DEPARTMENT OF THE ARMY
US ARMY RESEARCH, DEVELOPMENT AND ENGINEERING COMMAND
ARMAMENT RESEARCH, DEVELOPMENT AND ENGINEERING CENTER
PICATINNY, NEW JERSEY 07806-5000

Q-5

14 May 2007

Docket No. 040-06377
Control No. 131469

License No. SUB-348

Ms. Betsy Ullrich
Nuclear Materials Safety Branch 2
Division of Nuclear Materials Safety
U.S. Nuclear Regulatory Commission – Region 1
475 Allendale Road
King of Prussia, Pa. 19406-1415

2007 MAY 18 AM 10:10
RECEIVED
REGION 1

Dear Ms. Ullrich,

This is a follow-up to your 16 October 2002 correspondence (encl 1) granting amendment 26 to ARDEC's source material license, SUB-348 (encl 2). As you are aware Bldg. 611B decommissioning activities were subsequently carried out during the August / September 2003 time frame. Please find attached a copy of the Final Survey Report for Bldg. 611B entitled "Final Survey Report for the TACOM – ARDEC PICATINNY ARSENAL BUILDING 611B" (encl 3). Also find enclosed for your reference a copy of the Final Survey Plan for the Bldg. 611B decommissioning project entitled "FINAL SURVEY PLAN for the TACOM – ARDEC PICATINNY ARSENAL BUILDING 611B " (encl 4). It is believed that the content of these reports provides sufficient documentation to substantiate compliance with the Derived Concentration Guidelines Levels for Bldg. 611B surfaces and adjacent soils as stated in amendment 26 of our SUB-348 license, and as such meets the criteria established for release for unrestricted use of this facility and grounds from a radiological standpoint.

Note that several prior attempts had been made by this office to converse further with the contractor, Duratek, on the contents of their final survey report (encl 3) prior to submittal to your agency, but without success. Therefore, in order not to further delay this action, that report and supplements are being submitted to you at this time. Please note that we have incorporated marginal notes to various pages in encl 3 to reflect updated information we had wanted the contractor to incorporate into that report before it's submittal.

Points of contact regarding this correspondence are either Mr. Joseph Fabiano, (973) 724-3742, joseph.a.fabiano@us.army.mil , or the undersigned at (973) 724-3126, richard.w.fliszar@us.army.mil.

Sincerely,

Richard W. Fliszar

Richard W. Fliszar
RDECOM-ARDEC Radiation Protection Officer

140600

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NMSS/RGN1 MATERIALS-002
REF. 131469

Docket No. 040-06377
Control No. 131469

License No. SUB-348

Copies Furnished (w/o encl):

AMSTA-AR-QES-C (Mr. Sami Hoxha – Chairman IRCC)
AMSTA-AR-QES (Ms. Allison Schwier)
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Commander, HQ U.S. Army Field Support Command, ATTN: AMSFS-SF (Mr. Frank Whitaker)
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Commander, HQ U.S. Army Research, Development and Engineering Command, ATTN: AMSRD-MSF (Ms. Laverne Ogieste)
AMSTA-AAR- AEE-P (Dr. Sheldon Cytron)

UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION I
475 ALLENDALE ROAD
KING OF PRUSSIA, PENNSYLVANIA 19406-1415

Received 31 October 2002
Joyce A. Fabiano

October 16, 2002

Docket No. 04006377 License No. SUB-348
Control No. 131469

Richard W. Fliszar
Health Physics Manager
Department of the Army
U. S. Army Tank-Automotive and Armaments Command
Armament Research, Development and Engineering Center
Picatinny Arsenal, NJ 07806-5000

SUBJECT: DEPARTMENT OF THE ARMY, ISSUANCE OF LICENSE AMENDMENT, CONTROL NO. 131469

Dear Mr. Fliszar:

This refers to your license amendment request. Enclosed with this letter is the amended license.

Please review the enclosed document carefully and be sure that you understand and fully implement all the conditions incorporated into the amended license. If there are any errors or questions, please notify the U.S. Nuclear Regulatory Commission, Region I Office, Licensing Assistance Team, (610) 337-5239, so that we can provide appropriate corrections and answers.

In accordance with 10 CFR 2.790, a copy of this letter will be placed in the NRC Public Document Room and will be accessible from the NRC Web site at http://www.nrc.gov/reading-rm.html.

Thank you for your cooperation.

Sincerely,

Betsy Ullrich
Senior Health Physicist
Nuclear Materials Safety Branch 2
Division of Nuclear Materials Safety

RECEIVED
REGION 1
2007 MAY 18 AM 10: 50

Enclosure:
Amendment No. 26

U.S. NUCLEAR REGULATORY COMMISSION

Amendment No. 26

MATERIALS LICENSE

Pursuant to the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974 (Public Law 93-438), and Title 10, Code of Federal Regulations, Chapter I, Parts 30, 31, 32, 33, 34, 35, 36, 39, 40, and 70, and in reliance on statements and representations heretofore made by the licensee, a license is hereby issued authorizing the licensee to receive, acquire, possess, and transfer byproduct, source, and special nuclear material designated below; to use such material for the purpose(s) and at the place(s) designated below; to deliver or transfer such material to persons authorized to receive it in accordance with the regulations of the applicable Part(s). This license shall be deemed to contain the conditions specified in Section 183 of the Atomic Energy Act of 1954, as amended, and is subject to all applicable rules, regulations, and orders of the Nuclear Regulatory Commission now or hereafter in effect and to any conditions specified below.

Licensee	In accordance with the letter dated May 9, 2002,
1. Department of the Army U.S. Army Tank-automotive & Armaments Command, Armament Research, Development, and Engineering Center	3. License number SUB-348 is amended in its entirety to read as follows:
	4. Expiration date July 31, 2011
2. Picatinny Arsenal, New Jersey 07806-5000	5. Docket No. 040-06377 Reference No.

6. Byproduct, source, and/or special nuclear material	7. Chemical and/or physical form	8. Maximum amount that licensee may possess at any one time under this license
A. Depleted Uranium	A. Any	A. 11,000 kilograms
B. Natural Uranium	B. Any	B. 100 kilograms
C. Thorium	C. Any	C. 20 kilograms

9. Authorized use:

A. through C. Research and development as defined in 10 CFR 30.4.

CONDITIONS

10. Licensed material may be used or stored only at the licensee's facilities located at Picatinny Arsenal, New Jersey.

11. Licensed material shall only be used by, or under the supervision of, individuals designated, in writing, by the Ionizing Radiation Control Committee.

12. The Radiation Safety Officer for this license is Richard W. Fliszar.

13. The licensee is authorized to transport licensed material in accordance with the provisions of 10 CFR Part 71, "Packaging and Transportation of Radioactive Material."

License Number
SUB-348

Docket or Reference Number
040-06377

Amendment No. 26

MATERIALS LICENSE
SUPPLEMENTARY SHEET

14. The licensee may use the following Derived Concentration Guideline Level (DCGL) for decommissioning of soil at the licensee's facilities at the Building 611B site, Picatinny Arsenal, New Jersey, with the intention of release of the grounds around the facility for unrestricted use: not more than 186 picocuries of depleted uranium per gram of soil (pCi/g).

