-1B & PM-6A	1. Gas proportional 2. Automatic background 3. Alarm features 4. Sensitivity 5. Ease of use 6. Ease of calibration	Controlled area exit portal monitors	HP-OP-107 Frequency - Every 6 months Calibrated to NIST traceable Tc-99 source	- Daily	Tc-99 - 5,000 dpm/100 cm^2 - 3" from detector
Ludlum Model 3 & Model 177	1. GM "pancake" detector 2. Ease of use 3. Thin window detector windows	Performance of direct measurement of beta emitting isotopes on equipment and building surfaces	HP-OP-111 & HP-OP-113 Frequency - Every 6 months Calibrated to NIST traceable Tc-99 source	- Daily or prior to use - One point on each scale ± 10%	Tc-99 - 13%
Eberline RO-7	1. High range (20 K R/h) beta-gamma 2. Extension or remote prove 3. Reliability 4. Accuracy 5. Portable 6. Ion chamber 7. Under water measurement capability	High range beta-gamma exposure rate measurements used primarily in the hot cells and storage pool	HP-OP-123 Frequency - every 6 months Calibrated by the manufacturer to NIST traceable Cs-137 and Tl-204 sources	- Prior to use - Each range and detector to be used; one point ± 10%	Low range: relatively flat response to photon energies from 100 kev to 1 mev Mid/high range; over-response at photon energies from 40 to 400 kev. Relatively flat response to photon energies above 400 kev. Ranges: gamma 1 mR/h to 20,000 R/h Beta 100 mR/h to 20,000 R/h

Table 3.6 Instruments

Instrument	Use	Procedure
Ludlum M-77 Stretch Probe	Extendable GM detector	HP-OP-102
F&J High Volume Air Sampler	Air sampling 4-10 CFM	HP-OP-115
SAIC Radeco High Volume Air Sampler	Air sampling	HP-OP-115
Ludlum 125 & 19 Micro-R Meter	Low level gamma exposure rates	HP-OP-119
F&J Low Volume Air Sampler	Air sampling 2 CFM	HP-OP-117
Eberline RM-14	AC powered stationary GM "frisker"	HP-OP-121
Eberline 6112B Teletecter	Extendable GM detector	HP-OP-125
Alnor Alarming Dosimeter R-100	Dose monitoring device	HP-OP-143
Buck Lapel Air Sampler	Breathing zone air samples	HP-OP-145

3.3.4.3 Hot Particle Control

The BCLDP hot particle control program is based upon the guidance described in the NCRP Report No. 106 [3.32] and proven programs from the commercial nuclear power industry. Compliance with DOE Order 5480.11 and 10 CFR 20 concerning exposure to hot particles is required by BCLDP health physics. Discussion of the hot particle control program is found in the document "Radiation Protection Program for the Battelle Columbus Laboratories Decommissioning Project, Section 2.4" and in procedure HP-OP-201, "Hot Particle Control" [3.33].

3.3.4.4 Air Sampling

The BCLDP air sampling program is based upon the requirements of DOE Order 5480.11 and 10 CFR 20. When conflict between these two documents is encountered, as in the case of some derived air concentration (DAC) values, BCLDP uses the more restrictive value.

Work place air monitoring is classified by the purpose of the sample as either "breathing zone" or "general area". Because of the very low DAC values for Th-232 and Pu-239, 300 ft^3 samples are desired when sampling.

Further information can be obtained concerning the BCLDP air sampling program from the following documents:

"Radiation Protection Program for BCLDP"
HP-AP-11.0, "Air Sampling and Analysis"
"Air Sampling Technique and Analysis Technical Basis Document".

3.3.4.5 Access Control

Access control pertains primarily to limiting or controlling the access to posted controlled areas. Access control applies to visitors as well as staff. The document "Radiation Protection Program for the BCLDP, Section 6.0" discusses the requirements for access control. Procedures HP-OP-012, "Posting and Access Control" [3.34], and HP-AP-23.0, "Access Control of Visitors" [3.35] implement these access control requirements. Access is granted only to radiation worker qualified personnel or escorted visitors approved by the SH&ES Manager.

3.3.4.6 Contamination Control

The BCLDP contamination control program provides control measures to minimize the extent of the contamination of areas, equipment and personnel. These control measures are designed to minimize the potential for inhalation or ingestion of radioactive material, unauthorized or unplanned exposures and the spread of radioactive material to uncontrolled areas or the environment. Guidance concerning limits for contamination is from Regulatory Guide 1.86 [3.36]. Control of contamination has been accomplished by:

- Establishing limits for radioactive contamination levels and boundaries for contaminated areas
- Identifying and posting sources of contamination
- Planning work to minimize the spread of contamination
- Monitoring personnel as soon as possible after leaving contamination areas and before leaving controlled areas
- Performing periodic surveillance to verify that clean areas have not been contaminated and to verify the effectiveness of the contamination control program
- Controlling access to contaminated areas.

BCLDP believes that controlling contamination leads to less need for protective clothing, reduced waste generation and enhanced access to all project areas.

Further discussion concerning contamination control may be found in:

"Radiation Protection Program for the BCLDP, Section 3.5"
HP-OP-012, "Posting and Access Control"
HP-OP-201, "Hot Particle Control".

3.3.4.7 Radiation Work Permits

The BCLDP Radiation Work Permit Program is based upon compliance with "U.S. DOE Radiological Control Manual, Article 321" [3.37].

Radiation work permits (RWPs) are required under the following conditions:

- Entry into any posted "Radiological Area"
- When work in a controlled area involves exposure greater than 0.5 mR/hr
- Transferring any source of non-exempt quantity or concentration
- Health physics determines that a situation warrants radiological controls in the form of an RWP.

Further discussion of RWPs may be found in:

"Radiation Protection Program for BCLDP, Section 6.6"
HP-AP-1.0, "Issue and Use of Radiation Work Permits".

3.3.4.8 Surveillance and Maintenance

The BCLDP Health Physics Surveillance and Maintenance Program is based upon compliance with 10 CFR 20.1501 and DOE Order 5480.11. Frequencies are based upon guidance found in the document INPO 88-010, Chapter VI, "Control of Radioactive Contamination" and Chapter III, "External Radiation Exposure" [3.38].

Further discussion of the surveillance and maintenance program may be found in procedure HP-OP-017, "Health Physics Routine Surveillance" [3.39].

3.3.4.9 Releases

The BCLDP Release Program is based upon the requirements of DOE Order 5400.5 and Regulatory Guide 1.86. The purposes of the release program are:

- Specify the limits and methodology for release of materials from the controlled areas
- Minimize the potential for unintentionally releasing contaminated items to the uncontrolled areas.

Limits for the release of materials are discussed, along with the bases for these limits, in the following documents:

"Radiation Protection Plan for the BCLDP, Section 7.6"
"Release of Materials from Controlled Areas", HP-OP-011 [3.40]
"Surface Release Criteria Technical Basis Document"
"Volumetric Release Criteria Technical Basis Document".

3.3.5 External Support Organizations and Functions

Organization	Health Physics Related Function	Cognizant Manager
Quality Department	Assessments, Surveillances, Walkdowns, Nonconformancies	Manager, Quality Department, BCLDP
Radiation Protection Oversight Group	Independent Oversight and Assessment, Surveillancies, Walkdowns, and Technical Support	Manager, Regulatory Compliance and Environmental Safety & Health Oversight
Battelle Radiation Safety Officer	Oversight, Compliance Assessment, Regulatory Review and Interpretation	Manager, Environment, Safety and Health Department
Radiation Safety Committee	License Review, USQD, OSR, TSR, and SAR	Office of the Chief Executive Officer (OCEO)

3.4 Contractor Personnel

Contractor personnel working on the decommissioning project shall comply with the requirements of the project as described in the upper-tier documents. These documents include the Radiation Protection Program Plan, Occupational Safety and Health Program Plan [3.41], and this Decommissioning Plan. BCLDP will utilize two basic approaches to contractors to ensure their health and safety:

(1) The contractor will fall completely under the BCLDP program and perform work using BCLDP procedures, as described in the upper tier documents,

or

(2) The contractor will fall under the BCLDP upper-tier program requirements but perform work using their own procedures with possible supplementation by BCLDP procedures.

In the first approach, there is no difference between the performance of contractor and BCLDP personnel. In the second approach, there will be differences but the overall safety margin will be the same for both groups. The second approach requires BCLDP to review a contractor's program/procedures to predetermine acceptability.

BCLDP will provide oversight of all contractor personnel and activities to ensure compliance with BCLDP requirements.

3.5 Radioactive Waste Management

Waste management activities of the BCLDP will be conducted in accordance with the BCLDP Waste Management Plan [3.42] and supporting procedures. The waste generated as a result of decontamination and decommissioning (D&D) of the remaining eleven buildings and their surrounding earth/soil will be in accordance with applicable NRC, DOE, and State of Ohio requirements. Waste generated as a result of D&D activities will be building rubble, soil, and miscellaneous contaminated material. The contaminants will be uranium, thorium, mixed fission products, and transuranic isotopes. The concentrations of the contaminants have not been fully determined.

Since, for disposal purposes, all of the radioactive contamination being addressed by the BCLDP is owned by the DOE, waste materials generated as a result of these D&D operations will be disposed of at DOE-owned and/or DOE-approved disposal facilities. Project management of the BCLDP is illustrated in Section 2.2, "Decommissioning Organization and Responsibilities" (see Figure 2.8).

Waste generated as part of the BCLDP will be segregated by radioactive content, physical form, and chemical form. The generation of mixed waste will be minimized to the maximum extent practical.

Volume reduction will be extensively utilized for economic and environmental reasons. Compaction of suitable waste forms will be conducted onsite and offsite. Offsite volume reduction by supercompaction, incineration, and metal smelting will be performed by Scientific Ecology Group (SEG) in Oak Ridge, Tennessee, for suitable waste forms. Volume reduction will be performed to meet approved DOE waste disposal site waste certification criteria [3.43].

3.5.1 Waste Interim Storage

Segregation of waste for interim storage will be implemented to support volume reduction and disposal site waste acceptance criteria. Waste will be certified by the generator at the point of generation as to radiological content, chemical content, and physical form prior to transporting to the Central Staging Area (CSA). Further segregation or decontamination may take place at the CSA to support volume reduction or waste acceptance criteria requirements.

3.5.2 Waste Characterization

The method for determining the curie content of a waste package for gamma-ray emitting species is based on high resolution gamma-ray spectroscopy and gross radiation field measurements. Radionuclide ratios and gross radiation field measurements at a defined distance, plus dose rate curves for each detected isotope, are used to calculate individual isotopic and total curie contents for each waste package. The difficult-to-measure radionuclides, such as the TRU isotopes, are determined either from inferential calculations, based on the isotopic ratios of the wastes and using the ORIGEN2 computer code or by analysis of samples taken from the wastes.

Characterization of highly radioactive materials, which would be heavily shielded in packaging, is performed by sampling and laboratory analysis before packaging. The activity of the radionuclides will then be scaled up to the estimated activity in the final waste package.

3.5.3 Liquid Waste

Contaminated liquids that must be treated for disposal include liquids in drains, pipes, and sumps; 20,000 cubic feet (150,000 gallons) of spent fuel pool water; several hundred gallons of cell door hydraulic oil; contaminated mercury; and any contaminated liquids generated during the D&D activities themselves.

When feasible, contaminated liquids generated during D&D will be treated to remove contamination and recycled. Such treatment will include settling and filtration through a system capable of removing 10 micron particles or less, ion exchange, evaporation, and solidification. Solidifying agents that may be used include cement, concrete, or silica-based

immobilizing agents such as Aquaset. Alternatively, an extruder-evaporator solidification method may be used. With an extruder-evaporator, a volume reduction factor of 8 or more can be expected. If cement is used, the resulting volume of solidified waste will be about 2 times greater than the volume of the original liquid waste residue.

As with D&D generated liquids, spent fuel pool water will be evaporated following extended filtration. Liquids from drains, pipes, and sumps will be collected and solidified or incinerated. Contaminated hydraulic oil will be solidified or incinerated. Contaminated mercury, if found, will be packaged in suitable containers for shipment and disposal as mixed hazardous waste.

3.5.4. Release for Unrestricted Use

Much of the waste generated by D&D activities will be evaluated for decontamination. Standard methods of decontamination of surfaces will be applied to minimize waste volumes. Surfaces that have been decontaminated will be surveyed for unrestricted use. Radiological surveys will be performed by qualified technicians using approved procedures (see list of approved procedures in Attachment 3). Material such as soils and building rubble will also be surveyed to ensure that adequate decontamination efforts have been applied. Materials surveyed for unrestricted use will be released in accordance with NRC approved release criteria based on the Surface Release Criteria Technical Basis Document and the Volumetric Release Technical Basis Document (Attachments 1 and 2).

3.5.5 Transportation and Disposal

Transportation of hazardous materials will be in accordance with Title 49 Code of Federal Regulations (49 CFR) [3.44]. Packaging requirements beyond 49 CFR will be in accordance with approved DOE disposal site requirements as stated in specific BCLDP Waste Certification Plans.

Final disposal of waste generated as a result of BCLDP D&D activities will be at DOE-owned and/or DOE-approved facilities. These disposal facilities may require specific waste certification plans to be developed by the BCLDP prior to shipping waste materials for processing (volume reduction) or disposal. Waste certification plans will be developed by the BCLDP and approved by the disposal sites prior to shipping waste materials. The waste certification plans will meet Federal, State, and disposal site criteria to ensure proper disposal for BCLDP waste materials.

3.6 References

3.1 "Environmental Report on Radiological and Non-Radiological Parameters", Annual Report, Submitted by Battelle to the U.S. Department of Energy, September 1989

3.2 "Reporting of Defects and Noncompliance", Regulation 10 CFR Part 21, U.S. Nuclear Regulatory Commission, June 10, 1977

3.3 "Procedures and Responsibilities for Implementation of 10 CFR Part 21, Reporting of Defects and Noncompliance", Battelle Columbus Laboratories, December 5, 1977

3.4 "Criteria and Procedures for the Reporting of Defects", Regulation 10 CFR Parts 21 and 50, U.S. Nuclear Regulatory Commission, November 4, 1988

3.5 Docket No. 70-8, 10 CFR Part 21 Report, Letter to the U.S. Nuclear Regulatory Commission, November 11, 1977

3.6 Docket No. 70-8, 10 CFR Part 21 Report, Letter to the U.S. Nuclear Regulatory Commission, July 18, 1980

3.7 "Radiation Protection Plan for the Battelle Columbus Laboratories Decommissioning Project"

3.8 Letter dated December 8, 1992 from D.E. Olesen to Battelle Columbus Operations Staff, re: ALARA Program

3.9 "BCLDP ALARA Program", HP-AP-8.0, Revision 1, December 1992

3.10 10 CFR 20, "Standards for Protection Against Radiation"

3.11 DOE Order 5400.5. "Radiation Protection of the Public and the Environment"

3.12 DOE Order 5480.11, "Radiation Protection for Occupational Worker"

3.13 "Radiological Performance Reports", HP-AP-12.0, November 1992

3.14 "Radiological Awareness Reports", HP-AP-21.0, January 1993

3.15 "ALARA Reports", HP-AP-31.0, Revision 1, December 1992

3.16 "Issue and Use of Radiation Work Permits", HP-AP-1.0

3.17 "BCLDP External Personnel Dosimetry Program", HP-AP-2.0, Revision 2, September 1992

3.18 "Administering the Personnel Bioassay Program", HP-AP-5.0, December 1990

3.19 "Respiratory Protection Program for BCLDP", RS-AP-1.0, Revision 1, June 1992

3.20 NUREG-0041, "Manual of Respiratory Protection Against Airborne Radioactive Materials"

3.21 "Air Sampling and Analysis", HP-AP-11.0

3.22 "General Procedure for Operating a Continuous Air Monitor (CAM)", HP-OP-015, May 1990

3.23 "Use of Filter Type Respirators", RS-OP-004, July 1992

3.24 "Use of the Powered Air Purifying Respirators", RS-OP-006, July 1992

3.25 "Use of the Self-Contained Breathing Apparatus", RS-OP-008, July 1992

3.26 "Use of Supplied Air Bubble Hoods", RS-OP-010, August 1992

3.27 "Use of Breathing Air Systems", HP-OP-029, September 1992

3.28 "Certification of Grade D or E Breathing Air", RS-OP-016, October 1992

3.29 ANSI N-323, "Radiation Protection Instrumentation Test and Calibration Report"

3.30 Regulatory Guide, Division 8-OP-032-5, "Test and Calibration of Radiation Protection Instrumentation"

3.31 "Control of Measuring and Test Equipment and Instruments", HP-AP-29.0, Revision 1, November 1992

3.32 National Council of Radiation Protection and Measurements, Report No. 106, "Limits for Exposure to "Hot Particles" on the Skin", December 1989

3.33 "Hot Particle Control", HP-OP-201

3.34 "Posting and Access Control", HP-OP-012

3.35 "Access Control of Visitors", HP-AP-23.0

3.36 Regulatory Guide 1.86, "Termination of Operating Licenses for Nuclear Reactors"

3.37 "DOE Radiological Control Manual"

3.38 INPO 88-010, "Good Practices Manual"

3.39 "Health Physics Routine Surveillance", HP-OP-017

3.40 "Release of Materials from Controlled Areas", HP-OP-011

3.41 "Occupational Safety and Health Program for BCLDP", DD-93-01, December 1992

3.42 "BCLDP Waste Management Program Quality Assurance Plan", Revision 3, WA-QAP-1.0, August 1991

3.43 "Hanford Site Solid Waste Acceptance Criteria", Report WHC-EP-0063-1, Westinghouse Hanford Company, September 1989

3.44 Title 49 Code of Federal Regulations, "Transportation"

4. Planned Final Radiation Survey

Upon the completion of D&D activities in an area/building, a Planned Final Radiation Survey (PFRS) will be conducted to verify that the decommissioning objectives have been met for all buildings, parts thereof, and associated grounds being released. The PFRS will be prepared as a BCLDP Work Plan and will be specific for each area/building. Where appropriate, based on process knowledge and/or characterization information, the PFRS will be a statistical survey of the D&D area. In all cases, it will utilize the same basic methodologies as the site characterization processes and equivalent personnel, instruments, procedures, grid patterns, fixed reference locations, radioanalytical supports, and management review will be utilized.

To guide the PFRS, the BCLDP has prepared and issued procedure DD-CP-002, "Facility Post-Decontamination Final Status Survey". The latest revision of this procedure has been included as Attachment 5. This procedure will be used to develop the specific BCLDP Work Plan. As stated previously (Section 2.1.2.1) the facility will meet the release criteria for unrestricted use as a final status after decommissioning.

4.1 References

4.1 Annex C Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material, U.S. Nuclear Regulatory Commission, August 1987.

5. Funding

Decommissioning of these facilities will be conducted under a cost share agreement with the U.S. Department of Energy (DOE), under which DOE is contractually obligated to fund 100 percent of the pre D&D Surveillance and Maintenance costs and 90 percent of all other D&D costs. Radioactive waste from the BCLDP will be disposed of at DOE-owned and/or DOE-approved disposal sites. The BCLDP is included in DOE's Environmental Restoration and Waste Management Five Year Plan [5.1] and DOE has approved the technical, cost and schedule baseline for completion of all facilities. Decommissioning costs, including decontamination and waste disposal, are estimated to be $149 million dollars of which $39 million dollars have already been spent through FY 1992. Final cost estimates for each building will be developed as the building characterizations are completed. The Certification for Financial Assurance for the D&D project is currently being completed and will be transmitted to the NRC when finalized.

5.1 References

5.1 Environmental Restoration and Waste Management. Five-Year Plan, Report DOE/S-070, U.S. Department of Energy, September 1989.

6. Physical Security Plan and Material Control and Accounting Plan Provisions in Place During Decommissioning

This section is no longer applicable since the requirements for maintaining the NRC approved physical security plan and special nuclear control and accounting plan was removed when the SNM inventory held under the license was shipped off-site.

ATTACHMENT 1

SURFACE RELEASE CRITERIA TECHNICAL BASIS DOCUMENT

SURFACE RELEASE CRITERIA TECHNICAL BASIS DOCUMENT

for

Battelle Columbus Laboratories
Decommissioning Project (BCLDP)

October 1992

BATTELLE
505 King Avenue
Columbus, Ohio 43201

EXECUTIVE SUMMARY

Surface release criteria and procedures have been developed for the unrestricted release of materials, equipment, and facilities by the BCLDP. Latest instrumentation technology and nuclear industry standards have been utilized to develop and apply these criteria and procedures. The BCLDP will release materials, equipment, and facilities at or below the limits defined in Table 1. In addition, it is BCLDP's policy to use ALARA principles and analyses to determine what actions are necessary or warranted when materials, equipment, areas, and/or buildings have residual contamination below the Table 1 limits.

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SURFACE RELEASE CRITERIA
TECHNICAL BASIS DOCUMENT FOR BCLDP

Introduction

The BCLDP is an extensive project to remediate 13 buildings and associated facilities such that they can be released for unrestricted use to the general public. This document establishes the technical basis by which present radiological surface release criteria are applied to accomplish the remedial action.

Radiological release criteria for surfaces were first defined in ANSI N13.11 (draft), "Control of Radioactive Surface Contamination on Materials, Equipment, and Facilities to Be Released for Uncontrolled Use" and were later published in U.S. Nuclear Regulatory Commission Regulatory Guide 1.86, "Termination of Operating Licenses for Nuclear Reactors". There is little difference between these two standards, and both serve as guidance documents when establishing release criteria. The Department of Energy (DOE) Order 5400.5, "Radiation Protection of the Public and the Environment" also provides release criteria for surface radioactivity and the criteria stated therein contain only subtle differences from those in the other reference documents. For the BCLDP, DOE 5400.5 and Regulation Guide 1.86 will be used to provide criteria that are followed as upper limits of radioactive surface contamination for unconditional release of equipment, materials, and areas. DOE Order 5400.5 requirements are mandatory for the BCLDP because the radioactive material being removed is the property of the DOE and the DOE provides 90% funding for the project. Regulatory Guide 1.86 requirements are mandatory because Battelle is an NRC Licensee and the BCLDP is being conducted under an NRC required decommissioning plan.

Release Criteria

The surface radiological contamination release criteria for the BCLDP are shown in Table 1, "Surface Contamination Guidelines for BCLDP." These criteria are provided by DOE Order 5400.5 "Radiation Protection of the Public and the Environment," which reference Regulatory Guide 1.86. DOE Order 5400.5 does not define the release levels for nuclides such as transuranics (TRU), Ra-226 and Th-230, therefore, BCLDP will adopt the guidance of Regulatory Guide 1.86 for these isotopes and these limits are also shown in Table 1. The criteria in Table 1 are the maximum allowable quantities of radioactive material that may be left on surfaces of equipment and buildings that are released to the general public for unrestricted use. The term "Unconditional Free Release" is a generally accepted term in industry that is used synonymously with this unrestricted use. It is the policy of the BCLDP to aggressively apply the principles of As Low As Reasonably Achievable (ALARA) to release criteria. The release criteria stated in Table 1 shall be applied as an upper limit of radioactive surface contamination for free release of equipment, materials, and areas by BCLDP.

Release limits are grouped into several categories depending on the radiotoxicity of the radioisotope as seen in Table 1. For each area, BCLDP will identify radioisotopes through analytical techniques and determine their corresponding activity fractions. Release limits can then be determined on the weighted activity fraction of each radioisotope. If radioisotopes or activity fractions are not known or vary significantly, then release limits will be based on the most restrictive nuclides to be encountered by the BCLDP. These release limits for gross alpha and gross beta-gamma activity are shown in Table 2. Table 2 is taken from BCLDP Procedure HP-OP-011, "Release of Materials From Radiologically Controlled Areas."

Radiological Release Logic for the BCLDP

Consistent with the requirements of DOE Order 5400.5, Section II.5, "Release of Property Having Residual Radioactive Material," and the DOE Radiological Control Manual, Section 422, "Release to Uncontrolled Areas," all facilities, areas, buildings, equipment, and materials, having surface activity or activity concentrations in excess of applicable limits (Table 1) shall require decontamination; and/or removal and disposal as radioactive waste. Facilities, buildings, areas, equipment, and materials that do not have detectable contamination, (i.e., above the LLD) and are not suspected of potential internal contamination, shall be released without any further assessment or evaluation. As required by DOE Order 5400.5, Section II.2.b, "ALARA Evaluations," formal ALARA evaluations and cost benefit analyses shall be performed as part of Decontamination and Decommissioning Plans for facilities, buildings, and large volumes of associated equipment and materials with residual radioactivity above the LLD.

As dictated in DOE Order 5400.5, Section II.5.c.1-4, "Release of Materials and Equipment," individual items not addressed by specific Decontamination & Decommissioning plans with residual radioactivity above the LLD but below applicable limits will also be subjected to an ALARA process and assessed for potential contamination prior to release by the BCLDP. This ALARA process consists of a field assessment by a trained evaluator (usually a Health Physics Supervisor) prior to releasing any materials or equipment with detectable contamination below the limit. BCLDP Procedure HP-OP-011, "Release of Materials from Radiologically Controlled Areas" further defines and establishes requirements for the uncontrolled release of materials and equipment from radiological areas. Figure 1 contains a flow chart which graphically depicts the release logic utilized by the BCLDP.

In summary, it is the practice of the BCLDP that all releases of buildings, areas, materials, and/or equipment will meet or better the limits and criteria found in Table 1. In addition, for buildings, areas, materials, and/or equipment with residual radioactivity below those in Table 1 but above the LLD of our radiation detection equipment, it is the practice of the BCLDP to use sound ALARA principles and analyses to determine what, if any, decontamination actions are warranted prior to release. It should be made clear this does not mean that all materials, equipment, areas, or buildings will be released at or near the LLD since there may not be a reasonable ALARA basis to do so.

Figure 1. Radiological Release Logic for the BCLDP

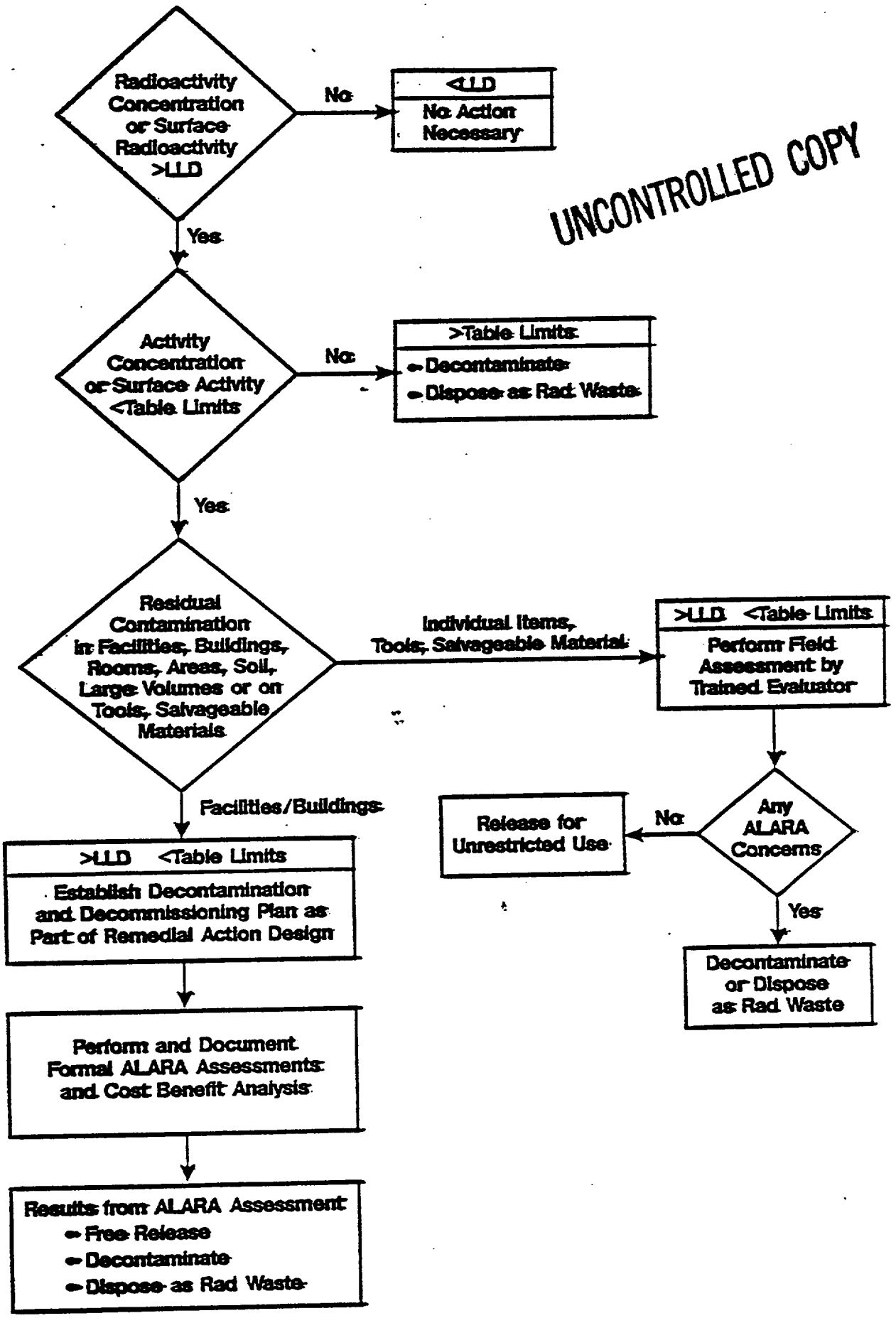

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Table 1. Surface Contamination Guidelines for BCLDP

Radionuclides[2]	Allowable Total Residual Surface Contamination (dpm/100 cm²)[1]		
	Average[3,4]	Maximum[4,5]	Removable[4,6]
Transuranics, I-125, I-129, Ra-226, Ac-227, Ra-228, Th-228, Th-230, Pa-231	Reserved (100)*	Reserved (300)*	Reserved (20)*
Th-Natural, Sr-90, I-126, I-131, I-133, Ra-223, Ra-224, U-232, Th-232	1,000	3,000	200
U-Natural, U-235, U-238, and associated decay product, alpha emitters	5,000	15,000	1,000
Beta-gamma emitters (radionuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above.[7]	5,000	15,000	1,000

(1) As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute measured by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

(2) Where surface contamination by both alpha- and beta-gamma-emitting radionuclides exists, the limits established for alpha- and beta-gamma-emitting radionuclides should apply independently.

(3) Measurements of average contamination should not be averaged over an area of more than 1 m^2. For objects of less surface area, the average should be derived for each such object.

(4) The average and maximum dose rates associated with surface contamination resulting from beta-gamma emitters should not exceed 0.2 mrad/hr and 1.0 mrad/hr, respectively, at 1 cm.

(5) The maximum contamination level applies to an area of not more than 100 cm^2

(6) The amount of removable material per 100 cm^2 of surface area should be determined by wiping an area of that size with dry filter or soft absorbent paper, applying moderate pressure, and measuring the amount of radioactive material on the wiping with an appropriate instrument of known efficiency. When removable contamination on objects of surface area less than 100 cm^2 is determined, the activity per unit area should be based on the actual area and the entire surface should be wiped. It is not necessary to use wiping techniques to measure removable contamination levels if direct scan surveys indicate that the total residual surface contamination levels are within the limits for removable contamination.

(7) This category of radionuclides includes mixed fission products, including the Sr-90 which has been separated from the other fission products or mixtures where the Sr-90 has been enriched.

* Regulatory Guide 1.86

Table 2. Release Limits for Gross Activity (Unknown Isotopes) - Regulatory

EMISSION	REMOVABLE (dpm/100 cm^2)	TOTAL (Fixed and Removable) (dpm/100 cm^2)
Alpha	*20	*100
Beta - Gamma	**200	**1000

* Based on TRU, Ra-226 and Th-230
** Based on Sr-90 and Th-232

Natural and Electronic Background

The application of release criteria standards cannot be successfully applied without the understanding of background. Two types of background exist: natural and electronic. Natural and electronic background significantly impact the release criteria by the following:

- Natural background, by providing a quantity of radioactive material which is available to be detected.
- Electronic background, by influencing the least amount of radioactivity that can be measured by a particular instrument.

It is necessary to distinguish the difference of the two types of background. Obviously, the term background could apply to either. The following are the terms as accepted by industry practice.

Generic term - natural background, the amount of radioactive material that exists in a substance, surface, or material as a result of nature. The quantity of natural background is generally expressed in terms of picocuries/gram (pCi/g), femtocuries/liter (10^{-15} Ci/l), milligrams/milliliter (mg/ml), disintegrations per minute (dpm), or other suitable combinations of activity or quantity per unit mass or area. Cosmic radiation is also considered a part of natural background. Natural background is detectable and must be accounted for when making activity determinations. For example, field beta/gamma type instruments, might have background that ranges from 100 to 500 counts/minute. For a laboratory type alpha scintillation counter, the background might be 1 count per 2 minutes of counting time.

Generic term - electronic background, the amount of electronic signal produced by electronic noise which results in a meter or scaler deflection. Instrument background is generally expressed in counts per minute (cpm), picocuries/gram (pCi/g), milligrams/liter (mg/l), or other suitable units. Electronic background (background) is determined by measuring the signal output for a particular instrument when subjected to an area or matrix that contains no radioactive material other than natural or cosmic radiation.

Determining Background

Accurately determining both types of background must be accomplished before applying release criteria. Two industry accepted practices exist for determining natural background in materials. The first method is to accurately measure the naturally-occurring radioactivity in materials with the appropriate analytical instrument. This is accomplished by collecting a clean sample of similar material from an uncontaminated source. An example of this type of natural background determination is to measure the radioactivity in a piece of lumber from the hardware store or a quart of motor oil from Wal-Mart®. The expected results for such an analysis would be 1 to 2 pCi/g in wood for natural uranium and less than 0.1 pCi/l for mixed fission products in oil. This same process can also be applied to chemical contaminates in various matrices.

The other type of material background analysis is a statistical procedure called Chauveneus Determination. This process requires making a large number of radiation measurements in a defined area and then casting out the larger measured results. The average of the smaller remaining results is considered to be background for the defined population.

Both of these techniques are applied for determination of natural background for the BCLDP.

Instrumentation and Application

Release surveys will be performed using suitable instrumentation and industry standards. It should be noted that the upper end of the release criteria defined in the applicable regulatory standards and being applied to the BCLDP were developed in part based on the detection limitations of the field instruments available at the time the standards were published. The BCLDP will utilize field instruments, laboratory techniques, and survey techniques capable of achieving detection limits at or below the upper bounds of the release criteria stated in Table 1. Current BCLDP instruments have detection limits lower than the surface contamination guidelines for the most restrictive nuclides shown in Table 1. However, the BCLDP will not continue to upgrade with state-of-the-art detection systems simply to drive the lower limit of detection (LLD) continually lower. Surfaces with detectable radioactive contamination levels greater than the LLD but less than the stated release criteria will be evaluated based upon ALARA analyses for decontamination, disposal, or free release. Materials greater than the release criteria will be decontaminated or disposed of as of radioactive waste.

Lower Limits of Detection

The lower limit of detection (LLD) as used in this technical basis document is the smallest amount of sample activity that will yield a net count for which there is a 95% confidence level that the activity is, in fact, present. The LLD is an *a priori* (before the fact) estimate of the capabilities of a given detection system. The LLD does not depend on the sample activity but rather on the detection capability of the detection process itself (i.e., detection efficiency and background count rate).

The formula for LLD is given below:

$$LLD = \frac{3 + 4.65(S_b)}{Eff\,(T)}$$ [See Equation 6, Attachment 1]

where

S_b = standard deviation of background or blank counts (c) for a counting time, defined as $\sqrt{C_b}$

T = counting time for samples, background or blanks; in units of minutes (m). All counting times are set equal.

Eff = counting efficiency in units of c/d; the number of counts (detections) per the number of disintegrations from a calibration source.

An excerpt from Brodsky's and Gallaghar's Paper, "Statistical Considerations in Practical Contamination Monitoring" published in Radiation Protection Management, Volume 8, No. 4 is found in Attachment 1. The paper discusses the derivation of the LLD formula and discusses Type I α (false detection) and Type II β (false non-detection) errors. For radioactivity measurements performed by BCLDP, the LLD, as defined above, establishes a 5% chance of incorrectly detecting activity when it is absent and a 95% confidence that activity will be detected when it is present.

Typical LLDs have been calculated for the detection equipment used by BCLDP to determine contamination levels for free release. Attachments 2, 3, and 4 show the LLD calculations for the Tennelec 5100 counter, the Ludlum 2929 counter, and the NE Alpha/Beta Contamination Detector.

Attachments 2 and 3 also show a typical determination of LLDs for the Tennelec 5100 and the Ludlum 2929 counters used by BCLDP. These detectors both are utilized to determine alpha and beta-gamma activity on smears generated during wipe tests for removable contamination. Both counters are capable of detecting removable activity levels well below those defined for the most conservative nuclides listed in Table 1 (i.e., 20 dpm/100 cm^2 alpha, 200 dpm/100^2 beta-gamma).

Attachment 4 also shows the estimate of the LLDs for the NE alpha/beta contamination detector for uniform distributed sources and for point sources during contamination surveys. As shown in Attachment 4, the NE detector is capable of detecting below the total activity levels (fixed plus removable) of the most restrictive nuclides of Table 1 for distributed source configurations of surface radioactivity. Also, the NE instrument can detect below the maximum activity levels of the most restrictive nuclides in Table 1 for point sources of surface radioactivity.

Instrument Calibration

Field instruments and laboratory instruments shall be calibrated in accordance with ANSI N323, "Radiation Protection Instrumentation Test and Calibration". Instrument calibrations will be in accordance with formal procedures including reference checks and documented maintenance programs.

Quality Assurance

Instrument calibrations shall be performed with National Institute of Standards and Testing (NIST) traceable standards. Reference checks shall be performed in accordance with formal BCLDP procedures. Final release of buildings and grounds shall be verified by an Independent Verification Contractor (IVC).

Release surveys will be performed or directed by technicians whose qualifications meet ANSI/ANS 3.1, "Selection, Qualification, and Training of Personnel for Nuclear Power Plants" and DOE Order 5480.11, "Radiation Protection for Occupational Workers". Routine oversight of the release program will be performed by a department of the BCLDP other than that of those performing the release surveys.

Attachment 1

2. FORMULAS FOR DECISION LEVEL, MINIMUM DETECTABLE AMOUNT, AND CONVERSION FROM COUNTS TO ACTIVITY

2.1. Decision Level (L_c), Decision Amount (DA) and Minimum Detectable Amount (or Activity) (MDA)

For describing consistently the detection capabilities of measurements or analytical procedures, a number of methods of specifying minimum detectable amount (MDA) were considered by the Health Physics Society Standards Committee, Working Group 2.5, in developing the MDA formulations for bioassay performance criteria[7,8]. The method selected was based on an approach originally developed by Currie[9], whose formulations have received increasing acceptance and use in radioactivity measurements[10-12].

The simplest formula for MDA from Reference 8 is also the one most useful and instructive for application to smear surveys. The formulation assumes that the major source of error (uncertainty), with proper quality assurance, in the count of a smear is the random Poisson fluctuation in a count, from one count to another. Uncertainties in bias ("fixed" or "deterministic" errors), and other sources of random fluctuation, can be taken into account separately once the main concepts of MDA are understood. (These other sources of error are discussed in detail in References 8 and 12.)

Currie, as a noted research radiochemist as well as capable statistician, has considered in detail the actual steps taken when calculating the result of a radioactivity measurement [9,12]. In particular, he has introduced the consideration that the result for even a zero-activity sample must account for the random fluctuations in both the count of the zero-activity sample itself and the count of the blank that is subtracted from the sample count.

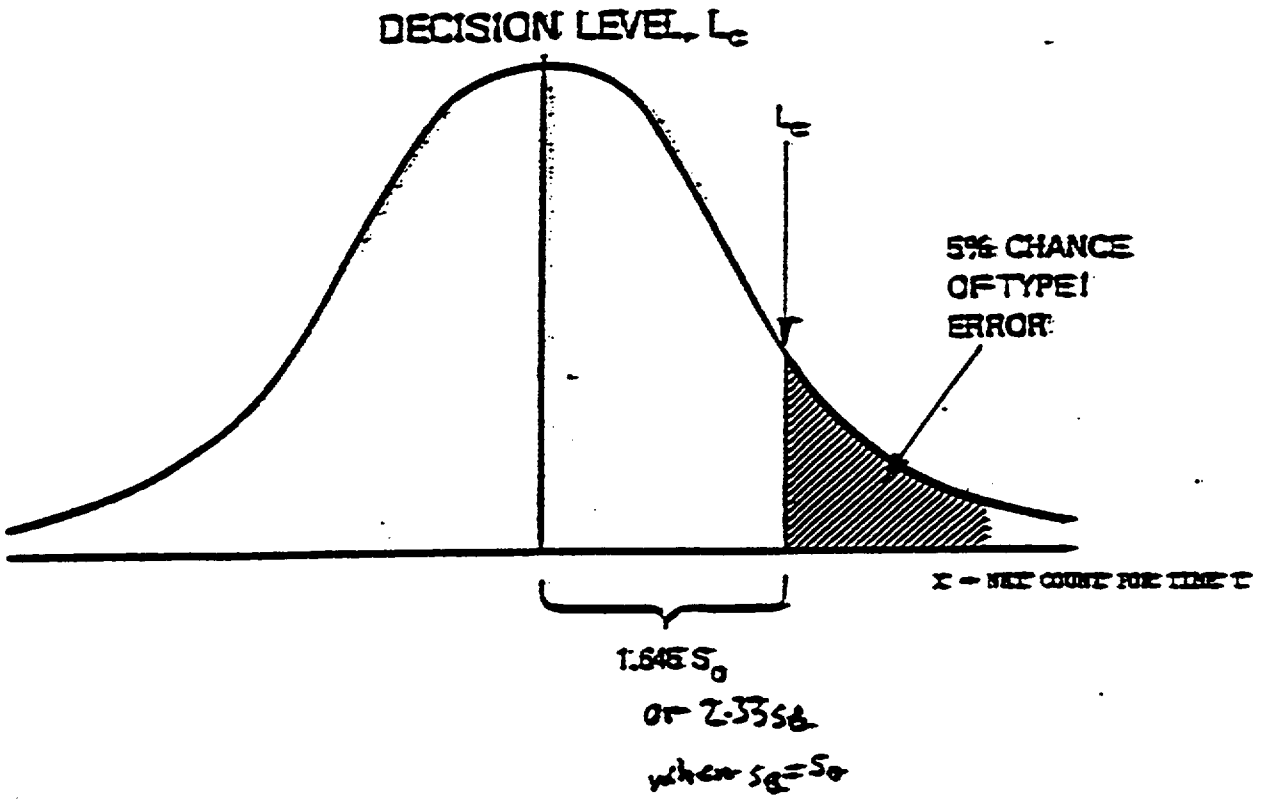
Figures 1 and 2, and their sub-titles, summarize graphically the main steps of Currie in his formulation of MDA[9]. In Figure 1, a decision level for total counts ("decision limit", as used by Currie[9]), L_c, is defined as the net count level (for a total sample counting time T) of a zero-activity sample, with the count of an appropriate blank in time T subtracted, for which there is no more than a 5% chance that any repeated net count would exceed this level. That is, the net count should not exceed L_c more than 5 % of the time if the smear has not picked up any radioactivity. Thus, the convention is established that a net count will be considered positive for smearable activity if it is greater than L_c.

It is important to note that, in Figure 1, the x-axis represents the scale of total net counts. In the statistics of Poisson count variates, it is in the total count domain that precisions of measurement are determined. Count-rates, such as counts per minute, are generally derived quantities, unless the count is for one minute. Therefore, all derivations and discussions are carried out for the general case, with T appearing in the formulas.

It also should be noted that the definition of L_c is equivalent, in statistical terminology, to the use of a one-tailed "alpha" (α) level of 0.05 (or 5%) as the limit of a "Type I" error. A Type I error can be conveniently remembered as "jumping to a conclusion" that a positive indication of contamination has been found, when indeed there is none, but instead just a random high count (of 5% chance) has been obtained from an actual zero-activity sample. It is the desired (conservative) way of making a decision that the radioactivity searched for has been detected. The selection of a 0.05 probability of a Type I error means that we have considered it acceptable to be wrong 5 % of the time in order to detect most of the contaminated samples.

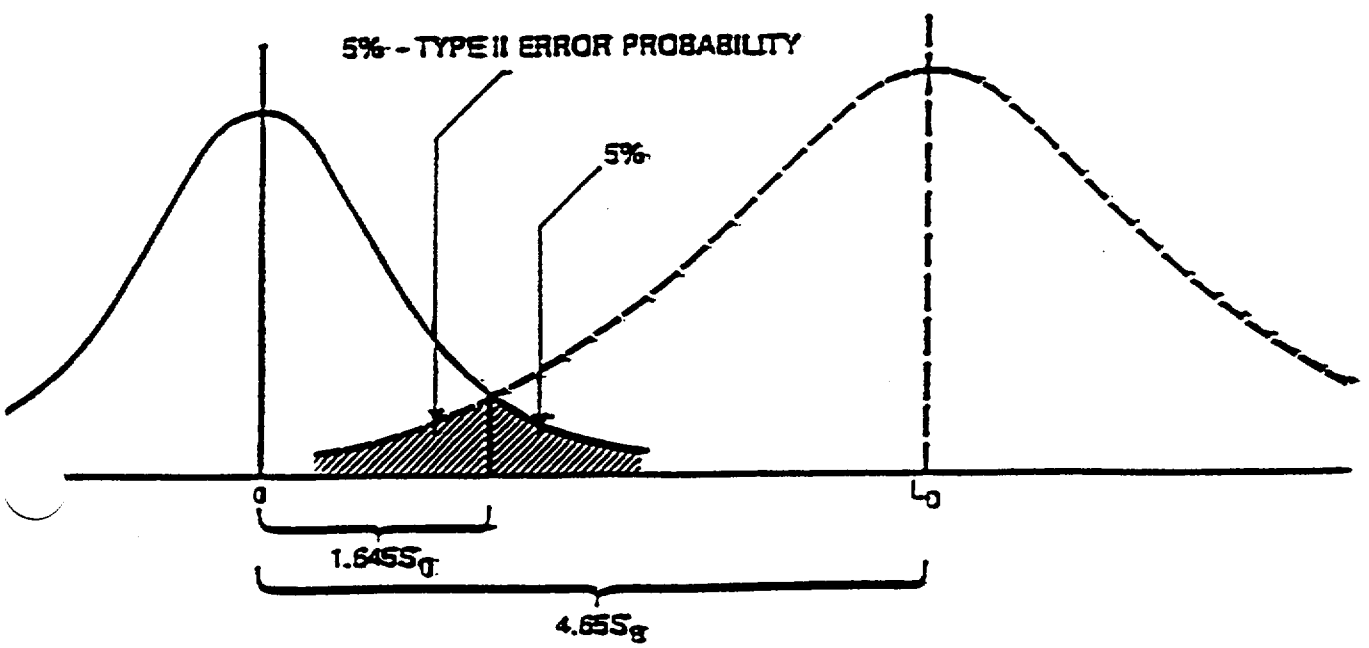
If the standard deviation of the net count of a zero activity sample is symbolized by s_o, then by the statistical rules for compounding

Figure 1. The decision level, L_c, is chosen so that there will be a 5% chance that a net signal from a zero-activity sample compared to a blank will be greater than L_c. Approximately, assuming Normal distribution statistics, $L_c = 1.645\, s_0 = 1.645\, (s^2_{zero\ sample} + s^2_{blank})^{1/2}$. (Adapted from NUREG-1156[8], with permission.)



re 2. The detection limit, L_D, is placed far enough above zero so that there is a 5% chance that an L_D ntity will give a signal less than L_c. $L_D = 4.65\, s_B$ when the counting times of the sample and ground are the same, and all s^2 values are approximately the same. Otherwise, $L_D = 1.645\, s_0 + 1.645\, (s^2_{sample} + s^2_{blank})^{1/2}$. (From NUREG-1156[8], with permission.)

ETECTION LIMIT, L_D (PAIRED BLANK)



errors from independent variables.

$$s_o = (s_{bo}^2 + s_B^2)^{1/2}, \quad (1)$$

where:

s_{bo} = the standard deviation in the total count over counting time T of the zero-activity sample (e.g., a smear of a "clean" surface), and

s_B = the standard deviation of the total count of an "appropriate blank" over the same time T.

This net count (sample - blank) will then have a frequency distribution that is Poisson, but which fits approximately under the Normal (Gaussian) distribution envelope for net counts greater than about 30. The matched Normal distribution would have a mean net count of zero (for the zero-activity sample) and a standard deviation of s_o. Using Normal distribution tables for the probability density function (PDF), the decision level ("detection limit" for making the decision that something is detected) would be a number of net counts in time T equal to:

$$L_c = 1.645\, s_o \quad (2)$$

as shown in Figure 1. This figure shows that 5 % of the area under the PDF lies to the right of 1.645 s_o. This value of L_c is like an arbitrarily selected alarm level, above which we have decided to call a sample measurement positive. That is, we have decided to assume that the sample (smear) is contaminated – even though we could be wrong 5 % of the time; we might just be observing only an extreme fluctuation in the net count of a zero-activity sample that much of the time.

Definition of "Appropriate Blank"

It is important here to understand the need for selecting the "appropriate blank" and for determining the count accurately for this appropriate blank for the routine sample counting time T. This determination must be made under the same geometry and counting conditions as used for the sample. Considerations in selecting the appropriate blank are discussed in detail in References 8 and 12. An ideal blank is not always available, but usually a close approximation can be obtained. When the blank is not ideal, estimates of any maximum biases introduced can be made and used to conservatively correct the calculated decision level and MDA.

For purposes of this article, the following definition of an appropriate blank, paraphrased from the ANSI N13.30 standard[7], should suffice to demonstrate the factors to be considered:

> "An appropriate blank is a sample...identical in physiochemically and radiologically significant ways...to the sample to be analyzed, except that it contains no quantity of the analyte to be measured..." (except the ambient level that might already be in the blank due to natural activity in the filter paper, etc.)

Here, the term "analyte" would mean the radionuclide(s) of interest in the smear survey. Of course, the "ambient level" mentioned in the definition would be, for example, the number of counts produced by natural radioactivity in the filter paper in the same channels used for detecting the contaminant of interest in the smear samples. Or, if variable ambient contamination from natural radon decay products might interfere with the measurement by superimposing on counts from the contamination of interest, then the "appropriate blank" for determining the man-made contamination of interest might need to include the maximum count from natural contamination that might be expected on a blank, in order to provide a conservative estimate of detection limit and MDA. Reasons for making MDA estimates conservative, when extraneous uncertainties are present, are also discussed in Reference 8.

Definitions of Decision Amount (DA) and Minimum Detectable Amount (MDA)

The definitions here will assume (as does the standard[7,8]) that an appropriate blank has been selected and counted for the same counting time T as the sample. Moreover, we assume that the blank has been counted on the same day, or with the same batch of measurements, as the sample, so that counting conditions have not changed, as verified by check QA measurements made with the batch and/or standard calibration sources measured with the same batch. An appropriate blank counted under these conditions will be referred to as a "paired blank".

For a carefully selected and measured paired blank, the assumption may be made in Equation 1 that $s_{sb} = s_B$, so that Equation 2 becomes:

$$L_{sc} = 1.645\, s_{sc} = 1.645(2s_B^2)^{1/2}$$

$$= 1.645\,(2)^{1/2}\, s_B = 1.645(1.414)\, s_B$$

$$= 2.33\, s_B, \qquad (3)$$

which is the decision level in terms of total counts. To convert this number to units of activity, a calibration factor K must be used together with the time T, giving the equation for the "Decision Amount (DA)", the amount of activity that would be indicated on a smear sample result when the decision would be made that it is positive:

$$DA = 2.33\, s_B/KT, \qquad (4)$$

where:

s_B = the standard deviation of the blank count, for time T (which for pure Poisson fluctuations would be the square root of the number of counts in time T),

K = a calibration constant, in units of counts/minute per microcurie, or counts per minute per dpm, obtained by counting an appropriate standard of known activity and similar geometry and composition as the smear sample, and

T = the counting time for the paired blank, which should be made the same in these equations as the counting time for each smear sample to be counted (even though a much longer blank count may be taken for improving the precision of interpreted activities (see "well-known blank" below)).

In order to conservatively derive detection capabilities, Currie[9] defined the "Detection Limit, L_D" as a total count high enough so that, if a decision was made the count was positive at or above L_c, then the Normal distribution envelope of count variations (Figure 2) about L_D would fall less than 5% of the time to the left of L_c. Thus, if a decision is made that the smear is positive at the count level of L_c, then an amount of activity that would give a count L_D on the average, would give a particular count less than the decision level only 5 % of the time. That is, there would be only a 5 % chance of assuming no activity is present when actually an activity giving an expected count L_D was present. In statistical terminology, there would be only a 0.05 probability of making a Type II error – of "missing something when it was there". (In statistical testing criteria, the probability of a Type II error is called "beta"(β), and is not always taken as 0.05.)

Actually, Currie used separate symbols, k instead of 1.645, in his derivation of L_D, and assumed that the distribution in counts at L_D could be wider than for the zero-activity sample since the counts would be larger and Poisson distributed, so that variance would be proportional to the mean number of counts (as indicated by the wider dotted curve in Figure 2). Using additional assumptions and solving for L_D, and after setting k = 1.645 for both alpha and beta, Currie obtained the following equation for

L_D, which is fairly widely known:

$$L_D = 4.65\, s_B + 2.71 \qquad (5)$$

When examining Currie's derivation, the Health Physics Society working group[7] realized that the constant 2.71 was an artifact of the mixed assumptions of Normal and Poisson distribution, and that in the limit of very low background (and very low blank) counting, s_B would be zero and the constant 2.71 should be 3 (Reference 8). As seen in Figure 3, when the expected number of counts is $m = 3$ in the Poisson formula, $P(x) = \exp(-m)\, m^x/x!$, then $x = 0$ counts are obtained only 5 % of the time, consistent with the "beta" probability chosen. (Note that $\exp(-3)\,1/1 = 0.05$, as indicated in Figure 3.) Thus, in the limit of low blank counts, the value of 3 should be substituted for 2.71 above.