15. The licensee may use the following Derived Concentration Guideline Level (DCGL) for decommissioning of building surfaces at the licensee's facilities at the Building 611B site, Picatinny Arsenal, New Jersey, with the intention of release of Building 611B for unrestricted use: not more than 5,550 disintegrations per minute of depleted uranium per 100 centimeters-squared surface area (dpm/100 cm^2) and providing that the removable fraction of residual contamination is less than 10 percent of the total residual contamination.

16. Except as specifically provided otherwise in this license, the licensee shall conduct its program in accordance with the statements, representations, and procedures contained in the documents, including any enclosures, listed below. The U.S. Nuclear Regulatory Commission's regulations shall govern unless the statements, representations, and procedures in the licensee's application and correspondence are more restrictive than the regulations.

    A. Letter dated November 29, 1999, with the "Decommissioning Plan for Buildings 611B, TACOM-ARDEC, Picatinny Arsenal, NJ"
    B. Letter dated May 19, 2000, with enclosures
    C. Application dated April 30, 2001
    D. Letter dated June 22, 2001

For the U.S. Nuclear Regulatory Commission

Date October 21, 2002

By

John D. Kinneman, Chief
Nuclear Materials Safety Branch 2
Division of Nuclear Materials Safety
Region I
King of Prussia, Pennsylvania 19406

14359138

Duratek, Inc.

Final Survey Plan for the TACOM – ARDEC Picatinny Arsenal Building 611B

Revision 1
January 2002

Duratek™

Radioactive Field Services
Commercial Operations
628 Gallaher Road
Kingston, TN 37763

biano, Joseph A [AMSTA-AR-QAW]

From: Fabiano, Joseph A [AMSTA-AR-QAW]
Sent: Thursday, October 31, 2002 11:07 AM
To: Styvaert, Mike [ROCK ISLAND]
Cc: Fabiano, Joseph A [AMSTA-AR-QAW]; Perry, Oscar T [AMSTA-AR-PSS]; Clune, Michael F [AMSTA-AR-CCL-A]; Solecki, Thomas J [AMSTA-AR-PSE]; Lane, Donald R [AMSTA-AR-PSS]; Best, Gary R [AMSTA-AR-PSS]; Kirkpatrick, John J [AMSTA-AR-PSS]; Gabel, Ted [AMSTA-AR-PSE]; Bostonian, John III [AMSTA-AR-FSA-D]; Miller, Timothy L [AMSTA-AR-PW]; jvandeventer (E-mail); Myers, Wesley G II [AMSTA-AR-PSE]; Moore, Connie [ROCK ISLAND]
Subject: FW: B611B License No. SUB-348 Amendment No. 26

B611B_Li.pdf

Good Morning Mike- Please provide a projected start date for the remediation of B611b and grounds. The spring of 2003 would be most favorable.

The trailing memo contains the Nuclear Regulatory Commission's response, to our license SUB-348 amendment request, which includes the use of the following DCGL's for the decommissioning of:

Soil at the B611B site - not more than 186 picocuries of depleted uranium per gram of soil (pCi/g)

lding surfaces at the B611B site - not more than 5,500 disintegrations per minute of DU : 100 centimeters-squared surface area providing that the removable fraction of residual contamination is less than 10 percent of the total residual contamination (page 2 of 2 paragraph 15).

Best Regards- Joe

-----Original Message-----
From: jfabiano [mailto:jfabiano]
Sent: Thursday, October 31, 2002 10:09 AM
To: jfabiano
Subject: B611B License No. SUB-348 Amendment No. 26

Please open the attached document.
This document was sent to you using an HP Digital Sender.

Digital Sender Model:	HP 9100C
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http://www.digitalsender.hp.com/reader-en

Fabiano, Joseph A [AMSTA-AR-QAW]

From: Fabiano, Joseph A [AMSTA-AR-QAW]

Sent: Wednesday, September 24, 2003 10:51 AM

To: Styvaert, Mike [ROCK ISLAND]

Cc: Fabiano, Joseph A [AMSTA-AR-QAW]; Fliszar, Richard W [AMSTA-AR-QAW]; Christopher.M.Hallam@nab02.usace.army.mil; Hans.B.Honerlah@nab02.usace.army.mil; Brescia, Joseph A [AMSTA-AR-WEA]; Douglas Schult (dschult@duratekinc.com)

Subject: Project 99-031 Derivation of a Site Specific DCGL For the Remediation to TACOM-ARDEC Building 318 and Evaluation of Final Survey Results

Signed By: joseph.a.fabiano@us.army.mil

Greetings Mike- Please expedite the unconditional release for unrestrictive use of Building 318 and arrange, possibly with end of year funds if required, for Duratek to provide this office a final draft of the Derivation of a Site Specific DCGL with the: (all) input parameters used in the code; output(s) of the computer runs that show the calculation of the DCGL; sensitivity analysis or explanation as to where the parameters which were not default values came from (a reference or experiment, for example); reason why the default value selected was appropriate for ARDEC's Bldg. 318; and the site specific analytical results to support those parameters which were not default values. The required documentation would then be submitted, with a cover letter from this office, to the Nuclear Regulatory Commission for review, evaluation, and acceptance.

Have a great day- Joe

Fabiano, Joseph A [AMSTA-AR-QAW]

n: Elizabeth Ullrich [EXU@nrc.gov]
Sent: Thursday, May 23, 2002 7:44 AM
To: jfabiano@pica.army.mil
Subject: Re: Final Survey Plan for Building 611B, Revision 1, January 2002

Joe,

The plan was received and processed while I was on travel doing inspections. It was assigned to me for review.

Betsy

>>> "Fabiano, Joseph A [AMSTA-AR-QAW]" <jfabiano@pica.army.mil> 05/23/02 06:52AM >>>
Good Morning Betsy,

Please verify receipt of the subject as stated which was federal expressed to you on 09 May 2002.

Best Regards, Joe

DEPARTMENT OF THE ARMY
UNITED STATES ARMY TANK - AUTOMOTIVE AND ARMAMENTS COMMAND
ARMAMENT RESEARCH, DEVELOPMENT AND ENGINEERING CENTER
PICATINNY ARSENAL, NEW JERSEY 07806-5000

May 09, 2002

Quality Evaluation and Safety Team

Docket No. 04006377
Control No. 127545

License No. SUB-348

Betsy Ulrich
Senior Health Physicist
Nuclear Regulatory Commission
Nuclear Materials Safety Branch 2
Division of Nuclear Materials Safety
Mail Control Number 12377545
475 Allendale Road
King of Prussia, PA 19406

Dear Ms. Ulrich,

This refers to your letter dated November 24, 2000 concerning re-calculation of the DCGL for building surfaces of facilities at the Building 611B site. Please review the enclosed Final Survey Plan for the TACOM-ARDEC Picatinny Arsenal Building 611B, Revision 1, January 2002 from Duratek, Inc which includes a revised DCGL for building surfaces using the computer code RESRAD-Build Version 3.0 and areas of the original plan that have been strengthened or improved

Reference to License No.SUB-348, Amendment [X] will be made in the Radiation Work Permit prior to any decommissioning action rather than to the SUB-348, Amendment No. 21 mentioned throughout the workpackage prepared by the contractor.

Should you have any questions concerning this action Mr. Fabiano or the undersigned may be reached at 1-973-724-3126/3742: jfabiano@pica.army.mil or rfliszar@pica.army.mil or fax number 1-973-724-7047.

Sincerely

Richard W. Fliszar

RICHARD W. FLISZAR
Health Physics Manager
TACOM-ARDEC Radiation Protection Officer
Quality Engineering Directorate

Printed on Recycled Paper

Copies Furnished (w/o encl)

AMSTA-AR-PSS (Mr. O.T. Perry – IRCC Chairman)
AMSTA-AR-QAW (Mr. James Elliott/Mr. Kraig Rauch)
AMSIO-SF (Mr. Michael Styvaert)
AMSTA-CS-CZ (Ms. Karen McGuire)
AMCSF-P (Mr. John Manfre/Mr. Richard Lovell)
AMCSG-R (Major Jason Dunavant)
Duratek, Inc. (Mr. Robin Shult)

Approvals Page

FINAL SURVEY PLAN
for the
TACOM - ARDEC
PICATINNY ARSENAL
BUILDING 611B

Revision 1
January 2002

Prepared by:	Douglas Schult, CHP	1/30/02 Date
Reviewed by:	Elizabeth Langille, CHP	1/30/02 Date
Reviewed by:	Robin Shult, Commercial Operations General Manager	1/30/02 Date
Approved by:	Mike Styvaert, Army Project Manager	2/1/2002 Date

Radiological Field Services
Commercial Operations
628 Gallaher Road
Kingston, TN 37763

PREFACE

This revision to the Final Survey Plan for Building 611B addresses comments from the NRC contained in a letter dated November 24,2000. In the referenced letter the NRC stated that the DCGL for building surfaces proposed in Revision 0 of the plan was not acceptable. Therefore this revision of the plan includes a revised DCGL for building surfaces. The computer code RESRAD-Build Version 3.0 was used to calculate the revised DCGL based on an assumed industrial exposure scenario. Included is a discussion on the assumptions made in calculating the DCGL and the computer runs used to perform the calculation.

In preparing this revision to the Final Survey Plan for Building 611B it was noted there were several areas where the plan could be strengthened or improved. Some of these areas are related to contractual requirements and some are related to experience gained since Revision 0 of the plan was issued in November 1999.

To aide those who have reviewed Revision 0 of the Final Survey Plan for Building 611B the following list outlines areas of the plan that have been strengthened or improved:

1. The DCGL for building surfaces has been revised, (Section 3.1 and Appendix C).

2. A criteria for evaluating removable activity concentrations on building surfaces has been added to support an assumption used in calculating the DCGL for building surfaces, (Sections 3.1 and 3.3).

3. The action level of "approximately 100 pCi/g" for soil has been removed and replaced with a commitment to ALARA, (Section 3.2).

4. The plan now states that direct beta measurements will be used to assess total activity concentrations on building surfaces, (Sections 1.3 and 5.4.2).

5. The plan now states that direct beta measurements will be performed using a detector calibrated to Tc-99. The detector's efficiency will ignore variations in end point beta energies and differences in beta yields, (Section 1.3).

6. The plan now states that the Wicoxon Rank Sum Test will be used, when appropriate, to evaluate direct beta measurement results collected on building surfaces. Included is the need for establishing reference background areas, (Section 4.2.1).

7. The plan now states that the Sign Test will be used, when appropriate, to evaluate soil sample results since the DCGL for soils is much larger than the expected background concentrations of the radionuclides of interest, (Section 4.2.2).

8. The plan now states that, if required, elevated measurement criteria will be used and guidance on their use is provided, (Sections 4.2.1, 4.2.2 and 4.7).

9. The plan now allows for the possibility of Class 1, Class 2, and Class 3 survey units and provides guidance on when their use would be appropriate, (Section 5.2).

10. The plan no longer requires scanning MDAs to be equal to approximately 50% of the applicable DCGL. The plan now states that if the scanning MDAs are not less than the DCGLs then the number of direct measurements or soil samples may need to be increased, (Section 4.6).

11. .The plan now provides an equation for determining the scanning MDA for a sodium iodide detector, (Section 6.3).

12. The plan now includes as a reference NUREG-1727, NMSS DECOMMISSIONING STANDARD REVIEW PLAN, September 2000, (Section 10.2).

Implementation this revision of the Final Survey Plan for Building 611B will result in documentation showing that Building 611B and the surrounding ground meets the criteria for release for unrestricted use allowing Building 611B and the surrounding grounds to be removed from the Army's Radioactive Material License, License No. SUB-348.

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1.0 SITE INFORMATION

Building 611B is licensed to the US Army Tank Automotive Command (TACOM) - Armament Research, Development and Engineering Center (ARDEC) at the Picatinny Arsenal in New Jersey under the NRC Radioactive Materials License Number SUB-[illegible], [illegible] No. 21. The purpose of this final survey plan is to specify the survey protocols and subsequent data analyses necessary to show that Building 611B and the surrounding grounds meets the criteria established for release for unrestricted use. Implementation of this revision of the Final Survey Plan will result in documentation showing that Building 611B and the surrounding grounds meet the criteria for release for unrestricted use, allowing the building and surrounding ground to be removed from the Army's Radioactive Material License. The license itself is not being terminated since it authorizes the use/storage of radioactive materials at several facilities at the Picatinny Arsenal.

1.1 Site Description

Building 611B is centrally situated in a fenced area approximately 40,000 ft^2. The building is a single-story structure of about 1,100 ft^2 containing two test-firing ranges, one of which was a Depleted Uranium (DU) range while the other was designated a non-DU range. The walls of the non-DU range are constructed of concrete block; the floors are concrete and tile; and the roof is a steel, hemispherical structure that is approximately 6 feet wide, 8 feet high, and 40 feet long. The DU range is a concrete tube about 8 feet in diameter and 40 feet long. Other structures include an instrument room, foyer, and two storage rooms.

A diagram of the Building and the surrounding area is provided as Figure 1-1.