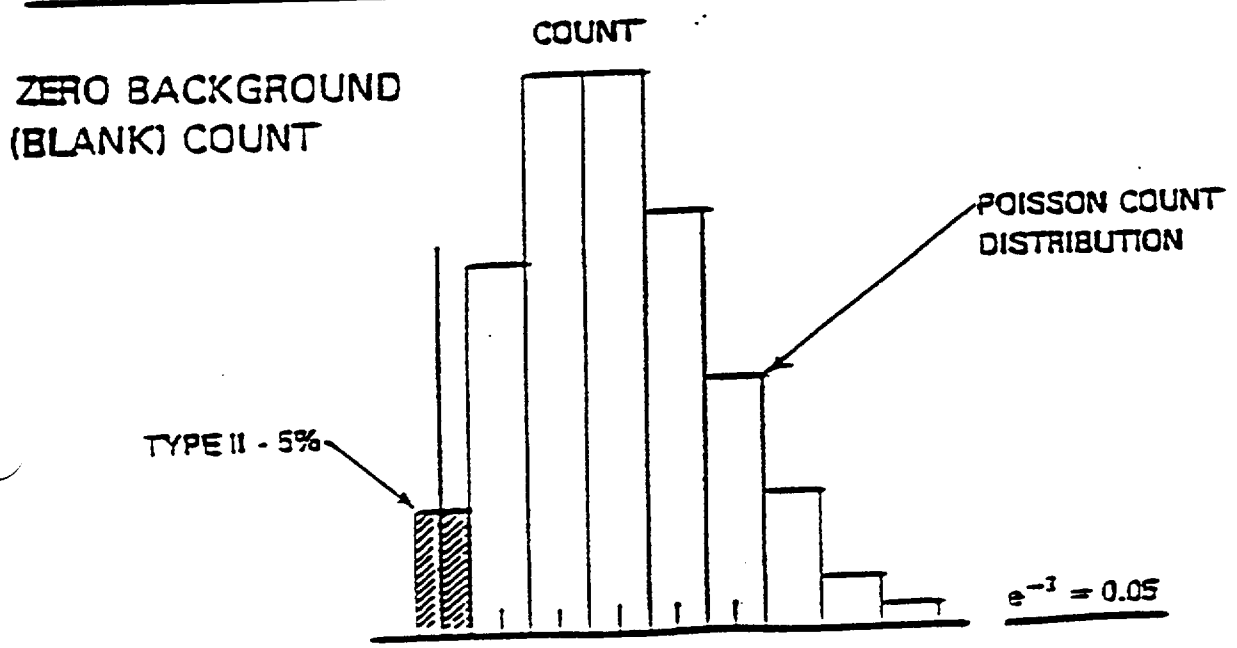
Currie also obtained the constant 4.65 in Equation 5 using the assumption that the total counts were large enough (e.g., greater than 70) so that it could be assumed that the standard deviation of the count L_D was approximately the same as that of the blank (i.e., that the dotted curve of Figure 2 was not significantly wider than the solid curve). With this assumption, and ignoring the 2.71 or 3 term for large counts, the origin of the value 4.65 can be seen by examining the last equation in the subtitle to Figure 2, and reducing both standard deviations to $(2)^{1/2}\, s_B$, as done to obtain Equation 3.

With recognition of the above assumptions and adopted conventions, the equation for the detection limit, in terms of total counts, becomes:

$$L_D = 4.65\, s_B + 3 \qquad (6)$$

This equation was examined for consistency with a beta = 0.05 level in the intermediate range between that for large counts where the Poisson can be considered within the Normal envelope, and for zero blank counts, and the approximation to beta = 0.05 was found to be sufficient to utilize this simple equation as a standard method for consistently defining detection capabilities[13].

Figure 3. When the number of counts are not large (B greater than about 70), the Normal distribution assumption begins to lose validity. When counts are zero or close to zero, L_C becomes 0, and the detection limit becomes about 3, since $\exp(-3) = 0.05$. (From NUREG-1156[8], with permission.)



Just as information does not suddenly become zero below MDA, a measurement can not be assumed accurate because it falls above MDA. As a rule of thumb, a determination of activity should be about three times MDA (i.e. 3MDA) before the precision can be represented by a standard error of 10 percent or less[8,9].

Special care must be taken in liquid scintillation counting to assure not only that the blank is appropriate, but also that counting efficiency does not change due to changes in light collection efficiency or quenching from sample to sample. Since smear samples are collecting various kinds of dust, dirt and other unknown contamination along with whatever other radioactive material is being monitored, various chemical reactions might be possible in the scintillation liquid that produce light exceeding that from any radioactive decay in the sample[15]. Other phenomena that might contribute to background counts are excitation of the glass vial, vial cap, and scintillation liquid by sunlight or fluorescent light, leading to delayed light emission. Scintillation counting is very susceptible to various sources of chemiluminescence and changes in purity of the scintillation fluid. Thus, special quality control provisions must be included in smear analysis procedures when liquid scintillation counting is used.

In recording data, it is usually best to determine the standard error of each determination to two significant digits, and then carry out the result to the decimal digit of the second digit of the standard error (SE). No recommendation was made here in this regard, since uncertainties in transfer of removable contamination on a single smear will usually be quite large anyway. However, for consistency in recording data, and for simplicity of instructions to the counting technicians, it might be best to adhere to the convention of two digits for the standard error. Otherwise, inconsistencies in results of as much as 50% can be introduced by the rounding of an SE of 1.49 to 1. In any case, the convention for recording data should be specified in the smear counting procedure, and should be used consistently by each person recording data.

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Attachment 2

ATTACHMENT 2

LLD for Tennelec 5100 Counter

Tennelec 5100 Data:

$t = 2$ min.
R Bkg $\alpha = 0.1$ cpm
R Bkg $\beta = 1.0$ cpm
Eff $\alpha = .21$
Eff $\beta = .42$

$S_b = \sqrt{CBkg}$
C Bkg $\alpha = 0.2$ c
C Bkg $\beta = 2.0$ c
$S_b\,\alpha = 0.45$
$S_b\,\beta = 1.41$

$$LLD\alpha(dpm) = \frac{3 + (4.65)\ (S_b\alpha)}{(Eff\alpha)(T)}$$

$$= \frac{3 + 4.65\ (0.45)}{(.21)(2)}$$

$$= \boxed{12.13 \text{ dpm}}$$

$$LLD\beta(dpm) = \frac{3 + 4.65\ (S_b\beta)}{(Eff_\beta)(T)}$$

$$= \frac{3 + 4.65\ (1.41)}{(.42)(2)}$$

$$= \boxed{11.38 \text{ dpm}}$$

Attachment 3

ATTACHMENT 3

LLD for Ludlum Model 2929 Counter

Ludlum 2929 Data

$T = 1$ min
$R\,Bkg\,\alpha = 0.2$ cpm
$R\,Bkg\,\beta = 28$ cpm
$Eff\,\alpha = 0.36$
$Eff_{\beta} = 0.36$

$S_b = \sqrt{C\,Bkg}$
$C\,Bkg\,\alpha = 0.2$ c
$C\,Bkg\,\beta = 28$ c
$S_b\,\alpha = 0.45$
$S_b\,\beta = 5.29$

$$LLD\alpha(dpm) = \frac{3 + (4.65)\ (S_b\alpha)}{(Eff\alpha)(T)}$$

$$= \frac{3 + 4.65\ (0.45)}{(0.36)(1)}$$

$$= \boxed{14.11 \text{ dpm}}$$

$$LLD\beta(dpm) = \frac{3 + 4.65\ (S_b\beta)}{(Eff_{\beta})(T)}$$

$$= \frac{3 + 4.65\ (5.29)}{(0.36)(1)}$$

$$= \boxed{76.68 \text{ dpm}}$$

Attachment 4

ATTACHMENT 4

LLD for the NE Alpha/Beta Contamination Monitor

LLDs for 1 minute static counts:

NE Data:

$T = 1$ min.
R Bkg $\alpha = 0.2$ cpm
R Bkg $\beta = 200$ cpm
Eff $\alpha = 0.35$ c/d (Pu-239)
Eff $_{\beta} = 0.18$ c/d (Tc-99)

$S_b = \sqrt{C_{Bkg}}$
C Bkg $\alpha = 0.2$ c
C Bkg $\beta = 200$ c
$S_b \alpha = 0.45$
$S_b \beta = 14.14$

$$LLD\alpha(dpm) = \frac{3 + (4.65)\ (S_b\alpha)}{(Eff\alpha)(T)}$$

$$= \frac{3 + 4.65\ (0.45)}{(0.35)(1)}$$

$$= \boxed{14.55 \text{ dpm per } 100 \text{ cm}^2 \text{ probe area}}$$

$$LLD\beta(dpm) = \frac{3 + 4.65\ (S_b\beta)}{(Eff_{\beta})(T)}$$

$$= \frac{3 + 4.65\ (14.14)}{(0.18)(1)}$$

$$= \boxed{382 \text{ dpm per } 100 \text{ cm}_2 \text{ probe area}}$$

LLDs for Scanning Uniformly Distributed Sources of Surface Radioactivity

LLDs for uniformly distributed sources are expected to approach those of the minute static counts. BCLDP Procedure HP-OP-011 also instructs technicians to perform a static 1-minute count if increased count rate is detected.

LLDs for Scanning Point Sources of Surface Radioactivity

Width of NE probe = 6.7 cm
Assume Scanning Speed = 3 cm/sec
Time for Probe to Pass Over Point Source = 2.23 sec = 0.04 min

LLD α Point Source Scan

$$C_{Bkg}\alpha = \frac{0.2\ c}{min} \times 2.23\ sec \times \frac{1\ min}{60\ sec} = 0.01C$$

$$S_b\alpha = \sqrt{C_{Bkg}\alpha} = \sqrt{0.01} = 0.09$$

$$\frac{3 + 4.65\ (0.09)}{.35\ (0.04)} = 244\ dpm = 250\ dpm$$

$$= 244\ dpm = 250\ dpm$$

LLD$_\beta$ Point Source Scan

where $S_b\beta^- = \sqrt{C_{\beta^-}} = 2.73$

$$C_{\beta^-} = \frac{200c}{min} \times 2.23\ sec \times \frac{1\ min}{60\ sec} = 7.43c$$

$$Eff_{\beta^-} = 0.18$$

$$t = 2.23\ sec \times \frac{1\ min}{60\ sec} = 0.04\ min$$

LLD$_\beta$ Point Source Scan

$$\frac{3 + 4.65\ (2.73)}{.18\ (0.04)} = 2179\ dpm = 2200\ dpm$$

Many assumptions are made when estimating the LLD for detection of a point source of surface radioactivity (i.e., scanning speeds, distance of probe from the source, background rates, etc.) and all may fluctuate given field conditions. Based on the above assumptions, the LLDs for the NE instrument for a point source of surface radioactivity are approximately 250 dpm (alpha) and 2200 dpm (beta). Both activity levels are significantly less than the most restrictive "maximum" values given in Table 1.

ATTACHMENT 2

VOLUMETRIC RELEASE CRITERIA TECHNICAL BASIS DOCUMENT

DD-93-03
Revision 0

VOLUMETRIC RELEASE CRITERIA TECHNICAL BASIS DOCUMENT

for

Battelle Columbus Laboratories
Decommissioning Project (BCLDP)

UNCONTROLLED COPY

April, 1993

BATTELLE
505 King Avenue
Columbus, Ohio 43201

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. . . Putting Technology To Work

REVISION RECORD INDICATING
LATEST DOCUMENT REVISION

Title Volumetric Release Criteria Technical Basis Document

No. DD-93-03, Rev 0
Page ii

INDEX OF PAGE REVISIONS

Page No.	i	ii	iii	iv	v					
Rev. No.	0	0	0	0	0					

Page No.	1	2	3	4	5	6	7	8	9	10
Rev. No.	0	0	0	0	0	0	0	0	0	0

Page No.	11	12	13	14	15	16	17	18	19	20
Rev. No.	0	0	0	0	0					

Page No.	21	22	23	24	25	26	27	28	29	30
Rev. No.										

Page No.	31	32	33	34	35	36	37	38	39	40
Rev. No.										

REVISION RECORD	
Rev. No.	Date

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Rev. No.	Date

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APPROVAL PAGE

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EXECUTIVE SUMMARY

Volumetric release criteria and associated procedures have been developed for the unrestricted release of materials and liquids by the Battelle Columbus Laboratories Decommissioning Project (BCLDP). Latest instrumentation technology and nuclear industry standards have been utilized to develop and apply these criteria and procedures. The BCLDP will release soils, bulk materials, and solid volumes at or below the concentration limits defined in Table 1 of this document, BCLDP Guidelines for Residual Radioactivity Concentrations for Soil and Solid Volumes. Water released as effluents to the environment will be released at or below the concentrations found in 10CFR20, Appendix B, Table 2, Column 2. Water released to sanitary sewage systems will satisfy 10CFR20, Appendix B, Table 3 and 10CFR20.303 requirements. Materials, equipment, and buildings are also released with consideration of surface contamination levels. Surface release criteria for the BCLDP are defined in a separate project document entitled, "Surface Release Criteria Technical Basis Document for the BCLDP (DD-93-02)." Bulk liquids such as oils, solvents, and hazardous wastes will be processed and disposed according to applicable regulations.

VOLUMETRIC RELEASE CRITERIA TECHNICAL BASIS DOCUMENT FOR BCLDP

Introduction

The Battelle Columbus Laboratories Decommissioning Project (BCLDP) is an extensive project to remediate 13 buildings and associated facilities such that they can be released for unrestricted use to the general public. As part of this effort, release criteria are being established to serve as requirements for remedial action. This document establishes the technical basis by which applicable volumetric release criteria for residual radioactivity have been selected to serve as the basis for performing the remedial action.

Volumetric residual radioactivity is the amount of radioactivity per unit mass or volume and is usually defined for solid and liquid media. General volumetric residual radioactivity release criteria and guidance are contained in many source documents governing BCLDP activities; (1) DOE Order 5400.5, (2) Nuclear Regulatory Commission (NRC) Guidance as presented in Attachment 1, and (3) 10 CFR 20 requirements. For the BCLDP, DOE Order 5400.5 requirements are applicable because the radioactive material being removed is the property of DOE and the DOE provides funding for the project. NRC requirements are also applicable for the BCLDP because Battelle is an NRC Licensee and the BCLDP is being conducted under an NRC decommissioning plan.

Volumetric Release Criteria (i.e., soil and liquid radioactivity concentrations) are ultimately determined by the maximum dose limit to a member of the public, commonly referred to as the Public Dose Limit (PDL). Given the same environmental pathways, transport parameters, isotopes, and source activities, as the acceptable dose limit is increased, so does the acceptable source term concentration (i.e., release criteria). Differences between DOE and NRC guidance concerning the PDL are described below. The PDL is expressed as mrem/year Effective Dose Equivalent (EDE) to the maximally exposed member of the general public. A PDL has been used for the derivation of concentrations of acceptable radioactive isotopes in air and water found in the regulations and is also used as the basis for site-specific release criteria for residual radioactivity in soil. Despite the importance of the PDL, a single value does not exist for all applications. For example:

- DOE specifies 100 mrem/year for use in developing site-specific guidelines for soil as well as for evaluating the external gamma radiation limit. In addition, DOE uses this same value to develop its derived concentration guide for air and water (DOE Order 5400.5, Chapter III).

- NRC specifies 100 mrem/year in 10 CFR 20; however, NRC further specifies 10 mrem/year for use in developing site-specific guidelines for release of licensed facilities for unrestricted use as seen in Attachment 1.

- NRC specifies 50 mrem/year for limiting radioactivity concentrations in effluent concentrations in Table 2, Appendix B, 10CFR20.

Release Criteria

Residual Radioactivity Concentrations for Soil

The BCLDP has completed a review of the guidance given in the source documents and has completed environmental pathway and dose analyses for residual soil radioactivity. Residual Radioactivity Concentration criteria for soil and solid volumes to be used by the BCLDP are shown in Table 1, "BCLDP Guidelines for Residual Radioactivity Concentrations for Soil and Solid Volumes". Criteria for residual radioactivity concentrations in soil are defined in a number of references. DOE Order 5400.5, Section IV.a.2 provides generic guidelines for residual concentrations of Ra-226, Ra-228, Th-230, and Th-232. NRC Guidance has been received by the BCLDP as shown in Attachment 1 which contains soil radioactivity concentration guidelines for Co-60, Sr-90, Cs-137, Ra-226, and Ra-228. Attachment 1 contains NRC guidance for soil radioactivity concentration guidelines for natural, enriched and depleted uranium. Table 1 is a compilation of the soil residual radioactivity concentration guidelines to be utilized by the BCLDP generated primarily from the various reference documents mentioned in the above sentences and from soil guidelines generated from computer pathway analyses.

Table 1. BCLDP Guidelines for Residual Radioactivity Concentrations for Soil and Solid Volumes

Radionuclide	Predominant Pathway	King Avenue Concentration (pCi/g)	West Jefferson Concentration (pCi/g)
Natural Uranium	Dust	10[1]	na[b]
Enriched Uranium	Dust	30[1]	30[1]
Depleted Uranium	Dust	35[1]	35[1]
Ac-227	Dust	19[c]	19
Am-241	Dust	na	270
Am-243	Dust	na	140
Ce-144	Water	na	2,100
Cm-243	Water	na	0.79
Cm-244	Water	na	1.0
Co-60	Direct	8[2]	8[2]
Cs-134	Direct	na	33
Cs-137	Direct	15[2]	15[2]
C-14	Water	940	940
Eu-152	Water	na	390
Eu-154	Water	na	260

Radionuclide	Predominant Pathway	King Avenue Concentration (pCi/g)	West Jefferson Concentration (pCi/g)
Eu-155	Water	na	1,900
Fe-55	Dust	na	2.7E+07
H-3	Water	41,000	38,000
I-129	Water	na	13
Mn-54	Direct	na	61
Ni-59	Plant	na	1.3E+07
Ni-63	Plant	na	4.9E+06
Np-237	Water	na	0.58
Pa-231	Water	18	18
Pb-210	Dust	140	na
Pu-238	Dust	na	320
Pu-239	Dust	na	290
Pu-240	Dust	na	290
Pu-241	Dust	na	13,000
Pu-242	Dust	na	310
Ra-226	Direct	5(2,3)	na
Ra-228	Direct	5(2,3)	na
Ru-106	Water	na	180
Sb-125	Water	na	1,100
Sm-151	Dust	na	6,700
Sr-90	Plant	5(2)	5(2)
Th-228	Direct	29	na
Th-230	Dust	5(3)	na
Th-232	Dust	5(3)	na

Table 1 Notes and References

Notes:

a. Activity concentrations above natural background concentrations. Where more than one radionuclide is present, the sum of the ratios of the individual radionuclide concentrations to their respective concentration limits shall not exceed 1.

b. Indicates that this radionuclide is not expected to be found at the indicated site.

c. Concentrations for which no specific reference is cited have been derived from RESRAD calculations.

References:

1. Options 1 and 2 of the Branch Technical Position, "Disposal or Onsite Storage of Thorium or Uranium Wastes from Past Operations" (46 FR 52061, October 23, 1981).

2. NRC Memorandum, "Acceptable Cleanup Criteria and Practices for Decontamination and Decommissioning (License No. SNM-7)" dated April 17, 1992, to Harley L. Toy, License Coordinator and Manager, Nuclear Sciences, Battelle Memorial Institute from J.W.N. Hickey, Chief, Fuel Cycle Safety Branch, Division of Industrial and Medical Nuclear Safety, Office of Nuclear Material Safety and Safeguards.

3. DOE Order 5400.5, "Radiation Protection of the Public and the Environment".

The criteria in Table 1 are the maximum allowable concentrations of radioactive material above background levels that may be left in soil and solid volumes that are released to the general public for unrestricted use. The term "Unconditional Free Release" is a generally accepted term in industry that is used synonymously with this unrestricted use. It is the policy of the BCLDP to aggressively apply the principles of As Low As Reasonably Achievable (ALARA) to releases as discussed in the section entitled "Radiological Release Logic for the BCLDP" on Page 11 of this document. The release criteria stated in Table 1 shall be applied as an upper limit of radioactive volume contamination for free release of soil and solid volumes by BCLDP. Table 1 includes all isotopes and their predominant exposure pathways which are expected to be encountered by the BCLDP at each remediation site. If additional isotopes are encountered, an isotopic release criteria which meets DOE and NRC regulations will be determined and documented prior to performing remedial actions.

DOE Order 5400.5 requires an environmental pathway analysis code to be utilized for determining applicable activity concentrations for isotopes when numerical concentration values are not defined by the order (i.e., required for nuclides other than Th-232, Th-230, Ra-228, and Ra-226). RESRAD is an acronym for the DOE's Residual Radioactivity Materials computer program and this program has environmental pathway modeling and dose assessment capabilities. Input parameters, such as an acceptable public dose limit and local hydrogeologic parameters, must be supplied to the code. The code then derives associated soil radioactivity concentrations for a number of environmental pathways (e.g., direct exposure, ground water transport, farming). The activity concentrations generated by RESRAD are based on a 100 mrem/yr effective dose equivalent (EDE) limit to a member of the public and are also computed using local hydrology and soil parameters. The concentrations are also derived based on the most conservative pathway analysis used in the RESRAD code. Attachment 2 contains the complete output report generated by the RESRAD code for the assessment of the BCLDP isotopes. The report includes all input data and parameters used to run the code.

The radionuclides anticipated from historical evidence and observed in various sample analyses vary significantly between the King Avenue and West Jefferson sites. To accommodate the variety of mixtures that will be encountered in remediation activities, RESRAD calculations have been performed to obtain soil guidelines. The guidelines are maximum concentrations for the individual

radionuclides that may be present. These individual guidelines can be utilized to obtain guidelines for any mixture if the amount of any isotope present is ratioed to its limit as a fraction and the summation of the individual isotope fractions are less than unity (i.e., 1). The mixture sum is stated as the condition:

$$\sum C_i/SG_i \leq 1$$

where

C_i = concentration of the ith radionuclide (pCi/g), and
SG_i = soil guideline of the ith radionuclide (pCi/g).

The RESRAD radionuclide library contains principal radionuclides and associated radionuclides. Associated radionuclides are decay products with half-lives less than six months and are assumed to be in equilibrium with their principal radionuclide. The associated radionuclides are accounted for in dose and soil guideline calculations by their inclusion in the dose conversion factors of their respective principal radionuclides, i.e., they are not contained explicitly in the library. The principal and associated radionuclides of the uranium and thorium series are given in Table 2.

King Avenue Radionuclides. The radionuclides found at the King Avenue site and their individual RESRAD-derived soil guidelines are listed in Table 3. The individual soil guidelines in Table 3 are the more restrictive values calculated for residual material deposited at the surface at a depth of 5 meters. The soil guidelines in Table 3 are based on a water table depth of 45 feet, which was obtained from the driller's log for a well in the vicinity of Building 15. Direct exposure and dust inhalation pathways dominate exposure pathways, so RESRAD default soil parameters were used. The entries in Table 3 are sufficient to determine soil guidelines for thorium and the types of uranium handled at King Avenue: natural, depleted, and enriched (un-irradiated). Other radionuclides can also be included in mixture sums. Soil guidelines derived in this way for various uranium forms and natural thorium are given in Table 4. Two properties of enriched and depleted uranium should be noted with respect to these soil guidelines:

1. Uranium is stripped of its decay products in both the conversion to uranium hexa-fluoride -- the feed material for the enrichment process and the production of metal and oxides -- and in the enrichment process itself. The one exception is U-234, which is assumed to be in equilibrium with U-238 and to be enriched and depleted in the same proportion as U-235.

2. The longest possible time for decay product in-growth is about 50 years, since enriched and depleted uranium did not exist in significant quantities prior to that time. This effectively limits RESRAD principal decay products to U-234 for U-238 and Pa-231 (about 0.1% of the parent activity) for U-235.

Table 2. Principal and Associated Radionuclides of the Uranium and Thorium Series in the RESRAD Library.

Principal Radionuclide	Associated Radionuclides
Uranium-238	Thorium-234
	Protactinium-234
Uranium-234	
Thorium-230	
Radium-226	Lead-214
	Bismuth-214
	Polonium-214
	Lead-210
	Bismuth-210
	Polonium-210
Thorium-232	
Radium-228	Actinium-228
Thorium-228	Radium-224
	Radon-220
	Polonium-216
	Lead-212
	Bismuth-212
	Polonium-212
	Thallium-208
Uranium-235	Thorium-231
Protactinium-231	
Actinium-227	Thorium-227
	Radium-223
	Radon-219
	Polonium-215
	Lead-211
	Bismuth-211
	Thallium-207

Table 3. RESRAD Derived Maximum Individual Nuclide Soil Guidelines (SG) for King Avenue

Nuclide	Year[a]	Cover Depth[b], m	SG, pCi/g
Ac-227	0	0	19
C-14	4	0	940
Co-60	0	0	16
Cs-137	0	0	68
H-3	4	5	41,000
Pa-231	739	0	18
Pb-210	0	0	140
Ra-226	0	0	24
Ra-228	3	0	31
Sr-90	0	0	2,400
Th-228	0	0	29
Th-230	11	0	470
Th-232	25	0	19
U-234	0	0	1,200
U-235	0	0	270
U-238	0	0	860

a. Year of maximum dose calculated by RESRAD.
b. Depth of a 100 m^2 by 15 cm contaminated zone.

The soil guidelines given in Table 4 for natural uranium and thorium assume all decay products are in equilibrium.

Table 4. RESRAD Determined Soil Guidelines (SG) for Uranium and Thorium Derived From Individual Nuclide Mixture Sums for King Avenue

Nuclide Mixture	SG, pCi/g
Natural Uranium	17[a]
Enriched Uranium, 3%	180[b]
Enriched Uranium, 93%	46[c]
Depleted Uranium	600[d]
Natural Thorium	8.4[e]

a. Activity concentration of U-238. Assumes short- and long-lived daughters of U-238 and U-235 are in equilibrium.

b. Activity concentration of U-238. Assumes short-lived daughters of U-238 and U-235 are in equilibrium and U-234 is enriched by the same factor as U-235.

c. Activity concentration of U-235. Assumes short-lived daughters of U-238 and U-235 are in equilibrium and U-234 is enriched by the same factor as U-235.

d. Activity concentration of U-238. Assumes short-lived daughters of U-238 and U-235 are in equilibrium, and U-234 and U-235 are depleted to 50% of their proportions in natural uranium.

e. Activity concentration of Th-232. Assumes short- and long-lived daughters of Th-232 are in equilibrium.

West Jefferson Radionuclides. The radionuclides that might be found at the West Jefferson site are given in Table 5. Unlike the King Avenue site where several distinct forms of uranium have been used, irradiated enriched uranium is the principal form used at West Jefferson. Since a wide variety of mixtures of spent fuel, fission products, and neutron activation products are possible, the specification of generic soil guidelines is not feasible. Rather, it will be necessary to calculate mixture sums based on the results of analyses and individual soil guidelines to determine guidelines for specific situations.

Deposition coefficients based on laboratory measurements were used for americium and plutonium nuclides; RESRAD default values were used for other nuclides. A water table depth of 25 feet was used for the RESRAD calculations; this depth was obtained from driller's logs for four test boreholes drilled prior to the construction of the JN-1 storage pool. The soil guidelines given in Table 5 are the more restrictive of values calculated for residual material for surface deposition at a depth of 5 meters.

External Gamma Radiation from Ground Surfaces

DOE Order 5400.5, Section IV-4.c and EPA Regulation 40 CFR 192 state that surface gamma radiation levels from ground surfaces shall not exceed 20 μR/h. However, NRC Guidance received by the BCLDP in Attachment 1 states gamma exposure rates at 1 meter above the ground surface shall not exceed 5 μR/h above background. This more restrictive level was derived by the NRC to keep remediated areas with full time occupancy (2000 hrs/yr) to exposures of less than or equal to 10 mrem per year.

This more restrictive criteria of 5 μR/hr at 1 meter above the ground will be utilized by the BCLDP as an additional criteria for free release of material volumes for the release of ground, building, and materials.

Table 5. RESRAD Derived Maximum Individual Nuclide Soil Guidelines (SG) for West Jefferson

Nuclide	Year[a]	Cover Depth[b], m	SG, pCi/g
Ac-227	0	0	19
Am-241	0	0	270
Am-243	0	0	140
Ce-144	0	0	2,100
Cm-243	1	5	0.79
Cm-244	1	5	1.0
Co-60	0	0	16
Cs-134	0	0	33
Cs-137	0	0	68
C-14	2	0	940
Eu-152	1	5	390
Eu-154	1	5	260
Eu-155	1	5	1,900
Fe-55	0	0	2.7e+07
H-3	1	5	38,000
I-129	4	0	13
Mn-54	0	0	61
Ni-59	0	0	1.3e+07
Ni-63	0	0	4.9e+06
Np-237	2	0	0.58
Pa-231	411	0	18
Pu-238	0	0	320
Pu-239	0	0	290
Pu-240	0	0	290
Pu-241	11	0	13,000
Pu-242	0	0	310
Ru-106	1	5	180
Sb-125	1	5	1,100
Sm-151	2	0	6,700
Sr-90	0	0	2,400
U-233	0	0	1,200
U-234	0	0	1,200
U-235	0	0	270
U-236	0	0	1,300
U-238	0	0	860

a. Year of maximum dose calculated by RESRAD.
b. Depth of a 100 m^2 by 15 cm contaminated zone.

Solid Material Volumes

Soil criteria will be considered applicable for any solid material volumes that are being considered for unconditional release by the BCLDP. This is considered to be a conservative approach since most solid materials containing residual radioactivity such as concrete rubble or building debris will not have the potential uses similar to those of soil (e.g., farming, top soil) and therefore are unlikely to enter human ingestion pathways.

Radioactivity Concentrations for Water and Bulk Liquid Releases

DOE Order 5400.5, Chapter 3 provides derived concentration guides for water releases based on a public effective dose equivalent limit of 100 mrem/year. NRC guidance in the revised 10 CFR 20 also establishes a public dose limit of 100 mrem/yr. However, effluent concentrations for water listed in 10CFR20, Appendix B, Table 2 are designed to a public effective dose limit of 50 mrem/yr. As a result, water concentration values in 10CFR20, Appendix B, Table 2 are approximately 50% of the concentration values listed in DOE Order 5400.5, Chapter 3, "Derived Concentration Guides for Water." Water releases will generally be to storm or sanitary sewer systems. Direct releases to drinking water supplies such as injection to ground water or directly to other drinking water sources are not planned by the BCLDP.

Examples of the difference in water concentration values for U-238 and Th-232 are demonstrated below:

Nuclide	10 CFR 20 Appendix B, Table 2 (μCi/ml)	DOE Order 5400.5 Chapter 3 (μCi/ml)
U-238	3E-7	6E-7
Th-232	3E-8	5E-8

Due to its NRC license, the BCLDP will comply with the more stringent water concentration guides of 10CFR20, Appendix B, Table 2 for water released as effluents to the environment. An exception will be for water released to sanitary sewers where the guidance of 10CFR20, Appendix B, Table 3 will apply and the guidance of 10CFR20.303 must be satisfied. In situations where more than one radionuclide is present, the sum of the ratios of the individual radionuclide concentrations to their respective concentration limits shall not exceed one. Bulk liquids other than water with detectable radioactivity above background levels of the material will be managed appropriately by the BCLDP's Waste Management Group. Attachment 4 of this document is a table which shows the release criteria for water, soil, and solids for each isotope expected to be encountered by the BCLDP.

Radiological Release Logic for the BCLDP

Consistent with the requirements of DOE Order 5400.5, Section II.5, "Release of Property Having Residual Radioactive Material," and the DOE Radiological Control Manual, Section 422, "Release to Uncontrolled Areas," materials having activity concentrations in excess of applicable limits (Table 1 of this document and 10 CFR 20, Appendix B, Table 2) shall require decontamination and/or removal and disposal as radioactive waste. Materials that do not have detectable contamination (i.e., above the LLD) shall be released without any further assessment or evaluation. As required by DOE Order 5400.5, Section II.2.b, "ALARA Evaluations," formal ALARA evaluations and cost benefit analyses shall be performed as part of Decontamination and Decommissioning Plans for facilities, buildings, and large volumes of associated equipment and materials with residual radioactivity above the LLD but below the limits presented.

As dictated in DOE Order 5400.5, Section II.5.c.1-4, "Release of Materials and Equipment," individual items not addressed by specific Decontamination & Decommissioning plans with residual radioactivity above the LLD but below applicable limits will also be subjected to an ALARA process and assessed for potential decontamination activities prior to release by the BCLDP. This ALARA process consists of a field assessment by a trained evaluator (usually a Health Physics Supervisor) prior to releasing any materials with detectable contamination below the limit. In addition, all volumetric releases, solid or liquid, will be conducted using a permit approved by the Environment, Safety and Health Manager. BCLDP Procedures HP-OP-011, "Release of Materials from Radiologically Controlled Areas" and HP-OP-106, "Volumetric Releases and Permitting Requirements" further define and establish requirements for the uncontrolled release of materials and equipment from radiological areas. Figure 1 contains a flow chart which graphically depicts the release logic utilized by the BCLDP.

In summary, it is the practice of the BCLDP that all releases of materials and bulk liquids will meet or be below the limits and criteria found in Table 1 of this document and 10 CFR 20, Appendix B, Table 2. In addition, for materials with residual radioactivity below those in Table 1 but above the LLD of radiation detection equipment, it is the practice of the BCLDP to use sound ALARA principles and analyses to determine what, if any, decontamination actions are warranted prior to release. It should be made clear this does not mean that all materials will be released at or near the LLD since there may not be a reasonable ALARA basis to do so.

Natural and Electronic Background

The application of release criteria standards cannot be successfully applied without the understanding of background. Two types of background exist: natural and electronic. Natural and electronic background significantly impact the release criteria by the following:

- Natural background, by providing a quantity of radioactive material which is available to be detected.

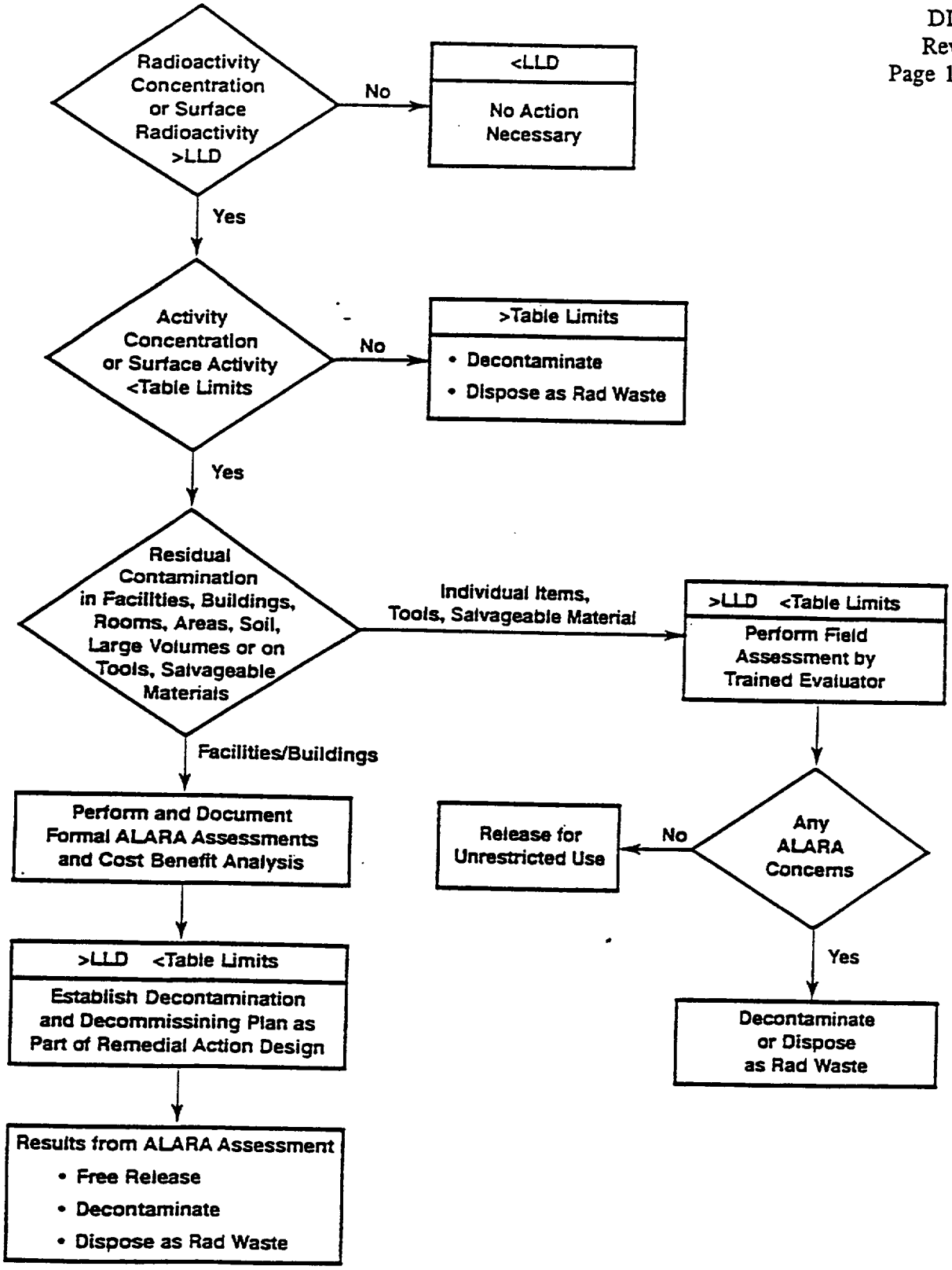

Figure 1. Radiological Release Logic for the BCLDP

- Electronic background, by influencing the least amount of radioactivity that can be measured by a particular instrument.

It is necessary to distinguish the difference of the two types of background. Obviously, the term background could apply to either. The following are the terms as accepted by industry practice.

Generic term - natural background, the amount of radioactive material that exists in a substance, surface, or material as a result of nature. The quantity of natural background is generally expressed in terms of picocuries/gram (pCi/g), femtocuries/liter (10^{-15} Ci/l), milligrams/milliliter (mg/ml), disintegrations per minute (dpm), or other suitable combinations of activity or quantity per unit mass or area. Cosmic radiation is also considered a part of natural background. Natural background is detectable and must be accounted for when making activity determinations. For example, field beta/gamma type instruments might have background that ranges from 100 to 500 counts/minute. For a laboratory type alpha scintillation counter, the background might be 1 count per 2 minutes of counting time.

Generic term - electronic background, the amount of electronic signal produced by electronic noise which results in a meter or scaler deflection. Instrument background is generally expressed in counts per minute (cpm), picocuries/gram (pCi/g), milligrams/liter (mg/l), or other suitable units. Electronic background (background) is determined by measuring the signal output for a particular instrument when subjected to an area or matrix that contains no radioactive material.

Determining Background

Accurately determining both types of background must be accomplished before applying release criteria. Two industry accepted practices exist for determining natural background in materials. The first method is to accurately measure the naturally-occurring radioactivity in materials with the appropriate analytical instrument. This is accomplished by collecting a clean sample of similar material from an uncontaminated source. An example of this type of natural background determination is to measure the radioactivity in a piece of lumber from the hardware store or a quart of motor oil from Wal-Mart®. The expected results for such an analysis would be 1 to 2 pCi/g in wood for natural uranium and less than 0.1 pCi/l for mixed fission products in oil. This same process can also be applied to chemical contaminates in various matrices.

The other type of material background analysis is a statistical procedure called Chavenet's Determination. This process requires making a large number of radiation measurements in a defined area and then casting out the larger or smaller measured results which do not fit the criteria. The average of the remaining results is considered to be background for the defined population.

Both of these techniques are applied for determination of natural background for the BCLDP.

Instrumentation and Application

Release surveys will be performed using suitable instrumentation and industry standards. It should be noted that the upper end of the release criteria defined in the applicable regulatory standards and being applied to the BCLDP were developed in part based on the detection limitations of the field instruments available at the time the standards were published. The BCLDP will utilize field instruments, laboratory techniques, and survey techniques capable of achieving detection limits at or below the upper bounds of the release criteria stated in Table 1. Current BCLDP laboratory analyses techniques and instrumentation have detection limits lower than the concentration guidelines for the most restrictive nuclides shown in Table 1. However, the BCLDP will not continue to upgrade with state-of-the-art detection systems simply to drive the lower limit of detection (LLD) continually lower. Materials with detectable radioactive contamination levels greater than the LLD but less than the concentrations stated release criteria will be evaluated based upon ALARA analyses for decontamination, disposal, or free release. Materials greater than the release criteria will be decontaminated or disposed of as of radioactive waste.

Lower Limits of Detection

The lower limit of detection (LLD) as used in this technical basis document is the smallest amount of sample activity that will yield a net count for which there is a 95% confidence level that the activity is, in fact, present. The LLD is an *a priori* (before the fact) estimate of the capabilities of a given detection system. The LLD does not depend on the sample activity but rather on the detection capability of the detection process itself (i.e., detection efficiency and background count rate).

The formula for LLD is given below:

$$LLD = \frac{3 + 4.65(S_b)}{Eff\ (T)}$$ [See Equation 6, Attachment 3]

where

S_b = standard deviation of background or blank counts (C_b) for a counting time, defined as $\sqrt{C_b}$

T = counting time for samples, background or blanks; in units of minutes (m). All counting times are set equal.

Eff = counting efficiency in units of c/d; the number of counts (detections) per the number of disintegrations from a calibration source.

An excerpt from Brodsky's and Gallaghar's Paper, "Statistical Considerations in Practical Contamination Monitoring" published in Radiation Protection Management, Volume 8, No. 4 is found in Attachment 3. The paper discusses the derivation of the LLD formula and discusses Type I α (false detection) and Type II β (false non-detection) errors. For radioactivity measurements performed by BCLDP, the LLD, as defined above, establishes a 5% chance of incorrectly detecting activity when it is absent and a 95% confidence that activity will be detected when it is present.

Instrument Calibration

Field instruments and laboratory instruments shall be calibrated in accordance with ANSI N323, "Radiation Protection Instrumentation Test and Calibration". Instrument calibrations will be in accordance with formal procedures including reference checks and documented maintenance programs.

Quality

Instrument calibrations shall be performed with National Institute of Standards and Testing (NIST) traceable standards. Reference checks shall be performed in accordance with formal BCLDP procedures. Final release of buildings and grounds shall be verified by an Independent Verification Contractor (IVC).

Release surveys will be performed or directed by technicians whose qualifications meet ANSI/ANS 3.1, "Selection, Qualification, and Training of Personnel for Nuclear Power Plants" and DOE Order 5480.11, "Radiation Protection for Occupational Workers". Routine oversight of the release program will be performed by a department of the BCLDP other than that of those performing the release surveys.

UNCONTROLLED COPY

Attachments

to

VOLUMETRIC RELEASE CRITERIA TECHNICAL BASIS DOCUMENT

for

Battelle Columbus Laboratories Decommissioning Project (BCLDP)

April, 1993

BATTELLE
505 King Avenue
Columbus, Ohio 43201

Attachment 1

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555

April 17, 1992

RECEIVED

APR 23 1992

HARLEY TOY

Docket No. 70-8

Mr. Harley L. Toy
License Coordinator and
Manager, Nuclear Services
Battelle Memorial Institute
505 King Avenue
Columbus, Ohio 43201-2693

Dear Mr. Toy:

RE: CURRENT NRC GUIDANCE, ACCEPTABLE CLEANUP CRITERIA AND PRACTICES FOR DECONTAMINATION AND DECOMMISSIONING (LICENSE NO. SNM-7)

On January 24, 1992, we met with you at Nuclear Regulatory Commission Headquarters to discuss Battelle Memorial Institute's (BMI) draft revision of Certification of Financial Assurance for decontamination and decommissioning (D&D). During this meeting we also described to you the current NRC guidance, acceptable cleanup criteria and practices for D&D of the BMI facilities and the need for BMI to agree in writing to the current NRC cleanup criteria listed below.

Pending codification of radiological criteria for decommissioning, the NRC will continue to use existing guidance, criteria and practices listed below to determine whether sites have been sufficiently decontaminated so that they may be released for unrestricted use, pursuant to the decommissioning rules in 10 CFR 30.36, 40.42, 50.82, 70.38, and 72.54. These cleanup criteria will be applied on a site-specific basis with emphasis, when necessary, to ensure that residual contamination levels are As Low As Is Reasonably Achievable (ALARA).

1. Options 1 and 2 of the Branch Technical Position "Disposal or Onsite Storage of Thorium or Uranium Wastes from Past Operations" (46 FR 52061, October 23, 1981).

2. "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material," Policy and Guidance Directive FC 83-23, Division of Industrial and Medical Nuclear Safety, August 1987.

3. "Termination of Operating Licenses for Nuclear Reactors," Regulatory Guide 1.86, June 1974, Table 1, for surface contamination of reactor facility structures. Also Cobalt-60, Cesium-137, and Europium-152 that may exist in concrete, components, structures, and soil should be removed such that the exposure rate is less than 5 microroentgen per hour above natural background at 1 meter, with an overall dose objective of 10 millirem per year (cf. Letter to Stanford University from James R. Miller, Chief, Standardization and Special Projects Branch, Division of Licensing, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission, April 21, 1982, Docket No. 50-141, (Enclosure 1).

4. The Environmental Protection Agency's (EPA's) "National Primary Drinking Water Standards," 40 CFR Part 141. In accordance with FC 83-23, the maximum contaminant levels for radionuclides in public drinking water as established by the EPA should be used as reference standards for protection of groundwater and surface water resources.

5. The EPA's "Radiation Dose Guidelines for Protection Against Transuranium Elements Present in the Environment as a Result of Unplanned Contamination" (42 FR 60956; November 30, 1977). This document provides guidelines for acceptable levels of transuranium elements in soil.

In addition to these criteria, guidelines, and standards, the NRC will continue to use the additional guidelines listed in Table 1 on acceptable levels of contamination in soil to be released for unrestricted use.

Table 1. Additional Guidelines on Acceptable Levels of Contamination in Soil To be Released for Unrestricted Use

Radionuclide*	Maximum Soil Concentration (in pCi/g)
Cobalt-60@	8
Strontium-90#	5
Cesium-137@	15
Radium-226&	5
Radium-228&	5

*If only one radionuclide is present, then the maximum concentration is the value listed in the table. However, if more than one radionuclide is present, determine for each radionuclide the ratio between the measured concentration in soil and the concentration listed in the table. The sum of all such ratios may not exceed one (i.e., unity).

@Memorandum to W. E. Cline, Chief, Nuclear Materials Safety and Safeguards Branch, NRC, Region II, from J. W. N. Hickey, Chief, Operations Branch, Division of Fuel Cycle, Medical Academic, and Commercial Use Safety: Evaluation of Acceptability of Proposed Decommissioning Activities, May 6, 1987 (Enclosure 2).

#United Nuclear Corporation Resources Company, Approved Soil Decontamination Criteria for the Decommissioning of the UNC Facility, Docket No. 70-820, May 12, 1981.

&U.S. Environmental Protection Agency, Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings, 40 CFR Part 192, Subparts B and E, July 1, 1991.

Please respond back in writing your acceptance of these criteria or any questions you may have regarding them within three weeks from receipt of this letter. We want BMI to accept these criteria in writing because the Commission will approve and support BMI's unrestricted release of its facilities which meet these criteria.

If you have any questions or if we can be of additional assistance, please contact Dr. Tin Mo of my staff at (301) 504-2570.

Sincerely,

for

John W. N. Hickey, Chief
Fuel Cycle Safety Branch
Division of Industrial and
Medical Nuclear Safety
Office of Nuclear Material Safety
and Safeguards

Enclosures: As stated

cc: Dr. Kenneth Brog, BMI
Mr. Jefferson Neff, DOE, Columbus Field Office

WASHINGTON, D. C. 20555

APR 21 1982

Docket No. 50-141

Dr. Roland A. Finston, Director
Health Physics and Biosafety
Stanford University
67 Encina Hall
Stanford, California 94305

Dear Dr. Finston:

By letter dated March 17, 1981, we provided radiation criteria for release of the dismantled Stanford Research Reactor to unrestricted access. That criteria specified Reg. Guide 1.86 for surface contamination and 5 micro Rem per hour at one meter for reactor generated, gamma emitting isotopes.

Since March 17, 1981, we have refined further our position with respect to release criteria and have determined that radiation from gamma emitting isotopes is also acceptable if the potential exposure to individuals is less than 10 mRem per year with reasonable occupancy assumptions. If you wish to justify gamma exposure rates from reactor generated isotopes that are greater than 5 micro Rem per hour, you should show that reasonable occupancy of that area would be sufficiently less than 2000 hours per year, which would result in exposures of less than 10 mRem per year.

Sincerely,

James R. Miller, Chief
Standardization and Special
Projects Branch
Division of Licensing

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

ENCLOSURE

MAY 06 1987

MEMORANDUM FOR: William E. Cline, Chief
Nuclear Materials Safety and Safeguards Branch
Region II

FROM: John W. N. Hickey, Chief
Operations Branch
Division of Fuel Cycle, Medical, Academic and Commercial Use Safety

SUBJECT: EVALUATION OF ACCEPTABILITY OF PROPOSED DECOMMISSIONING ACTIVITIES

In your memorandum of April 16, 1987, you requested guidance on the acceptable concentration of Co-60 and Cs-137 in soil to allow the release of the Department of the Army, Fort McClellan, Alabama, facility. The primary pathway for exposure of individuals for these nuclides is by direct radiation. Therefore, the determination of acceptability for surface contamination of ground areas should be based on the following criteria:

External Radiation

The gamma exposure at 1 meter above the ground surface shall not exceed 10 uR/h above background for an area of greater than 30 ft x 30 ft and shall not exceed 20 uR/h above background for any discrete area (i.e., less than 30 ft x 30 ft).

Concentration criteria have also been developed for Co-60 and Cs-137 for situations in which subsurface contamination may be present, such as when burials of material have been made. These criteria are as follows:

Radionuclide	Concentration Limit Above Background (pCi/g)
Co-60	8
Cs-137	15

Where more than one radionuclide is present, the sum of the ratios of the individual radionuclide concentrations to their respective concentration limits shall not exceed 1.

I hope that this information is satisfactory as you evaluate the adequacy of the Department of the Army's decommissioning. If you have further questions, please feel free to contact me.

John W. N. Hickey, Chief
Operations Branch
Division of Fuel Cycle, Medical, Academic, and Commercial Use Safety

8706260094 870616
REG2 LIC30 PDR
01-02861-04

Enclosures:
1. Ltr to Mr. Rourk fm JLDascanio dtd 4/6/87.
2. Draft ltr to Dept of Army and Memo to JPotter fm JBKahle dtd 3/12/87.