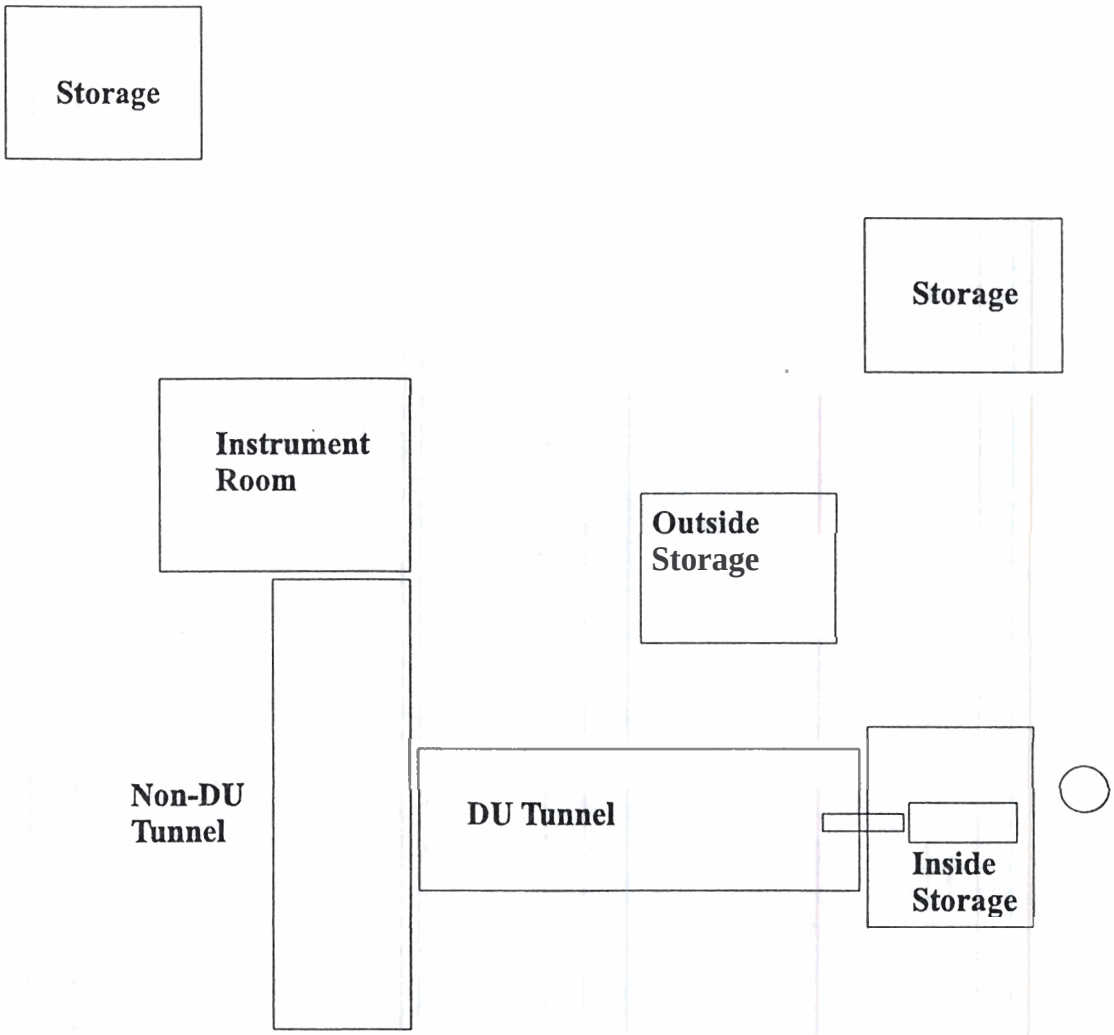
1.2 Site History

Building 611B was designed for testing of munitions and contained only non-radioactive munitions until approximately 1959 when an east-west tunnel was added to the existing structure for DU munitions testing. The site has not been used for DU munitions testing since approximately 1985 and will no longer be used for DU testing.

Depleted Uranium use within Building 611B consisted of limited DU firing within the confines of the firing range and target room of the building. The target room was ventilated thru by a High Efficiency Particulate Air (HEPA) filtered ventilation system. This system discharged cycled air after four stages of filtration to an area above the storage room located at the end of the firing range/target room.

There has been limited migration of DU from the active use areas of Building 611B to adjacent soils and areas within the facility. DU migration was identified in the characterization report where activity was identified in the soil around the building at the access points, on the interior structural surfaces of the building and areas around the building runoff locations.

Figure 1-1
Building 611B Layout



1.3 Radionuclides of Concern

The radionuclides of concern within Building 611B and surrounding structures and in the surrounding soils are those associated with depleted uranium. Depleted uranium consists of three naturally occurring, long lived uranium isotopes, uranium-234, uranium-235, and uranium-238. As compared to naturally occurring uranium, depleted uranium contains less uranium-234 and uranium-235. The relative fractions, in terms of activity concentrations, of the three long lived uranium isotopes in the depleted uranium used at the Picatinny Arsenal are:

- U-234 0.305
- U-235 0.013
- U-238 0.682

NOTE: The relative fractions of the uranium isotopes in depleted uranium assumed above are conservative. If deemed necessary this Final Survey Plan, specifically Sections 1.3 and 3.0, may be revised to take advantage of less conservative relative fractions. If this Final Survey Plan is so revised, it will be forwarded to the NRC for review along with the basis for the new relative fractions.

The half lives of uranium-234, uranium-235, and uranium-238 are 2.4475 years, 7.04E8 years, and 4.47E9 years respectively. Uranium238 and uranium-234 are both members of the uranium decay chain and will eventually reach equilibrium. However the time required to reach equilibrium is measured in millenniums. Due to the half lives involved, the relative ratios of the three uranium isotopes in depleted uranium will remain essentially constant.

While uranium-234 and uranium-238 are both members of the uranium decay chain, uranium-235 is a member of the actinium decay chain. Table 1-1 shows the first several radionuclides of the uranium decay chain and Table 1-2 shows the first several members of the actinium decay chain.

Table 1-1
Uranium Decay Chain
(partial)

Nuclide	Half Life	Major Radiations Energies (MeV) and intensities (%)		
		Alpha	Beta	Gamma
U-238	4.51E9 years	5.15 MeV 25% 4.20 MeV 75%		
Th-234	2.41E1 days		0.103 MeV 21% 0.193 MeV 79%	0.063MeV 3.5% 0.93 MeV 4.0%
Pa-234m*	1.17E0 min		2.29 MeV 98%	0.765 MeV 0.3% 1.001 MeV 0.6%
U-234	2.27E5 years	4.72 MeV 28% 4.77 MeV 72%		0.053 MeV 0.2%
Th-230	8.0E4 years	4.62 MeV 24% 4.68 Mev 76%		0.068 MeV 0.6% 0.142 MeV 0.1%

* In the above table the fact that Pa-235m undergoes an isomeric transition to its ground state approximately 0.13 % of the time is ignored.

Table 1-2
Actinium Decay Chain
(partial)

Nuclide	Half Life	Major Radiations Energies (MeV) and intensities (%)		
		Alpha	Beta	Gamma
U-235	7.1E8 years	4.37 MeV 18% 4.40 MeV 57% 4.58 MeV 8%		0.143 Mev 11% 0.185 MeV 54% 0.204 MeV 5%
Th-231	2.55E1 hours		0.140 MeV 45% 0.220 MeV 15% 0.305 MeV 40%	0.026 MeV 2% 0.084 MeV 10%
Pa-231	3.25E4 years	4.95 MeV 22% 5.01 MeV 24% 5.02 MeV 23%		0.027 MeV 6% 0.29 MeV 6%

Based on the relative fractions of the radionuclides associated with depleted uranium and their decay chains compliance with the DCGL for building surfaces will be evaluated based on direct beta measurements collected using a detector calibrated using Tc-99. The use of a detector calibrated using Tc-99 will be conservative considering the energy and yields of the beta particles emitted during the decay of depleted **uranium.** Compliance with the DCGL for soil will be demonstrated by gamma spectroscopy, The gamma spectral analysis will focus on Th-234 a short lived daughter of U-238. However since U-238 accounts for only 68.2 % of the activity associated with depleted uranium, the limit for Th-234 in soil will be set at 68.2 % of the DCGL for depleted uranium in soil.

2.0 ORGANIZATION AND RESPONSIBILITIES

Duratek will implement an integrated management approach that includes project management oversight and technical support. The full resources of Duratek's Bear Creek and Gallaher Road offices, including professional engineering and quality assurance staff, will support the Project Sponsor and the on-site team to ensure successful project execution and completion.

The on-site survey team will consist of a Project Manager/Supervisor and Senior HP Technicians. These personnel will, as a minimum, be trained, qualified, and experienced in field radiological survey procedures and have current HAZWOPER training.

2.1 Project Sponsor (Off-site)

The Project Sponsor provides the project lead for any home office support on an as needed basis. He/she will assist the Project Manager with the coordination of any project activities as needed.

2.2 Project Manager/Supervisor (On-site)

The Project Manager is the primary point of contact and interface. The minimum requirements for the Project Manager are 5-10 years of health physics experience including prior management experience.

Helshe will be responsible for the supervision and coordinate the daily activities including the overview of the final status surveys. In order to ensure regulatory compliance, helshe will be qualified in the use of the survey instruments used and be familiar with the aspects of surveying as described in NUREG-1575 and this Survey Plan.

2.3 Health Physics (HP) Technician(s)

The HP Technician(s) are responsible for performing the final status surveys and collecting samples as necessary. They will be qualified in the use of the survey instruments and the performance of surveys in accordance with NUREG-1575 as well as this Survey Plan.

3.0 DERIVED CONCENTRATION GUIDELINE VALUES, DCGLs

Subpart E to 10 CFR 20 provides the criteria for release for unrestricted use. It states that the total effective dose equivalent (TEDE) to a member of a critical group, due to residual contamination that is distinguishable from background, shall not exceed 25 mrem/yr and that the residual contamination levels are reduced to levels that are as low as reasonably achievable (ALARA). In order to demonstrate compliance with the criteria for release for unrestricted use, DCGLs are calculated. Since residual contamination is expected within

Building 611B and in the surrounding soil, DCGLs for both building surfaces and soil will be required. The DCGLs relate activity concentrations on building surfaces (dpm/100 cm^2) [redacted] n soil (pCi/g) to the TEDE of 25 mrem/yr.

Building 611B is located in a fenced area of approximately 40,000 ft^2. Building 611B is a single story structure of approximately 1,100 ft^2. It consists of two test firing ranges, an instrument room, two storage rooms, and a foyer. One of the test firing ranges is hemispherical structure approximately six feet wide, eight feet high, and 40 feet long. The other test firing range consists of a tube eight feet in diameter and 40 feet long. The area in which Building 611B contains no surface water.

3.1 Building Surfaces

Based on the physical attributes of Building 611B and its location on an active military base it was determined that a conservative exposure scenario on which to base the DCGL for DU on building [redacted] was an industrial worker scenario. The computer code RESRAD-BUILD, Version *3.0* was used to calculate the DCGL. Attachment C contains a copy of the RESRAD-BUILD run. In calculating the DCGL the RESRAD-BUILD default values were used with the following exceptions:

- The evaluation times of 0, 1, 2, 5, 10,100, 1000 years were selected.
- The exposure duration was set at 250 days
- The fraction of the exposure duration spent inside was set at 0.33 days; (250 days)(24 hours/day)(.33) = 1,980 hours.
- The removable activity fraction was set at 0.1.
- The area source type was selected.

As the RESRAD-BUILD run in Appendix C shows, an assumed DU activity concentration of 100 pCi/m^2 results in a maximum dose in the first year of exposure of 1.0E-2 mrem. Given that the criteria for release for unrestricted use is 25 mrem/yr the DCGL for building surfaces is:

$$DCGL = \frac{25\,mrem}{yr} * \frac{100\,pCi/m^2}{1.0E-2\,mrem/yr} * \frac{2.22\,dpm}{pCi} * \frac{m^2}{1E+4\,cm^2} * \frac{100\,cm^2}{100\,cm^2} = 5{,}550\,dpm/100\,cm^2$$

As stated above, the DCGL for DU on building surfaces was calculated in part based on a removable activity fraction of 0.1. Therefore surveys for removable activity will be required during the final survey to show that the removable DU activity concentration is less than *550* dpm/100 cm^2. Since inhalation is the primary exposure pathway associated with an industrial scenario involving DU, appropriate steps will be taken to reduce removable activity concentration of DU to as low as reasonably achievable. These steps may include vacuuming, mopping, and removal of surface coverings.

3.2 Soil

Initially, a DandD code run was utilized to determine a Derived Concentration Guideline Level (DCGL) for the exterior grounds as shown in Attachment D. An arbitrary value of 100 pCi/g of DU, with the same isotopic ratios as above for building surfaces, was input using the default Residential Scenario. This resulted in a TEDE of 5129 mrem/yr, as shown in Table 3-1. Scaling to a TEDE pf 25 mrem/yr results in a concentration guideline level of 0.49 pCi/g.

Table 3-1
Pathway Component of Maximum Annual Dose from 100 pCi/g of Depleted Uranium

Pathway	TEDE (mrem)	Percentage
External	0.328	0.01
Inhalation	0.053	0.00
Agricultural	8.98	0.18
Soil	0.027	0.00
Drinking	1,230	23.96
Irrigated	2,550	49.80
Aquatic	1,340	26.06
Total	**5,129.3**	**100**

As seen in the above table, the results were extremely high, due mainly to the water pathways including groundwater irrigation of crops, consumption of aquatic foodstuff, and drinking water fi-om a well on the site.

Appendix E of draft NUREG-1549 allows for the modification of pathways based on input from a site-specific model. For example, the aquatic pathway (the consumption of fish from a contaminated pond), can be set to zero if there is no pond or surface water that could support fish. The Building 611B site does not contain such surface water. However, the removal of this pathway increases the guideline level only about 50% to 0.66 pCi/g.

The two other major dose producing pathways, irrigation and drinking water, both assume that there is, or will be, a well on the site providing contaminated groundwater for drinking and crop irrigation. Without further information on the future uses of the site, it would be imprudent to assume that the development of a groundwater well would not occur.

In order to determine a more reasonable (and achievable) DCGL for the soils surrounding the building, it was necessary to modify the contaminated zone affecting the groundwater aquifer. The DandD code does not lend itself to this modification, so the computer code **RESRAD** Version 5.82 was used.