Official Co

Attachment 2

RESRAD
(RESIDUAL RADIOACTIVITY MATERIALS PROGRAM)

SOIL GUIDELINE CALCULATIONS
KING AVENUE RADIONUCLIDES
NO SOIL COVER

Summary : King Avenue -- all nuclides -- no cover
File : C:\RESRAD4\KA\ALLNUCS.KA

Table of Contents

Part I: Mixture Sums and Single Radionuclide Guidelines

Site-Specific Parameter Summary 2
Summary of Pathway Selections 7
Contaminated Zone and Total Dose Summary 8
Total Dose Components
Time = 0.000E+00 9
Time = 1.000E+00 11
Time = 3.000E+00 13
Time = 1.000E+01 15
Time = 3.000E+01 17
Time = 1.000E+02 19
Time = 3.000E+02 21
Time = 1.000E+03 23
Dose/Source Ratios and Radionuclide Soil Guidelines 25

Site-Specific Parameter Summary

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R011	Area of contaminated zone (m**2)	1.000E+02	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	1.500E-01	1.000E+00	---	THICK0
R011	Length parallel to aquifer flow (m)	1.000E+02	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	1.000E+02	1.000E+02	---	BRLD
R011	Time since placement of material (yr)	0.000E+00	0.000E+00	---	TI
R011	Times for calculations (yr)	1.000E+00	1.000E+00	---	T(2)
R011	Times for calculations (yr)	3.000E+00	3.000E+00	---	T(3)
R011	Times for calculations (yr)	1.000E+01	1.000E+01	---	T(4)
R011	Times for calculations (yr)	3.000E+01	3.000E+01	---	T(5)
R011	Times for calculations (yr)	1.000E+02	1.000E+02	---	T(6)
R011	Times for calculations (yr)	3.000E+02	3.000E+02	---	T(7)
R011	Times for calculations (yr)	1.000E+03	1.000E+03	---	T(8)
R011	Times for calculations (yr)	not used	3.000E+03	---	T(9)
R011	Times for calculations (yr)	not used	1.000E+04	---	T(10)
R012	Initial principal radionuclide (pCi/g): Ac-227	1.000E+01	0.000E+00	---	S(1)
R012	Initial principal radionuclide (pCi/g): C-14	1.000E+01	0.000E+00	---	S(2)
R012	Initial principal radionuclide (pCi/g): Co-60	1.000E+01	0.000E+00	---	S(3)
R012	Initial principal radionuclide (pCi/g): Cs-137	1.000E+01	0.000E+00	---	S(4)
R012	Initial principal radionuclide (pCi/g): H-3	1.000E+01	0.000E+00	---	S(5)
R012	Initial principal radionuclide (pCi/g): Pa-231	1.000E+01	0.000E+00	---	S(6)
R012	Initial principal radionuclide (pCi/g): Pb-210	1.000E+01	0.000E+00	---	S(7)
R012	Initial principal radionuclide (pCi/g): Ra-226	1.000E+01	0.000E+00	---	S(8)
R012	Initial principal radionuclide (pCi/g): Ra-228	1.000E+01	0.000E+00	---	S(9)
R012	Initial principal radionuclide (pCi/g): Sr-90	1.000E+01	0.000E+00	---	S(10)
R012	Initial principal radionuclide (pCi/g): Th-228	1.000E+01	0.000E+00	---	S(11)
R012	Initial principal radionuclide (pCi/g): Th-230	1.000E+01	0.000E+00	---	S(12)
R012	Initial principal radionuclide (pCi/g): Th-232	1.000E+01	0.000E+00	---	S(13)
R012	Initial principal radionuclide (pCi/g): U-234	1.000E+01	0.000E+00	---	S(14)
R012	Initial principal radionuclide (pCi/g): U-235	1.000E+01	0.000E+00	---	S(15)
R012	Initial principal radionuclide (pCi/g): U-238	1.000E+01	0.000E+00	---	S(16)
R012	Concentration in groundwater (pCi/L): Ac-227	not used	0.000E+00	---	W(1)
R012	Concentration in groundwater (pCi/L): C-14	not used	0.000E+00	---	W(2)
R012	Concentration in groundwater (pCi/L): Co-60	not used	0.000E+00	---	W(3)
R012	Concentration in groundwater (pCi/L): Cs-137	not used	0.000E+00	---	W(4)
R012	Concentration in groundwater (pCi/L): H-3	not used	0.000E+00	---	W(5)
R012	Concentration in groundwater (pCi/L): Pa-231	not used	0.000E+00	---	W(6)
R012	Concentration in groundwater (pCi/L): Pb-210	not used	0.000E+00	---	W(7)
R012	Concentration in groundwater (pCi/L): Ra-226	not used	0.000E+00	---	W(8)
R012	Concentration in groundwater (pCi/L): Ra-228	not used	0.000E+00	---	W(9)
R012	Concentration in groundwater (pCi/L): Sr-90	not used	0.000E+00	---	W(10)
R012	Concentration in groundwater (pCi/L): Th-228	not used	0.000E+00	---	W(11)
R012	Concentration in groundwater (pCi/L): Th-230	not used	0.000E+00	---	W(12)
R012	Concentration in groundwater (pCi/L): Th-232	not used	0.000E+00	---	W(13)
R012	Concentration in groundwater (pCi/L): U-234	not used	0.000E+00	---	W(14)
R012	Concentration in groundwater (pCi/L): U-235	not used	0.000E+00	---	W(15)
R012	Concentration in groundwater (pCi/L): U-238	not used	0.000E+00	---	W(16)
R013	Cover depth (m)	0.000E+00	0.000E+00	---	COVER0
R013	Density of cover material (g/cm**3)	not used	1.600E+00	---	DENSCV
R013	Cover depth erosion rate (m/yr)	not used	1.000E-03	---	VCV

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
013	Density of contaminated zone (g/cm**3)	1.600E+00	1.600E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	4.000E-01	4.000E-01	---	TPCZ
013	Contaminated zone effective porosity	2.000E-01	2.000E-01	---	EPCZ
013	Contaminated zone hydraulic conductivity (m/yr)	5.550E+03	1.000E+01	---	HCCZ
013	Contaminated zone b parameter	4.050E+00	5.300E+00	---	BCZ
R013	Evapotranspiration coefficient	6.000E-01	6.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	1.000E+00	1.000E+00	---	PRECIP
013	Irrigation (m/yr)	0.000E+00	2.000E-01	---	RI
013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	2.000E-01	2.000E-01	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	1.000E+06	1.000E+06	---	WAREA
014	Density of saturated zone (g/cm**3)	1.600E+00	1.600E+00	---	DENSAQ
014	Saturated zone total porosity	4.000E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	2.000E-01	2.000E-01	---	EPSZ
R014	Saturated zone hydraulic conductivity (m/yr)	5.550E+03	1.000E+02	---	HCSZ
014	Saturated zone hydraulic gradient	2.000E-02	2.000E-02	---	HGWT
014	Saturated zone b parameter	4.050E+00	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	1.000E-03	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	1.000E+01	1.000E+01	---	DWIBWT
014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL
014	Individual's use of groundwater (m**3/yr)	not used	1.500E+02	---	UW
R015	Number of unsaturated zone strata	1	1	---	NS
R015	Unsat. zone 1, thickness (m)	1.367E+01	4.000E+00	---	H(1)
015	Unsat. zone 1, soil density (g/cm**3)	1.600E+00	1.600E+00	---	DENSUZ(1)
015	Unsat. zone 1, total porosity	4.000E-01	4.000E-01	---	TPUZ(1)
015	Unsat. zone 1, effective porosity	2.000E-01	2.000E-01	---	EPUZ(1)
015	Unsat. zone 1, soil-specific b parameter	4.050E+00	5.300E+00	---	BUZ(1)
	Unsat. zone 1, hydraulic conductivity (m/yr)	5.550E+03	1.000E+02	---	HCUZ(1)
016	Distribution coefficients for Ac-227				
016	Contaminated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCACTC(1)
016	Unsaturated zone 1 (cm**3/g)	2.000E+01	2.000E+01	---	DCACTU(1,1)
16	Saturated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCACTS(1)
16	Leach rate (/yr)	0.000E+00	0.000E+00	6.632E-02	RLEACH(1)
016	Distribution coefficients for C-14				
16	Contaminated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCACTC(2)
16	Unsaturated zone 1 (cm**3/g)	0.000E+00	0.000E+00	---	DCACTU(2,1)
16	Saturated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCACTS(2)
016	Leach rate (/yr)	0.000E+00	0.000E+00	1.285E+01	RLEACH(2)
16	Distribution coefficients for Co-60				
16	Contaminated zone (cm**3/g)	1.000E+03	1.000E+03	---	DCACTC(3)
016	Unsaturated zone 1 (cm**3/g)	1.000E+03	1.000E+03	---	DCACTU(3,1)
016	Saturated zone (cm**3/g)	1.000E+03	1.000E+03	---	DCACTS(3)
16	Leach rate (/yr)	0.000E+00	0.000E+00	1.333E-03	RLEACH(3)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for Cs-137				
R016	Contaminated zone (cm**3/g)	1.000E+03	1.000E+03	---	DCACTC(4)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+03	1.000E+03	---	DCACTU(4,1)
R016	Saturated zone (cm**3/g)	1.000E+03	1.000E+03	---	DCACTS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.333E-03	RLEACH(4)
R016	Distribution coefficients for H-3				
R016	Contaminated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCACTC(5)
R016	Unsaturated zone 1 (cm**3/g)	0.000E+00	0.000E+00	---	DCACTU(5,1)
R016	Saturated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCACTS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.285E+01	RLEACH(5)
R016	Distribution coefficients for Pa-231				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCACTC(6)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCACTU(6,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCACTS(6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.661E-02	RLEACH(6)
R016	Distribution coefficients for Pb-210				
R016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCACTC(7)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+02	1.000E+02	---	DCACTU(7,1)
R016	Saturated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCACTS(7)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.332E-02	RLEACH(7)
R016	Distribution coefficients for Ra-226				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCACTC(8)
R016	Unsaturated zone 1 (cm**3/g)	7.000E+01	7.000E+01	---	DCACTU(8,1)
R016	Saturated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCACTS(8)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.902E-02	RLEACH(8)
R016	Distribution coefficients for Ra-228				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCACTC(9)
R016	Unsaturated zone 1 (cm**3/g)	7.000E+01	7.000E+01	---	DCACTU(9,1)
R016	Saturated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCACTS(9)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.902E-02	RLEACH(9)
R016	Distribution coefficients for Sr-90				
R016	Contaminated zone (cm**3/g)	3.000E+01	3.000E+01	---	DCACTC(10)
R016	Unsaturated zone 1 (cm**3/g)	3.000E+01	3.000E+01	---	DCACTU(10,1)
R016	Saturated zone (cm**3/g)	3.000E+01	3.000E+01	---	DCACTS(10)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.429E-02	RLEACH(10)
R016	Distribution coefficients for Th-228				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCACTC(11)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCACTU(11,1)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCACTS(11)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.222E-05	RLEACH(11)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for Th-230				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCACTC(12)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCACTU(12,1)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCACTS(12)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.222E-05	RLEACH(12)
R016	Distribution coefficients for Th-232				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCACTC(13)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCACTU(13,1)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCACTS(13)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.222E-05	RLEACH(13)
R016	Distribution coefficients for U-234				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCACTC(14)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCACTU(14,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCACTS(14)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.661E-02	RLEACH(14)
R016	Distribution coefficients for U-235				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCACTC(15)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCACTU(15,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCACTS(15)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.661E-02	RLEACH(15)
R016	Distribution coefficients for U-238				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCACTC(16)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCACTU(16,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCACTS(16)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.661E-02	RLEACH(16)
	Inhalation rate (m**3/yr)	8.400E+03	8.400E+03	---	INHALR
	Mass loading for inhalation (g/m**3)	2.000E-04	2.000E-04	---	MLINH
R017	Dilution length for airborne dust, inhalation (m)	3.000E+00	3.000E+00	---	LM
R017	Occupancy factor, inhalation	5.000E-01	4.500E-01	---	FO3
R017	Occupancy and shielding factor, external gamma	6.000E-01	6.000E-01	---	FO1
R017	Shape factor, external gamma	1.000E+00	1.000E+00	---	FS1
R017	Fractions of annular areas within AREA:				
R017	Outer annular radius (m) = √(1/π)	not used	1.000E+00	---	FRACA(1)
R017	Outer annular radius (m) = √(10/π)	not used	1.000E+00	---	FRACA(2)
R017	Outer annular radius (m) = √(20/π)	not used	1.000E+00	---	FRACA(3)
R017	Outer annular radius (m) = √(50/π)	not used	1.000E+00	---	FRACA(4)
R017	Outer annular radius (m) = √(100/π)	not used	1.000E+00	---	FRACA(5)
R017	Outer annular radius (m) = √(200/π)	not used	1.000E+00	---	FRACA(6)
R017	Outer annular radius (m) = √(500/π)	not used	1.000E+00	---	FRACA(7)
R017	Outer annular radius (m) = √(1000/π)	not used	1.000E+00	---	FRACA(8)
R017	Outer annular radius (m) = √(5000/π)	not used	1.000E+00	---	FRACA(9)
R017	Outer annular radius (m) = √(1.E+04/π)	not used	1.000E+00	---	FRACA(10)
R017	Outer annular radius (m) = √(1.E+05/π)	not used	0.000E+00	---	FRACA(11)
R017	Outer annular radius (m) = √(1.E+06/π)	not used	0.000E+00	---	FRACA(12)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R018	Fruits, vegetables and grain consumption (kg/yr)	1.600E+02	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	1.400E+01	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	9.200E+01	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	6.300E+01	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	5.400E+00	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	9.000E-01	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	3.650E+01	0.000E+00	---	SOIL
R018	Drinking water intake (L/yr)	4.100E+02	4.100E+02	---	DWI
R018	Fraction of drinking water from site	1.000E+00	1.000E+00	---	FDW
R019	Livestock fodder intake for meat (kg/day)	6.800E+01	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	5.500E+01	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	5.000E+01	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	1.600E+02	1.600E+02	---	LWI6
R019	Mass loading for foliar deposition (g/m**3)	1.000E-04	1.000E-04	---	MLFD
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
R019	Depth of roots (m)	9.000E-01	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	1.000E+00	1.000E+00	---	FGWDW
R019	Livestock water fraction from ground water	1.000E+00	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	1.000E+00	1.000E+00	---	FGWIR
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV
R021	Total porosity of the building foundation	1.000E-01	1.000E-01	---	TPFL
R021	Volumetric water content of the cover material	not used	5.000E-02	---	PH2OCV
R021	Volumetric water content of the foundation	1.000E-02	1.000E-02	---	PH2OFL
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	not used	2.000E-06	---	DIFCV
R021	in foundation material	2.000E-08	2.000E-08	---	DIFFL
R021	in contaminated zone soil	2.000E-06	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	2.000E+00	2.000E+00	---	HMIX
R021	Average annual wind speed (m/sec)	2.000E+00	2.000E+00	---	WIND
R021	Average building air exchange rate (1/hr)	1.000E+00	1.000E+00	---	REXG
R021	Height of the building (room) (m)	2.500E+00	2.500E+00	---	HRM
R021	Building interior area factor	1.000E+00	1.000E+00	---	FAI
R021	Bulk density of building foundation (g/cm**3)	2.400E+00	2.400E+00	---	DENSFL
R021	Thickness of building foundation (m)	1.500E-01	1.500E-01	---	FLOOR
R021	Building depth below ground surface (m)	1.000E+00	1.000E+00	---	DMFL
R021	Fraction of time spent indoors	5.000E-01	5.000E-01	---	FIND
R021	Fraction of time spent outdoors (on site)	2.500E-01	2.500E-01	---	FOTD
R021	Emanating power of Rn-222 gas	2.000E-01	2.000E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	1.000E-01	1.000E-01	---	EMANA(2)

Summary of Pathway Selections

Pathway	User Selection
1 -- external gamma	active
2 -- inhalation	active
3 -- plant ingestion	active
4 -- meat ingestion	active
5 -- milk ingestion	active
6 -- aquatic foods	active
7 -- drinking water	active
8 -- radon	active
9 -- soil ingestion	active

Contaminated Zone Dimensions

Area:	100.00 square meters
Thickness:	0.15 meters
Cover Depth:	0.00 meters

Initial Soil Concentrations, pCi/g

Ac-227	1.000E+01
C-14	1.000E+01
Co-60	1.000E+01
Cs-137	1.000E+01
H-3	1.000E+01
Pa-231	1.000E+01
Pb-210	1.000E+01
Ra-226	1.000E+01
Ra-228	1.000E+01
Sr-90	1.000E+01
Th-228	1.000E+01
Th-230	1.000E+01
Th-232	1.000E+01
U-234	1.000E+01
U-235	1.000E+01
U-238	1.000E+01

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 100 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
TDOSE(t):	2.643E+02	2.500E+02	2.252E+02	1.673E+02	1.027E+02	3.432E+01	0.000E+00	4.054E-06
M(t):	2.643E+00	2.500E+00	2.252E+00	1.673E+00	1.027E+00	3.432E-01	0.000E+00	4.054E-08

Maximum TDOSE(t): 2.643E+02 mrem/yr at t = 0.000E+00 years

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Independent Pathways

adio- uclide	Ground		Dust		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
c-227	8.198E+00	0.0310	4.329E+01	0.1638	0.000E+00	0.0000	5.509E-01	0.0021	7.048E-03	0.0000	4.162E-06	0.0000	4.106E-01	0.0016
-14	0.000E+00	0.0000	1.357E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.749E-05	0.0000
o-60	6.244E+01	0.2363	9.692E-04	0.0000	0.000E+00	0.0000	3.556E-03	0.0000	8.848E-06	0.0000	5.225E-06	0.0000	7.117E-04	0.0000
s-137	1.464E+01	0.0554	2.068E-04	0.0000	0.000E+00	0.0000	1.474E-03	0.0000	1.142E-04	0.0000	2.248E-05	0.0000	1.369E-03	0.0000
-3	0.000E+00	0.0000	4.071E-07	0.0000	0.000E+00	0.0000	3.002E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.725E-06	0.0000
-231	6.592E-01	0.0025	8.400E+00	0.0318	0.000E+00	0.0000	4.040E-01	0.0015	5.168E-03	0.0000	3.052E-06	0.0000	3.011E-01	0.0011
-210	1.393E-02	0.0001	1.357E-01	0.0005	0.000E+00	0.0000	6.609E+00	0.0250	1.613E-02	0.0001	1.925E-04	0.0000	1.834E-01	0.0007
a-226	4.168E+01	0.1577	5.105E-02	0.0002	1.663E-01	0.0006	2.285E-02	0.0001	5.957E-05	0.0000	1.421E-05	0.0000	3.011E-02	0.0001
-228	2.232E+01	0.0844	2.908E-02	0.0001	0.000E+00	0.0000	2.493E-02	0.0001	6.499E-05	0.0000	1.551E-05	0.0000	3.285E-02	0.0001
-90	0.000E+00	0.0000	8.400E-03	0.0000	0.000E+00	0.0000	4.061E-01	0.0015	3.001E-04	0.0000	1.772E-03	0.0000	3.832E-03	0.0000
-228	3.222E+01	0.1219	2.003E+00	0.0076	4.802E-01	0.0018	4.603E-02	0.0002	5.800E-04	0.0000	3.425E-07	0.0000	2.053E-02	0.0001
-230	6.392E-03	0.0000	2.068E+00	0.0078	0.000E+00	0.0000	3.253E-02	0.0001	4.099E-04	0.0000	2.420E-07	0.0000	1.451E-02	0.0001
-232	3.851E-03	0.0000	1.034E+01	0.0391	0.000E+00	0.0000	1.719E-01	0.0007	2.165E-03	0.0000	1.279E-06	0.0000	7.665E-02	0.0003
234	4.403E-03	0.0000	8.400E-01	0.0032	0.000E+00	0.0000	9.549E-03	0.0000	1.222E-04	0.0000	1.732E-05	0.0000	7.118E-03	0.0000
235	2.909E+00	0.0110	7.754E-01	0.0029	0.000E+00	0.0000	9.182E-03	0.0000	1.175E-04	0.0000	1.665E-05	0.0000	6.844E-03	0.0000
238	3.656E-01	0.0014	7.754E-01	0.0029	0.000E+00	0.0000	9.182E-03	0.0000	1.175E-04	0.0000	1.665E-05	0.0000	6.844E-03	0.0000
tal	1.855E+02	0.7018	6.872E+01	0.2600	6.464E-01	0.0024	8.301E+00	0.0314	3.241E-02	0.0001	2.082E-03	0.0000	1.097E+00	0.0041

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.246E+01	0.1985
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.106E-05	0.0000
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.245E+01	0.2363
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.465E+01	0.0554
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.162E-06	0.0000
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.769E+00	0.0370
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.959E+00	0.0263
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.195E+01	0.1588
Ra-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.240E+01	0.0848
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.204E-01	0.0016
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.477E+01	0.1316
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.122E+00	0.0080
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.059E+01	0.0401
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.612E-01	0.0033
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.701E+00	0.0140
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.157E+00	0.0044
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.643E+02	1.0000

*Sum of all water independent and dependent pathways.

ɔummary : King Avenue -- all nuclides -- no cover
FIle : C:\RESRAD4\KA\ALLNUCS.KA

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Water Independent Pathways

Radio-	Ground		Dust		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
c-227	7.417E+00	0.0297	3.898E+01	0.1559	0.000E+00	0.0000	4.960E-01	0.0020	6.346E-03	0.0000	3.748E-06	0.0000	3.697E-01	0.0015
-14	0.000E+00	0.0000	3.539E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.499E-10	0.0000
Co-60	5.453E+01	0.2181	8.430E-04	0.0000	0.000E+00	0.0000	3.093E-03	0.0000	7.696E-06	0.0000	4.545E-06	0.0000	6.191E-04	0.0000
Cs-137	1.426E+01	0.0570	2.005E-04	0.0000	0.000E+00	0.0000	1.429E-03	0.0000	1.107E-04	0.0000	2.179E-05	0.0000	1.327E-03	0.0000
-3	0.000E+00	0.0000	1.004E-12	0.0000	0.000E+00	0.0000	7.403E-14	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.253E-12	0.0000
a-231	8.859E-01	0.0035	9.414E+00	0.0377	0.000E+00	0.0000	4.072E-01	0.0016	5.209E-03	0.0000	3.076E-06	0.0000	3.035E-01	0.0012
ɔb-210	1.331E-02	0.0001	1.289E-01	0.0005	0.000E+00	0.0000	6.280E+00	0.0251	1.533E-02	0.0001	1.829E-04	0.0000	1.743E-01	0.0007
Ra-226	4.077E+01	0.1631	5.379E-02	0.0002	1.620E-01	0.0006	2.199E-01	0.0009	5.405E-04	0.0000	1.960E-05	0.0000	3.482E-02	0.0001
˜a-228	2.843E+01	0.1137	5.873E-01	0.0023	1.357E-01	0.0005	3.446E-02	0.0001	2.189E-04	0.0000	1.350E-05	0.0000	3.415E-02	0.0001
r-90	0.000E+00	0.0000	7.793E-03	0.0000	0.000E+00	0.0000	3.767E-01	0.0015	2.784E-04	0.0000	1.644E-03	0.0000	3.555E-03	0.0000
h-228	2.235E+01	0.0894	1.385E+00	0.0055	3.342E-01	0.0013	3.183E-02	0.0001	4.010E-04	0.0000	2.368E-07	0.0000	1.420E-02	0.0001
Th-230	2.422E-02	0.0001	2.054E+00	0.0082	7.086E-05	0.0000	3.236E-02	0.0001	4.072E-04	0.0000	2.477E-07	0.0000	1.443E-02	0.0001
Th-232	3.098E+00	0.0124	1.031E+01	0.0412	8.881E-03	0.0000	1.743E-01	0.0007	2.169E-03	0.0000	3.007E-06	0.0000	8.018E-02	0.0003
-234	4.285E-03	0.0000	8.125E-01	0.0032	3.171E-10	0.0000	9.236E-03	0.0000	1.182E-04	0.0000	1.675E-05	0.0000	6.884E-03	0.0000
-235	2.831E+00	0.0113	7.502E-01	0.0030	0.000E+00	0.0000	8.889E-03	0.0000	1.137E-04	0.0000	1.610E-05	0.0000	6.626E-03	0.0000
ı-238	3.552E-01	0.0014	7.500E-01	0.0030	2.982E-16	0.0000	8.881E-03	0.0000	1.136E-04	0.0000	1.610E-05	0.0000	6.620E-03	0.0000
ɔtal	1.750E+02	0.6998	6.523E+01	0.2609	6.408E-01	0.0026	8.085E+00	0.0323	3.136E-02	0.0001	1.946E-03	0.0000	1.051E+00	0.0042

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.727E+01	0.1891
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.853E-10	0.0000
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.454E+01	0.2181
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.426E+01	0.0571
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.331E-12	0.0000
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.102E+01	0.0441
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.612E+00	0.0264
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.124E+01	0.1649
Ra-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.922E+01	0.1169
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.900E-01	0.0016
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.411E+01	0.0964
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.125E+00	0.0085
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.367E+01	0.0547
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.330E-01	0.0033
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.596E+00	0.0144
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.121E+00	0.0045
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.500E+02	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years

Water Independent Pathways

Radio-	Ground		Dust		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	6.070E+00	0.0270	3.160E+01	0.1403	0.000E+00	0.0000	4.021E-01	0.0018	5.144E-03	0.0000	3.038E-06	0.0000	2.997E-01	0.0013
C-14	0.000E+00	0.0000	2.407E-22	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.020E-21	0.0000
Co-60	4.159E+01	0.1847	6.377E-04	0.0000	0.000E+00	0.0000	2.340E-03	0.0000	5.821E-06	0.0000	3.438E-06	0.0000	4.683E-04	0.0000
Cs-137	1.353E+01	0.0601	1.884E-04	0.0000	0.000E+00	0.0000	1.343E-03	0.0000	1.040E-04	0.0000	2.048E-05	0.0000	1.247E-03	0.0000
H-3	0.000E+00	0.0000	6.104E-24	0.0000	0.000E+00	0.0000	4.501E-25	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.586E-23	0.0000
Pa-231	1.253E+00	0.0056	1.097E+01	0.0487	0.000E+00	0.0000	4.084E-01	0.0018	5.225E-03	0.0000	3.086E-06	0.0000	3.044E-01	0.0014
Pb-210	1.215E-02	0.0001	1.164E-01	0.0005	0.000E+00	0.0000	5.669E+00	0.0252	1.384E-02	0.0001	1.651E-04	0.0000	1.573E-01	0.0007
Ra-226	3.899E+01	0.1731	5.846E-02	0.0003	1.537E-01	0.0007	5.701E-01	0.0025	1.395E-03	0.0000	2.913E-05	0.0000	4.307E-02	0.0002
Ra-228	3.121E+01	0.1386	1.043E+00	0.0046	2.505E-01	0.0011	3.962E-02	0.0002	3.385E-04	0.0000	1.018E-05	0.0000	3.169E-02	0.0001
Sr-90	0.000E+00	0.0000	6.706E-03	0.0000	0.000E+00	0.0000	3.242E-01	0.0014	2.396E-04	0.0000	1.415E-03	0.0000	3.059E-03	0.0000
Th-228	1.075E+01	0.0477	6.620E-01	0.0029	1.619E-01	0.0007	1.521E-02	0.0001	1.917E-04	0.0000	1.132E-07	0.0000	6.785E-03	0.0000
Th-230	5.856E-02	0.0003	2.026E+00	0.0090	2.057E-04	0.0000	3.227E-02	0.0001	4.026E-04	0.0000	2.655E-07	0.0000	1.426E-02	0.0001
Th-232	1.042E+01	0.0463	1.038E+01	0.0461	5.847E-02	0.0003	1.811E-01	0.0008	2.210E-03	0.0000	5.778E-06	0.0000	8.706E-02	0.0004
U-234	4.058E-03	0.0000	7.601E-01	0.0034	2.732E-09	0.0000	8.641E-03	0.0000	1.105E-04	0.0000	1.567E-05	0.0000	6.440E-03	0.0000
U-235	2.680E+00	0.0119	7.022E-01	0.0031	0.000E+00	0.0000	8.332E-03	0.0000	1.066E-04	0.0000	1.506E-05	0.0000	6.211E-03	0.0000
U-238	3.353E-01	0.0015	7.016E-01	0.0031	7.663E-15	0.0000	8.308E-03	0.0000	1.063E-04	0.0000	1.506E-05	0.0000	6.192E-03	0.0000
Total	1.569E+02	0.6967	5.903E+01	0.2621	6.249E-01	0.0028	7.671E+00	0.0341	2.942E-02	0.0001	1.701E-03	0.0000	9.680E-01	0.0043

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years

Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.838E+01	0.1704
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.261E-21	0.0000
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.160E+01	0.1847
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.353E+01	0.0601
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.241E-23	0.0000
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.294E+01	0.0575
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.969E+00	0.0265
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.982E+01	0.1768
Ra-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.258E+01	0.1446
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.356E-01	0.0015
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.160E+01	0.0515
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.132E+00	0.0095
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.113E+01	0.0938
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.793E-01	0.0035
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.396E+00	0.0151
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.051E+00	0.0047
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.252E+02	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Water Independent Pathways

Radio-	Ground		Dust		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
c-227	3.007E+00	0.0180	1.513E+01	0.0905	0.000E+00	0.0000	1.926E-01	0.0012	2.463E-03	0.0000	1.455E-06	0.0000	1.435E-01	0.0009
-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	1.609E+01	0.0962	2.396E-04	0.0000	0.000E+00	0.0000	8.793E-04	0.0000	2.188E-06	0.0000	1.292E-06	0.0000	1.760E-04	0.0000
Cs-137	1.122E+01	0.0671	1.513E-04	0.0000	0.000E+00	0.0000	1.079E-03	0.0000	8.357E-05	0.0000	1.645E-05	0.0000	1.002E-03	0.0000
-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
a-231	1.896E+00	0.0113	1.306E+01	0.0781	0.000E+00	0.0000	3.786E-01	0.0023	4.844E-03	0.0000	2.861E-06	0.0000	2.822E-01	0.0017
rb-210	8.825E-03	0.0001	8.124E-02	0.0005	0.000E+00	0.0000	3.957E+00	0.0237	9.659E-03	0.0001	1.152E-04	0.0000	1.098E-01	0.0007
Ra-226	3.333E+01	0.1992	6.790E-02	0.0004	1.279E-01	0.0008	1.415E+00	0.0085	3.456E-03	0.0000	5.161E-05	0.0000	6.190E-02	0.0004
a-228	1.658E+01	0.0991	6.796E-01	0.0041	1.728E-01	0.0010	2.124E-02	0.0001	2.099E-04	0.0000	3.707E-06	0.0000	1.451E-02	0.0001
r-90	0.000E+00	0.0000	3.958E-03	0.0000	0.000E+00	0.0000	1.913E-01	0.0011	1.414E-04	0.0000	8.350E-04	0.0000	1.806E-03	0.0000
h-228	8.300E-01	0.0050	4.990E-02	0.0003	1.282E-02	0.0001	1.147E-03	0.0000	1.445E-05	0.0000	8.533E-09	0.0000	5.115E-04	0.0000
h-230	1.657E-01	0.0010	1.930E+00	0.0115	6.114E-04	0.0000	3.381E-02	0.0002	3.909E-04	0.0000	3.762E-07	0.0000	1.374E-02	0.0001
h-232	3.056E+01	0.1826	1.065E+01	0.0637	2.543E-01	0.0015	1.982E-01	0.0012	2.347E-03	0.0000	1.076E-05	0.0000	1.016E-01	0.0006
-234	3.357E-03	0.0000	6.010E-01	0.0036	2.601E-08	0.0000	6.832E-03	0.0000	8.741E-05	0.0000	1.238E-05	0.0000	5.092E-03	0.0000
-235	2.210E+00	0.0132	5.567E-01	0.0033	0.000E+00	0.0000	6.639E-03	0.0000	8.494E-05	0.0000	1.191E-05	0.0000	4.948E-03	0.0000
-238	2.736E-01	0.0016	5.546E-01	0.0033	2.384E-13	0.0000	6.567E-03	0.0000	8.402E-05	0.0000	1.191E-05	0.0000	4.895E-03	0.0000
otal	1.162E+02	0.6944	4.337E+01	0.2592	5.684E-01	0.0034	6.410E+00	0.0383	2.387E-02	0.0001	1.075E-03	0.0000	7.457E-01	0.0045

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.848E+01	0.1104
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.610E+01	0.0962
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.123E+01	0.0671
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.562E+01	0.0934
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.167E+00	0.0249
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.501E+01	0.2092
Ra-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.746E+01	0.1044
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.981E-01	0.0012
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.944E-01	0.0053
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.144E+00	0.0128
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.177E+01	0.2497
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.163E-01	0.0037
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.779E+00	0.0166
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.398E-01	0.0050
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.673E+02	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years

Water Independent Pathways

Radio-	Ground		Dust		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
c-227	3.996E-01	0.0039	1.819E+00	0.0177	0.000E+00	0.0000	2.315E-02	0.0002	2.961E-04	0.0000	1.749E-07	0.0000	1.725E-02	0.0002
_-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	1.055E+00	0.0103	1.442E-05	0.0000	0.000E+00	0.0000	5.289E-05	0.0000	1.316E-07	0.0000	7.772E-08	0.0000	1.059E-05	0.0000
Cs-137	6.514E+00	0.0634	7.978E-05	0.0000	0.000E+00	0.0000	5.686E-04	0.0000	4.405E-05	0.0000	8.672E-06	0.0000	5.281E-04	0.0000
-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
a-231	1.622E+00	0.0158	9.153E+00	0.0891	0.000E+00	0.0000	2.234E-01	0.0022	2.858E-03	0.0000	1.688E-06	0.0000	1.665E-01	0.0016
Pb-210	3.512E-03	0.0000	2.865E-02	0.0003	0.000E+00	0.0000	1.396E+00	0.0136	3.407E-03	0.0000	4.064E-05	0.0000	3.873E-02	0.0004
Ra-226	2.102E+01	0.2047	6.254E-02	0.0006	7.441E-02	0.0007	1.947E+00	0.0190	4.753E-03	0.0000	6.274E-05	0.0000	6.718E-02	0.0007
a-228	1.018E+00	0.0099	4.011E-02	0.0004	1.191E-02	0.0001	1.219E-03	0.0000	1.231E-05	0.0000	1.964E-07	0.0000	8.092E-04	0.0000
-90	0.000E+00	0.0000	8.644E-04	0.0000	0.000E+00	0.0000	4.179E-02	0.0004	3.088E-05	0.0000	1.824E-04	0.0000	3.944E-04	0.0000
-228	5.430E-04	0.0000	3.047E-05	0.0000	9.131E-06	0.0000	7.003E-07	0.0000	8.824E-09	0.0000	5.211E-12	0.0000	3.124E-07	0.0000
Th-230	3.770E-01	0.0037	1.653E+00	0.0161	1.313E-03	0.0000	4.372E-02	0.0004	3.709E-04	0.0000	8.163E-07	0.0000	1.232E-02	0.0001
Th-232	4.123E+01	0.4015	9.634E+00	0.0938	4.041E-01	0.0039	1.853E-01	0.0018	2.166E-03	0.0000	1.180E-05	0.0000	9.744E-02	0.0009
-234	1.969E-03	0.0000	3.027E-01	0.0029	1.498E-07	0.0000	3.444E-03	0.0000	4.405E-05	0.0000	6.234E-06	0.0000	2.565E-03	0.0000
-235	1.267E+00	0.0123	2.837E-01	0.0028	0.000E+00	0.0000	3.431E-03	0.0000	4.390E-05	0.0000	5.996E-06	0.0000	2.557E-03	0.0000
J-238	1.514E-01	0.0015	2.792E-01	0.0027	3.881E-12	0.0000	3.306E-03	0.0000	4.230E-05	0.0000	5.995E-06	0.0000	2.464E-03	0.0000
ital	7.467E+01	0.7270	2.326E+01	0.2264	4.918E-01	0.0048	3.872E+00	0.0377	1.407E-02	0.0001	3.274E-04	0.0000	4.087E-01	0.0040

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years

Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.259E+00	0.0220
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.055E+00	0.0103
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.515E+00	0.0634
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.117E+01	0.1087
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.470E+00	0.0143
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.318E+01	0.2257
Ra-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.072E+00	0.0104
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.326E-02	0.0004
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.836E-04	0.0000
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.088E+00	0.0203
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.156E+01	0.5020
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.108E-01	0.0030
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.557E+00	0.0152
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.364E-01	0.0042
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.027E+02	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Water Independent Pathways

Radio-	Ground		Dust		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	2.562E-04	0.0000	7.831E-04	0.0000	0.000E+00	0.0000	9.965E-06	0.0000	1.275E-07	0.0000	7.529E-11	0.0000	7.427E-06	0.0000
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	5.611E-05	0.0000	5.500E-10	0.0000	0.000E+00	0.0000	2.018E-09	0.0000	5.021E-12	0.0000	2.965E-12	0.0000	4.039E-10	0.0000
Cs-137	7.226E-01	0.0211	6.063E-06	0.0000	0.000E+00	0.0000	4.322E-05	0.0000	3.348E-06	0.0000	6.591E-07	0.0000	4.014E-05	0.0000
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pa-231	1.733E-01	0.0050	6.431E-01	0.0187	0.000E+00	0.0000	1.509E-02	0.0004	1.930E-04	0.0000	1.140E-07	0.0000	1.125E-02	0.0003
Pb-210	1.084E-04	0.0000	5.334E-04	0.0000	0.000E+00	0.0000	2.598E-02	0.0008	6.342E-05	0.0000	7.567E-07	0.0000	7.210E-04	0.0000
Ra-226	3.077E+00	0.0897	9.823E-03	0.0003	7.977E-03	0.0002	3.611E-01	0.0105	8.816E-04	0.0000	1.116E-05	0.0000	1.142E-02	0.0003
Ra-228	3.255E-05	0.0000	9.706E-07	0.0000	6.904E-07	0.0000	2.948E-08	0.0000	2.978E-10	0.0000	4.748E-12	0.0000	1.957E-08	0.0000
Sr-90	0.000E+00	0.0000	3.009E-06	0.0000	0.000E+00	0.0000	1.454E-04	0.0000	1.075E-07	0.0000	6.347E-07	0.0000	1.373E-06	0.0000
Th-228	2.828E-15	0.0000	1.226E-16	0.0000	8.798E-17	0.0000	2.817E-18	0.0000	3.549E-20	0.0000	2.096E-23	0.0000	1.256E-18	0.0000
Th-230	4.147E-01	0.0121	6.879E-01	0.0200	1.063E-03	0.0000	3.684E-02	0.0011	1.998E-04	0.0000	9.245E-07	0.0000	5.731E-03	0.0002
Th-232	2.334E+01	0.6801	4.022E+00	0.1172	4.130E-01	0.0120	7.754E-02	0.0023	9.054E-04	0.0000	4.978E-06	0.0000	4.083E-02	0.0012
U-234	3.313E-04	0.0000	1.977E-02	0.0006	2.764E-07	0.0000	2.317E-04	0.0000	2.902E-06	0.0000	4.034E-07	0.0000	1.674E-04	0.0000
U-235	1.434E-01	0.0042	1.929E-02	0.0006	0.000E+00	0.0000	2.441E-04	0.0000	3.123E-06	0.0000	3.880E-07	0.0000	1.819E-04	0.0000
U-238	1.418E-02	0.0004	1.806E-02	0.0005	1.900E-11	0.0000	2.139E-04	0.0000	2.737E-06	0.0000	3.879E-07	0.0000	1.594E-04	0.0000
Total	2.789E+01	0.8125	5.422E+00	0.1580	4.220E-01	0.0123	5.174E-01	0.0151	2.256E-03	0.0001	2.041E-05	0.0000	7.051E-02	0.0021

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.057E-03	0.0000
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.611E-05	0.0000
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.227E-01	0.0211
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.430E-01	0.0246
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.741E-02	0.0008
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.468E+00	0.1010
Ra-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.426E-05	0.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.506E-04	0.0000
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.043E-15	0.0000
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.146E+00	0.0334
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.790E+01	0.8128
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.051E-02	0.0006
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.631E-01	0.0048
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.262E-02	0.0010
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.432E+01	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years

Water Independent Pathways

Radio-	Ground		Dust		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0010	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.1480	0.000E+00	0.0000
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0010	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0010	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0010	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0033	0.000E+00	0.0000
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.1275
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0534	0.000E+00	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	1.0000	0.000E+00	0.2582	0.000E+00	0.0000	0.000E+00	0.0406	0.000E+00	0.0000
Ra-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.9300	0.000E+00	0.0079	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.9600	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	25.2973	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	1.0000	0.000E+00	*******	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	1.0000	0.000E+00	*******	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	0.000E+00	0.0038	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	17.1147	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.2830
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	37.5080	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0119
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.3030
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0019	0.000E+00	0.0000
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0001	0.000E+00	0.0000
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0510	0.000E+00	0.0000	0.000E+00	0.0408	0.000E+00	0.0013	0.000E+00	0.0000
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.2480	0.000E+00	0.0000	0.000E+00	0.0016	0.000E+00	0.0000	0.000E+00	0.0000
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.3550	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0005	0.000E+00	0.0000
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0114	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.2480	0.000E+00	0.0311	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0002	0.000E+00	0.0000
Ra-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0751	0.000E+00	0.0004	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0999	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

*Sum of all water independent and dependent pathways.

Summary : King Avenue -- all nuclides -- no cover
File : C:\RESRAD4\KA\ALLNUCS.KA

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Independent Pathways

Radio-	Ground		Dust		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	5.684E-20	0.0000	2.488E-22	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.092E-23	0.0000	2.551E-26	0.0000	5.710E-20	0.0000
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pa-231	3.954E-06	0.9753	1.731E-08	0.0043	0.000E+00	0.0000	0.000E+00	0.0000	7.594E-10	0.0002	1.774E-12	0.0000	3.972E-06	0.9797
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	8.177E-08	0.0202	3.580E-10	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	1.571E-11	0.0000	3.670E-14	0.0000	8.214E-08	0.0203
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	4.036E-06	0.9955	1.767E-08	0.0044	0.000E+00	0.0000	0.000E+00	0.0000	7.751E-10	0.0002	1.811E-12	0.0000	4.054E-06	1.0000

*Sum of all water independent and dependent pathways.

Dose/Source Ratios Summed Over All Pathways, (mrem/yr)/(pCi/g)

de (i)	t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Ac-227	5.246E+00	4.727E+00	3.838E+00	1.848E+00	2.259E-01	1.057E-04	0.000E+00	5.710E-21
C-14	7.106E-06	1.853E-11	1.261E-22	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Co-60	6.245E+00	5.454E+00	4.160E+00	1.610E+00	1.055E-01	5.611E-06	0.000E+00	0.000E+00
Cs-137	1.465E+00	1.426E+00	1.353E+00	1.123E+00	6.515E-01	7.227E-02	0.000E+00	0.000E+00
H-3	2.162E-07	5.331E-13	3.241E-24	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Pa-231	9.769E-01	1.102E+00	1.294E+00	1.562E+00	1.117E+00	8.430E-02	0.000E+00	3.972E-07
Pb-210	6.959E-01	6.612E-01	5.969E-01	4.167E-01	1.470E-01	2.741E-03	0.000E+00	0.000E+00
Ra-226	4.195E+00	4.124E+00	3.982E+00	3.501E+00	2.318E+00	3.468E-01	0.000E+00	0.000E+00
Ra-228	2.240E+00	2.922E+00	3.258E+00	1.746E+00	1.072E-01	3.426E-06	0.000E+00	0.000E+00
Sr-90	4.204E-02	3.900E-02	3.356E-02	1.981E-02	4.326E-03	1.506E-05	0.000E+00	0.000E+00
Th-228	3.477E+00	2.411E+00	1.160E+00	8.944E-02	5.836E-05	3.043E-16	0.000E+00	0.000E+00
Th-230	2.122E-01	2.125E-01	2.132E-01	2.144E-01	2.088E-01	1.146E-01	0.000E+00	0.000E+00
Th-232	1.059E+00	1.367E+00	2.113E+00	4.177E+00	5.156E+00	2.790E+00	0.000E+00	0.000E+00
U-234	8.612E-02	8.330E-02	7.793E-02	6.163E-02	3.108E-02	2.051E-03	0.000E+00	0.000E+00
U-235	3.701E-01	3.596E-01	3.396E-01	2.779E-01	1.557E-01	1.631E-02	0.000E+00	8.214E-09
U-238	1.157E-01	1.121E-01	1.051E-01	8.398E-02	4.364E-02	3.262E-03	0.000E+00	0.000E+00

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 100 mrem/yr

uclide (i)	t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
c-227	1.906E+01	2.116E+01	2.606E+01	5.412E+01	4.426E+02	9.463E+05	*7.244E+13	*7.244E+13
-14	1.407E+07	*4.454E+12	*4.454E+12	*4.454E+12	*4.454E+12	*4.454E+12	*4.454E+12	*4.454E+12
o-60	1.601E+01	1.834E+01	2.404E+01	6.213E+01	9.477E+02	1.782E+07	*1.131E+15	*1.131E+15
s-137	6.827E+01	7.010E+01	7.392E+01	8.907E+01	1.535E+02	1.384E+03	*8.652E+13	*8.652E+13
-3	4.626E+08	1.876E+14	*9.610E+15	*9.610E+15	*9.610E+15	*9.610E+15	*9.610E+15	*9.610E+15
	1.024E+02	9.078E+01	7.726E+01	6.402E+01	8.954E+01	1.186E+03	*4.716E+10	2.518E+08
	1.437E+02	1.512E+02	1.675E+02	2.400E+02	6.803E+02	3.648E+04	*7.631E+13	*7.631E+13
a	2.384E+01	2.425E+01	2.511E+01	2.857E+01	4.314E+01	2.883E+02	*9.882E+11	*9.882E+11
a-228	4.464E+01	3.422E+01	3.070E+01	5.726E+01	9.330E+02	2.919E+07	*2.721E+14	*2.721E+14
r-90	2.379E+03	2.564E+03	2.980E+03	5.049E+03	2.312E+04	6.642E+06	*1.380E+14	*1.380E+14
h-228	2.876E+01	4.147E+01	8.621E+01	1.118E+03	1.714E+06	*8.192E+14	*8.192E+14	*8.192E+14
-230	4.714E+02	4.705E+02	4.691E+02	4.665E+02	4.789E+02	8.722E+02	*2.018E+10	*2.018E+10
-232	9.440E+01	7.314E+01	4.734E+01	2.394E+01	1.940E+01	3.585E+01	*1.092E+05	*1.092E+05
234	1.161E+03	1.200E+03	1.283E+03	1.622E+03	3.218E+03	4.876E+04	*6.233E+09	*6.233E+09
235	2.702E+02	2.781E+02	2.944E+02	3.599E+02	6.425E+02	6.132E+03	*2.160E+06	*2.160E+06
238	8.642E+02	8.922E+02	9.511E+02	1.191E+03	2.291E+03	3.066E+04	*3.360E+05	*3.360E+05

t specific activity limit

Summary : King Avenue -- all nuclides -- no cover
File : C:\RESRAD4\KA\ALLNUCS.KA

Summed Dose/Source Ratios DSR(i,t) in (mrem/yr)/(pCi/g)
and Single Radionuclide Soil Guidelines G(i,t) in pCi/g
at tmin = time of minimum single radionuclide soil guideline
and at tmax = time of maximum total dose = 0.000E+00 years

Nuclide (i)	Initial pCi/g	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
Ac-227	1.000E+01	0.000E+00	5.246E+00	1.906E+01	5.246E+00	1.906E+01
C-14	1.000E+01	3.727 ± 0.001	1.060E-01	9.430E+02	7.106E-06	1.407E+07
Co-60	1.000E+01	0.000E+00	6.245E+00	1.601E+01	6.245E+00	1.601E+01
Cs-137	1.000E+01	0.000E+00	1.465E+00	6.827E+01	1.465E+00	6.827E+01
H-3	1.000E+01	3.727 ± 0.001	2.264E-03	4.417E+04	2.162E-07	4.626E+08
Pa-231	1.000E+01	738.7 ± 0.2	5.570E+00	1.795E+01	9.769E-01	1.024E+02
Pb-210	1.000E+01	0.000E+00	6.959E-01	1.437E+02	6.959E-01	1.437E+02
Ra-226	1.000E+01	0.000E+00	4.195E+00	2.384E+01	4.195E+00	2.384E+01
Ra-228	1.000E+01	2.7215 ± 0.0008	3.264E+00	3.064E+01	2.240E+00	4.464E+01
Sr-90	1.000E+01	0.000E+00	4.204E-02	2.379E+03	4.204E-02	2.379E+03
Th-228	1.000E+01	0.000E+00	3.477E+00	2.876E+01	3.477E+00	2.876E+01
Th-230	1.000E+01	11.356 ± 0.003	2.144E-01	4.664E+02	2.122E-01	4.714E+02
Th-232	1.000E+01	25.190 ± 0.008	5.193E+00	1.926E+01	1.059E+00	9.440E+01
U-234	1.000E+01	0.000E+00	8.612E-02	1.161E+03	8.612E-02	1.161E+03
U-235	1.000E+01	0.000E+00	3.701E-01	2.702E+02	3.701E-01	2.702E+02
U-238	1.000E+01	0.000E+00	1.157E-01	8.642E+02	1.157E-01	8.642E+02

RESRAD
(RESIDUAL RADIOACTIVITY MATERIALS PROGRAM)

SOIL GUIDELINE CALCULATIONS
KING AVENUE RADIONUCLIDES
5 METER SOIL COVER

Table of Contents

Part I: Mixture Sums and Single Radionuclide Guidelines

Site-Specific Parameter Summary 2
Summary of Pathway Selections 7
Contaminated Zone and Total Dose Summary 8
Total Dose Components
Time = 0.000E+00 11
Time = 1.000E+00 13
Time = 3.000E+00 15
Time = 1.000E+01 17
Time = 3.000E+01 19
Time = 1.000E+02 21
Time = 3.000E+02 23
Time = 1.000E+03 25
Dose/Source Ratios and Radionuclide Soil Guidelines 27

Site-Specific Parameter Summary

	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R011	Area of contaminated zone (m**2)	1.000E+02	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	1.500E-01	1.000E+00	---	THICK0
R011	Length parallel to aquifer flow (m)	1.000E+02	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	1.000E+02	1.000E+02	---	BRLD
R011	Time since placement of material (yr)	0.000E+00	0.000E+00	---	TI
R011	Times for calculations (yr)	1.000E+00	1.000E+00	---	T(2)
R011	Times for calculations (yr)	3.000E+00	3.000E+00	---	T(3)
R011	Times for calculations (yr)	1.000E+01	1.000E+01	---	T(4)
R011	Times for calculations (yr)	3.000E+01	3.000E+01	---	T(5)
R011	Times for calculations (yr)	1.000E+02	1.000E+02	---	T(6)
R011	Times for calculations (yr)	3.000E+02	3.000E+02	---	T(7)
R011	Times for calculations (yr)	1.000E+03	1.000E+03	---	T(8)
R011	Times for calculations (yr)	not used	3.000E+03	---	T(9)
R011	Times for calculations (yr)	not used	1.000E+04	---	T(10)
R012	Initial principal radionuclide (pCi/g): Ac-227	1.000E+01	0.000E+00	---	S(1)
R012	Initial principal radionuclide (pCi/g): C-14	1.000E+01	0.000E+00	---	S(2)
R012	Initial principal radionuclide (pCi/g): Co-60	1.000E+01	0.000E+00	---	S(3)
R012	Initial principal radionuclide (pCi/g): Cs-137	1.000E+01	0.000E+00	---	S(4)
R012	Initial principal radionuclide (pCi/g): H-3	1.000E+01	0.000E+00	---	S(5)
R012	Initial principal radionuclide (pCi/g): Pa-231	1.000E+01	0.000E+00	---	S(6)
R012	Initial principal radionuclide (pCi/g): Pb-210	1.000E+01	0.000E+00	---	S(7)
R012	Initial principal radionuclide (pCi/g): Ra-226	1.000E+01	0.000E+00	---	S(8)
R012	Initial principal radionuclide (pCi/g): Ra-228	1.000E+01	0.000E+00	---	S(9)
R012	Initial principal radionuclide (pCi/g): Sr-90	1.000E+01	0.000E+00	---	S(10)
R012	Initial principal radionuclide (pCi/g): Th-228	1.000E+01	0.000E+00	---	S(11)
R012	Initial principal radionuclide (pCi/g): Th-230	1.000E+01	0.000E+00	---	S(12)
R012	Initial principal radionuclide (pCi/g): Th-232	1.000E+01	0.000E+00	---	S(13)
R012	Initial principal radionuclide (pCi/g): U-234	1.000E+01	0.000E+00	---	S(14)
R012	Initial principal radionuclide (pCi/g): U-235	1.000E+01	0.000E+00	---	S(15)
R012	Initial principal radionuclide (pCi/g): U-238	1.000E+01	0.000E+00	---	S(16)
R012	Concentration in groundwater (pCi/L): Ac-227	not used	0.000E+00	---	W(1)
R012	Concentration in groundwater (pCi/L): C-14	not used	0.000E+00	---	W(2)
R012	Concentration in groundwater (pCi/L): Co-60	not used	0.000E+00	---	W(3)
R012	Concentration in groundwater (pCi/L): Cs-137	not used	0.000E+00	---	W(4)
R012	Concentration in groundwater (pCi/L): H-3	not used	0.000E+00	---	W(5)
R012	Concentration in groundwater (pCi/L): Pa-231	not used	0.000E+00	---	W(6)
R012	Concentration in groundwater (pCi/L): Pb-210	not used	0.000E+00	---	W(7)
R012	Concentration in groundwater (pCi/L): Ra-226	not used	0.000E+00	---	W(8)
R012	Concentration in groundwater (pCi/L): Ra-228	not used	0.000E+00	---	W(9)
R012	Concentration in groundwater (pCi/L): Sr-90	not used	0.000E+00	---	W(10)
R012	Concentration in groundwater (pCi/L): Th-228	not used	0.000E+00	---	W(11)
R012	Concentration in groundwater (pCi/L): Th-230	not used	0.000E+00	---	W(12)
R012	Concentration in groundwater (pCi/L): Th-232	not used	0.000E+00	---	W(13)
R012	Concentration in groundwater (pCi/L): U-234	not used	0.000E+00	---	W(14)
R012	Concentration in groundwater (pCi/L): U-235	not used	0.000E+00	---	W(15)
R012	Concentration in groundwater (pCi/L): U-238	not used	0.000E+00	---	W(16)
R013	Cover depth (m)	5.000E+00	0.000E+00	---	COVER0
R013	Density of cover material (g/cm**3)	1.600E+00	1.600E+00	---	DENSCV
R013	Cover depth erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCV
R013	Density of contaminated zone (g/cm**3)	1.600E+00	1.600E+00	---	DENSCZ

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	4.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone effective porosity	2.000E-01	2.000E-01	---	EPCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	5.550E+03	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	4.050E+00	5.300E+00	---	BCZ
R013	Evapotranspiration coefficient	6.000E-01	6.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	1.000E+00	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	0.000E+00	2.000E-01	---	RI
R013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	2.000E-01	2.000E-01	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	1.000E+06	1.000E+06	---	WAREA
R014	Density of saturated zone (g/cm**3)	1.600E+00	1.600E+00	---	DENSAQ
R014	Saturated zone total porosity	4.000E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	2.000E-01	2.000E-01	---	EPSZ
R014	Saturated zone hydraulic conductivity (m/yr)	5.550E+03	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	2.000E-02	2.000E-02	---	HGWT
R014	Saturated zone b parameter	4.050E+00	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	1.000E-03	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	1.000E+01	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL
R014	Individual's use of groundwater (m**3/yr)	not used	1.500E+02	---	UW
R015	Number of unsaturated zone strata	1	1	---	NS
R015	Unsat. zone 1, thickness (m)	8.670E+00	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	1.600E+00	1.600E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	4.000E-01	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	2.000E-01	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	4.050E+00	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	5.550E+03	1.000E+02	---	HCUZ(1)
R016	Distribution coefficients for Ac-227				
R016	Contaminated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCACTC(1)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+01	2.000E+01	---	DCACTU(1,1)
R016	Saturated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCACTS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	6.632E-02	RLEACH(1)
R016	Distribution coefficients for C-14				
R016	Contaminated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCACTC(2)
R016	Unsaturated zone 1 (cm**3/g)	0.000E+00	0.000E+00	---	DCACTU(2,1)
R016	Saturated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCACTS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.285E+01	RLEACH(2)
R016	Distribution coefficients for Co-60				
R016	Contaminated zone (cm**3/g)	1.000E+03	1.000E+03	---	DCACTC(3)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+03	1.000E+03	---	DCACTU(3,1)
R016	Saturated zone (cm**3/g)	1.000E+03	1.000E+03	---	DCACTS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.333E-03	RLEACH(3)

Site-Specific Parameter Summary (continued)

	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
:016	Distribution coefficients for Cs-137				
:016	Contaminated zone (cm**3/g)	1.000E+03	1.000E+03	---	DCACTC(4)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+03	1.000E+03	---	DCACTU(4,1)
R016	Saturated zone (cm**3/g)	1.000E+03	1.000E+03	---	DCACTS(4)
:016	Leach rate (/yr)	0.000E+00	0.000E+00	1.333E-03	RLEACH(4)
..016	Distribution coefficients for H-3				
R016	Contaminated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCACTC(5)
R016	Unsaturated zone 1 (cm**3/g)	0.000E+00	0.000E+00	---	DCACTU(5,1)
016	Saturated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCACTS(5)
016	Leach rate (/yr)	0.000E+00	0.000E+00	1.285E+01	RLEACH(5)
R016	Distribution coefficients for Pa-231				
016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCACTC(6)
016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCACTU(6,1)
..016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCACTS(6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.661E-02	RLEACH(6)
016	Distribution coefficients for Pb-210				
016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCACTC(7)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+02	1.000E+02	---	DCACTU(7,1)
R016	Saturated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCACTS(7)
016	Leach rate (/yr)	0.000E+00	0.000E+00	1.332E-02	RLEACH(7)
..016	Distribution coefficients for Ra-226				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCACTC(8)
016	Unsaturated zone 1 (cm**3/g)	7.000E+01	7.000E+01	---	DCACTU(8,1)
016	Saturated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCACTS(8)
016	Leach rate (/yr)	0.000E+00	0.000E+00	1.902E-02	RLEACH(8)
	Distribution coefficients for Ra-228				
	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCACTC(9)
	Unsaturated zone 1 (cm**3/g)	7.000E+01	7.000E+01	---	DCACTU(9,1)
..016	Saturated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCACTS(9)
:016	Leach rate (/yr)	0.000E+00	0.000E+00	1.902E-02	RLEACH(9)
016	Distribution coefficients for Sr-90				
016	Contaminated zone (cm**3/g)	3.000E+01	3.000E+01	---	DCACTC(10)
:016	Unsaturated zone 1 (cm**3/g)	3.000E+01	3.000E+01	---	DCACTU(10,1)
:016	Saturated zone (cm**3/g)	3.000E+01	3.000E+01	---	DCACTS(10)
016	Leach rate (/yr)	0.000E+00	0.000E+00	4.429E-02	RLEACH(10)
.016	Distribution coefficients for Th-228				
016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCACTC(11)
016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCACTU(11,1)
016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCACTS(11)
16	Leach rate (/yr)	0.000E+00	0.000E+00	2.222E-05	RLEACH(11)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for Th-230				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCACTC(12)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCACTU(12,1)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCACTS(12)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.222E-05	RLEACH(12)
R016	Distribution coefficients for Th-232				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCACTC(13)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCACTU(13,1)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCACTS(13)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.222E-05	RLEACH(13)
R016	Distribution coefficients for U-234				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCACTC(14)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCACTU(14,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCACTS(14)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.661E-02	RLEACH(14)
R016	Distribution coefficients for U-235				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCACTC(15)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCACTU(15,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCACTS(15)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.661E-02	RLEACH(15)
R016	Distribution coefficients for U-238				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCACTC(16)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCACTU(16,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCACTS(16)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.661E-02	RLEACH(16)
R017	Inhalation rate (m**3/yr)	8.400E+03	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	2.000E-04	2.000E-04	---	MLINH
R017	Dilution length for airborne dust, inhalation (m)	3.000E+00	3.000E+00	---	LM
R017	Occupancy factor, inhalation	5.000E-01	4.500E-01	---	FO3
R017	Occupancy and shielding factor, external gamma	6.000E-01	6.000E-01	---	FO1
R017	Shape factor, external gamma	1.000E+00	1.000E+00	---	FS1
R017	Fractions of annular areas within AREA:				
R017	Outer annular radius (m) = √(1/π)	not used	1.000E+00	---	FRACA(1)
R017	Outer annular radius (m) = √(10/π)	not used	1.000E+00	---	FRACA(2)
R017	Outer annular radius (m) = √(20/π)	not used	1.000E+00	---	FRACA(3)
R017	Outer annular radius (m) = √(50/π)	not used	1.000E+00	---	FRACA(4)
R017	Outer annular radius (m) = √(100/π)	not used	1.000E+00	---	FRACA(5)
R017	Outer annular radius (m) = √(200/π)	not used	1.000E+00	---	FRACA(6)
R017	Outer annular radius (m) = √(500/π)	not used	1.000E+00	---	FRACA(7)
R017	Outer annular radius (m) = √(1000/π)	not used	1.000E+00	---	FRACA(8)
R017	Outer annular radius (m) = √(5000/π)	not used	1.000E+00	---	FRACA(9)
R017	Outer annular radius (m) = √(1.E+04/π)	not used	1.000E+00	---	FRACA(10)
R017	Outer annular radius (m) = √(1.E+05/π)	not used	0.000E+00	---	FRACA(11)
R017	Outer annular radius (m) = √(1.E+06/π)	not used	0.000E+00	---	FRACA(12)
R018	Fruits, vegetables and grain consumption (kg/yr)	1.600E+02	1.600E+02	---	DIET(1)

Site-Specific Parameter Summary (continued)

	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R018	Leafy vegetable consumption (kg/yr)	1.400E+01	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	9.200E+01	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	6.300E+01	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	5.400E+00	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	9.000E-01	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	3.650E+01	0.000E+00	---	SOIL
R018	Drinking water intake (L/yr)	4.100E+02	4.100E+02	---	DWI
R018	Fraction of drinking water from site	1.000E+00	1.000E+00	---	FDW
R019	Livestock fodder intake for meat (kg/day)	6.800E+01	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	5.500E+01	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	5.000E+01	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	1.600E+02	1.600E+02	---	LWI6
R019	Mass loading for foliar deposition (g/m**3)	1.000E-04	1.000E-04	---	MLFD
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
R019	Depth of roots (m)	9.000E-01	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	1.000E+00	1.000E+00	---	FGWDW
R019	Livestock water fraction from ground water	1.000E+00	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	1.000E+00	1.000E+00	---	FGWIR
R021	Total porosity of the cover material	4.000E-01	4.000E-01	---	TPCV
R021	Total porosity of the building foundation	1.000E-01	1.000E-01	---	TPFL
R021	Volumetric water content of the cover material	5.000E-02	5.000E-02	---	PH2OCV
R021	Volumetric water content of the foundation	1.000E-02	1.000E-02	---	PH2OFL
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	2.000E-06	2.000E-06	---	DIFCV
R021	in foundation material	2.000E-08	2.000E-08	---	DIFFL
R021	in contaminated zone soil	2.000E-06	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	2.000E+00	2.000E+00	---	HMIX
R021	Average annual wind speed (m/sec)	2.000E+00	2.000E+00	---	WIND
R021	Average building air exchange rate (1/hr)	1.000E+00	1.000E+00	---	REXG
R021	Height of the building (room) (m)	2.500E+00	2.500E+00	---	HRM
R021	Building interior area factor	1.000E+00	1.000E+00	---	FAI
R021	Bulk density of building foundation (g/cm**3)	2.400E+00	2.400E+00	---	DENSFL
R021	Thickness of building foundation (m)	1.500E-01	1.500E-01	---	FLOOR
R021	Building depth below ground surface (m)	1.000E+00	1.000E+00	---	DMFL
R021	Fraction of time spent indoors	5.000E-01	5.000E-01	---	FIND
R021	Fraction of time spent outdoors (on site)	2.500E-01	2.500E-01	---	FOTD
R021	Emanating power of Rn-222 gas	2.000E-01	2.000E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	1.000E-01	1.000E-01	---	EMANA(2)

Summary of Pathway Selections

Pathway	User Selection
1 -- external gamma	active
2 -- inhalation	active
3 -- plant ingestion	active
4 -- meat ingestion	active
5 -- milk ingestion	active
6 -- aquatic foods	active
7 -- drinking water	active
8 -- radon	active
9 -- soil ingestion	active

Contaminated Zone Dimensions

Area:	100.00 square meters
kness:	0.15 meters
Cover Depth:	5.00 meters

Initial Soil Concentrations, pCi/g

Ac-227	1.000E+01
C-14	1.000E+01
Co-60	1.000E+01
Cs-137	1.000E+01
H-3	1.000E+01
Pa-231	1.000E+01
Pb-210	1.000E+01
Ra-226	1.000E+01
Ra-228	1.000E+01
Sr-90	1.000E+01
Th-228	1.000E+01
Th-230	1.000E+01
Th-232	1.000E+01
U-234	1.000E+01
U-235	1.000E+01
U-238	1.000E+01

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 100 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
TDOSE(t):	1.723E-03	1.692E-03	2.347E-03	1.440E-03	1.009E-03	3.092E-04	5.852E-05	1.037E-04
M(t):	1.723E-05	1.692E-05	2.347E-05	1.440E-05	1.009E-05	3.092E-06	5.852E-07	1.037E-06

ıximum TDOSE(t): 5.672E+01 mrem/yr at t = 474.2 ± 0.1 years

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 474.2 years

Water Independent Pathways

Radio-	Ground		Dust		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	7.050E-24	0.0000	0.000E+00	0.0000	2.764E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	1.570E-21	0.0000	0.000E+00	0.0000	6.156E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	9.801E-16	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	5.316E-25	0.0000	0.000E+00	0.0000	2.084E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	5.659E-29	0.0000	0.000E+00	0.0000	2.216E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	9.801E-16	0.0000	0.000E+00	0.0000	6.186E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 474.2 years

Water Dependent Pathways

adio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
:-227	1.528E-05	0.0000	6.689E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.935E-09	0.0000	6.857E-12	0.0000	1.535E-05	0.0000
-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-231	5.594E+01	0.9862	2.449E-01	0.0043	0.000E+00	0.0000	0.000E+00	0.0000	1.074E-02	0.0002	2.510E-05	0.0000	5.619E+01	0.9907
-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
a-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.764E-07	0.0000
a-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.156E-05	0.0000
h-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.801E-16	0.0000
-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.084E-08	0.0000
235	5.259E-01	0.0093	2.303E-03	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.010E-04	0.0000	2.360E-07	0.0000	5.283E-01	0.0093
238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.216E-12	0.0000
otal	5.647E+01	0.9954	2.472E-01	0.0044	0.000E+00	0.0000	0.000E+00	0.0000	1.085E-02	0.0002	2.534E-05	0.0000	5.672E+01	1.0000

um of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Independent Pathways

Radio-	Ground		Dust		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	2.333E-23	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	2.769E-28	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	4.769E-22	0.0000	0.000E+00	0.0000	1.723E-03	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-228	3.135E-23	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-228	2.169E-17	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	4.060E-29	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	2.169E-17	0.0000	0.000E+00	0.0000	1.723E-03	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Dependent Pathways

adio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
c-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
o-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.333E-23	0.0000
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.769E-28	0.0000
-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
a-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
o-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
a-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.723E-03	1.0000
a-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.135E-23	0.0000
r-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.169E-17	0.0000
-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
h-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.060E-29	0.0000
otal	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.723E-03	1.0000

ium of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Water Independent Pathways

Radio-Nuclide	Ground		Dust		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	2.066E-23	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	2.739E-28	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	4.726E-22	0.0000	0.000E+00	0.0000	1.692E-03	0.9996	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-228	6.179E-18	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-228	1.522E-17	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	2.068E-25	0.0000	0.000E+00	0.0000	7.400E-07	0.0004	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	4.045E-19	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	0.000E+00	0.0000	0.000E+00	0.0000	3.312E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	4.005E-29	0.0000	0.000E+00	0.0000	3.115E-18	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	2.181E-17	0.0000	0.000E+00	0.0000	1.692E-03	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
ıc-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
:-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
ɔo-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.066E-23	0.0000
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.739E-28	0.0000
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
a-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
b-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.692E-03	0.9996
Ra-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.179E-18	0.0000
r-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
h-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.522E-17	0.0000
.h-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.400E-07	0.0004
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.045E-19	0.0000
ı-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.312E-12	0.0000
-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.115E-18	0.0000
otal	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.692E-03	1.0000

Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years

Water Independent Pathways

Radio-	Ground		Dust		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	1.620E-23	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	2.679E-28	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	4.643E-22	0.0000	0.000E+00	0.0000	1.631E-03	0.6946	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-228	1.160E-17	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-228	7.500E-18	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	6.214E-25	0.0000	0.000E+00	0.0000	2.182E-06	0.0009	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	2.708E-18	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	0.000E+00	0.0000	0.000E+00	0.0000	2.897E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	3.896E-29	0.0000	0.000E+00	0.0000	8.127E-17	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	2.181E-17	0.0000	0.000E+00	0.0000	1.633E-03	0.6955	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
C-14	6.135E-04	0.2613	8.572E-05	0.0365	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.992E-04	0.2979
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.620E-23	0.0000
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.679E-28	0.0000
H-3	1.555E-05	0.0066	3.731E-10	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.555E-05	0.0066
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.631E-03	0.6946
Ra-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.160E-17	0.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.500E-18	0.0000
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.182E-06	0.0009
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.708E-18	0.0000
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.897E-11	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.127E-17	0.0000
Total	6.290E-04	0.2680	8.572E-05	0.0365	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.347E-03	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Water Independent Pathways

Radio-	Ground		Dust		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	6.916E-24	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	2.479E-28	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	4.363E-22	0.0000	0.000E+00	0.0000	1.433E-03	0.9952	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-228	8.487E-18	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-228	6.294E-19	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	2.086E-24	0.0000	0.000E+00	0.0000	6.853E-06	0.0048	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	1.249E-17	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	8.877E-29	0.0000	0.000E+00	0.0000	2.916E-10	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	3.539E-29	0.0000	0.000E+00	0.0000	2.672E-15	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	2.160E-17	0.0000	0.000E+00	0.0000	1.440E-03	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.916E-24	0.0000
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.479E-28	0.0000
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.433E-03	0.9952
Ra-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.487E-18	0.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.294E-19	0.0000
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.853E-06	0.0048
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.249E-17	0.0000
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.916E-10	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.672E-15	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.440E-03	1.0000

Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years

Water Independent Pathways

Radio-	Ground		Dust		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	6.078E-25	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	1.986E-28	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	3.653E-22	0.0000	0.000E+00	0.0000	9.913E-04	0.9827	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-228	6.916E-19	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-228	5.302E-22	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	6.443E-24	0.0000	0.000E+00	0.0000	1.749E-05	0.0173	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	2.346E-17	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	7.352E-28	0.0000	0.000E+00	0.0000	1.995E-09	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	2.691E-29	0.0000	0.000E+00	0.0000	5.170E-14	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	2.416E-17	0.0000	0.000E+00	0.0000	1.009E-03	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years

Water Dependent Pathways

:adio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
'c-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
o-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.078E-25	0.0000
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.986E-28	0.0000
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
a-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
b-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
ka-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.913E-04	0.9827
Ra-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.916E-19	0.0000
'r-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
h-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.302E-22	0.0000
h-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.749E-05	0.0173
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.346E-17	0.0000
J-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.995E-09	0.0000
-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.170E-14	0.0000
otal	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.009E-03	1.0000

Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Water Independent Pathways

Radio-	Ground		Dust		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	1.223E-28	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	9.145E-29	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	1.961E-22	0.0000	0.000E+00	0.0000	2.729E-04	0.8824	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-228	7.215E-23	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	2.613E-23	0.0000	0.000E+00	0.0000	3.636E-05	0.1176	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	4.316E-17	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	6.793E-27	0.0000	0.000E+00	0.0000	9.454E-09	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	1.075E-29	0.0000	0.000E+00	0.0000	6.497E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	4.316E-17	0.0000	0.000E+00	0.0000	3.092E-04	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.223E-28	0.0000
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.145E-29	0.0000
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.729E-04	0.8824
Ra-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.215E-23	0.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.636E-05	0.1176
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.316E-17	0.0000
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.454E-09	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.497E-13	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.092E-04	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years

Water Independent Pathways

Radio-	Ground		Dust		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	3.315E-23	0.0000	0.000E+00	0.0000	6.848E-06	0.1170	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	2.500E-22	0.0000	0.000E+00	0.0000	5.166E-05	0.8827	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	2.291E-16	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	8.406E-26	0.0000	0.000E+00	0.0000	1.737E-08	0.0003	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	1.814E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	2.291E-16	0.0000	0.000E+00	0.0000	5.852E-05	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.848E-06	0.1170
Ra-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.166E-05	0.8827
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.291E-16	0.0000
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.737E-08	0.0003
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.814E-12	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.852E-05	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Independent Pathways

Radio-	Ground		Dust		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	6.585E-26	0.0000	0.000E+00	0.0000	1.709E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	3.995E-19	0.0000	0.000E+00	0.0000	1.037E-04	0.9997	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	7.894E-14	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	1.353E-22	0.0000	0.000E+00	0.0000	3.511E-08	0.0003	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	1.440E-26	0.0000	0.000E+00	0.0000	3.738E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	7.894E-14	0.0000	0.000E+00	0.0000	1.037E-04	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	3.284E-27	0.0000	1.438E-29	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.298E-27	0.0000
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pa-231	2.284E-13	0.0000	1.000E-15	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.388E-17	0.0000	1.025E-19	0.0000	2.295E-13	0.0000
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.709E-11	0.0000
Ra-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sr-90	1.894E-16	0.0000	2.019E-19	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.183E-21	0.0000	5.101E-20	0.0000	1.897E-16	0.0000
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.037E-04	0.9997
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.894E-14	0.0000
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.511E-08	0.0003
U-235	4.724E-15	0.0000	2.068E-17	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.074E-19	0.0000	2.120E-21	0.0000	4.746E-15	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.738E-12	0.0000
Total	2.334E-13	0.0000	1.021E-15	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.479E-17	0.0000	1.556E-19	0.0000	1.037E-04	1.0000

*Sum of all water independent and dependent pathways.

Dose/Source Ratios Summed Over All Pathways, (mrem/yr)/(pCi/g)

Nuclide (i)	t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Ac-227	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.298E-28
C-14	0.000E+00	0.000E+00	6.992E-05	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Co-60	2.333E-24	2.066E-24	1.620E-24	6.916E-25	6.078E-26	1.223E-29	0.000E+00	0.000E+00
Cs-137	2.769E-29	2.739E-29	2.679E-29	2.479E-29	1.986E-29	9.145E-30	0.000E+00	0.000E+00
H-3	0.000E+00	0.000E+00	1.555E-06	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Pa-231	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.295E-14
Pb-210	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Ra-226	1.723E-04	1.692E-04	1.631E-04	1.433E-04	9.913E-05	2.729E-05	6.848E-07	1.709E-12
Ra-228	3.135E-24	6.179E-19	1.160E-18	8.487E-19	6.916E-20	7.215E-24	0.000E+00	0.000E+00
Sr-90	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.897E-17
Th-228	2.169E-18	1.522E-18	7.500E-19	6.294E-20	5.302E-23	0.000E+00	0.000E+00	0.000E+00
Th-230	0.000E+00	7.400E-08	2.182E-07	6.853E-07	1.749E-06	3.636E-06	5.166E-06	1.037E-05
Th-232	0.000E+00	4.045E-20	2.708E-19	1.249E-18	2.346E-18	4.316E-18	2.291E-17	7.894E-15
U-234	0.000E+00	3.312E-13	2.897E-12	2.916E-11	1.995E-10	9.454E-10	1.737E-09	3.511E-09
U-235	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.746E-16
U-238	4.060E-30	3.115E-19	8.127E-18	2.672E-16	5.170E-15	6.497E-14	1.814E-13	3.738E-13

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 100 mrem/yr

Nuclide (i)	t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Ac-227	*7.244E+13	*7.244E+13	*7.244E+13	*7.244E+13	*7.244E+13	*7.244E+13	*7.244E+13	*7.244E+13
C-14	*4.454E+12	*4.454E+12	1.430E+06	*4.454E+12	*4.454E+12	*4.454E+12	*4.454E+12	*4.454E+12
Co-60	*1.131E+15	*1.131E+15	*1.131E+15	*1.131E+15	*1.131E+15	*1.131E+15	*1.131E+15	*1.131E+15
Cs-137	*8.652E+13	*8.652E+13	*8.652E+13	*8.652E+13	*8.652E+13	*8.652E+13	*8.652E+13	*8.652E+13
H-3	*9.610E+15	*9.610E+15	6.429E+07	*9.610E+15	*9.610E+15	*9.610E+15	*9.610E+15	*9.610E+15
Pa-231	*4.716E+10	*4.716E+10	*4.716E+10	*4.716E+10	*4.716E+10	*4.716E+10	*4.716E+10	*4.716E+10
Pb-210	*7.631E+13	*7.631E+13	*7.631E+13	*7.631E+13	*7.631E+13	*7.631E+13	*7.631E+13	*7.631E+13
Ra-226	5.803E+05	5.911E+05	6.133E+05	6.977E+05	1.009E+06	3.665E+06	1.460E+08	*9.882E+11
Ra-228	*2.721E+14	*2.721E+14	*2.721E+14	*2.721E+14	*2.721E+14	*2.721E+14	*2.721E+14	*2.721E+14
Sr-90	*1.380E+14	*1.380E+14	*1.380E+14	*1.380E+14	*1.380E+14	*1.380E+14	*1.380E+14	*1.380E+14
Th-228	*8.192E+14	*8.192E+14	*8.192E+14	*8.192E+14	*8.192E+14	*8.192E+14	*8.192E+14	*8.192E+14
Th-230	*2.018E+10	1.351E+09	4.583E+08	1.459E+08	5.719E+07	2.750E+07	1.936E+07	9.644E+06
Th-232	*1.092E+05	*1.092E+05	*1.092E+05	*1.092E+05	*1.092E+05	*1.092E+05	*1.092E+05	*1.092E+05
U-234	*6.233E+09	*6.233E+09	*6.233E+09	*6.233E+09	*6.233E+09	*6.233E+09	*6.233E+09	*6.233E+09
U-235	*2.160E+06	*2.160E+06	*2.160E+06	*2.160E+06	*2.160E+06	*2.160E+06	*2.160E+06	*2.160E+06
U-238	*3.360E+05	*3.360E+05	*3.360E+05	*3.360E+05	*3.360E+05	*3.360E+05	*3.360E+05	*3.360E+05

*At specific activity limit

Summed Dose/Source Ratios DSR(i,t) in (mrem/yr)/(pCi/g)
and Single Radionuclide Soil Guidelines G(i,t) in pCi/g
at tmin = time of minimum single radionuclide soil guideline
and at tmax = time of maximum total dose = 474.2 ± 0.1 years

Nuclide (i)	Initial pCi/g	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
Ac-227	1.000E+01	474.1 ± 0.1	1.534E-06	6.518E+07	1.535E-06	6.515E+07
C-14	1.000E+01	2.4294 ± 0.0007	1.060E-01	9.431E+02	0.000E+00	*4.454E+12
Co-60	1.000E+01	0.000E+00	2.333E-24	*1.131E+15	0.000E+00	*1.131E+15
Cs-137	1.000E+01	0.000E+00	2.769E-29	*8.652E+13	0.000E+00	*8.652E+13
H-3	1.000E+01	2.4293 ± 0.0007	2.435E-03	4.107E+04	0.000E+00	*9.610E+15
Pa-231	1.000E+01	474.1 ± 0.1	5.599E+00	1.786E+01	5.619E+00	1.780E+01
Pb-210	1.000E+01	0.000E+00	0.000E+00	*7.631E+13	0.000E+00	*7.631E+13
Ra-226	1.000E+01	0.000E+00	1.723E-04	5.803E+05	2.764E-08	3.618E+09
Ra-228	1.000E+01	4.458 ± 0.001	1.238E-18	*2.721E+14	0.000E+00	*2.721E+14
Sr-90	1.000E+01	729.1 ± 0.2	8.434E-10	1.186E+11	0.000E+00	*1.380E+14
Th-228	1.000E+01	0.000E+00	2.169E-18	*8.192E+14	0.000E+00	*8.192E+14
Th-230	1.000E+01	973.3 ± 0.3	1.010E-05	9.902E+06	6.156E-06	1.624E+07
Th-232	1.000E+01	973.3 ± 0.3	6.316E-15	*1.092E+05	9.801E-17	*1.092E+05
U-234	1.000E+01	973.3 ± 0.3	3.420E-09	*6.233E+09	2.084E-09	*6.233E+09
U-235	1.000E+01	474.2 ± 0.1	5.279E-02	1.894E+03	5.283E-02	1.893E+03
U-238	1.000E+01	973.3 ± 0.3	3.640E-13	*3.360E+05	2.216E-13	*3.360E+05

*At specific activity limit

RESRAD
(RESIDUAL RADIOACTIVITY MATERIALS PROGRAM)

SOIL GUIDELINE CALCULATIONS
WEST JEFFERSON RADIONUCLIDES
NO SOIL COVER

Table of Contents

Part I: Mixture Sums and Single Radionuclide Guidelines

Site-Specific Parameter Summary 2
Summary of Pathway Selections 8
Contaminated Zone and Total Dose Summary 9
Total Dose Components
Time = 0.000E+00 12
Time = 2.118E+00 14
Time = 4.058E+00 16
Time = 1.148E+01 18
Time = 4.107E+02 20
Time = 1.000E+03 22
Dose/Source Ratios and Radionuclide Soil Guidelines 24

Site-Specific Parameter Summary

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R011	Area of contaminated zone (m**2)	1.000E+02	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	1.500E-01	1.000E+00	---	THICK0
R011	Length parallel to aquifer flow (m)	1.000E+02	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	1.000E+02	1.000E+02	---	BRLD
R011	Time since placement of material (yr)	0.000E+00	0.000E+00	---	TI
R011	Times for calculations (yr)	2.118E+00	1.000E+00	---	T(2)
R011	Times for calculations (yr)	4.058E+00	3.000E+00	---	T(3)
R011	Times for calculations (yr)	1.148E+01	1.000E+01	---	T(4)
R011	Times for calculations (yr)	4.107E+02	3.000E+01	---	T(5)
R011	Times for calculations (yr)	1.000E+03	1.000E+02	---	T(6)
R011	Times for calculations (yr)	not used	3.000E+02	---	T(7)
R011	Times for calculations (yr)	not used	1.000E+03	---	T(8)
R011	Times for calculations (yr)	not used	3.000E+03	---	T(9)
R011	Times for calculations (yr)	not used	1.000E+04	---	T(10)
R012	Initial principal radionuclide (pCi/g): Ac-227	1.000E+01	0.000E+00	---	S(1)
R012	Initial principal radionuclide (pCi/g): C-14	1.000E+01	0.000E+00	---	S(2)
R012	Initial principal radionuclide (pCi/g): Ce-144	1.000E+01	0.000E+00	---	S(3)
R012	Initial principal radionuclide (pCi/g): Co-60	1.000E+01	0.000E+00	---	S(4)
R012	Initial principal radionuclide (pCi/g): Cs-134	1.000E+01	0.000E+00	---	S(5)
R012	Initial principal radionuclide (pCi/g): Cs-137	1.000E+01	0.000E+00	---	S(6)
R012	Initial principal radionuclide (pCi/g): Eu-152	1.000E+01	0.000E+00	---	S(7)
R012	Initial principal radionuclide (pCi/g): Eu-154	1.000E+01	0.000E+00	---	S(8)
R012	Initial principal radionuclide (pCi/g): Eu-155	1.000E+01	0.000E+00	---	S(9)
R012	Initial principal radionuclide (pCi/g): Fe-55	1.000E+01	0.000E+00	---	S(10)
R012	Initial principal radionuclide (pCi/g): H-3	1.000E+01	0.000E+00	---	S(11)
R012	Initial principal radionuclide (pCi/g): I-129	1.000E+01	0.000E+00	---	S(12)
R012	Initial principal radionuclide (pCi/g): Mn-54	1.000E+01	0.000E+00	---	S(13)
R012	Initial principal radionuclide (pCi/g): Ni-59	1.000E+01	0.000E+00	---	S(14)
R012	Initial principal radionuclide (pCi/g): Ni-63	1.000E+01	0.000E+00	---	S(15)
R012	Initial principal radionuclide (pCi/g): Pa-231	1.000E+01	0.000E+00	---	S(16)
R012	Initial principal radionuclide (pCi/g): Ru-106	1.000E+01	0.000E+00	---	S(19)
R012	Initial principal radionuclide (pCi/g): Sb-125	1.000E+01	0.000E+00	---	S(20)
R012	Initial principal radionuclide (pCi/g): Sm-151	1.000E+01	0.000E+00	---	S(21)
R012	Initial principal radionuclide (pCi/g): Sr-90	1.000E+01	0.000E+00	---	S(22)
R012	Initial principal radionuclide (pCi/g): U-233	1.000E+01	0.000E+00	---	S(25)
R012	Initial principal radionuclide (pCi/g): U-234	1.000E+01	0.000E+00	---	S(26)
R012	Initial principal radionuclide (pCi/g): U-235	1.000E+01	0.000E+00	---	S(27)
R012	Concentration in groundwater (pCi/L): Ac-227	not used	0.000E+00	---	W(1)
R012	Concentration in groundwater (pCi/L): C-14	not used	0.000E+00	---	W(2)
R012	Concentration in groundwater (pCi/L): Ce-144	not used	0.000E+00	---	W(3)
R012	Concentration in groundwater (pCi/L): Co-60	not used	0.000E+00	---	W(4)
R012	Concentration in groundwater (pCi/L): Cs-134	not used	0.000E+00	---	W(5)
R012	Concentration in groundwater (pCi/L): Cs-137	not used	0.000E+00	---	W(6)
R012	Concentration in groundwater (pCi/L): Eu-152	not used	0.000E+00	---	W(7)
R012	Concentration in groundwater (pCi/L): Eu-154	not used	0.000E+00	---	W(8)
R012	Concentration in groundwater (pCi/L): Eu-155	not used	0.000E+00	---	W(9)
R012	Concentration in groundwater (pCi/L): Fe-55	not used	0.000E+00	---	W(10)
R012	Concentration in groundwater (pCi/L): H-3	not used	0.000E+00	---	W(11)
R012	Concentration in groundwater (pCi/L): I-129	not used	0.000E+00	---	W(12)
R012	Concentration in groundwater (pCi/L): Mn-54	not used	0.000E+00	---	W(13)

Site-Specific Parameter Summary (continued)

	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R012	Concentration in groundwater (pCi/L): Ni-59	not used	0.000E+00	---	W(14)
R012	Concentration in groundwater (pCi/L): Ni-63	not used	0.000E+00	---	W(15)
R012	Concentration in groundwater (pCi/L): Pa-231	not used	0.000E+00	---	W(16)
R012	Concentration in groundwater (pCi/L): Ru-106	not used	0.000E+00	---	W(19)
R012	Concentration in groundwater (pCi/L): Sb-125	not used	0.000E+00	---	W(20)
R012	Concentration in groundwater (pCi/L): Sm-151	not used	0.000E+00	---	W(21)
R012	Concentration in groundwater (pCi/L): Sr-90	not used	0.000E+00	---	W(22)
R012	Concentration in groundwater (pCi/L): U-233	not used	0.000E+00	---	W(25)
R012	Concentration in groundwater (pCi/L): U-234	not used	0.000E+00	---	W(26)
R012	Concentration in groundwater (pCi/L): U-235	not used	0.000E+00	---	W(27)
R013	Cover depth (m)	0.000E+00	0.000E+00	---	COVER0
R013	Density of cover material (g/cm**3)	not used	1.600E+00	---	DENSCV
R013	Cover depth erosion rate (m/yr)	not used	1.000E-03	---	VCV
R013	Density of contaminated zone (g/cm**3)	1.600E+00	1.600E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	4.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone effective porosity	2.000E-01	2.000E-01	---	EPCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	5.550E+03	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	4.050E+00	5.300E+00	---	BCZ
R013	Evapotranspiration coefficient	6.000E-01	6.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	1.000E+00	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	0.000E+00	2.000E-01	---	RI
R013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	2.000E-01	2.000E-01	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	1.000E+06	1.000E+06	---	WAREA
R014	Density of saturated zone (g/cm**3)	1.600E+00	1.600E+00	---	DENSAQ
R014	Saturated zone total porosity	4.000E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	2.000E-01	2.000E-01	---	EPSZ
R014	Saturated zone hydraulic conductivity (m/yr)	5.550E+03	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	2.000E-02	2.000E-02	---	HGWT
R014	Saturated zone b parameter	4.050E+00	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	1.000E-03	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	1.000E+01	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL
R014	Individual's use of groundwater (m**3/yr)	not used	1.500E+02	---	UW
R015	Number of unsaturated zone strata	1	1	---	NS
R015	Unsat. zone 1, thickness (m)	7.470E+00	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	1.600E+00	1.600E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	4.000E-01	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	2.000E-01	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	4.050E+00	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	5.550E+03	1.000E+02	---	HCUZ(1)
R016	Distribution coefficients for Ac-227				
R016	Contaminated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCACTC(1)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+01	2.000E+01	---	DCACTU(1,1)
R016	Saturated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCACTS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	6.632E-02	RLEACH(1)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for C-14				
R016	Contaminated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCACTC(2)
R016	Unsaturated zone 1 (cm**3/g)	0.000E+00	0.000E+00	---	DCACTU(2,1)
R016	Saturated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCACTS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.285E+01	RLEACH(2)
R016	Distribution coefficients for Ce-144				
R016	Contaminated zone (cm**3/g)	1.000E+03	1.000E+03	---	DCACTC(3)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+03	1.000E+03	---	DCACTU(3,1)
R016	Saturated zone (cm**3/g)	1.000E+03	1.000E+03	---	DCACTS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.333E-03	RLEACH(3)
R016	Distribution coefficients for Co-60				
R016	Contaminated zone (cm**3/g)	1.000E+03	1.000E+03	---	DCACTC(4)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+03	1.000E+03	---	DCACTU(4,1)
R016	Saturated zone (cm**3/g)	1.000E+03	1.000E+03	---	DCACTS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.333E-03	RLEACH(4)
R016	Distribution coefficients for Cs-134				
R016	Contaminated zone (cm**3/g)	1.000E+03	1.000E+03	---	DCACTC(5)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+03	1.000E+03	---	DCACTU(5,1)
R016	Saturated zone (cm**3/g)	1.000E+03	1.000E+03	---	DCACTS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.333E-03	RLEACH(5)
R016	Distribution coefficients for Cs-137				
R016	Contaminated zone (cm**3/g)	1.000E+03	1.000E+03	---	DCACTC(6)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+03	1.000E+03	---	DCACTU(6,1)
R016	Saturated zone (cm**3/g)	1.000E+03	1.000E+03	---	DCACTS(6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.333E-03	RLEACH(6)
R016	Distribution coefficients for Eu-152				
R016	Contaminated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCACTC(7)
R016	Unsaturated zone 1 (cm**3/g)	0.000E+00	0.000E+00	---	DCACTU(7,1)
R016	Saturated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCACTS(7)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.285E+01	RLEACH(7)
R016	Distribution coefficients for Eu-154				
R016	Contaminated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCACTC(8)
R016	Unsaturated zone 1 (cm**3/g)	0.000E+00	0.000E+00	---	DCACTU(8,1)
R016	Saturated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCACTS(8)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.285E+01	RLEACH(8)
R016	Distribution coefficients for Eu-155				
R016	Contaminated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCACTC(9)
R016	Unsaturated zone 1 (cm**3/g)	0.000E+00	0.000E+00	---	DCACTU(9,1)
R016	Saturated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCACTS(9)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.285E+01	RLEACH(9)

Site-Specific Parameter Summary (continued)

	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
2016	Distribution coefficients for Fe-55				
2016	Contaminated zone (cm**3/g)	1.000E+03	1.000E+03	---	DCACTC(10)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+03	1.000E+03	---	DCACTU(10,1)
R016	Saturated zone (cm**3/g)	1.000E+03	1.000E+03	---	DCACTS(10)
:016	Leach rate (/yr)	0.000E+00	0.000E+00	1.333E-03	RLEACH(10)
.:016	Distribution coefficients for H-3				
R016	Contaminated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCACTC(11)
R016	Unsaturated zone 1 (cm**3/g)	0.000E+00	0.000E+00	---	DCACTU(11,1)
016	Saturated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCACTS(11)
.016	Leach rate (/yr)	0.000E+00	0.000E+00	1.285E+01	RLEACH(11)
R016	Distribution coefficients for I-129				
016	Contaminated zone (cm**3/g)	1.000E-01	1.000E-01	---	DCACTC(12)
016	Unsaturated zone 1 (cm**3/g)	1.000E-01	1.000E-01	---	DCACTU(12,1)
..016	Saturated zone (cm**3/g)	1.000E-01	1.000E-01	---	DCACTS(12)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	6.544E+00	RLEACH(12)
016	Distribution coefficients for Mn-54				
016	Contaminated zone (cm**3/g)	2.000E+02	2.000E+02	---	DCACTC(13)
:016	Unsaturated zone 1 (cm**3/g)	2.000E+02	2.000E+02	---	DCACTU(13,1)
:016	Saturated zone (cm**3/g)	2.000E+02	2.000E+02	---	DCACTS(13)
016	Leach rate (/yr)	0.000E+00	0.000E+00	6.663E-03	RLEACH(13)
.016	Distribution coefficients for Ni-59				
:016	Contaminated zone (cm**3/g)	1.000E+03	1.000E+03	---	DCACTC(14)
'016	Unsaturated zone 1 (cm**3/g)	1.000E+03	1.000E+03	---	DCACTU(14,1)
016	Saturated zone (cm**3/g)	1.000E+03	1.000E+03	---	DCACTS(14)
016	Leach rate (/yr)	0.000E+00	0.000E+00	1.333E-03	RLEACH(14)
01	Distribution coefficients for Ni-63				
	Contaminated zone (cm**3/g)	1.000E+03	1.000E+03	---	DCACTC(15)
	Unsaturated zone 1 (cm**3/g)	1.000E+03	1.000E+03	---	DCACTU(15,1)
016	Saturated zone (cm**3/g)	1.000E+03	1.000E+03	---	DCACTS(15)
016	Leach rate (/yr)	0.000E+00	0.000E+00	1.333E-03	RLEACH(15)
016	Distribution coefficients for Pa-231				
016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCACTC(16)
016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCACTU(16,1)
016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCACTS(16)
016	Leach rate (/yr)	0.000E+00	0.000E+00	2.661E-02	RLEACH(16)
'16	Distribution coefficients for Ru-106				
'16	Contaminated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCACTC(19)
16	Unsaturated zone 1 (cm**3/g)	0.000E+00	0.000E+00	---	DCACTU(19,1)
16	Saturated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCACTS(19)
16	Leach rate (/yr)	0.000E+00	0.000E+00	1.285E+01	RLEACH(19)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for Sb-125				
R016	Contaminated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCACTC(20)
R016	Unsaturated zone 1 (cm**3/g)	0.000E+00	0.000E+00	---	DCACTU(20,1)
R016	Saturated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCACTS(20)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.285E+01	RLEACH(20)
R016	Distribution coefficients for Sm-151				
R016	Contaminated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCACTC(21)
R016	Unsaturated zone 1 (cm**3/g)	0.000E+00	0.000E+00	---	DCACTU(21,1)
R016	Saturated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCACTS(21)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.285E+01	RLEACH(21)
R016	Distribution coefficients for Sr-90				
R016	Contaminated zone (cm**3/g)	3.000E+01	3.000E+01	---	DCACTC(22)
R016	Unsaturated zone 1 (cm**3/g)	3.000E+01	3.000E+01	---	DCACTU(22,1)
R016	Saturated zone (cm**3/g)	3.000E+01	3.000E+01	---	DCACTS(22)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.429E-02	RLEACH(22)
R016	Distribution coefficients for U-233				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCACTC(25)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCACTU(25,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCACTS(25)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.661E-02	RLEACH(25)
R016	Distribution coefficients for U-234				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCACTC(26)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCACTU(26,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCACTS(26)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.661E-02	RLEACH(26)
R016	Distribution coefficients for U-235				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCACTC(27)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCACTU(27,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCACTS(27)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.661E-02	RLEACH(27)
R016	Distribution coefficients for daughter Pb-210				
R016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCACTC(17)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+02	1.000E+02	---	DCACTU(17,1)
R016	Saturated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCACTS(17)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.332E-02	RLEACH(17)
R016	Distribution coefficients for daughter Ra-226				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCACTC(18)
R016	Unsaturated zone 1 (cm**3/g)	7.000E+01	7.000E+01	---	DCACTU(18,1)
R016	Saturated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCACTS(18)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.902E-02	RLEACH(18)

Site-Specific Parameter Summary (continued)

	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
:016	Distribution coefficients for daughter Th-229				
:016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCACTC(23)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCACTU(23,1)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCACTS(23)
:016	Leach rate (/yr)	0.000E+00	0.000E+00	2.222E-05	RLEACH(23)
.016	Distribution coefficients for daughter Th-230				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCACTC(24)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCACTU(24,1)
016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCACTS(24)
016	Leach rate (/yr)	0.000E+00	0.000E+00	2.222E-05	RLEACH(24)
R017	Inhalation rate (m**3/yr)	8.400E+03	8.400E+03	---	INHALR
017	Mass loading for inhalation (g/m**3)	2.000E-04	2.000E-04	---	MLINH
017	Dilution length for airborne dust, inhalation (m)	3.000E+00	3.000E+00	---	LM
..017	Occupancy factor, inhalation	5.000E-01	4.500E-01	---	FO3
R017	Occupancy and shielding factor, external gamma	6.000E-01	6.000E-01	---	FO1
R017	Shape factor, external gamma	1.000E+00	1.000E+00	---	FS1
017	Fractions of annular areas within AREA:				
017	Outer annular radius (m) = √(1/π)	not used	1.000E+00	---	FRACA(1)
R017	Outer annular radius (m) = √(10/π)	not used	1.000E+00	---	FRACA(2)
R017	Outer annular radius (m) = √(20/π)	not used	1.000E+00	---	FRACA(3)
017	Outer annular radius (m) = √(50/π)	not used	1.000E+00	---	FRACA(4)
017	Outer annular radius (m) = √(100/π)	not used	1.000E+00	---	FRACA(5)
..017	Outer annular radius (m) = √(200/π)	not used	1.000E+00	---	FRACA(6)
R017	Outer annular radius (m) = √(500/π)	not used	1.000E+00	---	FRACA(7)
R017	Outer annular radius (m) = √(1000/π)	not used	1.000E+00	---	FRACA(8)
017	Outer annular radius (m) = √(5000/π)	not used	1.000E+00	---	FRACA(9)
017	Outer annular radius (m) = √(1.E+04/π)	not used	1.000E+00	---	FRACA(10)
:017	Outer annular radius (m) = √(1.E+05/π)	not used	0.000E+00	---	FRACA(11)
:0[illegible]	Outer annular radius (m) = √(1.E+06/π)	not used	0.000E+00	---	FRACA(12)
	Fruits, vegetables and grain consumption (kg/yr)	1.600E+02	1.600E+02	---	DIET(1)
J18	Leafy vegetable consumption (kg/yr)	1.400E+01	1.400E+01	---	DIET(2)
018	Milk consumption (L/yr)	9.200E+01	9.200E+01	---	DIET(3)
018	Meat and poultry consumption (kg/yr)	6.300E+01	6.300E+01	---	DIET(4)
018	Fish consumption (kg/yr)	5.400E+00	5.400E+00	---	DIET(5)
018	Other seafood consumption (kg/yr)	9.000E-01	9.000E-01	---	DIET(6)
018	Soil ingestion rate (g/yr)	3.650E+01	0.000E+00	---	SOIL
018	Drinking water intake (L/yr)	4.100E+02	4.100E+02	---	DWI
018	Fraction of drinking water from site	1.000E+00	1.000E+00	---	FDW
J19	Livestock fodder intake for meat (kg/day)	6.800E+01	6.800E+01	---	LFI5
019	Livestock fodder intake for milk (kg/day)	5.500E+01	5.500E+01	---	LFI6
019	Livestock water intake for meat (L/day)	5.000E+01	5.000E+01	---	LWI5
'19	Livestock water intake for milk (L/day)	1.600E+02	1.600E+02	---	LWI6
19	Mass loading for foliar deposition (g/m**3)	1.000E-04	1.000E-04	---	MLFD
019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
019	Depth of roots (m)	9.000E-01	9.000E-01	---	DROOT
19	Drinking water fraction from ground water	1.000E+00	1.000E+00	---	FGWDW
19	Livestock water fraction from ground water	1.000E+00	1.000E+00	---	FGWLW

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R019	Irrigation fraction from ground water	1.000E+00	1.000E+00	---	FGWIR
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV
R021	Total porosity of the building foundation	1.000E-01	1.000E-01	---	TPFL
R021	Volumetric water content of the cover material	not used	5.000E-02	---	PH2OCV
R021	Volumetric water content of the foundation	1.000E-02	1.000E-02	---	PH2OFL
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	not used	2.000E-06	---	DIFCV
R021	in foundation material	2.000E-08	2.000E-08	---	DIFFL
R021	in contaminated zone soil	2.000E-06	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	2.000E+00	2.000E+00	---	HMIX
R021	Average annual wind speed (m/sec)	2.000E+00	2.000E+00	---	WIND
R021	Average building air exchange rate (1/hr)	1.000E+00	1.000E+00	---	REXG
R021	Height of the building (room) (m)	2.500E+00	2.500E+00	---	HRM
R021	Building interior area factor	1.000E+00	1.000E+00	---	FAI
R021	Bulk density of building foundation (g/cm**3)	2.400E+00	2.400E+00	---	DENSFL
R021	Thickness of building foundation (m)	1.500E-01	1.500E-01	---	FLOOR
R021	Building depth below ground surface (m)	1.000E+00	1.000E+00	---	DMFL
R021	Fraction of time spent indoors	5.000E-01	5.000E-01	---	FIND
R021	Fraction of time spent outdoors (on site)	2.500E-01	2.500E-01	---	FOTD
R021	Emanating power of Rn-222 gas	2.000E-01	2.000E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.000E-01	---	EMANA(2)

Summary of Pathway Selections

Pathway	User Selection
1 -- external gamma	active
2 -- inhalation	active
3 -- plant ingestion	active
4 -- meat ingestion	active
5 -- milk ingestion	active
6 -- aquatic foods	active
7 -- drinking water	active
8 -- radon	active
9 -- soil ingestion	active

Contaminated Zone Dimensions

Area:	100.00 square meters
ckness:	0.15 meters
Cover Depth:	0.00 meters

Initial Soil Concentrations, pCi/g

Ac-227	1.000E+01
C-14	1.000E+01
Ce-144	1.000E+01
Co-60	1.000E+01
Cs-134	1.000E+01
Cs-137	1.000E+01
Eu-152	1.000E+01
Eu-154	1.000E+01
Eu-155	1.000E+01
Fe-55	1.000E+01
H-3	1.000E+01
I-129	1.000E+01
Mn-54	1.000E+01
Ni-59	1.000E+01
Ni-63	1.000E+01
Pa-231	1.000E+01
Ru-106	1.000E+01
Sb-125	1.000E+01
Sm-151	1.000E+01
Sr-90	1.000E+01
U-233	1.000E+01
U-234	1.000E+01
U-235	1.000E+01

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 100 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	2.118E+00	4.058E+00	1.148E+01	4.107E+02	1.000E+03
TDOSE(t):	2.625E+02	1.485E+02	1.901E+02	6.008E+01	5.666E+01	4.294E-15
M(t):	2.625E+00	1.485E+00	1.901E+00	6.008E-01	5.666E-01	4.294E-17

M[illegible]mum TDOSE(t): 1.902E+02 mrem/yr at t = 4.059 ± 0.001 years (within user specified time frame)

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 4.059 years

Water Independent Pathways

Radio-Nuclide	Ground		Dust		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	5.459E+00	0.0287	2.827E+01	0.1487	0.000E+00	0.0000	3.598E-01	0.0019	4.603E-03	0.0000	2.718E-06	0.0000	2.682E-01	0.0014
C-14	0.000E+00	0.0000	2.958E-28	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.253E-27	0.0000
Ce-144	1.270E-02	0.0001	5.896E-05	0.0000	0.000E+00	0.0000	4.029E-06	0.0000	1.177E-08	0.0000	1.390E-10	0.0000	1.427E-05	0.0000
Co-60	3.603E+01	0.1895	5.500E-04	0.0000	0.000E+00	0.0000	2.018E-03	0.0000	5.021E-06	0.0000	2.965E-06	0.0000	4.039E-04	0.0000
Cs-134	7.577E+00	0.0398	7.510E-05	0.0000	0.000E+00	0.0000	5.394E-04	0.0000	4.179E-05	0.0000	8.227E-06	0.0000	5.010E-04	0.0000
Cs-137	1.315E+01	0.0692	1.823E-04	0.0000	0.000E+00	0.0000	1.299E-03	0.0000	1.007E-04	0.0000	1.982E-05	0.0000	1.207E-03	0.0000
Eu-152	4.831E-22	0.0000	2.497E-26	0.0000	0.000E+00	0.0000	3.870E-27	0.0000	4.952E-29	0.0000	0.000E+00	0.0000	2.885E-27	0.0000
Eu-154	4.836E-22	0.0000	2.631E-26	0.0000	0.000E+00	0.0000	5.235E-27	0.0000	6.697E-29	0.0000	0.000E+00	0.0000	3.902E-27	0.0000
Eu-155	7.006E-24	0.0000	3.117E-27	0.0000	0.000E+00	0.0000	5.905E-28	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.401E-28	0.0000
Fe-55	0.000E+00	0.0000	5.702E-06	0.0000	0.000E+00	0.0000	1.236E-06	0.0000	7.481E-08	0.0000	2.651E-09	0.0000	5.389E-06	0.0000
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.994E-29	0.0000
I-129	3.135E-13	0.0000	3.311E-15	0.0000	0.000E+00	0.0000	2.349E-13	0.0000	1.213E-14	0.0000	7.166E-15	0.0000	2.182E-14	0.0000
Mn-54	5.951E-01	0.0031	1.465E-06	0.0000	0.000E+00	0.0000	4.165E-05	0.0000	5.144E-07	0.0000	1.215E-08	0.0000	2.618E-06	0.0000
Ni-59	0.000E+00	0.0000	1.688E-05	0.0000	0.000E+00	0.0000	5.341E-05	0.0000	1.322E-07	0.0000	5.308E-07	0.0000	5.298E-06	0.0000
Ni-63	0.000E+00	0.0000	3.830E-05	0.0000	0.000E+00	0.0000	1.402E-04	0.0000	3.470E-07	0.0000	1.394E-06	0.0000	1.391E-05	0.0000
Pa-231	1.407E+00	0.0074	1.158E+01	0.0609	0.000E+00	0.0000	4.068E-01	0.0021	5.205E-03	0.0000	3.074E-06	0.0000	3.032E-01	0.0016
Ru-106	5.283E-24	0.0000	4.076E-27	0.0000	0.000E+00	0.0000	4.505E-27	0.0000	1.120E-29	0.0000	0.000E+00	0.0000	8.478E-28	0.0000
Sb-125	6.794E-23	0.0000	5.002E-28	0.0000	0.000E+00	0.0000	3.285E-27	0.0000	2.448E-29	0.0000	0.000E+00	0.0000	5.622E-28	0.0000
Sm-151	4.002E-29	0.0000	3.961E-27	0.0000	0.000E+00	0.0000	2.639E-28	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.967E-28	0.0000
Sr-90	0.000E+00	0.0000	6.193E-03	0.0000	0.000E+00	0.0000	2.994E-01	0.0016	2.212E-04	0.0000	1.306E-03	0.0000	2.825E-03	0.0000
U-233	6.085E-03	0.0000	7.369E-01	0.0039	0.000E+00	0.0000	8.739E-03	0.0000	1.118E-04	0.0000	1.568E-05	0.0000	6.485E-03	0.0000
U-234	3.943E-03	0.0000	7.337E-01	0.0039	4.884E-09	0.0000	8.340E-03	0.0000	1.067E-04	0.0000	1.512E-05	0.0000	6.216E-03	0.0000
U-235	2.603E+00	0.0137	6.780E-01	0.0036	0.000E+00	0.0000	8.051E-03	0.0000	1.030E-04	0.0000	1.454E-05	0.0000	6.001E-03	0.0000
Total	6.685E+01	0.3515	4.201E+01	0.2209	4.884E-09	0.0000	1.095E+00	0.0058	1.050E-02	0.0001	1.391E-03	0.0000	5.951E-01	0.0031

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 4.059 years

Water Dependent Pathways

adio-uclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.437E+01	0.1807
-14	1.395E-11	0.0000	1.950E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.590E-11	0.0000
e-144	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.277E-02	0.0001
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.604E+01	0.1895
Cs-134	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.578E+00	0.0398
s-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.315E+01	0.0692
u-152	3.213E-11	0.0000	1.407E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.170E-15	0.0000	1.442E-17	0.0000	3.227E-11	0.0000
u-154	4.345E-11	0.0000	1.902E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.345E-15	0.0000	1.950E-17	0.0000	4.365E-11	0.0000
Eu-155	4.901E-12	0.0000	2.146E-14	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.414E-16	0.0000	2.200E-18	0.0000	4.924E-12	0.0000
Fe-55	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.240E-05	0.0000
3	3.334E-13	0.0000	7.996E-18	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.334E-13	0.0000
129	7.939E+01	0.4174	2.871E-02	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	6.099E-02	0.0003	1.425E-01	0.0007	7.962E+01	0.4187
Mn-54	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.951E-01	0.0031
Ni-59	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.625E-05	0.0000
-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.942E-04	0.0000
-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.370E+01	0.0721
-106	9.440E-12	0.0000	1.294E-14	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.626E-16	0.0000	8.473E-19	0.0000	9.454E-12	0.0000
Sb-125	6.260E-12	0.0000	3.813E-16	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.214E-16	0.0000	8.428E-16	0.0000	6.262E-12	0.0000
Sm-151	2.191E-12	0.0000	9.591E-15	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.208E-16	0.0000	9.831E-19	0.0000	2.201E-12	0.0000
-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.099E-01	0.0016
233	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.583E-01	0.0040
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.523E-01	0.0040
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.295E+00	0.0173
tal	7.939E+01	0.4174	2.871E-02	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	6.099E-02	0.0003	1.425E-01	0.0007	1.902E+02	1.0000

Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Independent Pathways

Radio-	Ground		Dust		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	8.198E+00	0.0312	4.329E+01	0.1649	0.000E+00	0.0000	5.509E-01	0.0021	7.048E-03	0.0000	4.162E-06	0.0000	4.106E-01	0.0016
C-14	0.000E+00	0.0000	1.357E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.749E-05	0.0000
Ce-144	4.768E-01	0.0018	2.262E-03	0.0000	0.000E+00	0.0000	1.545E-04	0.0000	4.514E-07	0.0000	5.332E-09	0.0000	5.475E-04	0.0000
Co-60	6.244E+01	0.2379	9.692E-04	0.0000	0.000E+00	0.0000	3.556E-03	0.0000	8.848E-06	0.0000	5.225E-06	0.0000	7.117E-04	0.0000
Cs-134	3.007E+01	0.1146	3.037E-04	0.0000	0.000E+00	0.0000	2.181E-03	0.0000	1.690E-04	0.0000	3.327E-05	0.0000	2.026E-03	0.0000
Cs-137	1.464E+01	0.0558	2.068E-04	0.0000	0.000E+00	0.0000	1.474E-03	0.0000	1.142E-04	0.0000	2.248E-05	0.0000	1.369E-03	0.0000
Eu-152	2.706E+01	0.1031	1.422E-03	0.0000	0.000E+00	0.0000	2.204E-04	0.0000	2.819E-06	0.0000	1.665E-09	0.0000	1.642E-04	0.0000
Eu-154	3.036E+01	0.1157	1.680E-03	0.0000	0.000E+00	0.0000	3.342E-04	0.0000	4.276E-06	0.0000	2.525E-09	0.0000	2.491E-04	0.0000
Eu-155	5.523E-01	0.0021	2.520E-04	0.0000	0.000E+00	0.0000	4.774E-05	0.0000	6.108E-07	0.0000	3.607E-10	0.0000	3.559E-05	0.0000
Fe-55	0.000E+00	0.0000	1.680E-05	0.0000	0.000E+00	0.0000	3.640E-06	0.0000	2.204E-07	0.0000	7.811E-09	0.0000	1.588E-05	0.0000
H-3	0.000E+00	0.0000	4.071E-07	0.0000	0.000E+00	0.0000	3.002E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.725E-06	0.0000
I-129	1.072E-01	0.0004	1.163E-03	0.0000	0.000E+00	0.0000	8.253E-02	0.0003	4.263E-03	0.0000	2.518E-03	0.0000	7.665E-03	0.0000
Mn-54	1.651E+01	0.0629	4.135E-05	0.0000	0.000E+00	0.0000	1.176E-03	0.0000	1.452E-05	0.0000	3.431E-07	0.0000	7.391E-05	0.0000
Ni-59	0.000E+00	0.0000	1.745E-05	0.0000	0.000E+00	0.0000	5.520E-05	0.0000	1.366E-07	0.0000	5.486E-07	0.0000	5.475E-06	0.0000
Ni-63	0.000E+00	0.0000	4.071E-05	0.0000	0.000E+00	0.0000	1.490E-04	0.0000	3.688E-07	0.0000	1.481E-06	0.0000	1.478E-05	0.0000
Pa-231	6.592E-01	0.0025	8.400E+00	0.0320	0.000E+00	0.0000	4.040E-01	0.0015	5.168E-03	0.0000	3.052E-06	0.0000	3.011E-01	0.0011
Ru-106	3.613E+00	0.0138	2.843E-03	0.0000	0.000E+00	0.0000	3.142E-03	0.0000	7.813E-06	0.0000	4.614E-09	0.0000	5.913E-04	0.0000
Sb-125	8.435E+00	0.0321	6.332E-05	0.0000	0.000E+00	0.0000	4.159E-04	0.0000	3.100E-06	0.0000	9.154E-07	0.0000	7.118E-05	0.0000
Sm-151	1.843E-06	0.0000	1.874E-04	0.0000	0.000E+00	0.0000	1.249E-05	0.0000	1.598E-07	0.0000	9.435E-11	0.0000	9.308E-06	0.0000
Sr-90	0.000E+00	0.0000	8.400E-03	0.0000	0.000E+00	0.0000	4.061E-01	0.0015	3.001E-04	0.0000	1.772E-03	0.0000	3.832E-03	0.0000
U-233	4.407E-03	0.0000	8.400E-01	0.0032	0.000E+00	0.0000	9.916E-03	0.0000	1.269E-04	0.0000	1.798E-05	0.0000	7.391E-03	0.0000
U-234	4.403E-03	0.0000	8.400E-01	0.0032	0.000E+00	0.0000	9.549E-03	0.0000	1.222E-04	0.0000	1.732E-05	0.0000	7.118E-03	0.0000
U-235	2.909E+00	0.0111	7.754E-01	0.0030	0.000E+00	0.0000	9.182E-03	0.0000	1.175E-04	0.0000	1.665E-05	0.0000	6.844E-03	0.0000
Total	2.061E+02	0.7850	5.417E+01	0.2064	0.000E+00	0.0000	1.485E+00	0.0057	1.747E-02	0.0001	4.413E-03	0.0000	7.505E-01	0.0029