Using the same input concentrations as above for the DandD code, RESRAD was first run using all default parameters for all pathways. The result was a TEDE of 102 mrem/yr for an inpc e n t r a t i o n of 100 pCi/g. When scaled to a TEDE of 25 mrem/yr, this provides a soil concentration of 24.5 pCi/g. The resulting RESRAD output is provided as Attachment E.

The input parameters were then modified to more accurately reflect the Building 611B site conditions as follows:

1. The total area initially considered affected (above 35 pCi/g) is approximately 300 m^2. (Reference 8.10) The total area of the Building 611B site is approximately 4,000 m^2 (Reference 8.9). The **RESRAD** input parameter "Contaminated Zone" was changed from a default of 10,000 m^2 to the more conservative site-specific value of 4,000 m^2.

2. Characterization survey soil sample results from the Building 611B site show that the soil contamination is restri[illegible] inc[illegible]s (1[illegible]m) of soil. The RESRAD input parameter "Thickness of contaminated zone" was changed from the default of 2 meters to a conservative site-specific value of 0.25 meters.

Using the above site-specific parameters, RESRAD was run again (Attachment F). The result was a TEDE of 13.4 mrem/yr for an input concentration of 100 pCi/g. When scaled to a TEDE of 25 mrem/yr, this provides a DCGL of 186 pCi/g.

In accordance with the ALARA philosophy, if discrete volumes o[illegible] soil (< 1.0 m^3) with elevated activity concentrations are encountered that approach the DCGL for soils (> 100 pCi/g) they will be remediated. This will result in less residual radioactivity and reduce the potential for having to evaluate the data using the Wilcoxon Rank Sum Test and the elevated measurement criteria

3.3 DCGL Summary

Table 3-2 summarizes the depleted uranium DCGLs for Building 611B. The primary DCGL for building surfaces is 5,500 dpm/100 cm^2. This DCGL is to be interpreted in terms of total activity as evaluated using direct beta measurements. In deriving this DCGL it was assumed that the removable activity fraction was less than 10 %. Therefor a secondary DCGL, in terms of removable activity, of 550 dpm/100 cm^2 is also specified for building surfaces.

The DCGL for depleted uranium in soil is 186 pCi/g. This DCGL is to be interpreted as the sum of the activity concentrations of the three uranium radionuclides. In order to allow for the use of gamma spectral analysis of soil samples in demonstrating compliance with the DCGL, the DCGL for depleted uranium in soil will be equated to a Th-234 activity concentration. Th-234 is the short lived daughter (t,, = 24.1 days) of U-238 and under all practical applications will be in equilibrium with U-238. Since U-238 accounts for 68.2 % of the uranium activity in depleted uranium the DCGL for depleted uranium can be shown to be equivalent to approximately 125 pCi/g of Th-234.

Table 3-2
Derived Concentration Guideline Levels
For Depleted Uranium

Building 611B Surfaces and Surrounding Soils DCGLs	
Building Surface Contamination	5,500 dpm/100 cm^2 (total) 550 dpm/100 cm^2 (removable)
Soil Contamination	186 pCi/g (depleted uranium) 125 pCi/g (Th-234)

4.0 SURVEY OVERVIEW

This section provides the basis for developing the MARSSIM survey of the facility. In order to design the survey, several parameters must be set to ensure that the survey will stand up to and meet the statistical evaluations to justify the release of the facility. These include the establishment of the Data Quality Objectives, Release Criteria or Derived Concentration Guideline Levels, establishing the acceptable decision errors and the calculation of the Relative Shift in order to determine the number of required measurements per survey unit.

4.1 Data Quality Objectives

- To ensure the proper release of the facility, the objectives of this survey plan are:
- The selection of appropriate instrumentation to adequately detect the radionuclides of concern,
- Establish proper count times and measurement MDAs (Minimum Detectable Activities) to verify that the release criteria are met,
- Perform surveys to verify the radiological status of the facility,
- Ensure that personnel exposure from residual contamination will not exceed 25 mrem/year to an individual based on the intended use of the facility, and
- Statistically evaluate the data to ensure that sufficient data is collected to prepare a report supporting the removal of the facility from the Radioactive Materials License.

Surveys and data evaluation will be based on the guidance in NUREG-1575, Multi-Agency Radiation Survey and Site Investigation Manual *(MARSSIM)*, and include measurements for direct surface activity, removable activity and exposure rates.

4.2 Non Parametric Statistics

4.2.1 Building Surfaces

Compliance with the DCGL for building surfaces will be demonstrated by collected direct measurements. Since these measurements are not radionuclide specific it may be necessary to use the Wilcoxon Rank Sum Test to evaluate the resulting data. The Wilcoxon Rank Sum Test will be used to evaluate survey data fiom survey units in which the average of the direct beta measurements are less than the DCGL but which have individual measurement results exceeding the DCGL. Each survey unit evaluated using the Wilcoxon Rank Sum Test will be compared to an appropriately chosen Reference Area.

If an individual measurement result exceeds the DCGL the area from which the measurement was collected will also be evaluated using the elevated measurement criteria.

4.2.2 Soils

Since the DCGL for depleted uranium is large compared to the expected back ground activity concentrations it will be assumed for the purpose of evaluating final survey data that radionuclides associated with depleted uranium are not present in background. This along with the fact that compliance with the DCGL for soils will be demonstrated by gamma spectroscopy which is a radionuclide specific analysis allows for the analysis of the final survey data, if necessary, using the Sign Test. The Sign Test does not require the use of reference background areas. The Sign Test will be used to evaluate survey data from survey units in which the average of all the discrete analyses is less than the DCGL but which have individual analysis results exceeding the DCGL.

If an individual sample analysis result exceeds the DCGL the area from which the sample was collected will also be evaluated using the elevated measurement criteria.

4.3 Decision Error

There are two types of decision error applied to analytical results: Type I (a) and Type II (β) errors. A Type I error, or false positive, is the probability that a survey result/measurement is above the release criteria when in fact it is not, while a Type II error, or false negative, is the probability of determining that a result/measurement is below the release criteria when it is not. The probability of making decision errors can be controlled by adopting an approach called hypothesis testing.

The null hypothesis (H_0) is treated like a baseline condition and is defined by MARSSIM as:

H_0 = residual radioactivity in the survey exceeds the release criterion!

This means that the site or survey area is assumed contaminated until proven otherwise. For the purpose of this Final Survey, both Type I (a) and Type II (β) will be set at 0.05 or 5 percent.

4.4 Relative Shift

The relative shift is defined as " A / o " where "A" is the DCGL - LBGR (Lower Bound of the Gray Region) and " σ " is the standard deviation of the contaminant distribution. In order to calculate the relative shift, the DCGL must be determined and two assumptions made to estimate the LBGR and the standard deviation of the measurement distribution. MARSSIM suggests that the LBGR be set at approximately 50% of the DCGL but can be adjusted later to provide a value for the relative shift between the range of 1 to 3. The standard deviation may be calculated from preliminary survey data, prior surveys of similar areas and materials or the standard deviation of a reference background area. It should be noted that " σ " represents the standard deviation prior to release after all area decontamination is thought to be complete. If no reference data is available to make a reasonable estimate, MARSSIM suggests using 30% of the mean survey unit background.