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Dependent Pathways

adio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
uclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
c-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.246E+01	0.1999
-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.106E-05	0.0000
e-144	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.798E-01	0.0018
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.245E+01	0.2379
Cs-134	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.008E+01	0.1146
s-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.465E+01	0.0558
u-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.706E+01	0.1031
u-154	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.036E+01	0.1157
u-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.526E-01	0.0021
e-55	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.655E-05	0.0000
-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.162E-06	0.0000
-129	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.054E-01	0.0008
n-54	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.652E+01	0.0629
i-59	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.880E-05	0.0000
-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.064E-04	0.0000
-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.769E+00	0.0372
u-106	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.619E+00	0.0138
b-125	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.436E+00	0.0321
-151	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.112E-04	0.0000
-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.204E-01	0.0016
233	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.619E-01	0.0033
-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.612E-01	0.0033
-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.701E+00	0.0141
tal	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.625E+02	1.0000

um of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 2.118E+00 years

Water Independent Pathways

Radio-	Ground		Dust		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	6.631E+00	0.0446	3.467E+01	0.2334	0.000E+00	0.0000	4.411E-01	0.0030	5.643E-03	0.0000	3.333E-06	0.0000	3.288E-01	0.0022
C-14	0.000E+00	0.0000	2.025E-17	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.578E-17	0.0000
Ce-144	7.188E-02	0.0005	3.372E-04	0.0000	0.000E+00	0.0000	2.304E-05	0.0000	6.731E-08	0.0000	7.951E-10	0.0000	8.164E-05	0.0000
Co-60	4.687E+01	0.3156	7.212E-04	0.0000	0.000E+00	0.0000	2.646E-03	0.0000	6.584E-06	0.0000	3.888E-06	0.0000	5.296E-04	0.0000
Cs-134	1.465E+01	0.0986	1.465E-04	0.0000	0.000E+00	0.0000	1.052E-03	0.0000	8.152E-05	0.0000	1.605E-05	0.0000	9.772E-04	0.0000
Cs-137	1.385E+01	0.0932	1.936E-04	0.0000	0.000E+00	0.0000	1.380E-03	0.0000	1.069E-04	0.0000	2.105E-05	0.0000	1.282E-03	0.0000
Eu-152	3.638E-11	0.0000	1.895E-15	0.0000	0.000E+00	0.0000	2.938E-16	0.0000	3.758E-18	0.0000	2.220E-21	0.0000	2.190E-16	0.0000
Eu-154	3.846E-11	0.0000	2.110E-15	0.0000	0.000E+00	0.0000	4.197E-16	0.0000	5.369E-18	0.0000	3.171E-21	0.0000	3.128E-16	0.0000
Eu-155	6.213E-13	0.0000	2.798E-16	0.0000	0.000E+00	0.0000	5.300E-17	0.0000	6.781E-19	0.0000	4.005E-22	0.0000	3.951E-17	0.0000
Fe-55	0.000E+00	0.0000	9.560E-06	0.0000	0.000E+00	0.0000	2.071E-06	0.0000	1.254E-07	0.0000	4.444E-09	0.0000	9.035E-06	0.0000
H-3	0.000E+00	0.0000	5.394E-19	0.0000	0.000E+00	0.0000	3.978E-20	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.285E-18	0.0000
I-129	1.026E-07	0.0000	1.097E-09	0.0000	0.000E+00	0.0000	7.788E-08	0.0000	4.022E-09	0.0000	2.375E-09	0.0000	7.233E-09	0.0000
Mn-54	2.915E+00	0.0196	7.235E-06	0.0000	0.000E+00	0.0000	2.057E-04	0.0000	2.541E-06	0.0000	6.002E-08	0.0000	1.293E-05	0.0000
Ni-59	0.000E+00	0.0000	1.715E-05	0.0000	0.000E+00	0.0000	5.426E-05	0.0000	1.343E-07	0.0000	5.393E-07	0.0000	5.382E-06	0.0000
Ni-63	0.000E+00	0.0000	3.944E-05	0.0000	0.000E+00	0.0000	1.444E-04	0.0000	3.573E-07	0.0000	1.435E-06	0.0000	1.432E-05	0.0000
Pa-231	1.104E+00	0.0074	1.036E+01	0.0697	0.000E+00	0.0000	4.086E-01	0.0028	5.228E-03	0.0000	3.087E-06	0.0000	3.046E-01	0.0021
Ru-106	1.316E-12	0.0000	1.025E-15	0.0000	0.000E+00	0.0000	1.133E-15	0.0000	2.817E-18	0.0000	1.664E-21	0.0000	2.132E-16	0.0000
Sb-125	7.486E-12	0.0000	5.563E-17	0.0000	0.000E+00	0.0000	3.654E-16	0.0000	2.723E-18	0.0000	8.042E-19	0.0000	6.253E-17	0.0000
Sm-151	2.745E-18	0.0000	2.752E-16	0.0000	0.000E+00	0.0000	1.834E-17	0.0000	2.346E-19	0.0000	1.385E-22	0.0000	1.367E-17	0.0000
Sr-90	0.000E+00	0.0000	7.165E-03	0.0000	0.000E+00	0.0000	3.464E-01	0.0023	2.560E-04	0.0000	1.512E-03	0.0000	3.269E-03	0.0000
U-233	5.312E-03	0.0000	7.845E-01	0.0053	0.000E+00	0.0000	9.283E-03	0.0001	1.187E-04	0.0000	1.674E-05	0.0000	6.904E-03	0.0000
U-234	4.156E-03	0.0000	7.828E-01	0.0053	1.388E-09	0.0000	8.899E-03	0.0001	1.138E-04	0.0000	1.613E-05	0.0000	6.633E-03	0.0000
U-235	2.745E+00	0.0185	7.230E-01	0.0049	0.000E+00	0.0000	8.573E-03	0.0001	1.097E-04	0.0000	1.551E-05	0.0000	6.390E-03	0.0000
Total	8.884E+01	0.5982	4.732E+01	0.3186	1.388E-09	0.0000	1.228E+00	0.0083	1.167E-02	0.0001	1.609E-03	0.0000	6.595E-01	0.0044

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 2.118E+00 years

Water Dependent Pathways

:adio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
'c-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.207E+01	0.2833
-14	9.303E-01	0.0063	1.300E-01	0.0009	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.060E+00	0.0071
e-144	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.233E-02	0.0005
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.688E+01	0.3156
Cs-134	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.465E+01	0.0986
s-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.385E+01	0.0932
u-152	2.375E+00	0.0160	1.040E-02	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	4.561E-04	0.0000	1.066E-06	0.0000	2.386E+00	0.0161
Eu-154	3.393E+00	0.0228	1.485E-02	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	6.517E-04	0.0000	1.523E-06	0.0000	3.408E+00	0.0229
Eu-155	4.285E-01	0.0029	1.876E-03	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.230E-05	0.0000	1.923E-07	0.0000	4.304E-01	0.0029
e-55	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.080E-05	0.0000
-3	2.478E-02	0.0002	5.944E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.478E-02	0.0002
-129	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.952E-07	0.0000
Mn-54	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.916E+00	0.0196
Ni-59	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.747E-05	0.0000
i-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.999E-04	0.0000
a-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.218E+01	0.0820
Ru-106	2.312E+00	0.0156	3.169E-03	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.883E-05	0.0000	2.076E-07	0.0000	2.316E+00	0.0156
Sb-125	6.782E-01	0.0046	4.131E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.815E-05	0.0000	9.130E-05	0.0000	6.784E-01	0.0046
m-151	1.482E-01	0.0010	6.490E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.847E-05	0.0000	6.652E-08	0.0000	1.489E-01	0.0010
r-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.586E-01	0.0024
-233	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.062E-01	0.0054
J-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.026E-01	0.0054
J-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.483E+00	0.0235
otal	1.029E+01	0.0693	1.610E-01	0.0011	0.000E+00	0.0000	0.000E+00	0.0000	1.386E-03	0.0000	9.436E-05	0.0000	1.485E+02	1.0000

S:— of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 4.058E+00 years

Water Independent Pathways

Radio-	Ground		Dust		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	5.459E+00	0.0287	2.828E+01	0.1487	0.000E+00	0.0000	3.598E-01	0.0019	4.603E-03	0.0000	2.718E-06	0.0000	2.682E-01	0.0014
C-14	0.000E+00	0.0000	2.978E-28	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.262E-27	0.0000
Ce-144	1.270E-02	0.0001	5.899E-05	0.0000	0.000E+00	0.0000	4.031E-06	0.0000	1.178E-08	0.0000	1.391E-10	0.0000	1.428E-05	0.0000
Co-60	3.604E+01	0.1895	5.501E-04	0.0000	0.000E+00	0.0000	2.018E-03	0.0000	5.021E-06	0.0000	2.965E-06	0.0000	4.039E-04	0.0000
Cs-134	7.578E+00	0.0399	7.512E-05	0.0000	0.000E+00	0.0000	5.395E-04	0.0000	4.180E-05	0.0000	8.229E-06	0.0000	5.011E-04	0.0000
Cs-137	1.315E+01	0.0692	1.823E-04	0.0000	0.000E+00	0.0000	1.299E-03	0.0000	1.007E-04	0.0000	1.982E-05	0.0000	1.207E-03	0.0000
Eu-152	4.866E-22	0.0000	2.514E-26	0.0000	0.000E+00	0.0000	3.898E-27	0.0000	4.987E-29	0.0000	0.000E+00	0.0000	2.905E-27	0.0000
Eu-154	4.871E-22	0.0000	2.650E-26	0.0000	0.000E+00	0.0000	5.272E-27	0.0000	6.745E-29	0.0000	0.000E+00	0.0000	3.929E-27	0.0000
Eu-155	7.056E-24	0.0000	3.139E-27	0.0000	0.000E+00	0.0000	5.947E-28	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.433E-28	0.0000
Fe-55	0.000E+00	0.0000	5.703E-06	0.0000	0.000E+00	0.0000	1.236E-06	0.0000	7.482E-08	0.0000	2.651E-09	0.0000	5.390E-06	0.0000
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.015E-29	0.0000
I-129	3.146E-13	0.0000	3.322E-15	0.0000	0.000E+00	0.0000	2.358E-13	0.0000	1.218E-14	0.0000	7.192E-15	0.0000	2.190E-14	0.0000
Mn-54	5.953E-01	0.0031	1.465E-06	0.0000	0.000E+00	0.0000	4.166E-05	0.0000	5.146E-07	0.0000	1.216E-08	0.0000	2.619E-06	0.0000
Ni-59	0.000E+00	0.0000	1.688E-05	0.0000	0.000E+00	0.0000	5.341E-05	0.0000	1.322E-07	0.0000	5.308E-07	0.0000	5.298E-06	0.0000
Ni-63	0.000E+00	0.0000	3.830E-05	0.0000	0.000E+00	0.0000	1.402E-04	0.0000	3.470E-07	0.0000	1.394E-06	0.0000	1.391E-05	0.0000
Pa-231	1.407E+00	0.0074	1.158E+01	0.0609	0.000E+00	0.0000	4.068E-01	0.0021	5.205E-03	0.0000	3.074E-06	0.0000	3.032E-01	0.0016
Ru-106	5.322E-24	0.0000	4.106E-27	0.0000	0.000E+00	0.0000	4.539E-27	0.0000	1.128E-29	0.0000	0.000E+00	0.0000	8.540E-28	0.0000
Sb-125	6.843E-23	0.0000	5.037E-28	0.0000	0.000E+00	0.0000	3.309E-27	0.0000	2.466E-29	0.0000	0.000E+00	0.0000	5.662E-28	0.0000
Sm-151	4.030E-29	0.0000	3.989E-27	0.0000	0.000E+00	0.0000	2.658E-28	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.981E-28	0.0000
Sr-90	0.000E+00	0.0000	6.193E-03	0.0000	0.000E+00	0.0000	2.994E-01	0.0016	2.212E-04	0.0000	1.307E-03	0.0000	2.826E-03	0.0000
U-233	6.085E-03	0.0000	7.369E-01	0.0039	0.000E+00	0.0000	8.739E-03	0.0000	1.118E-04	0.0000	1.568E-05	0.0000	6.486E-03	0.0000
U-234	3.943E-03	0.0000	7.337E-01	0.0039	4.883E-09	0.0000	8.341E-03	0.0000	1.067E-04	0.0000	1.512E-05	0.0000	6.217E-03	0.0000
U-235	2.603E+00	0.0137	6.780E-01	0.0036	0.000E+00	0.0000	8.051E-03	0.0000	1.030E-04	0.0000	1.454E-05	0.0000	6.001E-03	0.0000
Total	6.685E+01	0.3516	4.201E+01	0.2210	4.883E-09	0.0000	1.095E+00	0.0058	1.050E-02	0.0001	1.391E-03	0.0000	5.951E-01	0.0031

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 4.058E+00 years

Water Dependent Pathways

:adio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
:uclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
\c-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.437E+01	0.1808
:-14	1.405E-11	0.0000	1.963E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.601E-11	0.0000
:e-144	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.278E-02	0.0001
:o-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.604E+01	0.1896
:s-134	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.579E+00	0.0399
:s-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.315E+01	0.0692
.u-152	3.235E-11	0.0000	1.416E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.214E-15	0.0000	1.452E-17	0.0000	3.250E-11	0.0000
.u-154	4.376E-11	0.0000	1.916E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.405E-15	0.0000	1.964E-17	0.0000	4.396E-11	0.0000
:u-155	4.936E-12	0.0000	2.161E-14	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.481E-16	0.0000	2.215E-18	0.0000	4.959E-12	0.0000
:e-55	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.241E-05	0.0000
:-3	3.357E-13	0.0000	8.052E-18	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.357E-13	0.0000
-129	7.932E+01	0.4172	2.869E-02	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	6.094E-02	0.0003	1.424E-01	0.0007	7.955E+01	0.4184
:n-54	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.954E-01	0.0031
i-59	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.625E-05	0.0000
i-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.942E-04	0.0000
a-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.370E+01	0.0721
u-106	9.510E-12	0.0000	1.303E-14	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.653E-16	0.0000	8.536E-19	0.0000	9.524E-12	0.0000
b-125	6.305E-12	0.0000	3.841E-16	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.266E-16	0.0000	8.489E-16	0.0000	6.307E-12	0.0000
m-151	2.206E-12	0.0000	9.659E-15	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.237E-16	0.0000	9.901E-19	0.0000	2.216E-12	0.0000
r-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.099E-01	0.0016
-233	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.583E-01	0.0040
-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.523E-01	0.0040
-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.295E+00	0.0173
otal	7.932E+01	0.4172	2.869E-02	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	6.094E-02	0.0003	1.424E-01	0.0007	1.901E+02	1.0000

[illegible] of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.148E+01 years

Water Independent Pathways

Radio-	Ground		Dust		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	2.591E+00	0.0431	1.295E+01	0.2155	0.000E+00	0.0000	1.647E-01	0.0027	2.108E-03	0.0000	1.245E-06	0.0000	1.228E-01	0.0020
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ce-144	1.674E-05	0.0000	7.474E-08	0.0000	0.000E+00	0.0000	5.107E-09	0.0000	1.492E-11	0.0000	1.762E-13	0.0000	1.809E-08	0.0000
Co-60	1.316E+01	0.2191	1.948E-04	0.0000	0.000E+00	0.0000	7.147E-04	0.0000	1.778E-06	0.0000	1.050E-06	0.0000	1.430E-04	0.0000
Cs-134	6.081E-01	0.0101	5.824E-06	0.0000	0.000E+00	0.0000	4.183E-05	0.0000	3.241E-06	0.0000	6.380E-07	0.0000	3.885E-05	0.0000
Cs-137	1.079E+01	0.1796	1.444E-04	0.0000	0.000E+00	0.0000	1.030E-03	0.0000	7.977E-05	0.0000	1.570E-05	0.0000	9.562E-04	0.0000
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-154	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Fe-55	0.000E+00	0.0000	7.889E-07	0.0000	0.000E+00	0.0000	1.709E-07	0.0000	1.035E-08	0.0000	3.668E-10	0.0000	7.455E-07	0.0000
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
I-129	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Mn-54	1.363E-03	0.0000	3.251E-09	0.0000	0.000E+00	0.0000	9.243E-08	0.0000	1.142E-09	0.0000	2.697E-11	0.0000	5.810E-09	0.0000
Ni-59	0.000E+00	0.0000	1.586E-05	0.0000	0.000E+00	0.0000	5.019E-05	0.0000	1.242E-07	0.0000	4.989E-07	0.0000	4.979E-06	0.0000
Ni-63	0.000E+00	0.0000	3.419E-05	0.0000	0.000E+00	0.0000	1.252E-04	0.0000	3.098E-07	0.0000	1.244E-06	0.0000	1.242E-05	0.0000
Pa-231	1.946E+00	0.0324	1.307E+01	0.2175	0.000E+00	0.0000	3.684E-01	0.0061	4.712E-03	0.0001	2.783E-06	0.0000	2.746E-01	0.0046
Ru-106	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sb-125	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sm-151	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sr-90	0.000E+00	0.0000	3.539E-03	0.0001	0.000E+00	0.0000	1.711E-01	0.0028	1.264E-04	0.0000	7.466E-04	0.0000	1.615E-03	0.0000
U-233	8.592E-03	0.0001	5.798E-01	0.0097	0.000E+00	0.0000	6.941E-03	0.0001	8.876E-05	0.0000	1.217E-05	0.0000	5.105E-03	0.0001
U-234	3.226E-03	0.0001	5.717E-01	0.0095	3.318E-08	0.0000	6.499E-03	0.0001	8.315E-05	0.0000	1.178E-05	0.0000	4.844E-03	0.0001
U-235	2.122E+00	0.0353	5.299E-01	0.0088	0.000E+00	0.0000	6.326E-03	0.0001	8.094E-05	0.0000	1.133E-05	0.0000	4.716E-03	0.0001
Total	3.123E+01	0.5199	2.770E+01	0.4610	3.318E-08	0.0000	7.259E-01	0.0121	7.285E-03	0.0001	8.051E-04	0.0000	4.148E-01	0.0069

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.148E+01 years

Water Dependent Pathways

adio- uclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.583E+01	0.2634
-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
e-144	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.684E-05	0.0000
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.317E+01	0.2191
Cs-134	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.082E-01	0.0101
s-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.079E+01	0.1796
u-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
u-154	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Fe-55	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.716E-06	0.0000
-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-129	6.659E-20	0.0000	2.408E-23	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.116E-23	0.0000	1.195E-22	0.0000	6.678E-20	0.0000
n-54	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.364E-03	0.0000
i-59	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.166E-05	0.0000
-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.733E-04	0.0000
-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.566E+01	0.2606
-106	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
b-125	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
m-151	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.771E-01	0.0029
233	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.006E-01	0.0100
-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.863E-01	0.0098
-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.663E+00	0.0443
tal	6.659E-20	0.0000	2.408E-23	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.116E-23	0.0000	1.195E-22	0.0000	6.008E+01	1.0000

Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 4.107E+02 years

Water Independent Pathways

Radio-	Ground		Dust		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ce-144	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-134	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-154	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Fe-55	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
I-129	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Mn-54	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ni-59	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ru-106	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sb-125	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sm-151	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-233	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 4.107E+02 years

Water Dependent Pathways

adio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
c-227	1.155E-04	0.0000	5.057E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.218E-08	0.0000	5.183E-11	0.0000	1.160E-04	0.0000
-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
e-144	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-134	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
s-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
u-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
cu-154	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
e-55	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-129	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Mn-54	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ni-59	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
i-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
a-231	5.595E+01	0.9875	2.450E-01	0.0043	0.000E+00	0.0000	0.000E+00	0.0000	1.075E-02	0.0002	2.511E-05	0.0000	5.621E+01	0.9920
ku-106	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sb-125	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
m-151	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
233	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
J-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
J-235	4.503E-01	0.0079	1.972E-03	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.650E-05	0.0000	2.021E-07	0.0000	4.524E-01	0.0080
otal	5.640E+01	0.9955	2.469E-01	0.0044	0.000E+00	0.0000	0.000E+00	0.0000	1.083E-02	0.0002	2.531E-05	0.0000	5.666E+01	1.0000

Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Independent Pathways

Radio-	Ground		Dust		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ce-144	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-134	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-154	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Fe-55	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
I-129	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Mn-54	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ni-59	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ru-106	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sb-125	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sm-151	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-233	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	6.015E-29	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.015E-29	0.0000
-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
e-144	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-134	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
s-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
u-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-154	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Fe-55	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-129	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Mn-54	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ni-59	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
i-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
a-231	4.184E-15	0.9745	1.832E-17	0.0043	0.000E+00	0.0000	0.000E+00	0.0000	8.036E-19	0.0002	1.878E-21	0.0000	4.203E-15	0.9789
Ru-106	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sb-125	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sm-151	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-90	3.469E-18	0.0008	3.698E-21	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.998E-23	0.0000	9.342E-22	0.0000	3.474E-18	0.0008
-233	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	8.653E-17	0.0202	3.788E-19	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	1.662E-20	0.0000	3.883E-23	0.0000	8.692E-17	0.0202
Total	4.274E-15	0.9955	1.870E-17	0.0044	0.000E+00	0.0000	0.000E+00	0.0000	8.203E-19	0.0002	2.851E-21	0.0000	4.294E-15	1.0000

* of all water independent and dependent pathways.

Dose/Source Ratios Summed Over All Pathways, (mrem/yr)/(pCi/g)

Nuclide (i)	t= 0.000E+00	2.118E+00	4.058E+00	1.148E+01	4.107E+02	1.000E+03
Ac-227	5.246E+00	4.207E+00	3.437E+00	1.583E+00	1.160E-05	6.015E-30
C-14	7.106E-06	1.060E-01	1.601E-12	0.000E+00	0.000E+00	0.000E+00
Ce-144	4.798E-02	7.233E-03	1.278E-03	1.684E-06	0.000E+00	0.000E+00
Co-60	6.245E+00	4.688E+00	3.604E+00	1.317E+00	0.000E+00	0.000E+00
Cs-134	3.008E+00	1.465E+00	7.579E-01	6.082E-02	0.000E+00	0.000E+00
Cs-137	1.465E+00	1.385E+00	1.315E+00	1.079E+00	0.000E+00	0.000E+00
Eu-152	2.706E+00	2.386E-01	3.250E-12	0.000E+00	0.000E+00	0.000E+00
Eu-154	3.036E+00	3.408E-01	4.396E-12	0.000E+00	0.000E+00	0.000E+00
Eu-155	5.526E-02	4.304E-02	4.959E-13	0.000E+00	0.000E+00	0.000E+00
Fe-55	3.655E-06	2.080E-06	1.241E-06	1.716E-07	0.000E+00	0.000E+00
H-3	2.162E-07	2.478E-03	3.357E-14	0.000E+00	0.000E+00	0.000E+00
I-129	2.054E-02	1.952E-08	7.955E+00	6.678E-21	0.000E+00	0.000E+00
Mn-54	1.652E+00	2.916E-01	5.954E-02	1.364E-04	0.000E+00	0.000E+00
Ni-59	7.880E-06	7.747E-06	7.625E-06	7.166E-06	0.000E+00	0.000E+00
Ni-63	2.064E-05	1.999E-05	1.942E-05	1.733E-05	0.000E+00	0.000E+00
Pa-231	9.769E-01	1.218E+00	1.370E+00	1.566E+00	5.621E+00	4.203E-16
Ru-106	3.619E-01	2.316E-01	9.524E-13	0.000E+00	0.000E+00	0.000E+00
Sb-125	8.436E-01	6.784E-02	6.307E-13	0.000E+00	0.000E+00	0.000E+00
Sm-151	2.112E-05	1.489E-02	2.216E-13	0.000E+00	0.000E+00	0.000E+00
Sr-90	4.204E-02	3.586E-02	3.099E-02	1.771E-02	0.000E+00	3.474E-19
U-233	8.619E-02	8.062E-02	7.583E-02	6.006E-02	0.000E+00	0.000E+00
U-234	8.612E-02	8.026E-02	7.523E-02	5.863E-02	0.000E+00	0.000E+00
U-235	3.701E-01	3.483E-01	3.295E-01	2.663E-01	4.524E-02	8.692E-18

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 100 mrem/yr

de (i)	t= 0.000E+00	2.118E+00	4.058E+00	1.148E+01	4.107E+02	1.000E+03
ıc-227	1.906E+01	2.377E+01	2.910E+01	6.318E+01	8.619E+06	*7.244E+13
C-14	1.407E+07	9.431E+02	*4.454E+12	*4.454E+12	*4.454E+12	*4.454E+12
Ce-144	2.084E+03	1.383E+04	7.824E+04	5.939E+07	*3.190E+15	*3.190E+15
Co-60	1.601E+01	2.133E+01	2.775E+01	7.596E+01	*1.131E+15	*1.131E+15
s-134	3.325E+01	6.826E+01	1.319E+02	1.644E+03	*1.294E+15	*1.294E+15
s-137	6.827E+01	7.221E+01	7.602E+01	9.267E+01	*8.652E+13	*8.652E+13
Eu-152	3.696E+01	4.192E+02	3.077E+13	*1.810E+14	*1.810E+14	*1.810E+14
Eu-154	3.293E+01	2.934E+02	2.275E+13	*2.732E+14	*2.732E+14	*2.732E+14
u-155	1.810E+03	2.323E+03	2.017E+14	*4.651E+14	*4.651E+14	*4.651E+14
e-55	2.736E+07	4.809E+07	8.061E+07	5.827E+08	*2.423E+15	*2.423E+15
n-3	4.626E+08	4.035E+04	2.979E+15	*9.610E+15	*9.610E+15	*9.610E+15
I-129	4.869E+03	*1.733E+08	1.257E+01	*1.733E+08	*1.733E+08	*1.733E+08
n-54	6.055E+01	3.430E+02	1.680E+03	7.334E+05	*7.739E+15	*7.739E+15
i-59	1.269E+07	1.291E+07	1.311E+07	1.396E+07	*8.085E+10	*8.085E+10
i-63	4.846E+06	5.002E+06	5.150E+06	5.770E+06	*5.679E+13	*5.679E+13
Pa-231	1.024E+02	8.211E+01	7.297E+01	6.386E+01	1.779E+01	*4.716E+10
Ru-106	2.763E+02	4.318E+02	1.050E+14	*3.265E+15	*3.265E+15	*3.265E+15
b-125	1.185E+02	1.474E+03	1.586E+14	*1.033E+15	*1.033E+15	*1.033E+15
n-151	4.735E+06	6.716E+03	*2.631E+13	*2.631E+13	*2.631E+13	*2.631E+13
Sr-90	2.379E+03	2.789E+03	3.227E+03	5.646E+03	*1.380E+14	*1.380E+14
U-233	1.160E+03	1.240E+03	1.319E+03	1.665E+03	*9.633E+11	*9.633E+11
-234	1.161E+03	1.246E+03	1.329E+03	1.706E+03	*6.233E+09	*6.233E+09
-235	2.702E+02	2.871E+02	3.035E+02	3.755E+02	2.210E+03	*2.160E+06

*At specific activity limit

Summed Dose/Source Ratios DSR(i,t) in (mrem/yr)/(pCi/g)
and Single Radionuclide Soil Guidelines G(i,t) in pCi/g
at tmin = time of minimum single radionuclide soil guideline
and at tmax = time of maximum total dose = 4.059 ± 0.001 years

Nuclide (i)	Initial pCi/g	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
Ac-227	1.000E+01	0.000E+00	5.246E+00	1.906E+01	3.437E+00	2.910E+01
C-14	1.000E+01	2.118E+00	1.060E-01	9.431E+02	1.590E-12	*4.454E+12
Ce-144	1.000E+01	0.000E+00	4.798E-02	2.084E+03	1.277E-03	7.828E+04
Co-60	1.000E+01	0.000E+00	6.245E+00	1.601E+01	3.604E+00	2.775E+01
Cs-134	1.000E+01	0.000E+00	3.008E+00	3.325E+01	7.578E-01	1.320E+02
Cs-137	1.000E+01	0.000E+00	1.465E+00	6.827E+01	1.315E+00	7.602E+01
Eu-152	1.000E+01	0.000E+00	2.706E+00	3.696E+01	3.227E-12	3.099E+13
Eu-154	1.000E+01	0.000E+00	3.036E+00	3.293E+01	4.365E-12	2.291E+13
Eu-155	1.000E+01	0.000E+00	5.526E-02	1.810E+03	4.924E-13	2.031E+14
Fe-55	1.000E+01	0.000E+00	3.655E-06	2.736E+07	1.240E-06	8.062E+07
H-3	1.000E+01	2.118E+00	2.478E-03	4.035E+04	3.334E-14	3.000E+15
I-129	1.000E+01	4.058 ± 0.001	7.961E+00	1.256E+01	7.962E+00	1.256E+01
Mn-54	1.000E+01	0.000E+00	1.652E+00	6.055E+01	5.951E-02	1.680E+03
Ni-59	1.000E+01	0.000E+00	7.880E-06	1.269E+07	7.625E-06	1.311E+07
Ni-63	1.000E+01	0.000E+00	2.064E-05	4.846E+06	1.942E-05	5.150E+06
Pa-231	1.000E+01	410.6 ± 0.1	5.616E+00	1.781E+01	1.370E+00	7.297E+01
Ru-106	1.000E+01	0.000E+00	3.619E-01	2.763E+02	9.454E-13	1.058E+14
Sb-125	1.000E+01	0.000E+00	8.436E-01	1.185E+02	6.262E-13	1.597E+14
Sm-151	1.000E+01	2.118E+00	1.489E-02	6.716E+03	2.201E-13	*2.631E+13
Sr-90	1.000E+01	0.000E+00	4.204E-02	2.379E+03	3.099E-02	3.227E+03
U-233	1.000E+01	0.000E+00	8.619E-02	1.160E+03	7.583E-02	1.319E+03
U-234	1.000E+01	0.000E+00	8.612E-02	1.161E+03	7.523E-02	1.329E+03
U-235	1.000E+01	0.000E+00	3.701E-01	2.702E+02	3.295E-01	3.035E+02

At specific activity limit

RESRAD
(RESIDUAL RADIOACTIVITY MATERIALS PROGRAM)

SOIL GUIDELINE CALCULATIONS
WEST JEFFERSON RADIONUCLIDES
NO SOIL COVER
(Continued)

Table of Contents

Part I: Mixture Sums and Single Radionuclide Guidelines

Site-Specific Parameter Summary 2
Summary of Pathway Selections 7
Contaminated Zone and Total Dose Summary 8
Total Dose Components
Time = 0.000E+00 9
Time = 2.118E+00 10
Time = 4.058E+00 11
Time = 1.148E+01 12
Time = 4.107E+02 13
Time = 1.000E+03 14
Dose/Source Ratios and Radionuclide Soil Guidelines 15

Site-Specific Parameter Summary

	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
011	Area of contaminated zone (m**2)	1.000E+02	1.000E+04	---	AREA
011	Thickness of contaminated zone (m)	1.500E-01	1.000E+00	---	THICK0
R011	Length parallel to aquifer flow (m)	1.000E+02	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	1.000E+02	1.000E+02	---	BRLD
011	Time since placement of material (yr)	0.000E+00	0.000E+00	---	TI
011	Times for calculations (yr)	2.118E+00	1.000E+00	---	T(2)
011	Times for calculations (yr)	4.058E+00	3.000E+00	---	T(3)
R011	Times for calculations (yr)	1.148E+01	1.000E+01	---	T(4)
R011	Times for calculations (yr)	4.107E+02	3.000E+01	---	T(5)
011	Times for calculations (yr)	1.000E+03	1.000E+02	---	T(6)
011	Times for calculations (yr)	not used	3.000E+02	---	T(7)
R011	Times for calculations (yr)	not used	1.000E+03	---	T(8)
R011	Times for calculations (yr)	not used	3.000E+03	---	T(9)
011	Times for calculations (yr)	not used	1.000E+04	---	T(10)
012	Initial principal radionuclide (pCi/g): Am-241	1.000E+01	0.000E+00	---	S(2)
R012	Initial principal radionuclide (pCi/g): Am-243	1.000E+01	0.000E+00	---	S(3)
R012	Initial principal radionuclide (pCi/g): Cm-243	1.000E+01	0.000E+00	---	S(4)
012	Initial principal radionuclide (pCi/g): Cm-244	1.000E+01	0.000E+00	---	S(5)
012	Initial principal radionuclide (pCi/g): Np-237	1.000E+01	0.000E+00	---	S(6)
R012	Initial principal radionuclide (pCi/g): Pu-238	1.000E+01	0.000E+00	---	S(9)
R012	Initial principal radionuclide (pCi/g): Pu-239	1.000E+01	0.000E+00	---	S(10)
012	Initial principal radionuclide (pCi/g): Pu-240	1.000E+01	0.000E+00	---	S(11)
012	Initial principal radionuclide (pCi/g): Pu-241	1.000E+01	0.000E+00	---	S(12)
012	Initial principal radionuclide (pCi/g): Pu-242	1.000E+01	0.000E+00	---	S(13)
R012	Initial principal radionuclide (pCi/g): U-236	1.000E+01	0.000E+00	---	S(23)
R012	Initial principal radionuclide (pCi/g): U-238	1.000E+01	0.000E+00	---	S(24)
012	Concentration in groundwater (pCi/L): Am-241	not used	0.000E+00	---	W(2)
012	Concentration in groundwater (pCi/L): Am-243	not used	0.000E+00	---	W(3)
R012	Concentration in groundwater (pCi/L): Cm-243	not used	0.000E+00	---	W(4)
R012	Concentration in groundwater (pCi/L): Cm-244	not used	0.000E+00	---	W(5)
	Concentration in groundwater (pCi/L): Np-237	not used	0.000E+00	---	W(6)
	Concentration in groundwater (pCi/L): Pu-238	not used	0.000E+00	---	W(9)
	Concentration in groundwater (pCi/L): Pu-239	not used	0.000E+00	---	W(10)
R012	Concentration in groundwater (pCi/L): Pu-240	not used	0.000E+00	---	W(11)
R012	Concentration in groundwater (pCi/L): Pu-241	not used	0.000E+00	---	W(12)
012	Concentration in groundwater (pCi/L): Pu-242	not used	0.000E+00	---	W(13)
012	Concentration in groundwater (pCi/L): U-236	not used	0.000E+00	---	W(23)
R012	Concentration in groundwater (pCi/L): U-238	not used	0.000E+00	---	W(24)
013	Cover depth (m)	0.000E+00	0.000E+00	---	COVER0
013	Density of cover material (g/cm**3)	not used	1.600E+00	---	DENSCV
013	Cover depth erosion rate (m/yr)	not used	1.000E-03	---	VCV
013	Density of contaminated zone (g/cm**3)	1.600E+00	1.600E+00	---	DENSCZ
013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCZ
013	Contaminated zone total porosity	4.000E-01	4.000E-01	---	TPCZ
013	Contaminated zone effective porosity	2.000E-01	2.000E-01	---	EPCZ
013	Contaminated zone hydraulic conductivity (m/yr)	5.550E+03	1.000E+01	---	HCCZ
013	Contaminated zone b parameter	4.050E+00	5.300E+00	---	BCZ
013	Evapotranspiration coefficient	6.000E-01	6.000E-01	---	EVAPTR
013	Precipitation (m/yr)	1.000E+00	1.000E+00	---	PRECIP
013	Irrigation (m/yr)	0.000E+00	2.000E-01	---	RI

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	2.000E-01	2.000E-01	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	1.000E+06	1.000E+06	---	WAREA
R014	Density of saturated zone (g/cm**3)	1.600E+00	1.600E+00	---	DENSAQ
R014	Saturated zone total porosity	4.000E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	2.000E-01	2.000E-01	---	EPSZ
R014	Saturated zone hydraulic conductivity (m/yr)	5.550E+03	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	2.000E-02	2.000E-02	---	HGWT
R014	Saturated zone b parameter	4.050E+00	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	1.000E-03	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	1.000E+01	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL
R014	Individual's use of groundwater (m**3/yr)	not used	1.500E+02	---	UW
R015	Number of unsaturated zone strata	1	1	---	NS
R015	Unsat. zone 1, thickness (m)	7.470E+00	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	1.600E+00	1.600E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	4.000E-01	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	2.000E-01	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	4.050E+00	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	5.550E+03	1.000E+02	---	HCUZ(1)
R016	Distribution coefficients for Am-241				
R016	Contaminated zone (cm**3/g)	1.200E+02	2.000E+01	---	DCACTC(2)
R016	Unsaturated zone 1 (cm**3/g)	1.200E+02	2.000E+01	---	DCACTU(2,1)
R016	Saturated zone (cm**3/g)	1.200E+02	2.000E+01	---	DCACTS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.110E-02	RLEACH(2)
R016	Distribution coefficients for Am-243				
R016	Contaminated zone (cm**3/g)	1.200E+02	2.000E+01	---	DCACTC(3)
R016	Unsaturated zone 1 (cm**3/g)	1.200E+02	2.000E+01	---	DCACTU(3,1)
R016	Saturated zone (cm**3/g)	1.200E+02	2.000E+01	---	DCACTS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.110E-02	RLEACH(3)
R016	Distribution coefficients for Cm-243				
R016	Contaminated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCACTC(4)
R016	Unsaturated zone 1 (cm**3/g)	0.000E+00	0.000E+00	---	DCACTU(4,1)
R016	Saturated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCACTS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.285E+01	RLEACH(4)
R016	Distribution coefficients for Cm-244				
R016	Contaminated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCACTC(5)
R016	Unsaturated zone 1 (cm**3/g)	0.000E+00	0.000E+00	---	DCACTU(5,1)
R016	Saturated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCACTS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.285E+01	RLEACH(5)

Site-Specific Parameter Summary (continued)

	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for Np-237				
R016	Contaminated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCACTC(6)
R016	Unsaturated zone 1 (cm**3/g)	0.000E+00	0.000E+00	---	DCACTU(6,1)
R016	Saturated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCACTS(6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.285E+01	RLEACH(6)
R016	Distribution coefficients for Pu-238				
R016	Contaminated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCACTC(9)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	2.000E+03	---	DCACTU(9,1)
R016	Saturated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCACTS(9)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	6.663E-03	RLEACH(9)
R016	Distribution coefficients for Pu-239				
R016	Contaminated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCACTC(10)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	2.000E+03	---	DCACTU(10,1)
R016	Saturated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCACTS(10)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	6.663E-03	RLEACH(10)
R016	Distribution coefficients for Pu-240				
R016	Contaminated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCACTC(11)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	2.000E+03	---	DCACTU(11,1)
R016	Saturated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCACTS(11)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	6.663E-03	RLEACH(11)
R016	Distribution coefficients for Pu-241				
R016	Contaminated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCACTC(12)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	2.000E+03	---	DCACTU(12,1)
R016	Saturated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCACTS(12)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	6.663E-03	RLEACH(12)
R016	Distribution coefficients for Pu-242				
R016	Contaminated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCACTC(13)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	2.000E+03	---	DCACTU(13,1)
R016	Saturated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCACTS(13)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	6.663E-03	RLEACH(13)
R016	Distribution coefficients for U-236				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCACTC(23)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCACTU(23,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCACTS(23)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.661E-02	RLEACH(23)
R016	Distribution coefficients for U-238				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCACTC(24)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCACTU(24,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCACTS(24)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.661E-02	RLEACH(24)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for daughter Ac-227				
R016	Contaminated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCACTC(1)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+01	2.000E+01	---	DCACTU(1,1)
R016	Saturated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCACTS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	6.632E-02	RLEACH(1)
R016	Distribution coefficients for daughter Pa-231				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCACTC(7)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCACTU(7,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCACTS(7)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.661E-02	RLEACH(7)
R016	Distribution coefficients for daughter Pb-210				
R016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCACTC(8)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+02	1.000E+02	---	DCACTU(8,1)
R016	Saturated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCACTS(8)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.332E-02	RLEACH(8)
R016	Distribution coefficients for daughter Ra-226				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCACTC(14)
R016	Unsaturated zone 1 (cm**3/g)	7.000E+01	7.000E+01	---	DCACTU(14,1)
R016	Saturated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCACTS(14)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.902E-02	RLEACH(14)
R016	Distribution coefficients for daughter Ra-228				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCACTC(15)
R016	Unsaturated zone 1 (cm**3/g)	7.000E+01	7.000E+01	---	DCACTU(15,1)
R016	Saturated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCACTS(15)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.902E-02	RLEACH(15)
R016	Distribution coefficients for daughter Th-228				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCACTC(16)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCACTU(16,1)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCACTS(16)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.222E-05	RLEACH(16)
R016	Distribution coefficients for daughter Th-229				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCACTC(17)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCACTU(17,1)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCACTS(17)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.222E-05	RLEACH(17)
R016	Distribution coefficients for daughter Th-230				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCACTC(18)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCACTU(18,1)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCACTS(18)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.222E-05	RLEACH(18)

Site-Specific Parameter Summary (continued)

	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for daughter Th-232				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCACTC(19)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCACTU(19,1)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCACTS(19)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.222E-05	RLEACH(19)
R016	Distribution coefficients for daughter U-233				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCACTC(20)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCACTU(20,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCACTS(20)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.661E-02	RLEACH(20)
R016	Distribution coefficients for daughter U-234				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCACTC(21)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCACTU(21,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCACTS(21)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.661E-02	RLEACH(21)
R016	Distribution coefficients for daughter U-235				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCACTC(22)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCACTU(22,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCACTS(22)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.661E-02	RLEACH(22)
R017	Inhalation rate (m**3/yr)	8.400E+03	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	2.000E-04	2.000E-04	---	MLINH
R017	Dilution length for airborne dust, inhalation (m)	3.000E+00	3.000E+00	---	LM
R017	Occupancy factor, inhalation	5.000E-01	4.500E-01	---	FO3
R017	Occupancy and shielding factor, external gamma	6.000E-01	6.000E-01	---	FO1
R017	Shape factor, external gamma	1.000E+00	1.000E+00	---	FS1
R017	Fractions of annular areas within AREA:				
R017	Outer annular radius (m) = √(1/π)	not used	1.000E+00	---	FRACA(1)
R017	Outer annular radius (m) = √(10/π)	not used	1.000E+00	---	FRACA(2)
R017	Outer annular radius (m) = √(20/π)	not used	1.000E+00	---	FRACA(3)
R017	Outer annular radius (m) = √(50/π)	not used	1.000E+00	---	FRACA(4)
R017	Outer annular radius (m) = √(100/π)	not used	1.000E+00	---	FRACA(5)
R017	Outer annular radius (m) = √(200/π)	not used	1.000E+00	---	FRACA(6)
R017	Outer annular radius (m) = √(500/π)	not used	1.000E+00	---	FRACA(7)
R017	Outer annular radius (m) = √(1000/π)	not used	1.000E+00	---	FRACA(8)
R017	Outer annular radius (m) = √(5000/π)	not used	1.000E+00	---	FRACA(9)
R017	Outer annular radius (m) = √(1.E+04/π)	not used	1.000E+00	---	FRACA(10)
R017	Outer annular radius (m) = √(1.E+05/π)	not used	0.000E+00	---	FRACA(11)
R017	Outer annular radius (m) = √(1.E+06/π)	not used	0.000E+00	---	FRACA(12)
R018	Fruits, vegetables and grain consumption (kg/yr)	1.600E+02	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	1.400E+01	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	9.200E+01	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	6.300E+01	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	5.400E+00	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	9.000E-01	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	3.650E+01	0.000E+00	---	SOIL

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R018	Drinking water intake (L/yr)	4.100E+02	4.100E+02	---	DWI
R018	Fraction of drinking water from site	1.000E+00	1.000E+00	---	FDW
R019	Livestock fodder intake for meat (kg/day)	6.800E+01	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	5.500E+01	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	5.000E+01	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	1.600E+02	1.600E+02	---	LWI6
R019	Mass loading for foliar deposition (g/m**3)	1.000E-04	1.000E-04	---	MLFD
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
R019	Depth of roots (m)	9.000E-01	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	1.000E+00	1.000E+00	---	FGWDW
R019	Livestock water fraction from ground water	1.000E+00	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	1.000E+00	1.000E+00	---	FGWIR
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV
R021	Total porosity of the building foundation	1.000E-01	1.000E-01	---	TPFL
R021	Volumetric water content of the cover material	not used	5.000E-02	---	PH2OCV
R021	Volumetric water content of the foundation	1.000E-02	1.000E-02	---	PH2OFL
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	not used	2.000E-06	---	DIFCV
R021	in foundation material	2.000E-08	2.000E-08	---	DIFFL
R021	in contaminated zone soil	2.000E-06	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	2.000E+00	2.000E+00	---	HMIX
R021	Average annual wind speed (m/sec)	2.000E+00	2.000E+00	---	WIND
R021	Average building air exchange rate (1/hr)	1.000E+00	1.000E+00	---	REXG
R021	Height of the building (room) (m)	2.500E+00	2.500E+00	---	HRM
R021	Building interior area factor	1.000E+00	1.000E+00	---	FAI
R021	Bulk density of building foundation (g/cm**3)	2.400E+00	2.400E+00	---	DENSFL
R021	Thickness of building foundation (m)	1.500E-01	1.500E-01	---	FLOOR
R021	Building depth below ground surface (m)	1.000E+00	1.000E+00	---	DMFL
R021	Fraction of time spent indoors	5.000E-01	5.000E-01	---	FIND
R021	Fraction of time spent outdoors (on site)	2.500E-01	2.500E-01	---	FOTD
R021	Emanating power of Rn-222 gas	2.000E-01	2.000E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	1.000E-01	1.000E-01	---	EMANA(2)

Summary of Pathway Selections

Pathway	User Selection
1 -- external gamma	active
2 -- inhalation	active
3 -- plant ingestion	active
4 -- meat ingestion	active
5 -- milk ingestion	active
6 -- aquatic foods	active
7 -- drinking water	active
8 -- radon	active
9 -- soil ingestion	active

Contaminated Zone Dimensions

Area:	100.00 square meters
ckness:	0.15 meters
Cover Depth:	0.00 meters

Initial Soil Concentrations, pCi/g

Am-241	1.000E+01
Am-243	1.000E+01
Cm-243	1.000E+01
Cm-244	1.000E+01
Np-237	1.000E+01
Pu-238	1.000E+01
Pu-239	1.000E+01
Pu-240	1.000E+01
Pu-241	1.000E+01
Pu-242	1.000E+01
U-236	1.000E+01
U-238	1.000E+01

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 100 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	2.118E+00	4.058E+00	1.148E+01	4.107E+02	1.000E+03
TDOSE(t):	4.084E+01	3.927E+03	2.414E+01	2.126E+01	8.528E-08	4.168E-23
M(t):	4.084E-01	3.927E+01	2.414E-01	2.126E-01	8.528E-10	4.168E-25

aximum TDOSE(t): 3.927E+03 mrem/yr at t = 2.118E+00 years

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Independent Pathways

Radio-	Ground		Dust		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Am-241	1.566E-01	0.0038	3.360E+00	0.0823	0.000E+00	0.0000	1.846E-02	0.0005	3.071E-04	0.0000	1.813E-07	0.0000	1.232E-01	0.0030
Am-243	3.473E+00	0.0851	3.360E+00	0.0823	0.000E+00	0.0000	1.846E-02	0.0005	3.071E-04	0.0000	1.813E-07	0.0000	1.232E-01	0.0030
Cm-243	2.302E+00	0.0564	2.262E+00	0.0554	0.000E+00	0.0000	1.065E-01	0.0026	1.363E-03	0.0000	8.047E-07	0.0000	7.939E-02	0.0019
Cm-244	4.277E-03	0.0001	1.745E+00	0.0427	0.000E+00	0.0000	8.447E-02	0.0021	1.081E-03	0.0000	6.382E-07	0.0000	6.296E-02	0.0015
Np-237	4.918E+00	0.1204	3.166E+00	0.0775	0.000E+00	0.0000	1.432E-01	0.0035	1.832E-03	0.0000	1.082E-06	0.0000	1.068E-01	0.0026
Pu-238	4.269E-03	0.0001	2.972E+00	0.0728	0.000E+00	0.0000	1.559E-02	0.0004	2.593E-04	0.0000	1.531E-09	0.0000	1.040E-01	0.0025
Pu-239	2.360E-03	0.0001	3.295E+00	0.0807	0.000E+00	0.0000	1.764E-02	0.0004	2.934E-04	0.0000	1.733E-09	0.0000	1.177E-01	0.0029
Pu-240	4.060E-03	0.0001	3.295E+00	0.0807	0.000E+00	0.0000	1.764E-02	0.0004	2.934E-04	0.0000	1.733E-09	0.0000	1.177E-01	0.0029
Pu-241	0.000E+00	0.0000	6.462E-02	0.0016	0.000E+00	0.0000	3.527E-04	0.0000	5.868E-06	0.0000	3.466E-11	0.0000	2.354E-03	0.0001
Pu-242	3.421E-03	0.0001	3.102E+00	0.0759	0.000E+00	0.0000	1.682E-02	0.0004	2.798E-04	0.0000	1.652E-09	0.0000	1.122E-01	0.0027
U-236	3.726E-03	0.0001	7.754E-01	0.0190	0.000E+00	0.0000	9.182E-03	0.0002	1.175E-04	0.0000	1.665E-05	0.0000	6.844E-03	0.0002
U-238	3.656E-01	0.0090	7.754E-01	0.0190	0.000E+00	0.0000	9.182E-03	0.0002	1.175E-04	0.0000	1.665E-05	0.0000	6.844E-03	0.0002
Total	1.124E+01	0.2752	2.817E+01	0.6899	0.000E+00	0.0000	4.575E-01	0.0112	6.257E-03	0.0002	3.619E-05	0.0000	9.632E-01	0.0236

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.659E+00	0.0896
Am-243	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.975E+00	0.[illegible]
Cm-243	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.751E+00	0.
Cm-244	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.897E+00	0.
Np-237	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.336E+00	0.2041
Pu-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.096E+00	0.0758
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.433E+00	0.0841
Pu-240	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.435E+00	0.0841
Pu-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.733E-02	0.0016
Pu-242	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.234E+00	0.0792
U-236	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.953E-01	0.0195
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.157E+00	0.0283
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.084E+01	1.0000

Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 2.118E+00 years

Water Independent Pathways

Radio-nuclide	Ground		Dust		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Am-241	1.523E-01	0.0000	3.225E+00	0.0008	0.000E+00	0.0000	1.771E-02	0.0000	2.947E-04	0.0000	1.740E-07	0.0000	1.182E-01	0.0000
Am-243	3.384E+00	0.0009	3.235E+00	0.0008	0.000E+00	0.0000	1.777E-02	0.0000	2.956E-04	0.0000	1.746E-07	0.0000	1.186E-01	0.0000
Cm-243	5.198E-09	0.0000	7.160E-06	0.0000	0.000E+00	0.0000	3.832E-08	0.0000	6.375E-10	0.0000	3.766E-15	0.0000	2.557E-07	0.0000
Cm-244	3.274E-08	0.0000	2.623E-05	0.0000	1.467E-24	0.0000	1.404E-07	0.0000	2.335E-09	0.0000	1.387E-14	0.0000	9.369E-07	0.0000
Np-237	1.789E-07	0.0000	2.663E-05	0.0000	0.000E+00	0.0000	3.151E-07	0.0000	4.031E-09	0.0000	5.684E-10	0.0000	2.344E-07	0.0000
U-238	4.135E-03	0.0000	2.841E+00	0.0007	2.774E-15	0.0000	1.490E-02	0.0000	2.479E-04	0.0000	1.562E-09	0.0000	9.944E-02	0.0000
U-239	2.324E-03	0.0000	3.203E+00	0.0008	0.000E+00	0.0000	1.714E-02	0.0000	2.852E-04	0.0000	1.684E-09	0.0000	1.144E-01	0.0000
U-240	3.997E-03	0.0000	3.203E+00	0.0008	2.050E-19	0.0000	1.714E-02	0.0000	2.852E-04	0.0000	1.694E-09	0.0000	1.144E-01	0.0000
Pu-241	4.941E-04	0.0000	6.718E-02	0.0000	0.000E+00	0.0000	3.671E-04	0.0000	6.107E-06	0.0000	5.949E-10	0.0000	2.450E-03	0.0000
Pu-242	3.371E-03	0.0000	3.015E+00	0.0008	2.275E-25	0.0000	1.635E-02	0.0000	2.720E-04	0.0000	1.606E-09	0.0000	1.091E-01	0.0000
Th-236	3.518E-03	0.0000	7.225E-01	0.0002	1.243E-12	0.0000	8.556E-03	0.0000	1.095E-04	0.0000	1.551E-05	0.0000	6.377E-03	0.0000
Th-238	3.439E-01	0.0001	7.225E-01	0.0002	2.756E-15	0.0000	8.556E-03	0.0000	1.095E-04	0.0000	1.551E-05	0.0000	6.377E-03	0.0000
Total	3.899E+00	0.0010	2.023E+01	0.0052	1.249E-12	0.0000	1.185E-01	0.0000	1.906E-03	0.0000	3.139E-05	0.0000	6.894E-01	0.0002

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 2.118E+00 years

Water Dependent Pathways

Radio-nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Am-241	1.184E-03	0.0000	2.073E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.273E-07	0.0000	5.312E-10	0.0000	3.514E+00	0.0009
Am-243	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.756E+00	0.0017
[illegible]	1.221E+03	0.3108	5.344E+00	0.0014	0.000E+00	0.0000	0.000E+00	0.0000	2.344E-01	0.0001	5.478E-04	0.0000	1.226E+03	0.3122
[illegible]	9.398E+02	0.2393	4.115E+00	0.0010	0.000E+00	0.0000	0.000E+00	0.0000	1.805E-01	0.0000	4.218E-04	0.0000	9.441E+02	0.2404
Th-237	1.728E+03	0.4401	3.027E+00	0.0008	0.000E+00	0.0000	0.000E+00	0.0000	3.319E-01	0.0001	7.756E-04	0.0000	1.732E+03	0.4410
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.960E+00	0.0008
U-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.337E+00	0.0008
U-240	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.338E+00	0.0009
Pu-241	1.941E-06	0.0000	3.399E-09	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.728E-10	0.0000	8.711E-13	0.0000	7.050E-02	0.0000
Pu-242	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.144E+00	0.0008
Th-236	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.411E-01	0.0002
Th-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.082E+00	0.0003
Total	3.889E+03	0.9903	1.249E+01	0.0032	0.000E+00	0.0000	0.000E+00	0.0000	7.469E-01	0.0002	1.745E-03	0.0000	3.927E+03	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 4.058E+00 years

Water Independent Pathways

Radio-	Ground		Dust		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Am-241	1.485E-01	0.0062	3.105E+00	0.1286	0.000E+00	0.0000	1.706E-02	0.0007	2.837E-04	0.0000	1.676E-07	0.0000	1.138E-01	0.0047
Am-243	3.305E+00	0.1369	3.124E+00	0.1294	0.000E+00	0.0000	1.716E-02	0.0007	2.855E-04	0.0000	1.686E-07	0.0000	1.145E-01	0.0047
Cm-243	5.122E-09	0.0000	6.974E-06	0.0000	0.000E+00	0.0000	3.733E-08	0.0000	6.210E-10	0.0000	3.668E-15	0.0000	2.491E-07	0.0000
Cm-244	3.228E-08	0.0000	2.555E-05	0.0000	1.747E-23	0.0000	1.367E-07	0.0000	2.275E-09	0.0000	1.358E-14	0.0000	9.126E-07	0.0000
Np-237	2.051E-07	0.0000	2.502E-05	0.0000	0.000E+00	0.0000	2.967E-07	0.0000	3.795E-09	0.0000	5.323E-10	0.0000	2.202E-07	0.0000
Pu-238	4.016E-03	0.0002	2.726E+00	0.1129	1.870E-14	0.0000	1.429E-02	0.0006	2.378E-04	0.0000	1.582E-09	0.0000	9.540E-02	0.0040
Pu-239	2.292E-03	0.0001	3.120E+00	0.1293	0.000E+00	0.0000	1.670E-02	0.0007	2.778E-04	0.0000	1.641E-09	0.0000	1.115E-01	0.0046
Pu-240	3.941E-03	0.0002	3.119E+00	0.1292	2.284E-18	0.0000	1.669E-02	0.0007	2.777E-04	0.0000	1.658E-09	0.0000	1.114E-01	0.0046
Pu-241	8.867E-04	0.0000	6.887E-02	0.0029	0.000E+00	0.0000	3.766E-04	0.0000	6.266E-06	0.0000	1.028E-09	0.0000	2.514E-03	0.0001
Pu-242	3.326E-03	0.0001	2.937E+00	0.1217	2.935E-24	0.0000	1.592E-02	0.0007	2.649E-04	0.0000	1.565E-09	0.0000	1.063E-01	0.0044
U-236	3.338E-03	0.0001	6.772E-01	0.0281	6.925E-12	0.0000	8.019E-03	0.0003	1.026E-04	0.0000	1.454E-05	0.0000	5.977E-03	0.0002
U-238	3.252E-01	0.0135	6.772E-01	0.0281	1.847E-14	0.0000	8.019E-03	0.0003	1.026E-04	0.0000	1.454E-05	0.0000	5.977E-03	0.0002
Total	3.796E+00	0.1573	1.956E+01	0.8102	6.962E-12	0.0000	1.142E-01	0.0047	1.839E-03	0.0001	2.943E-05	0.0000	6.674E-01	0.0277

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 4.058E+00 years

Water Dependent Pathways

adio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
uclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
m-241	3.421E-14	0.0000	5.990E-17	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.570E-18	0.0000	1.535E-20	0.0000	3.385E+00	0.1402
m-243	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.561E+00	0.27[illegible]
m-243	1.759E-08	0.0000	7.701E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.378E-12	0.0000	7.894E-15	0.0000	7.284E-06	0.0[illegible]
m-244	1.318E-08	0.0000	5.772E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.532E-12	0.0000	5.916E-15	0.0000	2.665E-05	0.0[illegible]
p-237	2.611E-08	0.0000	4.572E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.015E-12	0.0000	1.172E-14	0.0000	2.577E-05	0.00[illegible]
u-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.840E+00	0.1177
u-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.251E+00	0.1347
u-240	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.252E+00	0.1347
u-241	1.043E-16	0.0000	1.827E-19	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.004E-20	0.0000	4.682E-23	0.0000	7.266E-02	0.0030
u-242	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.063E+00	0.1269
-236	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.946E-01	0.0288
-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.016E+00	0.0421
otal	5.688E-08	0.0000	1.805E-10	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.093E-11	0.0000	2.553E-14	0.0000	2.413E+01	1.0000

um of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.148E+01 years

Water Independent Pathways

adio-	Ground		Dust		Radon		Plant		Meat		Milk		Soil	
uclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
m-241	1.346E-01	0.0063	2.682E+00	0.1261	0.000E+00	0.0000	1.473E-02	0.0007	2.451E-04	0.0000	1.447E-07	0.0000	9.832E-02	0.0046
m-243	3.014E+00	0.1418	2.730E+00	0.1284	0.000E+00	0.0000	1.499E-02	0.0007	2.494E-04	0.0000	1.473E-07	0.0000	1.001E-01	0.0047
m-243	4.850E-09	0.0000	6.299E-06	0.0000	0.000E+00	0.0000	3.371E-08	0.0000	5.609E-10	0.0000	3.313E-15	0.0000	2.250E-07	0.0000
m-244	3.055E-08	0.0000	2.306E-05	0.0000	6.169E-22	0.0000	1.234E-07	0.0000	2.053E-09	0.0000	1.248E-14	0.0000	8.237E-07	0.0000
p-237	2.903E-07	0.0000	1.968E-05	0.0000	0.000E+00	0.0000	2.356E-07	0.0000	3.013E-09	0.0000	4.134E-10	0.0000	1.733E-07	0.0000
u-238	3.589E-03	0.0002	2.322E+00	0.1092	3.597E-13	0.0000	1.218E-02	0.0006	2.026E-04	0.0000	1.607E-09	0.0000	8.127E-02	0.0038
u-239	2.170E-03	0.0001	2.818E+00	0.1325	0.000E+00	0.0000	1.508E-02	0.0007	2.509E-04	0.0000	1.482E-09	0.0000	1.007E-01	0.0047
u-240	3.730E-03	0.0002	2.816E+00	0.1324	7.695E-17	0.0000	1.507E-02	0.0007	2.507E-04	0.0000	1.524E-09	0.0000	1.006E-01	0.0047
u-241	1.961E-03	0.0001	7.089E-02	0.0033	0.000E+00	0.0000	3.883E-04	0.0000	6.461E-06	0.0000	2.126E-09	0.0000	2.592E-03	0.0001
u-242	3.156E-03	0.0001	2.653E+00	0.1248	1.589E-22	0.0000	1.439E-02	0.0007	2.393E-04	0.0000	1.413E-09	0.0000	9.601E-02	0.0045
236	2.729E-03	0.0001	5.275E-01	0.0248	7.187E-11	0.0000	6.247E-03	0.0003	7.992E-05	0.0000	1.133E-05	0.0000	4.656E-03	0.0002
238	2.621E-01	0.0123	5.276E-01	0.0248	3.476E-13	0.0000	6.247E-03	0.0003	7.992E-05	0.0000	1.133E-05	0.0000	4.656E-03	0.0002
otal	3.428E+00	0.1612	1.715E+01	0.8063	7.258E-11	0.0000	9.932E-02	0.0047	1.604E-03	0.0001	2.296E-05	0.0000	5.888E-01	0.0277

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.148E+01 years

Water Dependent Pathways

dio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
clide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.930E+00	0.1378
[illegible]	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.859E+00	0.2755
[illegible]	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.563E-06	0.0000
[illegible]	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.404E-05	0.0000
-2[illegible]	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.039E-05	0.0000
-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.420E+00	0.1138
-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.936E+00	0.1381
-240	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.935E+00	0.1380
-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.584E-02	0.0036
-242	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.767E+00	0.1301
236	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.413E-01	0.0255
238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.006E-01	0.0377
tal	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.126E+01	1.0000

m of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 4.107E+02 years

Water Independent Pathways

Radio-Nuclide	Ground		Dust		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Am-243	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cm-243	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cm-244	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Np-237	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-240	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-242	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-236	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 4.107E+02 years

Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Am-243	3.088E-10	0.0036	1.352E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.932E-14	0.0000	1.386E-16	0.0000	3.102E-10	0.
Cm-243	8.079E-11	0.0009	3.537E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.552E-14	0.0000	3.626E-17	0.0000	8.116E-11	0
Cm-244	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0
Np-237	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-239	8.450E-08	0.9909	3.700E-10	0.0043	0.000E+00	0.0000	0.000E+00	0.0000	1.623E-11	0.0002	3.792E-14	0.0000	8.489E-08	0.9954
Pu-240	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-242	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-236	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	8.489E-08	0.9955	3.717E-10	0.0044	0.000E+00	0.0000	0.000E+00	0.0000	1.631E-11	0.0002	3.810E-14	0.0000	8.528E-08	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Independent Pathways

adio- uclide	Ground		Dust		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
n-243	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
n-243	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cm-244	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Np-237	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-240	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-242	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
236	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
otal	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Dependent Pathways

adio- clide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
n-243	3.751E-25	0.0090	1.642E-27	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.205E-29	0.0000	0.000E+00	0.0000	3.768E-25	0.0090
	4.466E-26	0.0011	1.955E-28	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.485E-26	0.0011
	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-239	4.107E-23	0.9854	1.798E-25	0.0043	0.000E+00	0.0000	0.000E+00	0.0000	7.889E-27	0.0002	1.843E-29	0.0000	4.126E-23	0.9899
240	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
242	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
236	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
al	4.149E-23	0.9955	1.817E-25	0.0044	0.000E+00	0.0000	0.000E+00	0.0000	7.961E-27	0.0002	1.843E-29	0.0000	4.168E-23	1.0000

m of all water independent and dependent pathways.

Dose/Source Ratios Summed Over All Pathways, (mrem/yr)/(pCi/g)

Nuclide (i)	t= 0.000E+00	2.118E+00	4.058E+00	1.148E+01	4.107E+02	1.000E+03
Am-241	3.659E-01	3.514E-01	3.385E-01	2.930E-01	0.000E+00	0.000E+00
Am-243	6.975E-01	6.756E-01	6.561E-01	5.859E-01	3.102E-11	3.768E-26
Cm-243	4.751E-01	1.226E+02	7.284E-07	6.563E-07	8.116E-12	4.485E-27
Cm-244	1.897E-01	9.441E+01	2.665E-06	2.404E-06	0.000E+00	0.000E+00
Np-237	8.336E-01	1.732E+02	2.577E-06	2.039E-06	0.000E+00	0.000E+00
Pu-238	3.096E-01	2.960E-01	2.840E-01	2.420E-01	0.000E+00	0.000E+00
Pu-239	3.433E-01	3.337E-01	3.251E-01	2.936E-01	8.489E-09	4.126E-24
Pu-240	3.435E-01	3.338E-01	3.252E-01	2.935E-01	0.000E+00	0.000E+00
Pu-241	6.733E-03	7.050E-03	7.266E-03	7.584E-03	0.000E+00	0.000E+00
Pu-242	3.234E-01	3.144E-01	3.063E-01	2.767E-01	0.000E+00	0.000E+00
U-236	7.953E-02	7.411E-02	6.946E-02	5.413E-02	0.000E+00	0.000E+00
U-238	1.157E-01	1.082E-01	1.016E-01	8.006E-02	0.000E+00	0.000E+00

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 100 mrem/yr

Nuclide (i)	t= 0.000E+00	2.118E+00	4.058E+00	1.148E+01	4.107E+02	1.000E+03
Am-241	2.733E+02	2.845E+02	2.955E+02	3.413E+02	*3.424E+12	*3.424E+12
Am-243	1.434E+02	1.480E+02	1.524E+02	1.707E+02	*1.995E+11	*1.995E+11
Cm-243	2.105E+02	8.156E-01	1.373E+08	1.524E+08	1.232E+13	*5.159E+13
Cm-244	5.270E+02	1.059E+00	3.753E+07	4.160E+07	*8.086E+13	*8.086E+13
Np-237	1.200E+02	5.775E-01	3.880E+07	4.905E+07	*7.045E+08	*7.045E+08
Pu-238	3.230E+02	3.378E+02	3.521E+02	4.133E+02	*1.711E+13	*1.711E+13
Pu-239	2.913E+02	2.996E+02	3.076E+02	3.406E+02	1.178E+10	*6.203E+10
Pu-240	2.911E+02	2.995E+02	3.075E+02	3.407E+02	*2.266E+11	*2.266E+11
Pu-241	1.485E+04	1.418E+04	1.376E+04	1.319E+04	*1.030E+14	*1.030E+14
Pu-242	3.092E+02	3.181E+02	3.265E+02	3.614E+02	*3.927E+09	*3.927E+09
U-236	1.257E+03	1.349E+03	1.440E+03	1.848E+03	*6.465E+08	*6.465E+08
U-238	8.642E+02	9.246E+02	9.838E+02	1.249E+03	*3.360E+05	*3.360E+05

*At specific activity limit

Summed Dose/Source Ratios DSR(i,t) in (mrem/yr)/(pCi/g)
and Single Radionuclide Soil Guidelines G(i,t) in pCi/g
at tmin = time of minimum single radionuclide soil guideline
and at tmax = time of maximum total dose = 2.118E+00 years

Nuclide (i)	Initial pCi/g	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
Am-241	1.000E+01	0.000E+00	3.659E-01	2.733E+02	3.514E-01	2.845E+02
Am-243	1.000E+01	0.000E+00	6.975E-01	1.434E+02	6.756E-01	1.480E+02
Cm-243	1.000E+01	2.118E+00	1.226E+02	8.156E-01	1.226E+02	8.156E-01
Cm-244	1.000E+01	2.118E+00	9.441E+01	1.059E+00	9.441E+01	1.059E+00
Np-237	1.000E+01	2.118E+00	1.732E+02	5.775E-01	1.732E+02	5.775E-01
Pu-238	1.000E+01	0.000E+00	3.096E-01	3.230E+02	2.960E-01	3.378E+02
Pu-239	1.000E+01	0.000E+00	3.433E-01	2.913E+02	3.337E-01	2.996E+02
Pu-240	1.000E+01	0.000E+00	3.435E-01	2.911E+02	3.338E-01	2.995E+02
Pu-241	1.000E+01	11.481 ± 0.003	7.584E-03	1.319E+04	7.050E-03	1.418E+04
Pu-242	1.000E+01	0.000E+00	3.234E-01	3.092E+02	3.144E-01	3.181E+02
U-236	1.000E+01	0.000E+00	7.953E-02	1.257E+03	7.411E-02	1.349E+03
U-238	1.000E+01	0.000E+00	1.157E-01	8.642E+02	1.082E-01	9.246E+02

RESRAD
(RESIDUAL RADIOACTIVITY MATERIALS PROGRAM)

SOIL GUIDELINE CALCULATIONS
WEST JEFFERSON RADIONUCLIDES
5 METER SOIL COVER

Table of Contents

·t I: Mixture Sums and Single Radionuclide Guidelines

.ite-Specific Parameter Summary 2
.ummary of Pathway Selections 8
Contaminated Zone and Total Dose Summary 9
Total Dose Components
Time = 0.000E+00 12
Time = 1.000E-02 14
Time = 8.210E-01 16
Time = 1.511E+00 18
Time = 1.461E+02 20
Time = 2.246E+02 22
Time = 3.951E+02 24
Time = 1.000E+03 26
Dose/Source Ratios and Radionuclide Soil Guidelines 28

Site-Specific Parameter Summary

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R011	Area of contaminated zone (m**2)	1.000E+02	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	1.500E-01	1.000E+00	---	THICKO
R011	Length parallel to aquifer flow (m)	1.000E+02	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	1.000E+02	1.000E+02	---	BRLD
R011	Time since placement of material (yr)	0.000E+00	0.000E+00	---	TI
R011	Times for calculations (yr)	1.000E-02	1.000E+00	---	T(2)
R011	Times for calculations (yr)	8.210E-01	3.000E+00	---	T(3)
R011	Times for calculations (yr)	1.511E+00	1.000E+01	---	T(4)
R011	Times for calculations (yr)	1.461E+02	3.000E+01	---	T(5)
R011	Times for calculations (yr)	2.246E+02	1.000E+02	---	T(6)
R011	Times for calculations (yr)	3.951E+02	3.000E+02	---	T(7)
R011	Times for calculations (yr)	1.000E+03	1.000E+03	---	T(8)
R011	Times for calculations (yr)	not used	3.000E+03	---	T(9)
R011	Times for calculations (yr)	not used	1.000E+04	---	T(10)
R012	Initial principal radionuclide (pCi/g): Ac-227	1.000E+01	0.000E+00	---	S(1)
R012	Initial principal radionuclide (pCi/g): C-14	1.000E+01	0.000E+00	---	S(2)
R012	Initial principal radionuclide (pCi/g): Ce-144	1.000E+01	0.000E+00	---	S(3)
R012	Initial principal radionuclide (pCi/g): Co-60	1.000E+01	0.000E+00	---	S(4)
R012	Initial principal radionuclide (pCi/g): Cs-134	1.000E+01	0.000E+00	---	S(5)
R012	Initial principal radionuclide (pCi/g): Cs-137	1.000E+01	0.000E+00	---	S(6)
R012	Initial principal radionuclide (pCi/g): Eu-152	1.000E+01	0.000E+00	---	S(7)
R012	Initial principal radionuclide (pCi/g): Eu-154	1.000E+01	0.000E+00	---	S(8)
R012	Initial principal radionuclide (pCi/g): Eu-155	1.000E+01	0.000E+00	---	S(9)
R012	Initial principal radionuclide (pCi/g): Fe-55	1.000E+01	0.000E+00	---	S(10)
R012	Initial principal radionuclide (pCi/g): H-3	1.000E+01	0.000E+00	---	S(11)
R012	Initial principal radionuclide (pCi/g): I-129	1.000E+01	0.000E+00	---	S(12)
R012	Initial principal radionuclide (pCi/g): Mn-54	1.000E+01	0.000E+00	---	S(13)
R012	Initial principal radionuclide (pCi/g): Ni-59	1.000E+01	0.000E+00	---	S(14)
R012	Initial principal radionuclide (pCi/g): Ni-63	1.000E+01	0.000E+00	---	S(15)
R012	Initial principal radionuclide (pCi/g): Pa-231	1.000E+01	0.000E+00	---	S(16)
R012	Initial principal radionuclide (pCi/g): Ru-106	1.000E+01	0.000E+00	---	S(19)
R012	Initial principal radionuclide (pCi/g): Sb-125	1.000E+01	0.000E+00	---	S(20)
R012	Initial principal radionuclide (pCi/g): Sm-151	1.000E+01	0.000E+00	---	S(21)
R012	Initial principal radionuclide (pCi/g): Sr-90	1.000E+01	0.000E+00	---	S(22)
R012	Initial principal radionuclide (pCi/g): U-233	1.000E+01	0.000E+00	---	S(25)
R012	Initial principal radionuclide (pCi/g): U-234	1.000E+01	0.000E+00	---	S(26)
R012	Initial principal radionuclide (pCi/g): U-235	1.000E+01	0.000E+00	---	S(27)
R012	Concentration in groundwater (pCi/L): Ac-227	not used	0.000E+00	---	W(1)
R012	Concentration in groundwater (pCi/L): C-14	not used	0.000E+00	---	W(2)
R012	Concentration in groundwater (pCi/L): Ce-144	not used	0.000E+00	---	W(3)
R012	Concentration in groundwater (pCi/L): Co-60	not used	0.000E+00	---	W(4)
R012	Concentration in groundwater (pCi/L): Cs-134	not used	0.000E+00	---	W(5)
R012	Concentration in groundwater (pCi/L): Cs-137	not used	0.000E+00	---	W(6)
R012	Concentration in groundwater (pCi/L): Eu-152	not used	0.000E+00	---	W(7)
R012	Concentration in groundwater (pCi/L): Eu-154	not used	0.000E+00	---	W(8)
R012	Concentration in groundwater (pCi/L): Eu-155	not used	0.000E+00	---	W(9)
R012	Concentration in groundwater (pCi/L): Fe-55	not used	0.000E+00	---	W(10)
R012	Concentration in groundwater (pCi/L): H-3	not used	0.000E+00	---	W(11)
R012	Concentration in groundwater (pCi/L): I-129	not used	0.000E+00	---	W(12)
R012	Concentration in groundwater (pCi/L): Mn-54	not used	0.000E+00	---	W(13)

Site-Specific Parameter Summary (continued)

	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
:012	Concentration in groundwater (pCi/L): Ni-59	not used	0.000E+00	---	W(14)
:012	Concentration in groundwater (pCi/L): Ni-63	not used	0.000E+00	---	W(15)
R012	Concentration in groundwater (pCi/L): Pa-231	not used	0.000E+00	---	W(16)
R012	Concentration in groundwater (pCi/L): Ru-106	not used	0.000E+00	---	W(19)
-012	Concentration in groundwater (pCi/L): Sb-125	not used	0.000E+00	---	W(20)
012	Concentration in groundwater (pCi/L): Sm-151	not used	0.000E+00	---	W(21)
012	Concentration in groundwater (pCi/L): Sr-90	not used	0.000E+00	---	W(22)
R012	Concentration in groundwater (pCi/L): U-233	not used	0.000E+00	---	W(25)
R012	Concentration in groundwater (pCi/L): U-234	not used	0.000E+00	---	W(26)
012	Concentration in groundwater (pCi/L): U-235	not used	0.000E+00	---	W(27)
R013	Cover depth (m)	5.000E+00	0.000E+00	---	COVER0
R013	Density of cover material (g/cm**3)	1.600E+00	1.600E+00	---	DENSCV
-013	Cover depth erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCV
013	Density of contaminated zone (g/cm**3)	1.600E+00	1.600E+00	---	DENSCZ
013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	4.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone effective porosity	2.000E-01	2.000E-01	---	EPCZ
013	Contaminated zone hydraulic conductivity (m/yr)	5.550E+03	1.000E+01	---	HCCZ
013	Contaminated zone b parameter	4.050E+00	5.300E+00	---	BCZ
:013	Evapotranspiration coefficient	6.000E-01	6.000E-01	---	EVAPTR
013	Precipitation (m/yr)	1.000E+00	1.000E+00	---	PRECIP
013	Irrigation (m/yr)	0.000E+00	2.000E-01	---	RI
013	Irrigation mode	overhead	overhead	---	IDITCH
013	Runoff coefficient	2.000E-01	2.000E-01	---	RUNOFF
013	Watershed area for nearby stream or pond (m**2)	1.000E+06	1.000E+06	---	WAREA
014	Density of saturated zone (g/cm**3)	1.600E+00	1.600E+00	---	DENSAQ
014	Saturated zone total porosity	4.000E-01	4.000E-01	---	TPSZ
014	Saturated zone effective porosity	2.000E-01	2.000E-01	---	EPSZ
014	Saturated zone hydraulic conductivity (m/yr)	5.550E+03	1.000E+02	---	HCSZ
	Saturated zone hydraulic gradient	2.000E-02	2.000E-02	---	HGWT
	Saturated zone b parameter	4.050E+00	5.300E+00	---	BSZ
014	Water table drop rate (m/yr)	1.000E-03	1.000E-03	---	VWT
014	Well pump intake depth (m below water table)	1.000E+01	1.000E+01	---	DWIBWT
014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL
014	Individual's use of groundwater (m**3/yr)	not used	1.500E+02	---	UW
015	Number of unsaturated zone strata	1	1	---	NS
015	Unsat. zone 1, thickness (m)	2.470E+00	4.000E+00	---	H(1)
15	Unsat. zone 1, soil density (g/cm**3)	1.600E+00	1.600E+00	---	DENSUZ(1)
15	Unsat. zone 1, total porosity	4.000E-01	4.000E-01	---	TPUZ(1)
.15	Unsat. zone 1, effective porosity	2.000E-01	2.000E-01	---	EPUZ(1)
015	Unsat. zone 1, soil-specific b parameter	4.050E+00	5.300E+00	---	BUZ(1)
15	Unsat. zone 1, hydraulic conductivity (m/yr)	5.550E+03	1.000E+02	---	HCUZ(1)
16	Distribution coefficients for Ac-227				
016	Contaminated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCACTC(1)
16	Unsaturated zone 1 (cm**3/g)	2.000E+01	2.000E+01	---	DCACTU(1,1)
16	Saturated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCACTS(1)
16	Leach rate (/yr)	0.000E+00	0.000E+00	6.632E-02	RLEACH(1)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for C-14				
R016	Contaminated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCACTC(2)
R016	Unsaturated zone 1 (cm**3/g)	0.000E+00	0.000E+00	---	DCACTU(2,1)
R016	Saturated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCACTS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.285E+01	RLEACH(2)
R016	Distribution coefficients for Ce-144				
R016	Contaminated zone (cm**3/g)	1.000E+03	1.000E+03	---	DCACTC(3)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+03	1.000E+03	---	DCACTU(3,1)
R016	Saturated zone (cm**3/g)	1.000E+03	1.000E+03	---	DCACTS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.333E-03	RLEACH(3)
R016	Distribution coefficients for Co-60				
R016	Contaminated zone (cm**3/g)	1.000E+03	1.000E+03	---	DCACTC(4)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+03	1.000E+03	---	DCACTU(4,1)
R016	Saturated zone (cm**3/g)	1.000E+03	1.000E+03	---	DCACTS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.333E-03	RLEACH(4)
R016	Distribution coefficients for Cs-134				
R016	Contaminated zone (cm**3/g)	1.000E+03	1.000E+03	---	DCACTC(5)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+03	1.000E+03	---	DCACTU(5,1)
R016	Saturated zone (cm**3/g)	1.000E+03	1.000E+03	---	DCACTS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.333E-03	RLEACH(5)
R016	Distribution coefficients for Cs-137				
R016	Contaminated zone (cm**3/g)	1.000E+03	1.000E+03	---	DCACTC(6)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+03	1.000E+03	---	DCACTU(6,1)
R016	Saturated zone (cm**3/g)	1.000E+03	1.000E+03	---	DCACTS(6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.333E-03	RLEACH(6)
R016	Distribution coefficients for Eu-152				
R016	Contaminated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCACTC(7)
R016	Unsaturated zone 1 (cm**3/g)	0.000E+00	0.000E+00	---	DCACTU(7,1)
R016	Saturated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCACTS(7)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.285E+01	RLEACH(7)
R016	Distribution coefficients for Eu-154				
R016	Contaminated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCACTC(8)
R016	Unsaturated zone 1 (cm**3/g)	0.000E+00	0.000E+00	---	DCACTU(8,1)
R016	Saturated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCACTS(8)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.285E+01	RLEACH(8)
R016	Distribution coefficients for Eu-155				
R016	Contaminated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCACTC(9)
R016	Unsaturated zone 1 (cm**3/g)	0.000E+00	0.000E+00	---	DCACTU(9,1)
R016	Saturated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCACTS(9)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.285E+01	RLEACH(9)

Site-Specific Parameter Summary (continued)

	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
016	Distribution coefficients for Fe-55				
016	Contaminated zone (cm**3/g)	1.000E+03	1.000E+03	---	DCACTC(10)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+03	1.000E+03	---	DCACTU(10,1)
R016	Saturated zone (cm**3/g)	1.000E+03	1.000E+03	---	DCACTS(10)
016	Leach rate (/yr)	0.000E+00	0.000E+00	1.333E-03	RLEACH(10)
016	Distribution coefficients for H-3				
R016	Contaminated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCACTC(11)
R016	Unsaturated zone 1 (cm**3/g)	0.000E+00	0.000E+00	---	DCACTU(11,1)
016	Saturated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCACTS(11)
016	Leach rate (/yr)	0.000E+00	0.000E+00	1.285E+01	RLEACH(11)
R016	Distribution coefficients for I-129				
016	Contaminated zone (cm**3/g)	1.000E-01	1.000E-01	---	DCACTC(12)
016	Unsaturated zone 1 (cm**3/g)	1.000E-01	1.000E-01	---	DCACTU(12,1)
016	Saturated zone (cm**3/g)	1.000E-01	1.000E-01	---	DCACTS(12)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	6.544E+00	RLEACH(12)
016	Distribution coefficients for Mn-54				
016	Contaminated zone (cm**3/g)	2.000E+02	2.000E+02	---	DCACTC(13)
016	Unsaturated zone 1 (cm**3/g)	2.000E+02	2.000E+02	---	DCACTU(13,1)
016	Saturated zone (cm**3/g)	2.000E+02	2.000E+02	---	DCACTS(13)
016	Leach rate (/yr)	0.000E+00	0.000E+00	6.663E-03	RLEACH(13)
016	Distribution coefficients for Ni-59				
016	Contaminated zone (cm**3/g)	1.000E+03	1.000E+03	---	DCACTC(14)
016	Unsaturated zone 1 (cm**3/g)	1.000E+03	1.000E+03	---	DCACTU(14,1)
016	Saturated zone (cm**3/g)	1.000E+03	1.000E+03	---	DCACTS(14)
016	Leach rate (/yr)	0.000E+00	0.000E+00	1.333E-03	RLEACH(14)
[illegible]	Distribution coefficients for Ni-63				
[illegible]	Contaminated zone (cm**3/g)	1.000E+03	1.000E+03	---	DCACTC(15)
[illegible]	Unsaturated zone 1 (cm**3/g)	1.000E+03	1.000E+03	---	DCACTU(15,1)
016	Saturated zone (cm**3/g)	1.000E+03	1.000E+03	---	DCACTS(15)
016	Leach rate (/yr)	0.000E+00	0.000E+00	1.333E-03	RLEACH(15)
016	Distribution coefficients for Pa-231				
016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCACTC(16)
016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCACTU(16,1)
016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCACTS(16)
016	Leach rate (/yr)	0.000E+00	0.000E+00	2.661E-02	RLEACH(16)
016	Distribution coefficients for Ru-106				
016	Contaminated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCACTC(19)
016	Unsaturated zone 1 (cm**3/g)	0.000E+00	0.000E+00	---	DCACTU(19,1)
016	Saturated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCACTS(19)
016	Leach rate (/yr)	0.000E+00	0.000E+00	1.285E+01	RLEACH(19)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for Sb-125				
R016	Contaminated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCACTC(20)
R016	Unsaturated zone 1 (cm**3/g)	0.000E+00	0.000E+00	---	DCACTU(20,1)
R016	Saturated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCACTS(20)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.285E+01	RLEACH(20)
R016	Distribution coefficients for Sm-151				
R016	Contaminated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCACTC(21)
R016	Unsaturated zone 1 (cm**3/g)	0.000E+00	0.000E+00	---	DCACTU(21,1)
R016	Saturated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCACTS(21)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.285E+01	RLEACH(21)
R016	Distribution coefficients for Sr-90				
R016	Contaminated zone (cm**3/g)	3.000E+01	3.000E+01	---	DCACTC(22)
R016	Unsaturated zone 1 (cm**3/g)	3.000E+01	3.000E+01	---	DCACTU(22,1)
R016	Saturated zone (cm**3/g)	3.000E+01	3.000E+01	---	DCACTS(22)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.429E-02	RLEACH(22)
R016	Distribution coefficients for U-233				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCACTC(25)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCACTU(25,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCACTS(25)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.661E-02	RLEACH(25)
R016	Distribution coefficients for U-234				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCACTC(26)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCACTU(26,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCACTS(26)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.661E-02	RLEACH(26)
R016	Distribution coefficients for U-235				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCACTC(27)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCACTU(27,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCACTS(27)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.661E-02	RLEACH(27)
R016	Distribution coefficients for daughter Pb-210				
R016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCACTC(17)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+02	1.000E+02	---	DCACTU(17,1)
R016	Saturated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCACTS(17)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.332E-02	RLEACH(17)
R016	Distribution coefficients for daughter Ra-226				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCACTC(18)
R016	Unsaturated zone 1 (cm**3/g)	7.000E+01	7.000E+01	---	DCACTU(18,1)
R016	Saturated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCACTS(18)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.902E-02	RLEACH(18)

Site-Specific Parameter Summary (continued)

	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
016	Distribution coefficients for daughter Th-229				
016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCACTC(23)
K016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCACTU(23,1)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCACTS(23)
-016	Leach rate (/yr)	0.000E+00	0.000E+00	2.222E-05	RLEACH(23)
016	Distribution coefficients for daughter Th-230				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCACTC(24)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCACTU(24,1)
016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCACTS(24)
016	Leach rate (/yr)	0.000E+00	0.000E+00	2.222E-05	RLEACH(24)
R017	Inhalation rate (m**3/yr)	8.400E+03	8.400E+03	---	INHALR
-017	Mass loading for inhalation (g/m**3)	2.000E-04	2.000E-04	---	MLINH
017	Dilution length for airborne dust, inhalation (m)	3.000E+00	3.000E+00	---	LM
017	Occupancy factor, inhalation	5.000E-01	4.500E-01	---	FO3
R017	Occupancy and shielding factor, external gamma	6.000E-01	6.000E-01	---	FO1
R017	Shape factor, external gamma	1.000E+00	1.000E+00	---	FS1
017	Fractions of annular areas within AREA:				
017	Outer annular radius (m) = √(1/π)	not used	1.000E+00	---	FRACA(1)
R017	Outer annular radius (m) = √(10/π)	not used	1.000E+00	---	FRACA(2)
R017	Outer annular radius (m) = √(20/π)	not used	1.000E+00	---	FRACA(3)
017	Outer annular radius (m) = √(50/π)	not used	1.000E+00	---	FRACA(4)
017	Outer annular radius (m) = √(100/π)	not used	1.000E+00	---	FRACA(5)
017	Outer annular radius (m) = √(200/π)	not used	1.000E+00	---	FRACA(6)
R017	Outer annular radius (m) = √(500/π)	not used	1.000E+00	---	FRACA(7)
R017	Outer annular radius (m) = √(1000/π)	not used	1.000E+00	---	FRACA(8)
017	Outer annular radius (m) = √(5000/π)	not used	1.000E+00	---	FRACA(9)
017	Outer annular radius (m) = √(1.E+04/π)	not used	1.000E+00	---	FRACA(10)
017	Outer annular radius (m) = √(1.E+05/π)	not used	0.000E+00	---	FRACA(11)
017	Outer annular radius (m) = √(1.E+06/π)	not used	0.000E+00	---	FRACA(12)
	Fruits, vegetables and grain consumption (kg/yr)	1.600E+02	1.600E+02	---	DIET(1)
018	Leafy vegetable consumption (kg/yr)	1.400E+01	1.400E+01	---	DIET(2)
018	Milk consumption (L/yr)	9.200E+01	9.200E+01	---	DIET(3)
018	Meat and poultry consumption (kg/yr)	6.300E+01	6.300E+01	---	DIET(4)
018	Fish consumption (kg/yr)	5.400E+00	5.400E+00	---	DIET(5)
018	Other seafood consumption (kg/yr)	9.000E-01	9.000E-01	---	DIET(6)
018	Soil ingestion rate (g/yr)	3.650E+01	0.000E+00	---	SOIL
018	Drinking water intake (L/yr)	4.100E+02	4.100E+02	---	DWI
018	Fraction of drinking water from site	1.000E+00	1.000E+00	---	FDW
019	Livestock fodder intake for meat (kg/day)	6.800E+01	6.800E+01	---	LFI5
019	Livestock fodder intake for milk (kg/day)	5.500E+01	5.500E+01	---	LFI6
019	Livestock water intake for meat (L/day)	5.000E+01	5.000E+04	---	LWI5
019	Livestock water intake for milk (L/day)	1.600E+02	1.600E+02	---	LWI6
019	Mass loading for foliar deposition (g/m**3)	1.000E-04	1.000E-04	---	MLFD
019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
019	Depth of roots (m)	9.000E-01	9.000E-01	---	DROOT
019	Drinking water fraction from ground water	1.000E+00	1.000E+00	---	FGWDW
019	Livestock water fraction from ground water	1.000E+00	1.000E+00	---	FGWLW

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R019	Irrigation fraction from ground water	1.000E+00	1.000E+00	---	FGWIR
R021	Total porosity of the cover material	4.000E-01	4.000E-01	---	TPCV
R021	Total porosity of the building foundation	1.000E-01	1.000E-01	---	TPFL
R021	Volumetric water content of the cover material	5.000E-02	5.000E-02	---	PH2OCV
R021	Volumetric water content of the foundation	1.000E-02	1.000E-02	---	PH2OFL
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	2.000E-06	2.000E-06	---	DIFCV
R021	in foundation material	2.000E-08	2.000E-08	---	DIFFL
R021	in contaminated zone soil	2.000E-06	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	2.000E+00	2.000E+00	---	HMIX
R021	Average annual wind speed (m/sec)	2.000E+00	2.000E+00	---	WIND
R021	Average building air exchange rate (1/hr)	1.000E+00	1.000E+00	---	REXG
R021	Height of the building (room) (m)	2.500E+00	2.500E+00	---	HRM
R021	Building interior area factor	1.000E+00	1.000E+00	---	FAI
R021	Bulk density of building foundation (g/cm**3)	2.400E+00	2.400E+00	---	DENSFL
R021	Thickness of building foundation (m)	1.500E-01	1.500E-01	---	FLOOR
R021	Building depth below ground surface (m)	1.000E+00	1.000E+00	---	DMFL
R021	Fraction of time spent indoors	5.000E-01	5.000E-01	---	FIND
R021	Fraction of time spent outdoors (on site)	2.500E-01	2.500E-01	---	FOTD
R021	Emanating power of Rn-222 gas	2.000E-01	2.000E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.000E-01	---	EMANA(2)

Summary of Pathway Selections

Pathway	User Selection
1 -- external gamma	active
2 -- inhalation	active
3 -- plant ingestion	active
4 -- meat ingestion	active
5 -- milk ingestion	active
6 -- aquatic foods	active
7 -- drinking water	active
8 -- radon	active
9 -- soil ingestion	active

Contaminated Zone Dimensions

Area:	100.00 square meters
Thickness:	0.15 meters
Cover Depth:	5.00 meters

Initial Soil Concentrations, pCi/g

Ac-227	1.000E+01
C-14	1.000E+01
Ce-144	1.000E+01
Co-60	1.000E+01
Cs-134	1.000E+01
Cs-137	1.000E+01
Eu-152	1.000E+01
Eu-154	1.000E+01
Eu-155	1.000E+01
Fe-55	1.000E+01
H-3	1.000E+01
I-129	1.000E+01
Mn-54	1.000E+01
Ni-59	1.000E+01
Ni-63	1.000E+01
Pa-231	1.000E+01
Ru-106	1.000E+01
Sb-125	1.000E+01
Sm-151	1.000E+01
Sr-90	1.000E+01
U-233	1.000E+01
U-234	1.000E+01
U-235	1.000E+01

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 100 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E-02	8.210E-01	1.511E+00	1.461E+02	2.246E+02	3.951E+02	1.000E+03
TDOSE(t):	6.935E-23	3.360E-16	1.457E+01	7.972E+01	5.668E+01	4.060E-01	1.778E+01	3.693E-03
M(t):	6.935E-25	3.360E-18	1.457E-01	7.972E-01	5.668E-01	4.060E-03	1.778E-01	3.693E-05

Sum TDOSE(t): 7.973E+01 mrem/yr at t = 1.5113 ± 0.0005 years

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.5113 years

Water Independent Pathways

Radio-	Ground		Dust		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ce-144	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	1.941E-23	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-134	5.311E-28	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	2.723E-28	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-154	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Fe-55	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
I-129	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Mn-54	2.370E-25	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ni-59	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ru-106	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sb-125	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sm-151	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
J-233	4.260E-27	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
J-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
J-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	1.965E-23	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.5113 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
C-14	1.313E-04	0.0000	1.835E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.497E-04	0.0000
Ce-144	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.941E-23	0.0000
Cs-134	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.311E-28	0.0000
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.723E-28	0.0000
Eu-152	3.463E-04	0.0000	1.516E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.651E-08	0.0000	1.554E-10	0.0000	3.479E-04	0.0000
Eu-154	5.032E-04	0.0000	2.203E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.666E-08	0.0000	2.258E-10	0.0000	5.056E-04	0.0000
Eu-155	6.584E-05	0.0000	2.883E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.265E-08	0.0000	2.955E-11	0.0000	6.614E-05	0.0000
Fe-55	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
H-3	3.620E-06	0.0000	8.683E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.620E-06	0.0000
I-129	7.950E+01	0.9971	2.875E-02	0.0004	0.000E+00	0.0000	0.000E+00	0.0000	6.108E-02	0.0008	1.427E-01	0.0018	7.973E+01	1.0000
Mn-54	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.370E-25	0.0000
Ni-59	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ru-106	4.904E-04	0.0000	6.721E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.884E-08	0.0000	4.401E-11	0.0000	4.911E-04	0.0000
Sb-125	1.114E-04	0.0000	6.788E-09	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.284E-08	0.0000	1.500E-08	0.0000	1.115E-04	0.0000
Sm-151	2.102E-05	0.0000	9.204E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.038E-09	0.0000	9.435E-12	0.0000	2.112E-05	0.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-233	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.260E-27	0.0000
U-234	0.000E+00	0.0000	0.000E+00	0.0000	7.869E-10	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.869E-10	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	7.950E+01	0.9971	2.878E-02	0.0004	7.869E-10	0.0000	0.000E+00	0.0000	6.108E-02	0.0008	1.427E-01	0.0018	7.973E+01	1.0000

Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Independent Pathways

Radio-	Ground		Dust		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ce-144	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	2.333E-23	0.3364	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-134	8.670E-28	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	2.769E-28	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-152	3.802E-23	0.5482	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-154	7.207E-24	0.1039	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Fe-55	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
I-129	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Mn-54	7.996E-25	0.0115	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ni-59	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ru-106	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sb-125	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sm-151	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-233	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	6.935E-23	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
c-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
e-144	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
o-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.333E-23	0.3364
s-134	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.670E-28	0.0000
s-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.769E-28	0.0000
u-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.802E-23	0.5482
u-154	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.207E-24	0.1039
u-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
e-55	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-129	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
n-54	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.996E-25	0.0115
i-59	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
i-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
a-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
u-106	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
b-125	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
n-151	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
r-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
233	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
tal	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.935E-23	1.0000

* of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E-02 years

Water Independent Pathways

Radio-	Ground		Dust		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ce-144	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	2.330E-23	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-134	8.642E-28	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	2.769E-28	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-152	3.342E-23	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-154	6.333E-24	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Fe-55	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
I-129	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Mn-54	7.931E-25	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ni-59	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ru-106	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sb-125	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sm-151	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-233	2.831E-29	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	0.000E+00	0.0000	0.000E+00	0.0000	3.360E-16	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	6.385E-23	0.0000	0.000E+00	0.0000	3.360E-16	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E-02 years

Water Dependent Pathways

Radio-nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
^c-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
e-144	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.330E-23	0.0000
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.642E-28	0.0000
Cs-134	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.769E-28	0.0000
s-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.342E-23	0.0000
u-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.333E-24	0.0000
Eu-154	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
^e-55	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-129	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.931E-25	0.0000
Mn-54	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ni-59	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
i-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
a-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
xu-106	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sb-125	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
^m-151	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
r-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-233	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.831E-29	0.0000
J-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.360E-16	1.0000
J-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
otal	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.360E-16	1.0000

's of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 8.210E-01 years

Water Independent Pathways

Radio-	Ground		Dust		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ce-144	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	2.111E-23	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-134	6.643E-28	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	2.744E-28	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-152	9.619E-28	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-154	1.782E-28	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Fe-55	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
I-129	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Mn-54	4.130E-25	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ni-59	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ru-106	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sb-125	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sm-151	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-233	2.319E-27	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	0.000E+00	0.0000	0.000E+00	0.0000	2.238E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	2.153E-23	0.0000	0.000E+00	0.0000	2.238E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 8.210E-01 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
C-14	9.309E-01	0.0639	1.301E-01	0.0089	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.061E+00	0.0728
Ce-144	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.111E-23	0.0000
Cs-134	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.643E-28	0.0000
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.744E-28	0.0000
Eu-152	2.546E+00	0.1747	1.115E-02	0.0008	0.000E+00	0.0000	0.000E+00	0.0000	4.890E-04	0.0000	1.143E-06	0.0000	2.558E+00	0.1755
Eu-154	3.773E+00	0.2590	1.652E-02	0.0011	0.000E+00	0.0000	0.000E+00	0.0000	7.247E-04	0.0000	1.693E-06	0.0000	3.790E+00	0.2601
Eu-155	5.139E-01	0.0353	2.250E-03	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	9.870E-05	0.0000	2.306E-07	0.0000	5.162E-01	0.0354
Fe-55	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
H-3	2.667E-02	0.0018	6.397E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.667E-02	0.0018
I-129	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Mn-54	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.130E-25	0.0000
Ni-59	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ru-106	5.522E+00	0.3789	7.568E-03	0.0005	0.000E+00	0.0000	0.000E+00	0.0000	2.121E-04	0.0000	4.956E-07	0.0000	5.529E+00	0.3795
Sb-125	9.386E-01	0.0644	5.718E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.082E-04	0.0000	1.264E-04	0.0000	9.389E-01	0.0644
Sm-151	1.498E-01	0.0103	6.558E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.877E-05	0.0000	6.722E-08	0.0000	1.505E-01	0.0103
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-233	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.319E-27	0.0000
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.238E-12	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	1.440E+01	0.9883	1.683E-01	0.0115	0.000E+00	0.0000	0.000E+00	0.0000	1.662E-03	0.0001	1.300E-04	0.0000	1.457E+01	1.0000

* of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.511E+00 years

Water Independent Pathways

Radio-	Ground		Dust		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ce-144	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	1.941E-23	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-134	5.311E-28	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	2.724E-28	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-154	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Fe-55	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
I-129	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Mn-54	2.370E-25	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ni-59	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ru-106	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sb-125	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sm-151	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-233	4.259E-27	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	0.000E+00	0.0000	0.000E+00	0.0000	7.507E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	1.965E-23	0.0000	0.000E+00	0.0000	7.507E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.511E+00 years

Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
C-14	1.318E-04	0.0000	1.842E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.502E-04	0.0000
Ce-144	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.941E-23	0.0000
Cs-134	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.311E-28	0.0000
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.724E-28	0.0000
Eu-152	3.475E-04	0.0000	1.521E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.675E-08	0.0000	1.560E-10	0.0000	3.491E-04	0.0000
Eu-154	5.051E-04	0.0000	2.211E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.701E-08	0.0000	2.267E-10	0.0000	5.074E-04	0.0000
Eu-155	6.608E-05	0.0000	2.893E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.269E-08	0.0000	2.965E-11	0.0000	6.638E-05	0.0000
Fe-55	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
H-3	3.633E-06	0.0000	8.714E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.633E-06	0.0000
I-129	7.948E+01	0.9971	2.875E-02	0.0004	0.000E+00	0.0000	0.000E+00	0.0000	6.107E-02	0.0008	1.427E-01	0.0018	7.972E+01	1.0000
Mn-54	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.370E-25	0.0000
Ni-59	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ru-106	4.922E-04	0.0000	6.746E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.891E-08	0.0000	4.418E-11	0.0000	4.929E-04	0.0000
Sb-125	1.118E-04	0.0000	6.812E-09	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.289E-08	0.0000	1.506E-08	0.0000	1.119E-04	0.0000
Sm-151	2.110E-05	0.0000	9.237E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.052E-09	0.0000	9.468E-12	0.0000	2.119E-05	0.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-233	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.259E-27	0.0000
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.507E-12	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	7.949E+01	0.9971	2.877E-02	0.0004	0.000E+00	0.0000	0.000E+00	0.0000	6.107E-02	0.0008	1.427E-01	0.0018	7.972E+01	1.0000

* of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.461E+02 years

Water Independent Pathways

Radio-	Ground		Dust		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ce-144	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-134	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	5.487E-29	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-154	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Fe-55	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
I-129	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Mn-54	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ni-59	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ru-106	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sb-125	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sm-151	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-233	4.858E-25	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	1.407E-26	0.0000	0.000E+00	0.0000	1.263E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	4.999E-25	0.0000	0.000E+00	0.0000	1.263E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.461E+02 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	5.343E-01	0.0094	2.339E-03	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.026E-04	0.0000	2.398E-07	0.0000	5.367E-01	0.0095
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ce-144	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-134	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.487E-29	0.0000
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-154	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Fe-55	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
I-129	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Mn-54	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ni-59	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pa-231	5.575E+01	0.9836	2.441E-01	0.0043	0.000E+00	0.0000	0.000E+00	0.0000	1.071E-02	0.0002	2.502E-05	0.0000	5.600E+01	0.9881
Ru-106	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sb-125	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sm-151	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-233	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.858E-25	0.0000
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.263E-08	0.0000
U-235	1.370E-01	0.0024	5.998E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.631E-05	0.0000	6.148E-08	0.0000	1.376E-01	0.0024
Total	5.642E+01	0.9955	2.470E-01	0.0044	0.000E+00	0.0000	0.000E+00	0.0000	1.084E-02	0.0002	2.532E-05	0.0000	5.668E+01	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 2.246E+02 years

Water Independent Pathways

Radio-	Ground		Dust		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ce-144	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-134	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	2.300E-29	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-154	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Fe-55	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
I-129	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Mn-54	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ni-59	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ru-106	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sb-125	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sm-151	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-233	1.137E-24	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	3.681E-26	0.0000	0.000E+00	0.0000	1.562E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	1.174E-24	0.0000	0.000E+00	0.0000	1.562E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 2.246E+02 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	3.121E-04	0.0008	1.366E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.994E-08	0.0000	1.400E-10	0.0000	3.135E-04	0.0008
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ce-144	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-134	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.300E-29	0.0000
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-154	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Fe-55	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
I-129	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Mn-54	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ni-59	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pa-231	4.006E-01	0.9868	1.754E-03	0.0043	0.000E+00	0.0000	0.000E+00	0.0000	7.694E-05	0.0002	1.798E-07	0.0000	4.024E-01	0.9913
Ru-106	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sb-125	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sm-151	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sr-90	1.583E-03	0.0039	1.688E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.825E-08	0.0000	4.264E-07	0.0000	1.586E-03	0.0039
U-233	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.137E-24	0.0000
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.562E-08	0.0000
U-235	1.640E-03	0.0040	7.182E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.151E-07	0.0000	7.362E-10	0.0000	1.648E-03	0.0041
Total	4.041E-01	0.9955	1.764E-03	0.0043	0.000E+00	0.0000	0.000E+00	0.0000	7.734E-05	0.0002	6.070E-07	0.0000	4.060E-01	1.0000

* of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.951E+02 years

Water Independent Pathways

Radio-	Ground		Dust		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ce-144	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-134	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-154	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Fe-55	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
I-129	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Mn-54	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ni-59	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ru-106	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sb-125	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sm-151	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-233	6.961E-24	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	2.308E-25	0.0000	0.000E+00	0.0000	1.925E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	7.192E-24	0.0000	0.000E+00	0.0000	1.925E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.951E+02 years

Water Dependent Pathways

adio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
ᵃc-227	2.932E-11	0.0000	1.284E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.632E-15	0.0000	1.316E-17	0.0000	2.945E-11	0.0000
-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
e-144	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-134	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
s-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
ɹ-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
ɛu-154	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
ᶠe-55	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-129	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Mn-54	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ni-59	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
ᵇ-231	1.651E+01	0.9286	1.107E-02	0.0006	0.000E+00	0.0000	0.000E+00	0.0000	3.172E-03	0.0002	7.412E-06	0.0000	1.653E+01	0.9294
ɛu-106	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sb-125	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
ᵀᵐ-151	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-90	2.424E-08	0.0000	2.584E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.793E-13	0.0000	6.527E-12	0.0000	2.427E-08	0.0000
233	3.442E-01	0.0194	9.434E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.610E-05	0.0000	3.707E-05	0.0000	3.444E-01	0.0194
J-234	3.932E-01	0.0221	1.078E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.552E-05	0.0000	4.235E-05	0.0000	3.934E-01	0.0221
J-235	5.169E-01	0.0291	1.965E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.929E-05	0.0000	4.083E-05	0.0000	5.173E-01	0.0291
ɹtal	1.777E+01	0.9992	1.146E-02	0.0006	0.000E+00	0.0000	0.000E+00	0.0000	3.413E-03	0.0002	1.277E-04	0.0000	1.778E+01	1.0000

Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Independent Pathways

Radio-	Ground		Dust		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ce-144	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-134	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-154	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Fe-55	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
I-129	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Mn-54	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ni-59	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ru-106	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sb-125	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sm-151	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-233	4.272E-21	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	1.353E-22	0.0000	0.000E+00	0.0000	3.511E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	4.407E-21	0.0000	0.000E+00	0.0000	3.511E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
c-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
e-144	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-134	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
s-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
u-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-154	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
e-55	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-129	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
n-54	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
i-59	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
i-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
a-231	1.250E-05	0.0034	8.379E-09	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.402E-09	0.0000	5.612E-12	0.0000	1.251E-05	0.0034
u-106	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
b-125	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
m-151	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
r-90	2.005E-25	0.0000	2.137E-28	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.398E-29	0.0000	2.007E-25	0.0000
-233	2.028E-07	0.0001	5.560E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.896E-11	0.0000	2.185E-11	0.0000	2.029E-07	0.0001
-234	3.670E-03	0.9937	9.777E-06	0.0026	3.932E-10	0.0000	0.000E+00	0.0000	1.396E-07	0.0000	6.724E-09	0.0000	3.680E-03	0.9964
-235	5.573E-07	0.0002	2.585E-10	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.070E-10	0.0000	3.138E-11	0.0000	5.577E-07	0.0002
otal	3.683E-03	0.9973	9.786E-06	0.0026	3.932E-10	0.0000	0.000E+00	0.0000	1.422E-07	0.0000	6.782E-09	0.0000	3.693E-03	1.0000

— of all water independent and dependent pathways.