4.5 Number of Samples/Measurements

The number of samples and/or measurements to be collected in each survey unit is dependent on the non parametric statistics to be used to test the null hypothesis, acceptable decision errors, and the relative shift. In cases where scanning sensitivities are not adaquate to see the DCGLs, the samples and measurements will need to be increased. Since non radionuclide specific direct beta measurements will be used to evaluate direct beta measurements on building surfaces they will be evaluated using the Wilcoxon Rank Sum Test. The Wilcoxon Rank Sum Test requires the evaluation off appropriately chosen reference areas.

Soil samples will be evaluated by gamma spectroscopy in order to quantify the Th-234 activity concentration present. Although Th-234 is present in background, it will be assumed that all Th-234 associated with the soil samples is due to the presence of depleted uranium since the naturally occumng Th-234 will be insignificant compared to the DCGL for depleted uranium. Since the results of a gamma spectral analysis is radionuclide specific, the Sign Test used to evaluate the analysis results. The Sign Test does not require the evaluation of reference areas.

4.5.1 Wilcoxon Rank Sum Test

Once the relative shift, A / a, has been determined and the decision errors defined the Table in Attachment A can be used to determine the number of measurements required to evaluate a given survey unit. The interpolated value of N12 gives the number of measurements required within a given survey unit. An equal number, N/2, of measurements are required from within the reference area.

4.5.2 Sign Test

Once the relative shift, A / σ, has been determined and the decision errors defined the Table in Attachment B can be used to determine the number of samples required to evaluate a given survey unit. The interpolated value of N gives the number of measurements required within a given survey unit. When using the Sign Test, samples are not required from a reference area.

4.6 Sample/Measurement Number Reasonableness

Once the number of samples/measurements has been calculated, it must be determined whether or not the number is reasonable for the survey. It is possible, even if the MARSSIM guidance is strictly followed, that there are not enough samples to produce the desired level of "contfort" or the number appears to be excessive. This is performed on a case-by-case basis and if the number of samples/measurements is not reasonable, then the data quality objectives or initial assumptions will be re-evaluated.

It must also be determined if either of the scanning MDAs (beta or gamma) calculated in accordance with Sections 6.2 and 6.3 of this plan exceed the DCGLs. If either of the scanning MDAs exceed the DCGLs the number of samples/measurements to be collected in each survey unit may need to be increased to account for the lack of scanning sensitivity.

When the scanning MDA exceeds the DCGL, an Area Factor, AF, is calculated as follows:

$$AF = \frac{MDA_{scanning}}{DCGL}$$

Then the size of the area of elevated activity that corresponds to the Area Factor, AF, is determined. This is calculated by decreasing the size of the assumed area of contamination and rerunning the computer code used to calculate the DCGL. The ratio of the new run to the original run is compared to the Area Factor. When the ratio equals the Area Factor, the size of the area of elevated activity that corresponds to the Area Factor has been determined, i.e. the size of the assumed area of contamination for the appropriate computer run.

The number of samples/measurements required to account for lack of scanning sensitivity, Ns, is calculated as follows:,

$$Ns = \frac{A}{As}$$

Where:	**A**	=	Survey Unit Area
	As	=	The size of the area of elevated activity that corresponds to the Area Factor

If Ns excceds the number of samples/measurements calculated using section 4.5.1 or section 4.5.2 of this plan then it represents the minimum number of samples/measurements to be collected from each survey unit.

4.7 Elevated Measurement Criteria

Measurement and sample analysis results that exceed the DCGLs will require that the area from which the result was obtained be evaluated using the elevated measurement criteria. The elevated measurement criteria is size dependent. Once the size of the area associated with the elevated activity is determined it is input, along with the elevated measurement result, into the computer code used to calculate the DCGL. The resulting annual dose divided by the criteria for release for unrestricted use, 25 mrem/yr, is the elevated measurement criteria. If the measurement/sample analysis result divided by the DCGL exceed the elevated measurement criteria the survey unit in question does not meet the criteria for release for unrestricted use.

5.0 SURVEY DESIGN AND IMPLEMENTATION

The purpose of the survey is to collect sufficient survey data to remove Building 611B from Radioactive Material License SUB-348, Amendment 21 and the NRC licen application. The project team will perform surveys according to project specific Duratek procedures and this Survey Plan. Implementation of this Survey Plan will include the following:

- Survey instrumentation will be set up and source checked to ensure proper operation.
- The Project Manger/Supervisor will perform preliminary inspections of the areas to identify additional specific survey requirements.
- The Project Manager/Supervisor will develop survey packages for the survey areas.
- The project team will grid the survey areas as specified by the following survey. protocols and mark or map the survey locations as applicable.
- The project team will take survey measurements and analyze samples using appropriate calibrated instruments and perform daily source and background checks before and after each day's work.
- Direct survey data collected during the project will be downloaded fiom the survey instrument into a database for storage and processing.
- The Project Manager will review the completed survey packages to ensure that all required surveys have been performed.

- The Project Manager will review the survey results to identify any areas exceeding the specified release criteria.

In order to support the final status surveys of the building, the facility will be cleared of all loose equipment and materials to the maximum extent possible. Surveys will then be performed as follows:

5.1 Instnunentation and Selection

Selection and use of survey instrumentation will ensure sensitivities are sufficient to detect the identified radionuclides at the minimum detection requirements. Table 4-1 provides a list of the instruments, types of radiations detected and calibration sources, which will be utilized.

Duratek will use the Ludlum Model 2350 Data Logger with a variety of detectors for direct measurements of beta surface activity as well as exposure rate measurements. The Data Logger is a portable microprocessor computer based counting instrument capable of operation with NaI(Tl) gamma scintillation, gas-flow proportional, GM and ZnS scintillation detectors.

Detector selection will depend upon the type of survey, surface contour and survey area size. The project team will typically use the 126 cm^2 gas-flow proportional detector for direct beta measurements for most areas and the 15.5 cm^2 GM detector for smaller areas in which the gas-flow proportional detector will not fit.

Exposure rate measurements and gamma scans will be performed using either a Ludlum Model 44-2 or 44-10 NaI(Tl) gamma scintillation detector.

Analysis for removable alpha and beta activity will be performed using either Tennelec gross alpha/beta counter or the Eberline BC-4 and SAC-4 scaler counters.

Table 4-1
Survey Instrumentation

Instrument/Detector	Detector Type	Radiation Detected	Calibration Source	Use
Ludlum Model 2350 wt. 43-68, 43-98 or 43-94 detector	Gas-flow proportional ($126cm^2$)	Alpha or beta	^{99}Tc (β) ^{230}Th (a)	Direct beta surveys; Beta scans on solid surfaces, soil and sand.
Ludlum Model 2350 wt. 44-40 detector	Shielded GM (15.5cm5)	Beta	^{99}Tc (β)	Direct beta surveys; Beta scans on solid surfaces, soil and sand.
Ludlum Model 2350 wt. 44-2 or 44-10 detector	NaI(Tl) Scintillator	Gamma	^{137}Cs (y)	Gamma exposure rate and gamma scans.
Eberline SAC-4 Scaler Counter	ZnS scintillator	Alpha	^{230}Th (a)	Smear counting
Eberline BC-4 Scaler Counter	Shielded GM	Beta	^{99}Tc (β)	Smear counting
Tennelec Planchette Counter	Shielded Gas-flow proportional	Alpha and Beta	^{99}Tc (β), ^{230}Th (a)	Smear counting
EG&G NOMAD Gamma Spectrometer	HPGe	Gamma energy and intensity	Mixed gamma	Nuclide identification and quantification soil and sand samples.