Dose/Source Ratios Summed Over All Pathways, (mrem/yr)/(pCi/g)

Nuclide (i)	t= 0.000E+00	1.000E-02	8.210E-01	1.511E+00	1.461E+02	2.246E+02	3.951E+02	1.000E+03
Ac-227	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.367E-02	3.135E-05	2.945E-12	0.000E+00
C-14	0.000E+00	0.000E+00	1.061E-01	1.502E-05	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Ce-144	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Co-60	2.333E-24	2.330E-24	2.111E-24	1.941E-24	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Cs-134	8.670E-29	8.642E-29	6.643E-29	5.311E-29	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Cs-137	2.769E-29	2.769E-29	2.744E-29	2.724E-29	5.487E-30	2.300E-30	0.000E+00	0.000E+00
Eu-152	3.802E-24	3.342E-24	2.558E-01	3.491E-05	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Eu-154	7.207E-25	6.333E-25	3.790E-01	5.074E-05	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Eu-155	0.000E+00	0.000E+00	5.162E-02	6.638E-06	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Fe-55	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
H-3	0.000E+00	0.000E+00	2.667E-03	3.633E-07	0.000E+00	0.000E+00	0.000E+00	0.000E+00
I-129	0.000E+00	0.000E+00	0.000E+00	7.972E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Mn-54	7.996E-26	7.931E-26	4.130E-26	2.370E-26	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Ni-59	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Ni-63	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Pa-231	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.600E+00	4.024E-02	1.653E+00	1.251E-06
Ru-106	0.000E+00	0.000E+00	5.529E-01	4.929E-05	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Sb-125	0.000E+00	0.000E+00	9.389E-02	1.119E-05	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Sm-151	0.000E+00	0.000E+00	1.505E-02	2.119E-06	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Sr-90	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.586E-04	2.427E-09	2.007E-26
U-233	0.000E+00	2.831E-30	2.319E-28	4.259E-28	4.858E-26	1.137E-25	3.444E-02	2.029E-08
U-234	0.000E+00	3.360E-17	2.238E-13	7.507E-13	1.263E-09	1.562E-09	3.934E-02	3.680E-04
U-235	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.376E-02	1.648E-04	5.173E-02	5.577E-08

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 100 mrem/yr

(i)	t= 0.000E+00	1.000E-02	8.210E-01	1.511E+00	1.461E+02	2.246E+02	3.951E+02	1.000E+03
c-227	*7.244E+13	*7.244E+13	*7.244E+13	*7.244E+13	1.863E+03	3.190E+06	3.395E+13	*7.244E+13
C-14	*4.454E+12	*4.454E+12	9.425E+02	6.657E+06	*4.454E+12	*4.454E+12	*4.454E+12	*4.454E+12
Ce-144	*3.190E+15	*3.190E+15	*3.190E+15	*3.190E+15	*3.190E+15	*3.190E+15	*3.190E+15	*3.190E+15
o-60	*1.131E+15	*1.131E+15	*1.131E+15	*1.131E+15	*1.131E+15	*1.131E+15	*1.131E+15	*1.131E+15
s-134	*1.294E+15	*1.294E+15	*1.294E+15	*1.294E+15	*1.294E+15	*1.294E+15	*1.294E+15	*1.294E+15
s-137	*8.652E+13	*8.652E+13	*8.652E+13	*8.652E+13	*8.652E+13	*8.652E+13	*8.652E+13	*8.652E+13
Eu-152	*1.810E+14	*1.810E+14	3.910E+02	2.865E+06	*1.810E+14	*1.810E+14	*1.810E+14	*1.810E+14
Eu-154	*2.732E+14	*2.732E+14	2.638E+02	1.971E+06	*2.732E+14	*2.732E+14	*2.732E+14	*2.732E+14
u-155	*4.651E+14	*4.651E+14	1.937E+03	1.507E+07	*4.651E+14	*4.651E+14	*4.651E+14	*4.651E+14
e-55	*2.423E+15	*2.423E+15	*2.423E+15	*2.423E+15	*2.423E+15	*2.423E+15	*2.423E+15	*2.423E+15
H-3	*9.610E+15	*9.610E+15	3.749E+04	2.753E+08	*9.610E+15	*9.610E+15	*9.610E+15	*9.610E+15
I-129	*1.733E+08	*1.733E+08	*1.733E+08	1.254E+01	*1.733E+08	*1.733E+08	*1.733E+08	*1.733E+08
n-54	*7.739E+15	*7.739E+15	*7.739E+15	*7.739E+15	*7.739E+15	*7.739E+15	*7.739E+15	*7.739E+15
-59	*8.085E+10	*8.085E+10	*8.085E+10	*8.085E+10	*8.085E+10	*8.085E+10	*8.085E+10	*8.085E+10
-63	*5.679E+13	*5.679E+13	*5.679E+13	*5.679E+13	*5.679E+13	*5.679E+13	*5.679E+13	*5.679E+13
a-231	*4.716E+10	*4.716E+10	*4.716E+10	*4.716E+10	1.786E+01	2.485E+03	6.050E+01	7.990E+07
u-106	*3.265E+15	*3.265E+15	1.809E+02	2.029E+06	*3.265E+15	*3.265E+15	*3.265E+15	*3.265E+15
-125	*1.033E+15	*1.033E+15	1.065E+03	8.939E+06	*1.033E+15	*1.033E+15	*1.033E+15	*1.033E+15
-151	*2.631E+13	*2.631E+13	6.646E+03	4.718E+07	*2.631E+13	*2.631E+13	*2.631E+13	*2.631E+13
r-90	*1.380E+14	*1.380E+14	*1.380E+14	*1.380E+14	*1.380E+14	6.307E+05	4.120E+10	*1.380E+14
-233	*9.633E+11	*9.633E+11	*9.633E+11	*9.633E+11	*9.633E+11	*9.633E+11	2.904E+03	4.928E+09
234	*6.233E+09	*6.233E+09	*6.233E+09	*6.233E+09	*6.233E+09	*6.233E+09	2.542E+03	2.718E+05
235	*2.160E+06	*2.160E+06	*2.160E+06	*2.160E+06	7.267E+03	6.068E+05	1.933E+03	*2.160E+06

At specific activity limit

Summed Dose/Source Ratios DSR(i,t) in (mrem/yr)/(pCi/g)
and Single Radionuclide Soil Guidelines G(i,t) in pCi/g
at tmin = time of minimum single radionuclide soil guideline
and at tmax = time of maximum total dose = 1.5113 ± 0.0005 years

Nuclide (i)	Initial pCi/g	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
Ac-227	1.000E+01	146.04 ± 0.04	5.377E-02	1.860E+03	0.000E+00	*7.244E+13
C-14	1.000E+01	0.8210 ± 0.0002	1.061E-01	9.425E+02	1.497E-05	6.680E+06
Ce-144	1.000E+01	0.000E+00	0.000E+00	*3.190E+15	0.000E+00	*3.190E+15
Co-60	1.000E+01	0.000E+00	2.333E-24	*1.131E+15	1.941E-24	*1.131E+15
Cs-134	1.000E+01	0.000E+00	8.670E-29	*1.294E+15	5.311E-29	*1.294E+15
Cs-137	1.000E+01	0.000E+00	2.769E-29	*8.652E+13	2.723E-29	*8.652E+13
Eu-152	1.000E+01	0.8210 ± 0.0002	2.558E-01	3.910E+02	3.479E-05	2.875E+06
Eu-154	1.000E+01	0.8210 ± 0.0002	3.790E-01	2.638E+02	5.056E-05	1.978E+06
Eu-155	1.000E+01	0.8210 ± 0.0002	5.162E-02	1.937E+03	6.614E-06	1.512E+07
Fe-55	1.000E+01	0.000E+00	0.000E+00	*2.423E+15	0.000E+00	*2.423E+15
H-3	1.000E+01	0.8210 ± 0.0002	2.667E-03	3.749E+04	3.620E-07	2.762E+08
I-129	1.000E+01	1.5110 ± 0.0005	7.972E+00	1.254E+01	7.973E+00	1.254E+01
Mn-54	1.000E+01	0.000E+00	7.996E-26	*7.739E+15	2.370E-26	*7.739E+15
Ni-59	1.000E+01	0.000E+00	0.000E+00	*8.085E+10	0.000E+00	*8.085E+10
Ni-63	1.000E+01	0.000E+00	0.000E+00	*5.679E+13	0.000E+00	*5.679E+13
Pa-231	1.000E+01	146.06 ± 0.04	5.605E+00	1.784E+01	0.000E+00	*4.716E+10
Ru-106	1.000E+01	0.8210 ± 0.0002	5.529E-01	1.809E+02	4.911E-05	2.036E+06
Sb-125	1.000E+01	0.8210 ± 0.0002	9.389E-02	1.065E+03	1.115E-05	8.972E+06
Sm-151	1.000E+01	0.8210 ± 0.0002	1.505E-02	6.646E+03	2.112E-06	4.735E+07
Sr-90	1.000E+01	224.55 ± 0.07	1.586E-04	6.307E+05	0.000E+00	*1.380E+14
U-233	1.000E+01	395.0 ± 0.1	3.441E-02	2.906E+03	4.260E-28	*9.633E+11
U-234	1.000E+01	395.1 ± 0.1	3.932E-02	2.543E+03	7.869E-11	*6.233E+09
U-235	1.000E+01	395.1 ± 0.1	5.173E-02	1.933E+03	0.000E+00	*2.160E+06

*At specific activity limit

RESRAD
(RESIDUAL RADIOACTIVITY MATERIALS PROGRAM)

SOIL GUIDELINE CALCULATIONS
WEST JEFFERSON RADIONUCLIDES
5 METER SOIL COVER
(Continued)

Table of Contents

Part I: Mixture Sums and Single Radionuclide Guidelines

Site-Specific Parameter Summary 2
Summary of Pathway Selections 7
Contaminated Zone and Total Dose Summary 8
Total Dose Components
Time = 0.000E+00 10
Time = 1.000E-02 11
Time = 8.210E-01 12
Time = 1.511E+00 13
Time = 1.461E+02 14
Time = 2.246E+02 15
Time = 3.951E+02 16
Time = 1.000E+03 17
Dose/Source Ratios and Radionuclide Soil Guidelines 18

Site-Specific Parameter Summary

	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
011	Area of contaminated zone (m**2)	1.000E+02	1.000E+04	---	AREA
011	Thickness of contaminated zone (m)	1.500E-01	1.000E+00	---	THICK0
K011	Length parallel to aquifer flow (m)	1.000E+02	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	1.000E+02	1.000E+02	---	BRLD
011	Time since placement of material (yr)	0.000E+00	0.000E+00	---	TI
011	Times for calculations (yr)	1.000E-02	1.000E+00	---	T(2)
011	Times for calculations (yr)	8.210E-01	3.000E+00	---	T(3)
R011	Times for calculations (yr)	1.511E+00	1.000E+01	---	T(4)
R011	Times for calculations (yr)	1.461E+02	3.000E+01	---	T(5)
011	Times for calculations (yr)	2.246E+02	1.000E+02	---	T(6)
011	Times for calculations (yr)	3.951E+02	3.000E+02	---	T(7)
K011	Times for calculations (yr)	1.000E+03	1.000E+03	---	T(8)
R011	Times for calculations (yr)	not used	3.000E+03	---	T(9)
011	Times for calculations (yr)	not used	1.000E+04	---	T(10)
012	Initial principal radionuclide (pCi/g): Am-241	1.000E+01	0.000E+00	---	S(2)
012	Initial principal radionuclide (pCi/g): Am-243	1.000E+01	0.000E+00	---	S(3)
012	Initial principal radionuclide (pCi/g): Cm-243	1.000E+01	0.000E+00	---	S(4)
012	Initial principal radionuclide (pCi/g): Cm-244	1.000E+01	0.000E+00	---	S(5)
012	Initial principal radionuclide (pCi/g): Np-237	1.000E+01	0.000E+00	---	S(6)
012	Initial principal radionuclide (pCi/g): Pu-238	1.000E+01	0.000E+00	---	S(9)
012	Initial principal radionuclide (pCi/g): Pu-239	1.000E+01	0.000E+00	---	S(10)
012	Initial principal radionuclide (pCi/g): Pu-240	1.000E+01	0.000E+00	---	S(11)
012	Initial principal radionuclide (pCi/g): Pu-241	1.000E+01	0.000E+00	---	S(12)
012	Initial principal radionuclide (pCi/g): Pu-242	1.000E+01	0.000E+00	---	S(13)
012	Initial principal radionuclide (pCi/g): U-236	1.000E+01	0.000E+00	---	S(23)
012	Initial principal radionuclide (pCi/g): U-238	1.000E+01	0.000E+00	---	S(24)
12	Concentration in groundwater (pCi/L): Am-241	not used	0.000E+00	---	W(2)
12	Concentration in groundwater (pCi/L): Am-243	not used	0.000E+00	---	W(3)
012	Concentration in groundwater (pCi/L): Cm-243	not used	0.000E+00	---	W(4)
012	Concentration in groundwater (pCi/L): Cm-244	not used	0.000E+00	---	W(5)
	Concentration in groundwater (pCi/L): Np-237	not used	0.000E+00	---	W(6)
	Concentration in groundwater (pCi/L): Pu-238	not used	0.000E+00	---	W(9)
12	Concentration in groundwater (pCi/L): Pu-239	not used	0.000E+00	---	W(10)
12	Concentration in groundwater (pCi/L): Pu-240	not used	0.000E+00	---	W(11)
12	Concentration in groundwater (pCi/L): Pu-241	not used	0.000E+00	---	W(12)
12	Concentration in groundwater (pCi/L): Pu-242	not used	0.000E+00	---	W(13)
12	Concentration in groundwater (pCi/L): U-236	not used	0.000E+00	---	W(23)
12	Concentration in groundwater (pCi/L): U-238	not used	0.000E+00	---	W(24)
13	Cover depth (m)	5.000E+00	0.000E+00	---	COVER0
13	Density of cover material (g/cm**3)	1.600E+00	1.600E+00	---	DENSCV
13	Cover depth erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCV
13	Density of contaminated zone (g/cm**3)	1.600E+00	1.600E+00	---	DENSCZ
13	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCZ
13	Contaminated zone total porosity	4.000E-01	4.000E-01	---	TPCZ
13	Contaminated zone effective porosity	2.000E-01	2.000E-01	---	EPCZ
13	Contaminated zone hydraulic conductivity (m/yr)	5.550E+03	1.000E+01	---	HCCZ
13	Contaminated zone b parameter	4.050E+00	5.300E+00	---	BCZ
13	Evapotranspiration coefficient	6.000E-01	6.000E-01	---	EVAPTR
13	Precipitation (m/yr)	1.000E+00	1.000E+00	---	PRECIP
3	Irrigation (m/yr)	0.000E+00	2.000E-01	---	RI

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	2.000E-01	2.000E-01	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	1.000E+06	1.000E+06	---	WAREA
R014	Density of saturated zone (g/cm**3)	1.600E+00	1.600E+00	---	DENSAQ
R014	Saturated zone total porosity	4.000E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	2.000E-01	2.000E-01	---	EPSZ
R014	Saturated zone hydraulic conductivity (m/yr)	5.550E+03	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	2.000E-02	2.000E-02	---	HGWT
R014	Saturated zone b parameter	4.050E+00	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	1.000E-03	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	1.000E+01	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL
R014	Individual's use of groundwater (m**3/yr)	not used	1.500E+02	---	UW
R015	Number of unsaturated zone strata	1	1	---	NS
R015	Unsat. zone 1, thickness (m)	2.470E+00	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	1.600E+00	1.600E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	4.000E-01	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	2.000E-01	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	4.050E+00	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	5.550E+03	1.000E+02	---	HCUZ(1)
R016	Distribution coefficients for Am-241				
R016	Contaminated zone (cm**3/g)	1.200E+02	2.000E+01	---	DCACTC(2)
R016	Unsaturated zone 1 (cm**3/g)	1.200E+02	2.000E+01	---	DCACTU(2,1)
R016	Saturated zone (cm**3/g)	1.200E+02	2.000E+01	---	DCACTS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.110E-02	RLEACH(2)
R016	Distribution coefficients for Am-243				
R016	Contaminated zone (cm**3/g)	1.200E+02	2.000E+01	---	DCACTC(3)
R016	Unsaturated zone 1 (cm**3/g)	1.200E+02	2.000E+01	---	DCACTU(3,1)
R016	Saturated zone (cm**3/g)	1.200E+02	2.000E+01	---	DCACTS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.110E-02	RLEACH(3)
R016	Distribution coefficients for Cm-243				
R016	Contaminated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCACTC(4)
R016	Unsaturated zone 1 (cm**3/g)	0.000E+00	0.000E+00	---	DCACTU(4,1)
R016	Saturated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCACTS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.285E+01	RLEACH(4)
R016	Distribution coefficients for Cm-244				
R016	Contaminated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCACTC(5)
R016	Unsaturated zone 1 (cm**3/g)	0.000E+00	0.000E+00	---	DCACTU(5,1)
R016	Saturated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCACTS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.285E+01	RLEACH(5)

Site-Specific Parameter Summary (continued)

Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
Distribution coefficients for Np-237				
Contaminated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCACTC(6)
Unsaturated zone 1 (cm**3/g)	0.000E+00	0.000E+00	---	DCACTU(6,1)
Saturated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCACTS(6)
Leach rate (/yr)	0.000E+00	0.000E+00	1.285E+01	RLEACH(6)
Distribution coefficients for Pu-238				
Contaminated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCACTC(9)
Unsaturated zone 1 (cm**3/g)	2.000E+02	2.000E+03	---	DCACTU(9,1)
Saturated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCACTS(9)
Leach rate (/yr)	0.000E+00	0.000E+00	6.663E-03	RLEACH(9)
Distribution coefficients for Pu-239				
Contaminated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCACTC(10)
Unsaturated zone 1 (cm**3/g)	2.000E+02	2.000E+03	---	DCACTU(10,1)
Saturated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCACTS(10)
Leach rate (/yr)	0.000E+00	0.000E+00	6.663E-03	RLEACH(10)
Distribution coefficients for Pu-240				
Contaminated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCACTC(11)
Unsaturated zone 1 (cm**3/g)	2.000E+02	2.000E+03	---	DCACTU(11,1)
Saturated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCACTS(11)
Leach rate (/yr)	0.000E+00	0.000E+00	6.663E-03	RLEACH(11)
Distribution coefficients for Pu-241				
Contaminated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCACTC(12)
Unsaturated zone 1 (cm**3/g)	2.000E+02	2.000E+03	---	DCACTU(12,1)
Saturated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCACTS(12)
Leach rate (/yr)	0.000E+00	0.000E+00	6.663E-03	RLEACH(12)
Distribution coefficients for Pu-242				
Contaminated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCACTC(13)
Unsaturated zone 1 (cm**3/g)	2.000E+02	2.000E+03	---	DCACTU(13,1)
Saturated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCACTS(13)
Leach rate (/yr)	0.000E+00	0.000E+00	6.663E-03	RLEACH(13)
Distribution coefficients for U-236				
Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCACTC(23)
Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCACTU(23,1)
Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCACTS(23)
Leach rate (/yr)	0.000E+00	0.000E+00	2.661E-02	RLEACH(23)
Distribution coefficients for U-238				
Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCACTC(24)
Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCACTU(24,1)
Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCACTS(24)
Leach rate (/yr)	0.000E+00	0.000E+00	2.661E-02	RLEACH(24)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for daughter Ac-227				
R016	Contaminated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCACTC(1)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+01	2.000E+01	---	DCACTU(1,1)
R016	Saturated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCACTS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	6.632E-02	RLEACH(1)
R016	Distribution coefficients for daughter Pa-231				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCACTC(7)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCACTU(7,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCACTS(7)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.661E-02	RLEACH(7)
R016	Distribution coefficients for daughter Pb-210				
R016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCACTC(8)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+02	1.000E+02	---	DCACTU(8,1)
R016	Saturated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCACTS(8)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.332E-02	RLEACH(8)
R016	Distribution coefficients for daughter Ra-226				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCACTC(14)
R016	Unsaturated zone 1 (cm**3/g)	7.000E+01	7.000E+01	---	DCACTU(14,1)
R016	Saturated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCACTS(14)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.902E-02	RLEACH(14)
R016	Distribution coefficients for daughter Ra-228				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCACTC(15)
R016	Unsaturated zone 1 (cm**3/g)	7.000E+01	7.000E+01	---	DCACTU(15,1)
R016	Saturated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCACTS(15)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.902E-02	RLEACH(15)
R016	Distribution coefficients for daughter Th-228				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCACTC(16)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCACTU(16,1)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCACTS(16)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.222E-05	RLEACH(16)
R016	Distribution coefficients for daughter Th-229				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCACTC(17)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCACTU(17,1)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCACTS(17)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.222E-05	RLEACH(17)
R016	Distribution coefficients for daughter Th-230				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCACTC(18)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCACTU(18,1)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCACTS(18)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.222E-05	RLEACH(18)

Site-Specific Parameter Summary (continued)

	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
016	Distribution coefficients for daughter Th-232				
016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCACTC(19)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCACTU(19,1)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCACTS(19)
016	Leach rate (/yr)	0.000E+00	0.000E+00	2.222E-05	RLEACH(19)
016	Distribution coefficients for daughter U-233				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCACTC(20)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCACTU(20,1)
016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCACTS(20)
016	Leach rate (/yr)	0.000E+00	0.000E+00	2.661E-02	RLEACH(20)
R016	Distribution coefficients for daughter U-234				
016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCACTC(21)
016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCACTU(21,1)
016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCACTS(21)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.661E-02	RLEACH(21)
016	Distribution coefficients for daughter U-235				
016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCACTC(22)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCACTU(22,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCACTS(22)
016	Leach rate (/yr)	0.000E+00	0.000E+00	2.661E-02	RLEACH(22)
017	Inhalation rate (m**3/yr)	8.400E+03	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	2.000E-04	2.000E-04	---	MLINH
R017	Dilution length for airborne dust, inhalation (m)	3.000E+00	3.000E+00	---	LM
017	Occupancy factor, inhalation	5.000E-01	4.500E-01	---	FO3
017	Occupancy and shielding factor, external gamma	6.000E-01	6.000E-01	---	FO1
017	Shape factor, external gamma	1.000E+00	1.000E+00	---	FS1
017	Fractions of annular areas within AREA:				
	Outer annular radius (m) = √(1/π)	not used	1.000E+00	---	FRACA(1)
	Outer annular radius (m) = √(10/π)	not used	1.000E+00	---	FRACA(2)
	Outer annular radius (m) = √(20/π)	not used	1.000E+00	---	FRACA(3)
017	Outer annular radius (m) = √(50/π)	not used	1.000E+00	---	FRACA(4)
017	Outer annular radius (m) = √(100/π)	not used	1.000E+00	---	FRACA(5)
017	Outer annular radius (m) = √(200/π)	not used	1.000E+00	---	FRACA(6)
017	Outer annular radius (m) = √(500/π)	not used	1.000E+00	---	FRACA(7)
017	Outer annular radius (m) = √(1000/π)	not used	1.000E+00	---	FRACA(8)
017	Outer annular radius (m) = √(5000/π)	not used	1.000E+00	---	FRACA(9)
017	Outer annular radius (m) = √(1.E+04/π)	not used	1.000E+00	---	FRACA(10)
017	Outer annular radius (m) = √(1.E+05/π)	not used	0.000E+00	---	FRACA(11)
017	Outer annular radius (m) = √(1.E+06/π)	not used	0.000E+00	---	FRACA(12)
018	Fruits, vegetables and grain consumption (kg/yr)	1.600E+02	1.600E+02	---	DIET(1)
018	Leafy vegetable consumption (kg/yr)	1.400E+01	1.400E+01	---	DIET(2)
018	Milk consumption (L/yr)	9.200E+01	9.200E+01	---	DIET(3)
018	Meat and poultry consumption (kg/yr)	6.300E+01	6.300E+01	---	DIET(4)
018	Fish consumption (kg/yr)	5.400E+00	5.400E+00	---	DIET(5)
018	Other seafood consumption (kg/yr)	9.000E-01	9.000E-01	---	DIET(6)
018	Soil ingestion rate (g/yr)	3.650E+01	0.000E+00	---	SOIL

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R018	Drinking water intake (L/yr)	4.100E+02	4.100E+02	---	DWI
R018	Fraction of drinking water from site	1.000E+00	1.000E+00	---	FDW
R019	Livestock fodder intake for meat (kg/day)	6.800E+01	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	5.500E+01	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	5.000E+01	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	1.600E+02	1.600E+02	---	LWI6
R019	Mass loading for foliar deposition (g/m**3)	1.000E-04	1.000E-04	---	MLFD
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
R019	Depth of roots (m)	9.000E-01	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	1.000E+00	1.000E+00	---	FGWDW
R019	Livestock water fraction from ground water	1.000E+00	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	1.000E+00	1.000E+00	---	FGWIR
R021	Total porosity of the cover material	4.000E-01	4.000E-01	---	TPCV
R021	Total porosity of the building foundation	1.000E-01	1.000E-01	---	TPFL
R021	Volumetric water content of the cover material	5.000E-02	5.000E-02	---	PH2OCV
R021	Volumetric water content of the foundation	1.000E-02	1.000E-02	---	PH2OFL
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	2.000E-06	2.000E-06	---	DIFCV
R021	in foundation material	2.000E-08	2.000E-08	---	DIFFL
R021	in contaminated zone soil	2.000E-06	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	2.000E+00	2.000E+00	---	HMIX
R021	Average annual wind speed (m/sec)	2.000E+00	2.000E+00	---	WIND
R021	Average building air exchange rate (1/hr)	1.000E+00	1.000E+00	---	REXG
R021	Height of the building (room) (m)	2.500E+00	2.500E+00	---	HRM
R021	Building interior area factor	1.000E+00	1.000E+00	---	FAI
R021	Bulk density of building foundation (g/cm**3)	2.400E+00	2.400E+00	---	DENSFL
R021	Thickness of building foundation (m)	1.500E-01	1.500E-01	---	FLOOR
R021	Building depth below ground surface (m)	1.000E+00	1.000E+00	---	DMFL
R021	Fraction of time spent indoors	5.000E-01	5.000E-01	---	FIND
R021	Fraction of time spent outdoors (on site)	2.500E-01	2.500E-01	---	FOTD
R021	Emanating power of Rn-222 gas	2.000E-01	2.000E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	1.000E-01	1.000E-01	---	EMANA(2)

Summary of Pathway Selections

Pathway	User Selection
1 -- external gamma	active
2 -- inhalation	active
3 -- plant ingestion	active
4 -- meat ingestion	active
5 -- milk ingestion	active
6 -- aquatic foods	active
7 -- drinking water	active
8 -- radon	active
9 -- soil ingestion	active

Contaminated Zone Dimensions

Area:	100.00 square meters
:kness:	0.15 meters
Cover Depth:	5.00 meters

Initial Soil Concentrations, pCi/g

Am-241	1.000E+01
Am-243	1.000E+01
Cm-243	1.000E+01
Cm-244	1.000E+01
Np-237	1.000E+01
Pu-238	1.000E+01
Pu-239	1.000E+01
Pu-240	1.000E+01
Pu-241	1.000E+01
Pu-242	1.000E+01
U-236	1.000E+01
U-238	1.000E+01

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 100 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E-02	8.210E-01	1.511E+00	1.461E+02	2.246E+02	3.951E+02	1.000E+03
TDOSE(t):	4.060E-29	8.563E-24	3.991E+03	5.585E-01	8.335E-09	1.652E-10	8.226E-01	5.208E-06
M(t):	4.060E-31	8.563E-26	3.991E+01	5.585E-03	8.335E-11	1.652E-12	8.226E-03	5.208E-08

aximum TDOSE(t): 3.991E+03 mrem/yr at t = 0.8210 ± 0.0002 years

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.8210 years

Water Independent Pathways

adio-	Ground		Dust		Radon		Plant		Meat		Milk		Soil	
uclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
[illegible]	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
m-244	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
p-237	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
u-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
u-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
u-240	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
u-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
u-242	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
236	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-238	4.015E-29	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
otal	4.015E-29	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.8210 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Am-241	4.595E-04	0.0000	8.047E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.826E-08	0.0000	2.062E-10	0.0000	4.604E-04	0.0000
Am-243	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cm-243	1.260E+03	0.3158	5.518E+00	0.0014	0.000E+00	0.0000	0.000E+00	0.0000	2.421E-01	0.0001	5.656E-04	0.0000	1.266E+03	0.3172
Cm-244	9.882E+02	0.2476	4.326E+00	0.0011	0.000E+00	0.0000	0.000E+00	0.0000	1.898E-01	0.0000	4.435E-04	0.0000	9.927E+02	0.2487
Np-237	1.729E+03	0.4332	3.028E+00	0.0008	0.000E+00	0.0000	0.000E+00	0.0000	3.321E-01	0.0001	7.760E-04	0.0000	1.732E+03	0.4341
Pu-238	0.000E+00	0.0000	0.000E+00	0.0000	1.532E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.532E-13	0.0000
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-240	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-241	2.981E-07	0.0000	5.220E-10	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.725E-11	0.0000	1.338E-13	0.0000	2.986E-07	0.0000
Pu-242	0.000E+00	0.0000	0.000E+00	0.0000	1.949E-21	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.949E-21	0.0000
U-236	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	8.375E-14	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.375E-14	0.0000
Total	3.977E+03	0.9966	1.287E+01	0.0032	2.369E-13	0.0000	0.000E+00	0.0000	7.640E-01	0.0002	1.785E-03	0.0000	3.991E+03	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Independent Pathways

adio-uclide	Ground		Dust		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
m-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
n-243	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
n-243	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cm-244	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Np-237	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-240	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-242	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
236	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
238	4.060E-29	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
otal	4.060E-29	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Dependent Pathways

adio-clide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
m-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
243	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-240	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-242	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-236	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.060E-29	1.0000
al	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.060E-29	1.0000

um of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E-02 years

Water Independent Pathways

Radio-	Ground		Dust		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Am-243	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cm-243	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cm-244	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Np-237	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-238	0.000E+00	0.0000	0.000E+00	0.0000	3.172E-24	0.3704	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-240	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-242	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-236	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	4.060E-29	0.0000	0.000E+00	0.0000	5.391E-24	0.6296	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	4.060E-29	0.0000	0.000E+00	0.0000	8.563E-24	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E-02 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Am-243	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0[illegible]
Cm-243	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.
Cm-244	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.
Np-237	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0[illegible]
Pu-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.172E-24	0.3704
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-240	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-242	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-236	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.391E-24	0.6296
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.563E-24	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 8.210E-01 years

Water Independent Pathways

Radio-Nuclide	Ground		Dust		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Am-243	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cm-243	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cm-244	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Np-237	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-238	0.000E+00	0.0000	0.000E+00	0.0000	1.733E-18	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-240	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-242	0.000E+00	0.0000	0.000E+00	0.0000	5.519E-29	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-236	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	4.015E-29	0.0000	0.000E+00	0.0000	1.729E-18	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	4.015E-29	0.0000	0.000E+00	0.0000	3.462E-18	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 8.210E-01 years

Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Am-241	4.595E-04	0.0000	8.047E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.826E-08	0.0000	2.062E-10	0.0000	4.604E-04	0.0000
Am-243	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cm-243	1.260E+03	0.3158	5.518E+00	0.0014	0.000E+00	0.0000	0.000E+00	0.0000	2.421E-01	0.0001	5.656E-04	0.0000	1.266E+03	0.3172
Cm-244	9.882E+02	0.2476	4.326E+00	0.0011	0.000E+00	0.0000	0.000E+00	0.0000	1.898E-01	0.0000	4.435E-04	0.0000	9.927E+02	0.2487
Np-237	1.729E+03	0.4332	3.028E+00	0.0008	0.000E+00	0.0000	0.000E+00	0.0000	3.321E-01	0.0001	7.760E-04	0.0000	1.732E+03	0.4341
Pu-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.733E-18	0.0000
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-240	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-241	2.981E-07	0.0000	5.220E-10	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.725E-11	0.0000	1.338E-13	0.0000	2.987E-07	0.0000
Pu-242	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.519E-29	0.0000
U-236	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.729E-18	0.0000
Total	3.978E+03	0.9966	1.287E+01	0.0032	0.000E+00	0.0000	0.000E+00	0.0000	7.640E-01	0.0002	1.785E-03	0.0000	3.991E+03	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.511E+00 years

Water Independent Pathways

Radio-	Ground		Dust		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Am-243	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cm-243	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cm-244	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Np-237	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-238	0.000E+00	0.0000	0.000E+00	0.0000	1.070E-17	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-240	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-242	0.000E+00	0.0000	0.000E+00	0.0000	6.264E-28	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-236	2.227E-29	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	3.977E-29	0.0000	0.000E+00	0.0000	1.065E-17	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	6.204E-29	0.0000	0.000E+00	0.0000	2.135E-17	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.511E+00 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Am-241	1.197E-07	0.0000	2.096E-10	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.299E-11	0.0000	5.371E-14	0.0000	1.199E-07	0.0000
Am-243	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0[illegible]
Cm-243	1.755E-01	0.3142	7.683E-04	0.0014	0.000E+00	0.0000	0.000E+00	0.0000	3.371E-05	0.0001	7.875E-08	0.0000	1.763E-01	0.[illegible]
Cm-244	1.363E-01	0.2440	5.966E-04	0.0011	0.000E+00	0.0000	0.000E+00	0.0000	2.617E-05	0.0000	6.116E-08	0.0000	1.369E-01	0.[illegible]
Np-237	2.448E-01	0.4384	4.288E-04	0.0008	0.000E+00	0.0000	0.000E+00	0.0000	4.703E-05	0.0001	1.099E-07	0.0000	2.453E-01	0.4[illegible]
Pu-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.070E-17	0.0000
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-240	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-241	1.414E-10	0.0000	2.475E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.715E-14	0.0000	6.344E-17	0.0000	1.416E-10	0.0000
Pu-242	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.264E-28	0.0000
U-236	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.227E-29	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.065E-17	0.0000
Total	5.566E-01	0.9966	1.794E-03	0.0032	0.000E+00	0.0000	0.000E+00	0.0000	1.069E-04	0.0002	2.498E-07	0.0000	5.585E-01	1.0000

Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.461E+02 years

Water Independent Pathways

adio- uclide	Ground		Dust		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
m-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
m-243	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
m-243	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cm-244	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Np-237	1.646E-29	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
J-238	0.000E+00	0.0000	0.000E+00	0.0000	1.556E-12	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
J-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-u-240	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-242	0.000E+00	0.0000	0.000E+00	0.0000	7.923E-21	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-236	1.140E-25	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-238	0.000E+00	0.0000	0.000E+00	0.0000	1.078E-12	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	1.140E-25	0.0000	0.000E+00	0.0000	2.634E-12	0.0003	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.461E+02 years

Water Dependent Pathways

adio- uclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
m-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
m-243	1.003E-11	0.0012	4.389E-14	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.926E-15	0.0000	4.499E-18	0.0000	1.007E-11	0.0012
	5.369E-12	0.0006	2.351E-14	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.031E-15	0.0000	2.410E-18	0.0000	5.394E-12	0.0006
	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.646E-29	0.0000
-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.556E-12	0.0002
-239	8.279E-09	0.9933	3.625E-11	0.0043	0.000E+00	0.0000	0.000E+00	0.0000	1.590E-12	0.0002	3.716E-15	0.0000	8.317E-09	0.9978
-240	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-242	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.923E-21	0.0000
236	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.140E-25	0.0000
238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.078E-12	0.0001
tal	8.295E-09	0.9951	3.632E-11	0.0044	0.000E+00	0.0000	0.000E+00	0.0000	1.593E-12	0.0002	3.722E-15	0.0000	8.335E-09	1.0000

um of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 2.246E+02 years

Water Independent Pathways

Radio-Nuclide	Ground		Dust		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Am-243	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cm-243	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cm-244	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Np-237	3.852E-29	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-238	0.000E+00	0.0000	0.000E+00	0.0000	2.527E-12	0.0153	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-240	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-242	0.000E+00	0.0000	0.000E+00	0.0000	1.846E-20	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-236	2.249E-25	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	1.556E-12	0.0094	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	2.249E-25	0.0000	0.000E+00	0.0000	4.083E-12	0.0247	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 2.246E+02 years

Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Am-243	3.078E-13	0.0019	1.348E-15	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.913E-17	0.0000	1.382E-19	0.0000	3.092E-13	0.0[illegible]
Cm-243	1.272E-13	0.0008	5.569E-16	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.443E-17	0.0000	5.708E-20	0.0000	1.278E-13	0.[illegible]
Cm-244	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.[illegible]
Np-237	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.852E-29	0.0[illegible]
Pu-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.527E-12	0.0153
Pu-239	1.600E-10	0.9682	7.004E-13	0.0042	0.000E+00	0.0000	0.000E+00	0.0000	3.072E-14	0.0002	7.179E-17	0.0000	1.607E-10	0.9726
Pu-240	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-242	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.846E-20	0.0000
U-236	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.249E-25	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.556E-12	0.0094
Total	1.604E-10	0.9708	7.023E-13	0.0043	0.000E+00	0.0000	0.000E+00	0.0000	3.081E-14	0.0002	7.198E-17	0.0000	1.652E-10	1.0000

Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.951E+02 years

Water Independent Pathways

adio-	Ground		Dust		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
m-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
m-243	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
m-243	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cm-244	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Np-237	2.359E-28	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
u-238	4.398E-29	0.0000	0.000E+00	0.0000	3.667E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
u-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
ru-240	3.699E-29	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
u-242	0.000E+00	0.0000	0.000E+00	0.0000	3.871E-20	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-236	9.366E-25	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-238	2.466E-29	0.0000	0.000E+00	0.0000	2.041E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	9.370E-25	0.0000	0.000E+00	0.0000	5.708E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.951E+02 years

Water Dependent Pathways

:adio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
uclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
m-241	3.471E-06	0.0000	9.515E-10	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.667E-10	0.0000	3.739E-10	0.0000	3.473E-06	0.0000
3	9.244E-10	0.0000	2.934E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.776E-13	0.0000	8.873E-14	0.0000	9.250E-10	0.0000
	1.811E-10	0.0000	5.989E-14	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.479E-14	0.0000	1.673E-14	0.0000	1.812E-10	0.0000
	1.117E-07	0.0000	3.062E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.146E-11	0.0000	1.203E-11	0.0000	1.118E-07	0.0000
237	6.460E-02	0.0785	1.771E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.241E-05	0.0000	6.958E-06	0.0000	6.463E-02	0.0786
u-238	1.346E-04	0.0002	3.691E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.586E-08	0.0000	1.450E-08	0.0000	1.347E-04	0.0002
u-239	1.733E-07	0.0000	5.815E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.329E-11	0.0000	1.578E-11	0.0000	1.734E-07	0.0000
u-240	4.335E-05	0.0001	1.188E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.326E-09	0.0000	4.669E-09	0.0000	4.337E-05	0.0001
u-241	1.052E-07	0.0000	2.883E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.020E-11	0.0000	1.133E-11	0.0000	1.052E-07	0.0000
u-242	2.320E-08	0.0000	6.361E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.457E-12	0.0000	2.499E-12	0.0000	2.322E-08	0.0000
-236	3.784E-01	0.4600	1.037E-04	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	7.269E-05	0.0001	4.076E-05	0.0000	3.787E-01	0.4603
238	3.789E-01	0.4606	1.039E-04	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	7.278E-05	0.0001	4.081E-05	0.0000	3.791E-01	0.4609
otal	8.221E-01	0.9994	2.254E-04	0.0003	0.000E+00	0.0000	0.000E+00	0.0000	1.579E-04	0.0002	8.855E-05	0.0001	8.226E-01	1.0000

Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Independent Pathways

Radio-	Ground		Dust		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Am-243	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cm-243	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cm-244	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Np-237	1.447E-25	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-238	2.634E-26	0.0000	0.000E+00	0.0000	6.836E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-240	6.392E-27	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-242	0.000E+00	0.0000	0.000E+00	0.0000	8.710E-20	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-236	1.459E-22	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	1.440E-26	0.0000	0.000E+00	0.0000	3.738E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	1.461E-22	0.0000	0.000E+00	0.0000	1.057E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Am-241	1.184E-11	0.0000	3.245E-15	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.273E-15	0.0000	1.275E-15	0.0000	1.184E-11	0.0000
Am-243	5.176E-15	0.0000	1.906E-18	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.942E-19	0.0000	4.256E-19	0.0000	5.179E-15	0.00[illegible]
Cm-243	4.622E-16	0.0000	1.831E-19	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.877E-20	0.0000	3.450E-20	0.0000	4.625E-16	0.0[illegible]
Cm-244	2.192E-13	0.0000	6.014E-17	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.209E-17	0.0000	2.360E-17	0.0000	2.193E-13	0.0[illegible]
Np-237	1.106E-07	0.0212	3.033E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.125E-11	0.0000	1.192E-11	0.0000	1.107E-07	0.02[illegible]
Pu-238	1.029E-06	0.1977	2.742E-09	0.0005	7.654E-14	0.0000	0.000E+00	0.0000	3.916E-11	0.0000	1.889E-12	0.0000	1.032E-06	0.1982
Pu-239	4.125E-13	0.0000	1.648E-16	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.923E-17	0.0000	3.041E-17	0.0000	4.128E-13	0.0000
Pu-240	8.153E-11	0.0000	2.237E-14	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.566E-14	0.0000	8.780E-15	0.0000	8.158E-11	0.0000
Pu-241	3.820E-13	0.0000	1.047E-16	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.337E-17	0.0000	4.114E-17	0.0000	3.822E-13	0.0000
Pu-242	1.785E-13	0.0000	3.680E-16	0.0000	9.752E-22	0.0000	0.000E+00	0.0000	1.373E-17	0.0000	5.096E-18	0.0000	1.789E-13	0.0000
U-236	2.903E-07	0.0557	7.974E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.574E-11	0.0000	3.126E-11	0.0000	2.904E-07	0.0558
U-238	3.765E-06	0.7229	9.335E-09	0.0018	4.185E-14	0.0000	0.000E+00	0.0000	1.880E-10	0.0000	3.769E-11	0.0000	3.774E-06	0.7248
Total	5.195E-06	0.9976	1.219E-08	0.0023	1.184E-13	0.0000	0.000E+00	0.0000	3.042E-10	0.0001	8.276E-11	0.0000	5.208E-06	1.0000

*Sum of all water independent and dependent pathways.

Dose/Source Ratios Summed Over All Pathways, (mrem/yr)/(pCi/g)

e	t= 0.000E+00	1.000E-02	8.210E-01	1.511E+00	1.461E+02	2.246E+02	3.951E+02	1.000E+03
m-241	0.000E+00	0.000E+00	4.604E-05	1.199E-08	0.000E+00	0.000E+00	3.473E-07	1.184E-12
m-243	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.007E-12	3.092E-14	9.250E-11	5.179E-16
m-243	0.000E+00	0.000E+00	1.266E+02	1.763E-02	5.394E-13	1.278E-14	1.812E-11	4.625E-17
Cm-244	0.000E+00	0.000E+00	9.927E+01	1.369E-02	0.000E+00	0.000E+00	1.118E-08	2.193E-14
Np-237	0.000E+00	0.000E+00	1.732E+02	2.453E-02	1.646E-30	3.852E-30	6.463E-03	1.107E-08
u-238	0.000E+00	3.172E-25	1.733E-19	1.070E-18	1.556E-13	2.527E-13	1.347E-05	1.032E-07
u-239	0.000E+00	0.000E+00	0.000E+00	0.000E+00	8.317E-10	1.607E-11	1.734E-08	4.128E-14
Pu-240	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.337E-06	8.158E-12
Pu-241	0.000E+00	0.000E+00	2.987E-08	1.416E-11	0.000E+00	0.000E+00	1.052E-08	3.822E-14
u-242	0.000E+00	0.000E+00	5.519E-30	6.264E-29	7.923E-22	1.846E-21	2.322E-09	1.789E-14
I-236	0.000E+00	0.000E+00	0.000E+00	2.227E-30	1.140E-26	2.249E-26	3.787E-02	2.904E-08
J-238	4.060E-30	5.391E-25	1.729E-19	1.065E-18	1.078E-13	1.556E-13	3.791E-02	3.774E-07

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 100 mrem/yr

uclide (i)	t= 0.000E+00	1.000E-02	8.210E-01	1.511E+00	1.461E+02	2.246E+02	3.951E+02	1.000E+03
m-241	*3.424E+12	*3.424E+12	2.172E+06	8.339E+09	*3.424E+12	*3.424E+12	2.879E+08	*3.424E+12
m-243	*1.995E+11	*1.995E+11	*1.995E+11	*1.995E+11	*1.995E+11	*1.995E+11	*1.995E+11	*1.995E+11
m-243	*5.159E+13	*5.159E+13	7.899E-01	5.673E+03	*5.159E+13	*5.159E+13	5.518E+12	*5.159E+13
m-244	*8.086E+13	*8.086E+13	1.007E+00	7.305E+03	*8.086E+13	*8.086E+13	8.946E+09	*8.086E+13
p-237	*7.045E+08	*7.045E+08	5.772E-01	4.076E+03	*7.045E+08	*7.045E+08	1.547E+04	*7.045E+08
u-238	*1.711E+13	*1.711E+13	*1.711E+13	*1.711E+13	*1.711E+13	*1.711E+13	7.423E+06	9.689E+08
u-239	*6.203E+10	*6.203E+10	*6.203E+10	*6.203E+10	*6.203E+10	*6.203E+10	5.766E+09	*6.203E+10
J-240	*2.266E+11	*2.266E+11	*2.266E+11	*2.266E+11	*2.266E+11	*2.266E+11	2.306E+07	*2.266E+11
J-241	*1.030E+14	*1.030E+14	3.348E+09	7.061E+12	*1.030E+14	*1.030E+14	9.502E+09	*1.030E+14
J-242	*3.927E+09	*3.927E+09	*3.927E+09	*3.927E+09	*3.927E+09	*3.927E+09	*3.927E+09	*3.927E+09
	*6.465E+08	*6.465E+08	*6.465E+08	*6.465E+08	*6.465E+08	*6.465E+08	2.641E+03	*6.465E+08
	*3.360E+05	*3.360E+05	*3.360E+05	*3.360E+05	*3.360E+05	*3.360E+05	2.638E+03	*3.360E+05

t specific activity limit

Summed Dose/Source Ratios DSR(i,t) in (mrem/yr)/(pCi/g)
and Single Radionuclide Soil Guidelines G(i,t) in pCi/g
at tmin = time of minimum single radionuclide soil guideline
and at tmax = time of maximum total dose = 0.8210 ± 0.0002 years

Nuclide (i)	Initial pCi/g	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
Am-241	1.000E+01	0.8211 ± 0.0002	4.605E-05	2.172E+06	4.604E-05	2.172E+06
Am-243	1.000E+01	395.1 ± 0.1	9.242E-11	*1.995E+11	0.000E+00	*1.995E+11
Cm-243	1.000E+01	0.8210 ± 0.0002	1.266E+02	7.899E-01	1.266E+02	7.899E-01
Cm-244	1.000E+01	0.8210 ± 0.0002	9.927E+01	1.007E+00	9.927E+01	1.007E+00
Np-237	1.000E+01	0.8210 ± 0.0002	1.732E+02	5.772E-01	1.732E+02	5.772E-01
Pu-238	1.000E+01	395.1 ± 0.1	1.346E-05	7.428E+06	1.532E-14	*1.711E+13
Pu-239	1.000E+01	395.1 ± 0.1	1.733E-08	5.770E+09	0.000E+00	*6.203E+10
Pu-240	1.000E+01	395.1 ± 0.1	4.334E-06	2.308E+07	0.000E+00	*2.266E+11
Pu-241	1.000E+01	0.8211 ± 0.0002	2.987E-08	3.347E+09	2.986E-08	3.348E+09
Pu-242	1.000E+01	395.1 ± 0.1	2.320E-09	*3.927E+09	1.949E-22	*3.927E+09
U-236	1.000E+01	395.1 ± 0.1	3.785E-02	2.642E+03	0.000E+00	*6.465E+08
U-238	1.000E+01	395.1 ± 0.1	3.790E-02	2.639E+03	8.375E-15	*3.360E+05

*At specific activity limit

ATTACHMENT 3

CURRENT INDEX FOR BCLDP PROCEDURES AND PLANS

INDEX *for* DDO
Procedures • Plans • Manuals

Prepared
by
W. J. Zielenbach
February 2, 1993

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Procedure numbers with letters in parenthesis following them indicate those procedures in the following controlled manuals: Health Physics Procedures (H) and Safety & Health Procedures (S).

Located in: File 3, Room 15-1-463 and File G, Room 13-0-046

BATTELLE • 505 King Avenue • Columbus, Ohio 43201

Procedure Number	Revision Number	Effective Date	Resp. Manager	Title
CONTROLLED DOCUMENTS:				
–		12-18-92	IHSM	Safety and Health Procedures Manual
–	7	01-26-93	SHESM	HP Procedures Manual
–	3	11-23-92	QM	Quality Manual, D&D Operations
–	1	03-28-91	WJBM	Emergency Plans and Procedures - West Jefferson North
–	2	07-01-91	PACM	Project Management System Manual
DD-93-01 (S)		12-09-92	SHESM	Occupational Safety and Health Program for BCLDP
DD-93-05	2	11-30-92	PACM	Subcontracting Plan
HP-AP-01.0 (H)	3	01-25-93	SHESM	Issue and Use of Radiation Work Permits
HP-AP-02.0 (H)	2	09-01-92	SHESM	External Personnel Dosimetry Program
HP-AP-03.0 (H)		11-14-90	SHESM	Documentation and Notification Procedure for Personnel Dosimetry Data Reviewed by Telephone
HP-AP-04.0 (H)		11-28-90	SHESM	Procedure for Administrating the Personnel Dosimetry Predetermined Exposure (Spike) Program
HP-AP-05.0 (H)		12-21-90	SHESM	Administrating the Personnel Bioassay Program
HP-AP-06.0 (H)	1	10-17-91	SHESM	Administrating the Bioassay Spike (Predetermined Concentrations) Program
HP-AP-08.0 (H)	1	12-04-92	SHESM	BCLDP ALARA Program
HP-AP-10.0 (H)		10-22-92	SHESM	Temporary Shielding
HP-AP-11.0 (H)		06-23-92	SHESM	Air Sampling and Analysis
HP-AP-12.0 (H)		11-05-92	SHESM	Radiological Performance Reports
HP-AP-13.0 (H)		06-23-92	SHESM	Personnel Decontamination
HP-AP-15.0 (H)		07-13-92	SHESM	DAC-Hr Tracking
HP-AP-17.0 (H)		10-30-92	SHESM	Human Entry into Hot Cells

Procedure Number	Revision Number	Effective Date	Resp. Manager	Title
HP-AP-19.0 (H)		07-16-92	SHESM	Control of Protective Clothing
HP-AP-21.0 (H)		01-06-93	SHESM	Radiological Awareness Reports
HP-AP-23.0 (H)		08-17-92	SHESM	Access Control of Visitors
HP-AP-29.0 (H)	1	11-06-92	SHESM	Control of Measuring and Test Equipment and Instruments (MTEI)
HP-AP-31.0 (H)	1	12-04-92	SHESM	Alara Reports
HP-AP-35.0 (H)	A	12-01-92	SHESM	Dosimetry QA Practices
HP-OP-011 (H)	3	01-25-93	SHESM	Release of Materials from Controlled Areas
HP-OP-012 (H)		05-11-92	SHESM	Radiological Area Posting and Access Control
HP-OP-013 (H)	1.1	01-12-93	SHESM	Operation of the Model 8020 Portacount Plus Maskfit Machine
HP-OP-014 (H)	0.1	06-29-92	SHESM	Control of Radioactive Material and Sources
HP-OP-015 (H)		05-02-90	SHESM	General Procedure for Operating a Continuous Air Monitor (CAM)
HP-OP-016 (H)		12-04-90 (11-13-92)*	WJBM	Collecting and Processing Air Filters from Stack Air Monitors and Stack Samplers Located in Buildings JN-1, JN-2, and JN-3
HP-OP-017 (H)	1	11-18-92	SHESM	Health Physics Routine Surveillence
HP-OP-019 (H)		06-15-92	SHESM	Radiation and Contamination Survey Techniques
HP-OP-020 (H)		04-13-90	SHESM	DOP Testing of HEPA Filters Using the ATI, TDA-2C Particulate Detection Apparatus and TDA-4A Smoke Generator
HP-OP-023 (H)		10-26-92	SHESM	HEPA Ventilation and Engineering Controls
HP-OP-027 (H)		09-14-92	SHESM	Use of Breathing Air Systems
HP-OP-029 (H)		08-20-92	SHESM	Decontamination of Equipment, Materials and Tools
HP-OP-031 (H)		09-03-92	SHESM	Removal of Objects from Contaminated Pools & Tanks

*Date when procedure approved for continued use without revision.

Procedure Number	Revision Number	Effective Date	Resp. Manager	Title
HP-OP-101 (H)	1.1	01-12-93	SHESM	Operation and Calibration of the Bicron RSO 5/50 ION Chamber
HP-OP-102 (H)		12-17-92	SHESM	Ludlum Model 77-3 Stretch Scope Operation and Calibration
HP-OP-103 (H)	1.1	01-12-93	SHESM	Operation and Calibration of the PAC-4G-3/AC21B
HP-OP-105 (H)	2	12-04-92	SHESM	Operation and Calibration of the Ludlum 2929
HP-OP-107 (H)	2	12-04-92	SHESM	Operation and Calibration of the Eberline Portal Monitors PCM-1B and PM-6A
HP-OP-111 (H)	1.1	01-12-93	SHESM	Operation and Calibration of the Ludlum Model 3 Survey Meter
HP-OP-113 (H)	1.1	01-12-93	SHESM	Operation and Calibration of the Ludlum Model 177
HP-OP-115 (H)	1	12-04-92	SHESM	High Volume Air Sampler Operation and Calibration
HP-OP-117 (H)	1	12-04-92	SHESM	Low Volume Air Sampler (etc.)
HP-OP-119 (H)	1	12-04-92	SHESM	Operation and Calibration of the Ludlum Models 12S and 19 Micro-R Meters
HP-OP-121 (H)	1.1	01-12-93	SHESM	Operation and Calibration of the Eberline RM-14
HP-OP-123 (H)		12-11-92	SHESM	Operation and Calibration of the Eberline Model RO-7
HP-OP-125 (H)		12-11-92	SHESM	Eberline Model 6112B Operation and Calibration
HP-OP-131 (H)	1.1	01-12-93	SHESM	Operation and Calibration of the Net Delta 3 and Electra Models
HP-OP-141 (H)	A	12-01-92	SHESM	Operation and Calibration of Pocket Ionization Chambers
HP-OP-143 (H)	1	12-17-92	SHESM	Operation & Calibration of the Alnor Digital Reading Dosimeter System
HP-OP-145 (H)	1	12-04-92	SHESM	Operation and Calibration of the Buck S.S. Pump Air Sampler
HP-OP-201 (H)		07-13-92	SHESM	Hot Particle Control

Procedure Number	Revision Number	Effective Date	Resp. Manager	Title
HS-AP-1.0 (S)		06-09-92	IHSM	Confined Space Entry
HS-AP-3.0 (S)		11-16-92	IHSM	Lockout/Tagout
HS-OP-001 (S)		07-13-92	IHSM	Completion of the Industrial Safety Check List
IL-AP-01.0 (H)		06-09-92	SHESM	Radiological Controls During Instrument Calibration at JN-2
RS-AP-1.0 (H)	1	06-23-92	SHESM	Respiratory Protection Program for BCLDP
RS-AP-3.0 (H)		08-13-92	TC	Radiation Protection Training
RS-AP-4.0 (H)		06-26-92	TC	Health Physics Technician Training and Qualification
RS-OP-002 (H)		07-13-92	SHESM	Selection and Use of Respiratory Protection Equipment
RS-OP-004 (H)		07-13-92	SHESM	Use of Filter Type Respirators
RS-OP-006 (H)		07-13-92	SHESM	Use of the Powered Air Purifying Respirator
RS-OP-008 (H)		07-31-92	SHESM	Use of the Self Contained Breathing Apparatus
RS-OP-010 (H)		08-10-92	SHESM	Use of Supplied Air Bubble Hoods
RS-OP-016 (H)		10-16-92	SHESM	Certification of Grades D or E Breathing Air

End of Controlled Documents

Procedure Number	Revision Number	Effective Date	Resp. Manager	Title
PLAN DOCUMENTS:				
–	2	07-02-92	SHESM	Radiation Protection Program for the BCLDP
–	1	07-18-90	SMM	Battelle Surplus Facilities Surveillance and Maintenance Program Plan (Revised)
–	–	09-15-92	QM	BCLDP Self Assessment Program Implementation Plan
–	–	06-00-92	KABM	Protocol for Drilling & Sampling
–	–	06-27-91	CM	Precharacterization of King Avenue Buildings (Plan)
–	–	05-02-91	CM	Radiological Characterization Plan for Building A
–	–	05-07-92	CM	KA-1 Characterization Plan
–	1	06-29-92	CM	KA-2 Characterization Plan
–	–	04-29-92	CM	KA-4 Characterization Plan
–	–	12-20-90	CM	Radiological Characterization Plan/Equipment Survey and Identification Plan for 6G-NW
–	–	09-11-92	CM	Radiological Characterization and Decontamination Plan for King Avenue Building 7A
–	–	04-29-92	CM	JN-1 Characterization Plan
–	–	04-29-92	CM	JN-2 Characterization Plan
–	–	05-15-91	CM	Radiological Characterization Plan for Selected Portions of JN-3 Bioshield, Subfloor Drainlines, and Fuel Storage Holes
–	–	07-20-90	WM	Waste Management--Building 3 Central Staging Area
–	–	09-09-91	WM	Transfer and Processing of Stored TRU Waste in Building JN-1
BCLDP-90-1		04-10-90	WM	Low Level Waste Certification Plan for Contact Handled and Remote Handled Waste for Disposal at the Hanford Site 200 Area

Procedure Number	Revision Number	Effective Date	Resp. Manager	Title
BCLDP-90-2	1	09-27-91	WM	A Waste Minimization and Pollution Prevention Awareness Plan for BCLDP
BCLDP-89-2	2	02-01-91	WM	Transuranic Waste Certification Plan for Newly Generated Contact-Handled Wastes
DD-92-01	--	04-10-92	WM	Waste Container Marking and Labeling Plan
DD-92-02	--	08-28-92	RALM	RAL Chem Hygiene Plan
DD-92-03	--	08-00-92	CM	Sampling and Analysis Plan for Soils in Building 6G-NW
DD-92-04	1	10-26-92	DOM	Readiness Reviews
DD-93-04		11-11-92	TC	BCL D&D Training Program Plan
DD-QAP-04.1	0.1	04-02-91	KABM	Quality Assurance Plan for Decontamination and Decommissioning Operations: Building 6, 6G-NW Area
DD-QAP-06.0		11-09-89	WJBM	Quality Assurance Plan for Decontamination and Decommissioning Operations: JN-1 Storage Pool
DD-QAP-07.1	0.1	04-02-91	KABM	Quality Assurance Plan for Decontamination and Decommissioning Operations in Building 3
DD-QAP-08.0		06-07-90	CM	Quality Assurance Plan for Radiological Characterization to Prepare for D&D Operations in the Battelle Facilities
DD-QAP-09.0		06-12-90	WM	Quality Assurance Plan for Transfer and Processing of Stored Transuranic (TRU) Waste in Building JN-1
DD-QAP-11.0		08-01-91	KABM	Quality Assurance Plan for Decontamination and Decommissioning Operations: Building A
DD-WP-001		11-30-92	KABM	Work Plan for Machinery Decontamination and Removal From King Avenue Building 2
EL-QAP-01.0		01-15-93	RALM	Quality Assurance Plan for the BCLDP Radioanalytical Laboratory
EM-QAP-01.0	1	03-20-91	EOM	Environmental Monitoring Plan for the BCLDP Project
EM-QAP-02.0		08-17-90	EOM	QA Plan for Battelle Groundwater Monitoring

Procedure Number	Revision Number	Effective Date	Resp. Manager	Title
EM-QAP-03.0		02-14-91	EOM	King Avenue Sump Sludge Removal, Sampling, and Analysis
RC-WP-001	1	01-04-93	RCEOM	Radiation Protection Oversight Work Plan
RC-WP-002		09-08-92	RCEOM	Regulatory Compliance Work Plan
RC-WP-003		12-11-92	RCEOM	Industrial Health and Safety Oversight Work Plan
RC-WP-004		11-11-92	RCEOM	Lessons Learned Implementation Work Plan
WA-QAP-01.0	3	08-08-91	WM	Waste Management Program Quality Assurance Plan

End of Plan Documents

Procedure Number	Revision Number	Effective Date	Resp. Manager	Title
PROCEDURE DOCUMENTS:				
DD-AP-02.0		09-21-89	RAM	Determination and Documentation of Required Preparatory D&D Activities
DD-CP-002* (HP-OP-002)		05-02-90	CM	Facility Post-Decontamination Re-Survey/ Re-Monitor
DD-CP-004 (HP-OP-004)	4	06-07-90	CM	Radioactive Contamination Monitoring Requirements for Facility Wall, Ceiling and Floor Surfaces
DD-CP-005 (HP-OP-005)	3	04-03-91	CM	Inventory and Radiological Survey Procedure
DD-CP-006 (HP-OP-006)	2	05-02-90	CM	Radiological Survey of Equipment, Piping, and Conduit
DD-CP-007 (HP-OP-007)	1	11-21-89	CM	Baseline Reference Values for Facility Radiological Characterization Surveys
DD-CP-008 (HP-OP-008)		05-06-91	CM	Smear and Direct Radioactive Contamination Monitoring
DD-CP-010 (HP-OP-010)	1	04-30-91	CM	Procedure for Establishing a Surface Reference Grid for Walls, Floors, and Ceilings for a Detailed Radiological Survey
DD-OP-001		05-09-89	RAM	Facility Decontamination for Small Quantities of Uranium and Thorium
DD-OP-020		04-13-90	RAM	Changing High Efficiency Particulate Absolute (HEPA) and Other Filters
DD-OP-030		06-10-91	WJBM	Entry to HEC Via Roof Plugs or Washdown Room HEC Access Door
DD-OP-035		06-13-91	WJBM	Placement of Storage or Shipping Containers into Hot Cells or Control Area for Loading or Unloading

*DD-CP procedures formerly HP-OP procedures as indicated.

Procedure Number	Revision Number	Effective Date	Resp. Manager	Title
DD-OP-040		06-13-91	WM	Bagging Requirements for Shipping and Storage Containers
DD-OP-051		10-17-89	WJBM	Movement of JN-1 Storage Pool Protective Cover
DD-OP-055	1	03-14-90	WJBM	Removal and Disassembly of JN-1 Storage Pool Hardware
DD-OP-060		04-06-90	RAM	Procedure for Use of Oxygen Cutting System
DD-OP-090		04-30-90 (01-22-93)	SHESM	DDO Hoisting and Rigging Requirements
DD-OP-092		06-07-90	WM	Qualification of Lifting, Hoisting, and Rigging Devices for Waste Casks
DD-OP-102		10-02-89	RAM	Removal of Hoods and Ducts
DD-OP-105		03-22-91	RAM	Size Reduction of Items and Other Contaminated Equipment
DD-OP-195		03-09-90	RAM	Removal of Contaminated Surfaces by Mechanical Scabbling
DD-OP-205	1	03-09-90	RAM	Decontamination Washing of Surfaces
DD-OP-215	1	03-09-90	RAM	Operation of Hand-Held Power Tools
DD-OP-222	2	11-14-90	RAM	On-Site Transfer of Packaged Contaminated Items and Waste to the Central Staging Area
DD-OP-305	1	09-17-91	WJBM	Operation Procedure for WVS-4000 System at Battelle OM-035-NS (NuPac)
DD-OP-315		09-17-91	WJBM	Operation of Underwater Vacuum System
DD-OP-320		10-16-91	WJBM	The Operation and Testing of the Evaporator Feed Line Pressure Monitoring/Shut-off Switch for JN-1 Pool Water Evaporation
EL-AP-01.0	3	09-07-90	RALM	Administrative Operating Procedures for the Radioanalytical Laboratory (JN-2)
EL-CP-001		03-13-90	RALM	Efficiency Calibration of Germanium Detectors
EL-TP-005	2	07-17-90	RALM	Procedure for Gross Alpha and Beta Analysis of Environmental Water and Air Samples and Routine Smears

Procedure Number	Revision Number	Effective Date	Resp. Manager	Title
EL-TP-006	1	07-16-90	RALM	Determination of Gross Alpha and Beta-Gamma Activities Using the Tennelec LB5100
EL-TP-007	1	08-17-90	RALM	Procedure for Screening Soil/Sediment/Sludge Samples Via Gross Alpha and Gross Beta Analysis
EL-TP-010	1	08-05-92	RALM	Procedure for Preparation of Soil Samples for Radioactive Analysis
EL-TP-011		02-21-90	RALM	Procedure for Gamma Spectrometric Analysis of Environmental Samples
EL-TP-021	2	09-04-90	RALM	Procedure for Strontium-90 Analysis of Environmental Samples
EL-TP-025	1	09-04-90	RALM	Procedure for Analysis of Radium-226/Radium-228 in Environmental Water Samples
EL-TP-031	3	08-17-90	RALM	Iodine-129 Analysis of Environmental Water Samples
EL-TP-051	1	09-04-90	RALM	Radiochemical Determination of Isotopic Plutonium in Environmental Samples
EM-AP-01.0		03-12-91	EOM	Administering of Battelle Columbus Operations Participation in DOE/EML Interlaboratory Comparison Program
EM-AP-02.0	0.1	05-06-91	EOM	Control Measures for Radiological Stack Emissions and Liquid Effluent Releases to Unrestricted Areas
EM-SP-001	0.1	11-29-90	EOM	Procedure for the Collection of Environmental Air Samples
EM-SP-002	0.2	11-29-90	EOM	Procedure for the Collection of Environmental Radiological Water and Liquid Effluent Samples
EM-SP-003		02-27-91	EOM	Collection of Environmental Soil Samples
EM-SP-004		02-27-91	EOM	Collection of Environmental Radiological Perennial Vegetation Samples - Grass or Other Ground Cover
EM-SP-005		02-27-91	EOM	Collection of Annual Vegetation Samples - Fieldcorn and/or Soybeans
EM-SP-006		01-17-91	EOM	Collection of Environmental Radiological Annual Vegetation Samples - Garden Crops

Procedure Number	Revision Number	Effective Date	Resp. Manager	Title
EM-SP-007		03-04-91	EOM	Procedure for the Collection of Environmental Radiological Fish Samples
EM-SP-008		08-27-90 (10-06-92)*	EOM	Beta-Gamma Radiation Monitoring of Nuclear Science Area
EM-SP-011		09-21-90 (10-06-92)	EOM	Collection of Environmental Radiological Sediment Samples
HL-OP-005		06-13-91	RALM	Procedure for Transferring of Contaminated Water from the Radiochemistry Laboratory Holding Tank to Transfer Tank
HL-OP-010		06-04-90	WJBM	Procedure for Changing Resins and Filters in JN1B Pump Room
HL-OP-020		01-06-93	WJBM	The Transfer of Radiochemistry Laboratory-Contaminated Water to the JN-1 Contaminated Water Holding Tank
HL-OP-050		06-19-89	WJBM	Procedure for Transferring Contaminated Water from Holding Tank to Evaporator Tank
HL-OP-055	1	11-11-91	WJBM	Procedure for Removal and Installation of Hot Cell Manipulators
HL-PP-213	1	08-20-91	ISM	Micrometer Calibration
HL-PP-213.2	1	08-20-91	ISM	Calibration of Micrometer Step Gage Block
HL-PP-216	1.1	01-10-92	ISM	Calibration of Stopwatch
HL-PP-231.1	1	08-20-92	ISM	Procedure for Calibration of a Mechanical Balance
HL-PP-246	2	11-04-91	ISM	Calibration of Hydraulic Pressure Gage
HL-PP-247.2		04-15-82 (08-21-91)	ISM	Calibration Procedure for Gas Flow Meters with 60-500 CFH Capacity
IL-CP-101	2	11-04-91	CLS	Procedures for the Calibration of the PAC 1 SAG Survey Meter
IL-CP-103		07-12-87	CLS	Procedures for the Calibration of the Neutron Survey Meter Eberline Model PNR-4

*Date when procedure approved for continued use without revision.

Procedure Number	Revision Number	Effective Date	Resp. Manager	Title
IL-CP-104	2	11-04-91	CLS	Procedure for the Calibration of AG-50/ 500-LS Beta-Gamma Survey Meter
IL-CP-108	1.1	12-20-91	CLS	Procedure for Calibration of Model 440 Low Energy Survey Meter
IL-CP-111	1.1	12-20-91	CLS	Calibration of the Eberline Beta-Gamma AMS-2 Constant Air Monitor
IL-CP-112	1	06-02-87	CLS	Procedures for Calibration of Alpha-3 Constant Air Monitor
IL-CP-129	2	11-04-91	CLS	Calibration Procedure for Eberline E-120 Survey Meter
IL-CP-133.1		04-21-87	CLS	Calibration of Gamma Sources Using the MDH 2025 System
IL-CP-134		05-20-87	CLS	Exposure of Film and Ring Badges
IL-CP-135		03-16-87	CLS	Procedures for Calibration of Single Channel Analyzers
IL-CP-147		11-15-79 (07-31-91)	CLS	Calibration of the Nuclear Measurements PC3A or B Proportional Counting System (Modified)
IL-CP-148		07-12-87	CLS	Procedures for Calibration of the Proportional Counting System - Nuclear Measurements Model PC-5
IL-CP-155	2	01-13-86	CLS	Procedures for Calibration of Alpha-5 Constant Air Monitor
IL-CP-156		09-11-78 (08-13-91)	CLS	Calibration Procedure for the Personnel Radiation Monitor Model RT-1A
IL-CP-163	2.1	12-13-91	CLS	PING-1 Calibration Procedure
IL-CP-165	0.1	12-20-91	CLS	Calibration of the Tennelec Model 536P Counter/Timer
IL-CP-166	3.1	12-31-91	CLS	Calibration of the Eberline Beta-Gamma AMS-3 Constant Air Monitor
IL-CP-170	1	02-10-87	CLS	Procedures for the Calibration of MM6B Monitoring Systems
IL-CP-173	0.1	12-13-91	CLS	Calibration of the Retired Facility Sump Monitor

Procedure Number	Revision Number	Effective Date	Resp. Manager	Title
IL-CP-210	2	08-05-92	CLS	Calibration Procedure for an Oscilliscope and Plug-in Units
IL-CP-211		04-16-81 (08-28-91)	CLS	Calibration Procedure for Taylor Type Aneroid Barometer
IL-CP-220		06-18-81 (08-28-91)	CLS	Calibration Procedure for the Model 3110 Digitec Calibrator
IL-CP-230	6	08-17-90 (09-18-92)	CLS	Calibration Procedure for Digital Multi and AC/DC Voltmeters
IL-CP-232	1	10-18-91	CLS	Calibration Procedure of Hewlett Packard 105B Quartz Oscillator SN731205
IL-CP-255		04-16-81 (08-28-91)	CLS	Calibration Procedure for Counters
IL-CP-514	1	12-03-91	CLS	Procedures for Calibration of Pulse Generator MP-1
NS-EP-002	6	02-18-91	SMM	Responsibilities and Activities of the PESU During a Radiological Emergency
NS-EP-003	2	05-23-89 (08-17-92)	SMM	Responsibilities and Activities of the Emergency Site Unit (ESU) During a Radiological Emergency
NS-EP-005	2.1	02-03-92	SMM	Responsibilities and Activities of the First Aid Unit During a Radiological Emergency
NS-EP-006	2	05-09-89 (08-17-92)	SMM	Procedures for Use of the Two-Way Radios During Activation of the Emergency Control Group Units
NS-EP-007	1	05-31-89 (08-17-92)	SMM	Responsibilities and Activities of the Fire Control Unit (FCU) During a Fire Emergency
NS-MS-030	1	06-06-84 (09-01-92)	WM	Standard for Non-Fixed Radioactive Contamination on External Surfaces of Shipping Packages and Packaging
NS-NS-02.1		07-16-84 (10-13-91)	SHESM	DOP Testing of HEPA Filters Using the NUCON F-1000-DD Model 5A Aerosol Detector and the Virtis Model SG-40 Aerosol Generator
NS-NS-130		11-11-85 (10-23-91)	WM	Determination of Scaling Factors Used to Calculate the TRU Content of Ion Exchange

Procedure Number	Revision Number	Effective Date	Resp. Manager	Title
NS-NS-203	1	11-04-91	TC	Standard for the Training of the West Jefferson Nuclear Sciences Emergency Response Team
NS-NS-206		09-21-79 (08-18-92)	TC	Contractor and Temporary Staff Orientation at the Nuclear Sciences Site
NS-TP-001	2	10-23-91	TC	Quarterly Training Plan for the West Jefferson Nuclear Sciences Emergency Response Team
PS-OP-040		09-26-89	CM	Removal of Material from Specific Locations on Contaminated Surfaces
PU-NS-21.2	1	08-11-82 (09-20-91)	SHESM	Procedure for Alpha and/or Beta-Gamma Activity Solubility Test on Air Sampler Filter
QA-AP-02.1	1.1	03-19-91	QM	Program Quality Grading
QA-AP-02.2		08-30-89	QM	Preparation and Control of Quality Assurance Plans
QA-AP-02.3	2	11-13-91	TC	Indoctrination, Training and Qualification
QA-AP-02.4	0.1	07-24-90 (11-18-92)	QM	Auditor Qualification and Certification
QA-AP-03.1	1	06-14-91	QM	Review of Internally Developed Technical Documents
QA-AP-03.2	1.1	06-08-92	DCM	Design Control
QA-AP-03.3		07-23-90	DCM	Design Review Board
QA-AP-04.1	2	06-17-92	QM	Procurement Document Control
QA-AP-05.1	2	05-12-92	QM	Preparation of Procedures
QA-AP-05.2	3.1	06-24-92	QM	Work Instructions
QD-AP-06.1	6	10-30-92	QM	Document Control
QA-AP-07.1	2	10-26-92	QM	Supplier Evaluation and Qualification
QA-AP-07.2	2.1	04-19-91	QM	Control of Purchased Items and Services
QA-AP-10.1	4	06-09-92	QM	Inspection of Items
QA-AP-10.2		12-12-91	QM	Quality Assurance Surveillences
QA-AP-15.1	2	12-12-91	QM	Nonconformance Reporting for Activities, Items and Materials
QA-AP-16.1	1.2	07-05-91	QM	Corrective Action

Procedure Number	Revision Number	Effective Date	Resp. Manager	Title
QA-AP-16.2	2	11-13-91	RCEOM	Reporting, Investigation, and Corrective Action for Occurrences Under DOE Contract W-7405-ENG-92
QA-AP-17.1	4.1	11-11-91	DCM	Project Records Management System for S&M and D&D Activities
QA-AP-18.1	1.1	07-05-91	QM	Internal Quality Audit Process
RC-AP-3.1		12-10-92	RCEOM	Identification and Implementation Verification of Environmental, Safety and Health Requirements
RC-AP-10.1		07-27-92	RCEOM	Radiation Protection Oversight
RS-EP-001		02-05-90	WM	Driver, Emergency, and Exclusive Use Instructions During the Transport of Radioactive Material
SC-SP-003	2	06-19-90	CM	Establishment of Sampling Grids and Identification of Sampling Locations in Support of Soil Sample Collection
SC-SP-004	1.1	07-23-90	CM	Collection of Soil Core Samples in Support of Site Soil Characterization
SC-SP-004.1	1	09-29-89	CM	Procedure for Well Installation and Well/Borehole Abandonment
SC-SP-004.2		06-12-90	CM	Manual Collection of Surface Soil Samples in Support of Site Characterization
SC-SP-005		06-23-89	CM	Field Operation of Fidler Detector: Surface Soil Scanning
SC-SP-005.1		06-22-89	CM	Electronic Check-Out of Bicron G5 (Fidler) Probe with Portable Analyzer (Analyst)
SC-SP-006		01-29-90	CM	Sampling of Sediment and Sludge in Ponds, Streams, Sumps, and Closures
SC-SP-009		11-06-89	CM	Determination of Hydraulic Conductivity Slug Test Method
SC-SP-010		11-13-89	CM	Procedures for Chemical Sample Labeling, Chain of Custody Documentation, Packaging and Shipment
SC-SP-011		11-13-89	CM	Collection of Soil Samples for Chemical Analysis in Support of Site Soil Characterization

Procedure Number	Revision Number	Effective Date	Resp. Manager	Title
SC-SP-012	0.1	05-30-90	CM	Collection of Groundwater Samples in Support of Site Groundwater Characterization
SC-TP-015		08-22-90	RALM	A Procedure for Generating Gamma-Ray Scans of Core Samples
SM-OP-001	1	01-07-91	SMM	Inspection and Maintenance Procedure for Buildings JN-1, JN-2, and JN-3
SW-AP-01.0		03-30-92	TSM	Custodial Control of Engineering/Scientific Computer Codes and Documentation
SW-AP-02.0		03-30-92	TSM	Verification and Validation of Engineering/Scientific Computer Codes
SW-AP-03.0		03-30-92	TSM	Identification of Engineering/Scientific Computer Codes Requiring Custodial Control
TD-AP-01.1		12-02-92	TC	The Personnel Training and Qualification Records System
TR-OP-003	A	11-10-92	WM	Packaging, Shipping, and Receiving of Radioactive Materials
WA-AP-01.0	1	07-06-90	WM	Review of Operations That Generate Radioactive Waste
WA-OP-003	1	06-11-91	WM	Procurement and Inspection of DOT-17C Galvanized/Aluminized Steel 55 Gallon Waste Drums
WA-OP-004	1	08-24-90	WM	Construction and Inspection of DOT 7A Type A LLNL Flush Panel Wooden Box
WA-OP-005	1	09-10-91	WM	Construction and Inspection of 4'x4'x7' Flush Panel Wooden Box
WA-OP-008		10-25-90	WM	Standard for and Acceptance/Rejection Inspection of Molded Drum Liners
WA-OP-009	1	08-08-91	WM	Procurement and Inspection of Wooden Pallets
WA-OP-010	1	10-09-91	WM	Retrieval and Transfer of Waste Containers From Storage
WA-OP-020	1	08-23-90	WM	Waste Separation, Segregation and Characterization
WA-OP-021	1	08-03-90	WM	Waste Volume Reduction/Treatment/ Stabilization

Procedure Number	Revision Number	Effective Date	Resp. Manager	Title
WA-OP-025	1	08-23-90	WM	In-Drum Solidification of Radioactive Liquids
WA-OP-026	1	08-03-90	WM	Packaging of Low Level Waste (LLW)
WA-OP-027		01-02-91	WM	Packaging of Transuranic (TRU) Waste
WA-OP-028		07-18-91	WM	Operation of 55-Gallon Drum Waste Compactors
WA-OP-049		02-28-91	WM	Efficiency Calibration of Germanium Detectors for Waste Management Operations
WA-OP-050	2	02-25-91	WM	Characterization of Radwaste Packages Using the Drum Scanning System
WA-OP-052	1.1	09-13-90	WM	Marking and Labeling Low-Level Waste Packages for Shipment to Westinghouse Hanford Site 200 Area by Exclusive Use Transport
WA-OP-053		09-18-90	WM	Shipping of Low Level Waste to Westinghouse Hanford Site 200 Area for Disposal
WA-OP-054	0.1	02-15-91	WM	Marking and Labeling of Transuranic (TRU) Waste Packages for Shipment to the Hanford Site by Exclusive Use Transport
WA-OP-055	0.1	02-15-91	WM	Certifying and Shipping of Transuranic Waste to the Hanford Site for Storage
WA-OP-056		04-25-91	WM	Marking and Labeling of Radioactive Waste (RMW) Packages for Shipment to the Hanford Site by Exclusive Use Transport
WA-OP-057		04-19-91	WM	Shipping of Radioactive Mixed Waste to the Hanford Site for Storage
WA-OP-058		01-11-93	WM	BCLDP Laundry Procedure

End of Procedure Documents

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Key to Responsible Persons for Procedures and Plans

February 2, 1993

ID	Title	Assigned Individual
CLS	Calibration Lab Supervisor	Bill Bradford
CM	Characterization Manager	Joe Poliziani
DCM	Document Control Manager	Bill Zielenbach
DOM	Decontamination Operations Manager	Ed Castleberry
EOM	Environmental Operations Manager	Steve Layendecker/ Subcontractors
IHSM	Industrial Health & Safety Manager	Larry Nee
ISM	Instrument Services Manager	Steve Bradley
KABM	KA Building Manager	Sam Basham
PACM	PA&C Manager	Gary Scott
QM	Quality Manager	Scott Brown
RALM	Radioanalytical Lab Manager	Tim Snider
RAM	Remedial Action Manager	Ron Carlson
RCEOM	RC & ESH Oversight Manager	Mark Jackson
SHESM	SH&E Support Manager	Steve Layendecker
SMM	S&M Manager	Gene Roe

Key to Responsible Persons for Procedures and Plans

February 2, 1993

ID	Title	Assigned Individual
TC	Training Coordinator	Ruth Baruth
TSM	Technical Support Manager	Ragiv Kohli
WJBM	WJ Building Manager	Joe Jacobson
WM	Waste Manager	Kathy Lawson

*ddsmkey

ATTACHMENT 4

BIOGRAPHICAL INFORMATION

Education

M.S., Radiation Biology, University of Tennessee, Knoxville, Tennessee, 1981
B.S., Biology, Tusculum College, Greeneville, Tennessee. 1979
29 CFR 1910.120 OSHA Training for Operations on Hazardous Waste Site, IT Corporation, Knoxville, Tennessee, 1989
Operation of a Panasonic TLD Program, Phillip Plato, Inc., Fort Meyers, Florida, 1987
Environmental Radiation Surveillance, Harvard School of Public Health, Boston, Massachusetts, 1986
Internal Dose Assessment, Technical Management Services, Chicago, Illinois, 1984
As Low As Reasonable Achievable (ALARA) Training Course, General Dynamics, Electric Boat Division, Groton, Connecticut, 1981

Qualifications

Mr. Layendecker is a certified health physicist with more than 10 years professional experience in Health Physics-related fields. His experience includes work at U.S. Nuclear Regulatory Commission (NRC) licensed plants, material licensees, and U.S. Department of Energy (DOE) facilities.

Relevant Experience

Safety, Health, and Environmental Support. Safety, Health, and Environmental Support Manager. Manages the Radiological Field Operations, Radiological Technical Support, Industrial Hygiene/Safety, and Environmental Support groups.

Prior Professional Experience

Senior Health Physicist, Nuclear Sciences, IT Corporation, Knoxville, Tennessee. Preformed health physics consulting in the areas of applied health physics, as low as reasonably achievable (ALARA) evaluations and radiation protection procedures.

Served as the Manager of Health Physics and was responsible for initiation and implementation of a radiation protection program for over 1,000 workers for the MK-Ferguson of Oak Ridge Company and Rust Engineering Company, Oak Ridge Operations. Also served as the IT/MK-Ferguson/Rust Engineering Project Manager and coordinated IT resources on the project.

Staff Health Physicist, Tennessee Valley Authority, Radiological Control, Chattanooga, Tennessee. Provided technical direction and oversight to all Tennessee Valley Authority (TVA) nuclear facilities, provided direct, on-site, operational support to Sequoyah Nuclear Station from 1988 to 1989 refueling outage, provided on-site support at Watts Bar Nuclear Station for design reviews and plant modification, performed internal assessments and investigations at all facilities, and participated as a qualified member of the TVA emergency response team.

Supervisor, Health Physics Section, Tennessee Valley Authority Watts Bar Nuclear Plant, Spring City, Tennessee. Managed the activities of the ALARA site program and radiation protection group and implemented a procedure system, an audit and assessment program, and an employee development program.

Radiological Engineer I, II, III, General Public Utilities Nuclear Three Mile Island Unit-2, Middletown, Pennsylvania. Implemented exposure management activities, conducted audits of the Radiological Controls Program, initiated and reviewed procedures, ensured compliance with regulatory requirements, performed internal/external dose assessments, and performed ALARA reviews of work activities.

Professional Recognition and Affiliations

Mr. Layendecker has been published in ***Experimental Hematology, Vol. 10, No. 4, April 1982,*** "The Relative Roles of the Spleen and Bone Marrow in Platelet Production in Mice".

Mr Layendecker is a Certified Health Physicist (Comprehensive) as recognized by the American Board of Health Physics and is a member of the Health Physics Society. He is also a certified lead auditor in accordance with ANSI/ASME NQA-1.

Education

B.S., Mechanical Engineering, The Ohio State University
M.S., Nuclear Engineering, The Ohio State University
Certified Health Physicist, 1992 Examination

Qualifications

Mr. Jensen is the Radiological Technical Support (RTS) Manager for the Safety, Health, and Environmental Support (SH&ES) Section at the Battelle Decontamination and Decommissioning Operations (DDO) Group for the Battelle Columbus Laboratories Decommissioning Project (BCLDP). Mr. Jensen has had extensive experience in the oversight of projects involving the use of radioactive materials and radiation producing devices. Mr. Jensen has also had experience in the other disciplines of safety. Mr. Jensen continues to participate in the overall development of the SH&ES section, in addition to continuing to coordinate with the Battelle Columbus Environment, Safety, and Health Department.

Relevant Experience

Radioactive Material Transfer. Mr. Jensen was assigned the task of finalizing the arrangement for Battelle Columbus to transfer approximately 13,000 Ci of Co-60 sources to The Ohio State University (OSU) as a donation. This material was stored at the West Jefferson facility and the transfer was just recently accomplished. This effort required the close coordination of several groups within the BCLDP, Battelle Columbus, OSU and its subcontractors.

Support Activities. Mr. Jensen had an interim assignment as the SH&ES Manager. In this capacity, efforts were made to establish new, dedicated Safety and Industrial Hygiene support units for the BCLDP as well as to greatly expand and enhance the existing Radiological Protection Program (RPP). Upon being assigned to the current position of RTS, Mr. Jensen continued to assist in the program development started earlier with emphasis on the technical aspects of the RPP.

Radiological Oversight. Provided radiological oversight at Battelle Columbus Operations for the past approximately three years. In addition to review and approval of operations with radioactive materials, also was involved with the licenses amendments for use of an in-house radiography source, and field use of radioactive materials. Mr. Jensen is involved in training of personnel, including providing materials to the Duxbury Radiation Safety Officer. He wrote the final radiological survey report for the Battelle-Kettering site, and brought the NRC license to closure. Mr. Jensen was also involved in Operational Readiness Reviews for areas and building about to undergo decommissioning as part of a joint effort between Battelle and DOE. Mr. Jensen spent a short time with the DDO RCES&HO group before being assigned to the Health, Safety, and Environmental Support Group.

Craig E. Jensen (Continued)

Prior Professional Experience

The Ohio State University. Responsible for several programs covering the gamut of radiological health and safety activities within the University's Office of Radiation Safety, including: radiological oversight of a 10 kW research reactor, review and comment on all radioactive material use protocols at OSU, primary Office liaison with the University's Medical Radionuclide Committee, small license (special nuclear material and source material) renewal and amendments to the Broad Scope license. In addition, during his almost five years with The Ohio State University (OSU), he was also involved with renewal effort for the OSU Broad Scope license, laboratory surveillance, low level radioactive waste management, spill and emergency response.

Nuclear Consulting Services, Inc. Performed radioiodine challenge testing of nuclear power plant activated carbon filter bank samples to ANSI specifications.

Toledo Edison Company. While at their Davis Besse Nuclear Power Station, he was involved with the Maintenance organization during two summers, in HVAC activities and also maintenance purchasing coordinator for various activities including reactor coolant pump seal replacement. Other experiences at Davis Besse included a summer with the major piping subcontractor during construction.

Professional Recognition and Affiliations

Member, Ohio Department of Health, Radiation Advisory Council 1992-1997

American Academy of Health Physics, 1992

Member, State of Ohio, Governor's Technical Advisory Group for Emergencies at Licensed Nuclear Facilities, 1990-1991. Group dissolved in 1991.

Engineer-in-Training Certification, Ohio. Passed in 1978, expired in 1988. (First part of Professional Engineer Certification)

Past President, Past Executive Council Member, and Charter Member of the Buckeye Chapter of the Health Physics Society

Plenary Member, Health Physics Society (national)

Associate Member, American Nuclear Society

Associate Member, American Society of Mechanical Engineers

Special Judge for the Local Health Physics Society Award, Central District Science Fair 1990-92

Education

Attended University of Alabama, Chemistry, Design Graphics and Analytical Trigonometry
Attended Troy State University, Nuclear Science Management
Attended Oak Ridge Universities, Applied Health Physics
U.S. Navy, Machinist Mate "A" School; Nuclear Power School; and Engineering Laboratory Technician School

Qualifications

Mr. Hall is currently Radiological Field Operations Manager responsible for managing four Health Physics Supervisors and approximately 40 Health Physics Technicians and Specialists. In addition, he has been responsible for the development and implementation of the BCLDP Radiological Protection Plan. With 22 years of Health Physics Radiation Protection experience, Mr. Hall has been involved with the administrative, operational and technical Health Physics activities.

Relevant Experience

Researcher for BCLDP. Assigned to determine responses to significant audit findings associated with the BCLDP.

Characterization Technician. Performed characterization surveys of several buildings including structural and equipment

Prior Professional Experience

Byron Nuclear Power Station. Senior Health Physics Technician provided health physics coverage for refueling, maintenance and power operations.

San Onofre Nuclear Generating Station. Senior Health Physics Technician supervising the company and contract health physics technicians during power operation and outage conditions. Supervised all aspects of health physics in the areas of routine and special radiological controls, instrumentation and repair, respiratory protection, and routine surveillance.

St. Lucie Nuclear Power Plant (PSESI). Provided health physics coverage during steam generator eddy current testing and subsequent tube plugging.

Browns Ferry Nuclear Power Station. Senior Health Physics Technician during the restoration of Unit 2 (included training of senior and junior technicians for the Radiological Preparedness drill for offsite radiological monitoring). Revised and upgraded health physics procedures; prepared unresolved safety question reports, undocumented plant modification reports, documents for technical specification changes, and drill scenarios for in-plant radiological and medical drills.

Charles R. Hall (Continued)

J.M. Farley Nuclear Power Plant. Health Physics Technician/Foreman supervising company and contract health physics technicians during power operation and outage conditions in areas of routine and special radiological controls, instrumentation and repair, respiratory protection, and routine surveillance. Designed, drafted and tested after installation, the post accident sampling system. Wrote and implemented the qualification program for health physics technicians.

Navy - Nuclear Propulsion Prototype. Engineering Laboratory Technician serving as lead ELT in charge of implementation of volatile chemistry control during construction, heat up, testing, and power operations. Was responsible for the initial qualification of ELTs during initial staff qualification and for plant interface with Knolls Atomic Power lab chemists and engineers.

Navy - USS George Bancroft. Engineering Laboratory Technician maintained reactor and steam plant chemistry control, radiological protection and qualification of new crew members.

Vogtle Electric Generating Plant (Bartlett). Radiological Consultant to the operations health physic supervisor with procedure development and writing; ALARA walkdowns of plant areas and systems, development of philosophy of conduct of department, development of the methodology for radiological instrumentation program and the radiological surveillance program.

Bartlett Nuclear, Inc. (Home Office). Radiological Consultant assisting with marketing strategy, needs of the nuclear industry that could be met by Bartlett Nuclear, and utility philosophies concerning contract service companies.

Waterford Steam Electric Station. Health Physics Operations Supervisor for the company and contract health physics technicians. Developed health physics program, advised senior plant personnel of radiological requirements, fuel load and startup, and commercial power operation. Supervised the development and operation of health physics instrumentation, counting room, respiratory protection, surveillance, and operations sections.

DD-CP-002
Revision 1

DECONTAMINATION AND DECOMMISSIONING OPERATIONS CHARACTERIZATION PROCEDURE

FACILITY POST-DECONTAMINATION FINAL STATUS SURVEY

UNCONTROLLED COPY

Prepared By:

A.C. Chance ACC

BATTELLE
505 King Avenue
Columbus, Ohio 43201

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REVISION RECORD INDICATING LATEST DOCUMENT REVISION

Title Facility Post-Decontamination No. DD-CP-002

Final Status Survey Page i of ii

INDEX OF PAGE REVISIONS

Page No.	i	ii	iii							
Rev. No.	1	1								

Page No.	1	2	3	4	5	6	7	8	9	10
Rev. No.	1	1	1	1	1	1	1	1	1	1

Page No.	11	12	13	14	15	16	17	18	19	20
Rev. No.	1	1	1	1	1	1 WJZ				

Page No.	21	22	23	24	25	26	27	28	29	30
Rev. No.										

Page No.	31	32	33	34	35	36	37	38	39	40
Rev. No.										

REVISION RECORD	
Rev. No.	Date
0	04-19-90
~~1~~ 2	~~03-15-93~~ 2
WJZ	WJZ

REVISION RECORD	
Rev. No.	Date

CURRENT REVISION	
Rev. No.	1
Date	3/17/93
Approval	WJZ

PROCEDURE/PLAN APPPROVAL PAGE

This procedure, DD-CP-002, has been reviewed and approved by the following:

APPROVED BY:

J. F. Poliziani — 3·15·93
J. Poliziani
Manager, Characterization
Date

Carl Horton — 16 March 93
C. Horton
Manager, Field Services
Date

S. M. Layendecker FOR — 3-16-93
S. Layendecker
Manager, Safety, Health & Environmental Support
Date

Mark E Jackson — 3/17/93
M. Jackson
Manager, RC and ESH&O Manager
Date

V.E. Castleberry — 3-17-93
V.E. Castleberry
Manager, Decontamination Operations
Date

S. Brown — 3-17-93
S. Brown
Manager, Quality
Date

FACILITY POST-DECONTAMINATION FINAL STATUS SURVEY

1.0 Scope

This document discusses the requirements for performing a final status survey on facility surfaces following completion of Battelle Columbus Laboratories Decommissioning Project (BCLDP) decontamination operations.

2.0 Purpose

The purpose of this document is to identify, describe, and establish procedures for the monitoring and documentation of residual contamination levels on the surfaces of a facility following decontamination. This survey will determine whether or not the radiological conditions are within the limits established in DD-93-02, "Surface Release Criteria, Technical Basis Document for Battelle Columbus Laboratories Decommissioning Project (BCLDP)."

3.0 References and Definitions

3.1 References

3.1.1 DD-93-02, "Surface Release Criteria, Technical Basis Document for Battelle Columbus Laboratories Decommissioning Project (BCLDP)."

3.1.2 DD-CP-004, "Radioactive Contamination Monitoring Requirements for Facility Wall, Ceiling, and Floor Surfaces".

3.1.3 DD-CP-008, "Smear and Direct Radioactive Contamination Monitoring".

3.1.4 DD-CP-010, "Procedure for Establishing a Surface Grid for Walls, Floors and Ceilings for a Detailed Radiological Survey".

3.1.5 QA-AP-5.2, "Work Instructions".

3.1.6 NUREG/CR-5489, "Manual for Conducting Radiological Surveys in Support of License Termination - Draft Report for Comment", 1992.

3.2 Definitions

3.2.1 Adjacent grid - Any 1 m^2 grid or portion of 1 m^2 grid that touches the designated grid.

3.2.2 Direct survey - Measurement of fixed-plus-removable contamination using radiation detection instrumentation appropriate for the types of radiation known or suspected to be present, in accordance with Reference 3.1.1.

3.2.3 Designated grid- A grid in which contamination was detected during the characterization process and which was marked for decontamination.

3.2.4 **Decision Level Value (DLV)** - The upper bound of the 95 percent confidence level for survey readings due primarily to naturally-occurring radionuclides (background) in building surfaces, such as concrete.

3.2.5 **Duplicate smear** - A smear taken in the same manner and at the same coordinate as the previous smear.

3.2.6 **Indirect survey** - Survey for removable contamination using smears or swipes and analyzing them in a counting chamber, in accordance with Reference 3.1.2.

3.2.7 **Non-designated grid** - Any 1 m^2 grid that is not a designated grid or an adjacent grid.

3.2.8 **Static 1-minute count** - A stationary 1-minute count performed with detector in contact with the surface.

4.0 Equipment

4.1 Gas proportional detectors and associated electronics sensitive to alpha and beta/gamma radioactivity and equipped with an aural indicator. These instruments may be operated in gas flow or static gas configuration and will be capable of detecting alpha-only and alpha-plus-beta activity and some electronics may also allow beta-only readings. Examples of gas proportional detectors are the Ludlum 239-1F floor monitor and the Eberline ESP-2 meter with a Ludlum 4320 detector.

4.2 Scintillator detectors and associated electronics sensitive to alpha, beta, or gamma radiation. These instruments may be capable of detecting both alpha and beta activity and discriminating between them. Examples of scintillator type instruments are the Delta 3/DP6 combination for alpha and beta detection/discrimination and a NaI crystal (Ludlum 12S Micro R meter) for gamma detection.

4.3 A pressurized ionization chamber, Micro R meter, or Geiger-Mueller instrument may be used to measure external penetrating radiation (gamma).

4.4 A high purity germanium (HPGe) detector and associated electronics may be used in the field for isotopic identification of contamination, and in the laboratory for determination of isotope(s) and quantity of contaminants in samples.

4.5 Smear papers and glassine envelopes.

4.6 Scaffolding equipment, ladders, and related elevated or remote access equipment.

4.7 Personal protective clothing and/or equipment and monitoring equipment as required by Health Physics and Industrial Safety.

5.0 Responsibilities and Requirements

5.1 **Field Services Manager** - Shall assure that all personnel assigned to participate in the re-survey verification activities have been trained in this procedure and their qualifications have been documented. Shall schedule activities and conduct assessments of activities.

5.2 **Characterization Survey Task Leader** - Shall ensure that procedures/instructions are implemented, that survey meters are calibrated and properly functioning, and that data sheets are properly and legibly completed.

5.3 **Health Physicist** - Shall review and evaluate the final status survey data and effectiveness of the decontamination process.

5.4 **Surveyor(s)** - Shall comply with all sections of this procedure and any related procedures.

5.5 **QA Manager or his Designee** - Shall be responsible for independent activity assessments (IAAs) to verify adequate implementation of procedural requirements.

5.6 **Regulatory Compliance & Environmental, Safety and Health Oversight Manager (RC&ESHO)** - Shall be responsible for oversight to verify regulatory compliance and technical issues.

6.0 Procedure

6.1 A Work Instruction (DDO-104) shall be completed in accordance with Reference 3.1.5.

6.2 Rooms/areas shall be gridded in accordance with DD-CP-010 (Reference 3.1.4)

6.3 The final status survey shall be performed in compliance with Reference 3.1.6. The general survey procedure is outlined in DD-CP-004 (See Reference 3.1.2).

6.3.1 The logic chart in Exhibit 1 outlines the basic steps of the final status survey.

6.4 The surveyor(s) shall scan the entire surface area of each designated grid section with an alpha/beta survey instrument as the fundamental survey technique. A scan shall be performed in both the alpha-plus-beta mode (or beta-only mode) and alpha-only mode. Scans shall be performed for each category of surface material, e.g., metal, solid concrete, concrete block. If adequate health physics records exist showing the effectiveness of decontamination, the number of grids monitored may be reduced to satisfy the requirements of Section 6.2.8.

6.4.1 Scanning may be done manually or by some mechanically driven device.

6.4.2 The window of the instrument detector shall by $\leq$ 0.5 cm from the surface.

6.4.3 The scanning speed shall be $\leq$ 5 cm/sec.

6.4.4 A periodic check shall be conducted a minimum of once per two hours of the instrument's operation (or as needed by instrument usage and experience) using a check source of established count rate. Document source check readings on Form DDO-099. Discontinue use of the monitoring instrument if the check source reading varies more than 10% of the established rate. All data collected since the last acceptable source check is void and shall be recollected.

6.4.5 A static 1-minute count shall be performed in each grid in which scanning indicated readings greater than the DLV. The static 1-minute count shall be performed at the point of highest reading in both the alpha-plus-beta and the alpha-only mode.

6.4.6 An indirect (smear) survey shall also be performed, in accordance with Reference 3.1.3, in each grid in which scanning indicated readings greater than the DLV.

6.4.6.1 All smears shall be referenced to a specific grid and numbered sequentially, with exceptions noted on survey form (DDO-011).

6.4.6.2 Perform one (1) duplicate and one (1) blank (unused) smear after each ten smears.

- Designate duplicate smears with an "R" (repeat) beside the sequential number on form DDO-011.
- Designate blank smears with a "B" beside the sequential number on form DDO-011.

6.4.6.3 A request for analysis (DDO-027) for gross alpha and gross beta counting data for smear samples shall be submitted to the radioanalytical laboratory (RAL). A completed Chain-of-Custody Record (DDO-128) may be submitted if the smear samples are to be returned to the Characterization Survey Task Leader.

- Analytical results shall be entered into the Characterization Database.
- The request for analysis, completed Chain-of-Custody (if required), completed Form DDO-011, and results from RAL, shall constitute a complete analysis package.

6.4.7 An exposure rate measurement shall be taken at 1 meter above the surface in the center of each grid in which scanning indicated readings greater than the DLV.

6.5 A large population statistical survey consisting of static 1-minute counts and indirect surveys shall be performed according to the chart below.

Total Number of Grids[a]	Number of grids to receive static 1-minute counts
< 30	100% of total grids
30 to 300	30 grids
> 300	10% of total grids[b]

[a] Grids are normally 1 m^2

[b] For non-designated grids, a maximum of 30 grids will receive a static 1-minute count

6.6 Record all readings and locations on Form DDO-011.

6.7 Grids as defined during the characterization survey to have exposure rates of 5 μR/hr above background or greater shall be remonitored during the final status survey. Exposure rate readings at a distance of 1 meter from the floor (ground) surface shall be taken at the center of the grid. Grids shall remain consistent as defined in the characterization survey.

6.8 Summarize each work day's survey/sampling activities, including any atypical events, on the Summary and/or Special Report Form (DDO-103).

7.0 Records

7.1 Records generated by implementation of this procedure are completed data sheets:

7.1.1 DDO-011, Characterization Radiological Survey Report

7.1.2 DDO-027, Radioanalytical Laboratory Analytical Request

7.1.3 DDO-090, Instrument Log and Signature Sheet

7.1.4 DDO-099, Field Source Check Log

7.1.5 DDO-103, Summary and/or Special Report Form

7.1.6 DDO-104, Work Instruction

7.1.7 DDO-128, Chain-of-Custody Record

7.1.8 Characterization Database

8.0 Forms and Exhibits Referenced in This Procedure

8.1 DDO-011, Characterization Radiological Survey Report

8.2 DDO-027, Radioanalytical Laboratory Analytical Request

8.3 DDO-090, Instrumentation/Personnel Log Sheet

8.4 DDO-099, Field Source Check Log

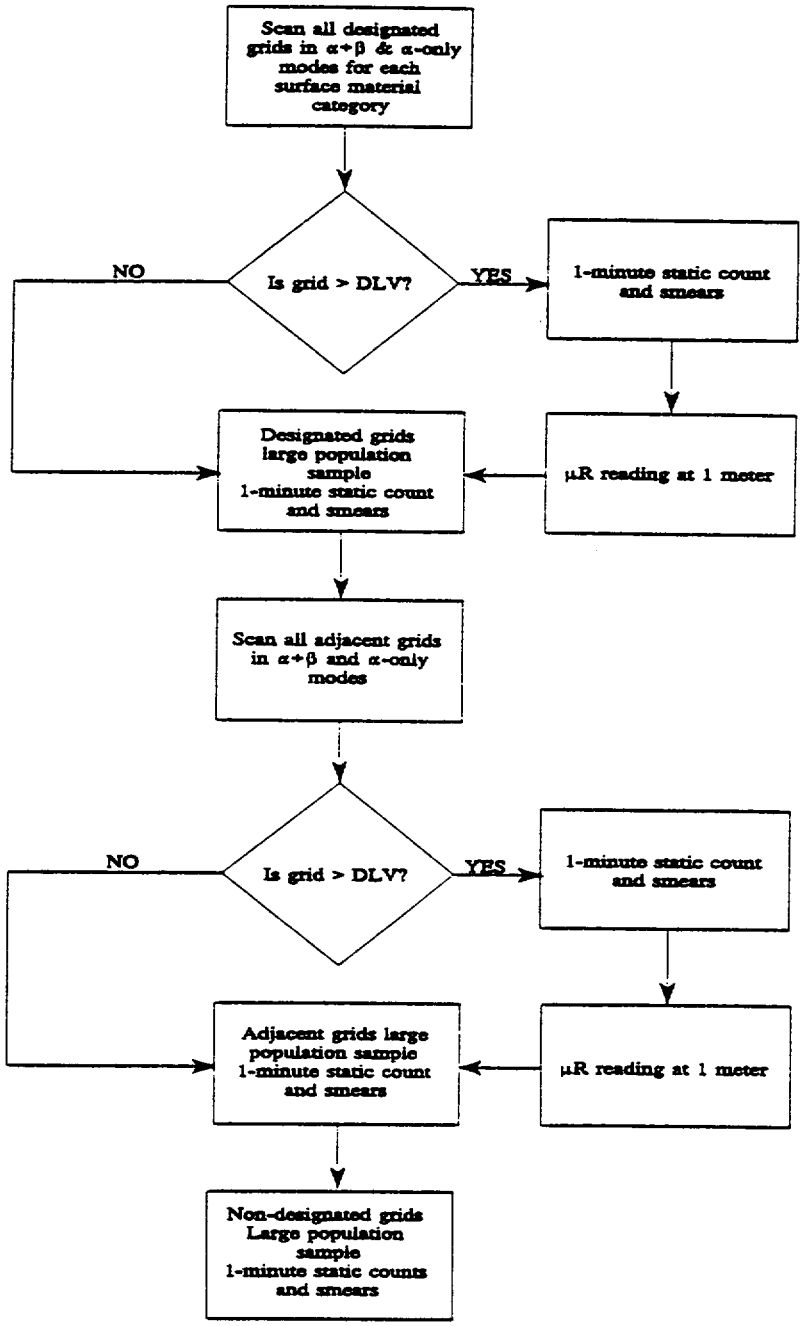
8.5 DDO-103, Summary and/or Special Report Form

8.6 DDO-104, Work Instruction

8.7 DDO-128, Chain-of-Custody Record

8.8 Exhibit 1, Logic Chart

EXHIBIT 1
LOGIC CHART



W.I. No: _____
Page ___ of ___

CHARACTERIZATION RADIOLOGICAL SURVEY REPORT

Building: _____ Room: _____ Surveyor(s): _____

Grid Location: _____ Surface Material: _____ Date: _____

Meter Type: _____ Probe Type: _____ Survey Type: _____

Meter ID: _____ Probe ID: _____ β Efficiency (%): _____

Calibration Date: _____ Probe Area (cm^2): _____ α Efficiency (%): _____

Background $\alpha + \beta$ (cpm): _____ Background α (cpm): _____

Grid ID	Grid Coordinate	γ (μR/hr)	Direct Survey Results		Indirect Survey	Sample (Y/N)
			Gross $\alpha + \beta$ (cpm)	Gross α (cpm)	Smear #	

Observer/Reviewer: _____ Date: _____

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W.I. No: _____
Page ___ of ___
Date: _____

CHARACTERIZATION RADIOLOGICAL SURVEY REPORT
CONTINUATION SHEET

Grid ID	Grid Coordinate	γ (μR/hr)	Direct Survey Results		Indirect Survey	Sample (Y/N)
			Gross $\alpha + \beta$ (cpm)	Gross α (cpm)	Smear #	

Observer/Reviewer: _____ Date: _____

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RADIOANALYTICAL LABORATORY ANALYTICAL REQUEST

Project No._____ *Date Submitted_____ *Submitted By & Phone No._____
Date Results Needed_____ *Results To be Sent & Phone No.:_____
(Designate Person - One Copy Only)

*Type of Sample(s): *Date or Period of Sample Collection:_____

Soil	Sediment	Water	Air	Filter	Smear(s)	Other (Specify)_____
☐	☐	☐	☐	☐	☐	☐

*Sample Place of Origin:_____

*Sample Description_____ Number of Samples:_____

Special Requests (by Submitter):_____

Submitter Code/HPS #_____

*Type of Analysis:

- ☐ Gross Alpha Beta
- ☐ Gamma Spectrometry
- ☐ Plutonium Isotope
- ☐ Tritium
- ☐ C-14
- ☐ Strontium 90
- ☐ Uranium Isotope
- ☐ Total Uranium
- ☐ Thorium Isotope
- ☐ I-129
- ☐ Radium 226/228
- ☐ Other (Specify below.)

_____

Sample Disposition:

- ☐ Archive**
- ☐ **Return to Submitter**
- ☐ Dispose (The Lab will not be responsible for disposal of chemicals.)

Reason for Analysis (Brief Statement):_____

FOR LAB USE ONLY

Received By_____
Date/Time

Authorized By_____
Signature (Lab Supervisor or Designee) Date/Time

Comments: _____

EL No._____

File Name:_____

System:_____

Disk #:_____

Completion Date:_____

Manager's Approval (Priority Status)_____

Requires Building Manager's or Health Physics Supervisor's approval for priority samples only, with reason stating why. Contact Laboratory Supervision prior to submitting.

* Mandatory entries for acceptance of samples.

** Requires Department/Building Manager's and Laboratory Manager's approval.

INSTRUMENTATION/PERSONNEL LOG SHEET

Room/Area: _____
Date: _____

When completed, attach this sheet to the Survey Data Sheet Package or the Background/Baseline Data Sheet Package which contains the data generated with this instrumentation, by the personnel, listed herein.

Instrument Listing

Note: The efficiencies, E for β (beta) and e for α (alpha), are the instrument responses, as a decimal fraction, to the 4 pi activity of a calibration source in the beta and the alpha mode. A is the face area in cm^2 of the Gas Proportional (GP) Detector used. R is the ratio of the face area of the GP Detector to 100 cm^2 or A cm^2/100 cm^2. For exposure rate instrumentation, complete columns 1, 2, 3 and 7.

1 Model/Type	2 Prop. No.	3 Cal. Date	Efficiency β E	Efficiency α e	7 Type	Detector Area A	R = A/100cm^2

Surveyor Listing

Initials	Print Name	Signature

NOTE: Insert information notes pertinent to the listed instrumentation or its use on the back of this sheet. Persons performing surveys or Background/Baseline evaluations must log on this sheet in the Surveyor Listing section.

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FIELD INSTRUMENT RESPONSE CHECK

Date: _____, 19__

Time	Bldg./Area	Project	Instrument ID	Instrument Mode (Alpha or Beta or Alpha + Beta)	Source	Pass/Fail	Initial

DDO-099, Rev. 11 WSZ

10/92 (jw)

SUMMARY AND/OR SPECIAL REPORT FORM

Building No. _____ W.I. No. _____ Date _____

Entered by _____ Date _____

Reviewed by _____ Date _____

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Number: WI-
Page: 1 of 2
RWP:

WORK INSTRUCTION

To:

Date:

From[1]:

Account No.:

Subject:

Location:

Project Plan (Work Plan, Task Plan):

Procedures Required (include Rev. No.):

Estimated Start Date:

Scheduled Completion Date:

Manpower Requirements:

Instruction:

(Use continuation sheets as needed)

Safety, Health & Environmental Support Manager Approval: _____ Date _____

Building Manager Approval: _____ Date _____

Functional Manager Approval: _____ Date _____

Work Completed by: _____ Date _____

Completed Data Reviewed and Approved By:

Documentation Review Completed By:

Originator	Date	Quality Representative	Date

(1) Distribute approved work instruction to work-assigned staff member, originator, Quality Manager, Project Records Manager, SH&E Support Manager/Health Physics Office, RC&ESH Manager, Building Group Project Manager, other affected organizations (Waste Management, Industrial Health & Safety, etc).

Number: WI-
Page: 2 of 2
Date:
RWP:

Work Instruction
Continuation Sheet

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BATTELLE ENVIRONMENTAL SURVEY
CHAIN-OF-CUSTODY RECORD*

Site		No. of Containers	Analysis															Remarks
Samplers (Signature)																		
Date of Collection	Sample ID Number(s)																	

Relinquished by (Signature)	Date	Time	Received by (Signature)	Date	Time	Received by (Signature)
Relinquished by (Signature)	Date	Time	Received by (Signature)	Date	Time	Received by (Signature)
Relinquished by (Signature)	Date	Time	Received for Laboratory (Signature)	Date	Time	Remarks

Y	N	FOR LAB USE ONLY
		Packages Rec'd w/Custody Seal Intact
		Sample Labels, Tags, and COC Agree

* A sample is under custody if:
1. It is in your possession, or
2. It is in your view, after being in your possession, or
3. It was in your possession and you locked it up, or
4. It is in a designated secure area.

DDO-128, Rev. 0