5.1.1 Instrument Calibration

The data loggers, associated detectors and all other portable instrumentation are calibrated on a semi-annual basis using National Institute of Standards and Technology (NIST) traceable sources and calibration equipment. Calibration typically includes:

- High Voltage calibration,
- Discriminator/threshold calibration,
- Window calibration,
  Alarm operation verification, and
- Scaler calibration verification

The detector calibration includes:

- Operating voltage determination,
- Calibration constant determination, and
- Dead time correction determination

Calibration labels showing the instrument identification number, calibration date and calibration due date are attached to all portable field instruments.

5.1.2 Sources

All sources used for calibration or efficiency determinations for the survey will be representative of the instrument's response to the identified radionuclides and are traceable to NIST. The sources, used du the surveys, will include ^{99}Tc, ^{230}Th, ^{137}Cs and mixed gamma sources.

Health Physics Technicians will control radioactive sources used for instrument response checks and efficiency determination. Sources will be stored securely and signed out when needed in the field. A source sign-out log will track the location of all sources when they are removed from the Duratek field office.

5.2 Survey Unit Classification

Survey units are discrete areas, consisting of building surfaces or land areas, of a specific size and shape for which separate decisions relative to the DCGL,s will be made. Survey units are defined based on the site's history, potential for residual contamination, and physical characteristics. All impacted areas are divided into survey units. Impacted areas are those areas with a potential of being contaminated. Non impacted areas are areas that do not have a potential for being contaminated and are not surveyed as part of the final survey.

Survey units are classified as Class1, 2, or 3. A Class 1 survey unit is a survey unit that has or had prior to remediation contamination levels approaching or exceeding the DCGL. A Class 2 survey unit is a survey unit that does not have contamination approaching or exceeding the DCGL. Typically Class 2 survey units are not remediated. If remediation is required the survey unit is reclassified as Class 1. A class 3 survey unit is a survey unit is a survey unit that is not expected to contain contamination or is expected to contain contamination at a fraction (< 10 %) of the DCGL.

Survey units are limited in size to ensure adequate survey coverage, The size limits are specified in the following Table.

Suwey Unit Classification	Size Limit, m^2
Class 1	
Building Surfaces	< 100
Land Areas	< 2,000
Class 2	
Building Surfaces	<1,000
Land Areas	< 10,000
Class 3	
Building Surfaces	No limit
Land Areas	No limit

Based on the data presented in reference 10.10, the DCGL for building surfaces and the size of Building 611B all of the survey units within the building will be classified as Class 1. The building exterior and anyremaining structures on the surrounding grounds will be classified as Class 2. Based on the DCGL for soils and Reference 10.10 the grounds surrounding Building 611B will be c[redacted]sified as Class 2.

Classifying the building exterior, remaining structures, and grounds as Class 2 reduces the required survey frequency, especially that associated with scanning. This will aid greatly in dealing with the unexploded ordinance concerns surrounding Building 611B.
The following is a list of likely survey units:

- DU tunnel,
- DU target area,
- Inside storage area,
- Non-DU tunnel,
- Instrument room and foyer,
- Outside storage areas (3),
- Building exterior (roof), and
- Grounds surrounding Building 611B.

It is possible that as remediation activities progress, in prepararion for the final survey, that some of the survey units listed may be combined. It is also possible that additional survey units may be established.

5.3 Survey Package Development

For each survey area/unit, the project team will develop a package, or portfolio, by performing a walk-down and preparing a worksheet/tracking sheet outlining the general survey instructions, location codes, and any specific survey instructions for any abnormal conditions within the survey area. Completion and review signature blocks will be used to track the progress of the surveys.

During the survey, the project team will update the survey package(s) with the survey data and results of any special surveys or sample analyses performed.

5.4 Survey Protocols/Requirements

The final status survey of the building will consist of beta scans, fixed beta measurements, and smears for gross alpha and gross beta analysis. The survey of the facility grounds will consist of gamma scans and soil sampling for gamma spectroscopy analysis. Surveys will be performed as follows:

5.4.1 Surface Scans

a. Beta Scans

For class 1 survey units, beta scans will be performed over 100% of the accessible building surfaces (interior) and the roof using a gas-flow proportional detector while listening to the audible output of the instrument. For class 2 survey units, beta scans will be performed over approximately 50% of the accessible building surfaces. All areas of elevated activity will be identified for further investigation and potential decontamination. Any area exceeding the $DCGL_W$ will be identified and decontaminated. Scan speeds will be established such that contamination at levels of approximately 50% of the $DCGL_W$ will be detected.

b. Gamma Scans

Gamma scans will be performed on the open land areas surrounding Building 611B. As a minimum, 10% of the open land areas will be scanned. If unexploded ordinance concerns can be adequately addressed, the scan coverage will increase to 25%. A NaI(Tl) gamma scintillation detector will be used with the Ludlum Model 2350 to help identify any areas of residual contamination in the soil or the building interior. The detector will be moved in a serpentine manner in close proximity with the ground while listening to the audible output of the instrument. Any areas where a noticeable increase in the count rate is determined will be flagged for further investigation and/or sampling.

5.4.2 Direct Beta Measurements

Direct beta measurement will be taken on the structural surfaces of Building 611B within each survey area/unit. The number of measurements and spacing will be determined in accordance with

MARSSIM and this Plan.

a. Number of Measurements

The number of measurement for each survey unit will be determined in accordance with section 4.5.1 and 4.6 of this plan. A relative shift of between 1 and 3 should be used, resulting in approximately 10-30 measurement per survey unit.

The number of measurements determined in accordance with section 4.5.1, N/2, represents the number of measurements to be collected from each survey unit. An equal number of measurements, N/2, needs to be collected from an appropriate reference area in order to evaluate the final survey data using the Wilcoxon Rank Sum Test

5.4.3 Removable Activity Measurements

Smears will be taken at each direct measurement location for gross alpha and gross beta analysis.

5.4.4 Soil Sampling

Surface (0-15 cm) soil samples will be collected from the open land areas surrounding building 611B. The number of samples and their spacing will be determined in accordance with MARSSIM and this plan.

a. The number of samples for each survey unit will be determined in accordance with sections 4.5.2 and 4.6 of this plan. A relative shift of between 1 and 3 should be used, resulting in approximately 10-30 samples per survey unit.

5.4.5 Sample/Measurement Grid Spacing

The grid spacing for the measurement and samples will be determined assuming a square grid pattern as follows:

$$L = \sqrt{\frac{A}{N}}$$

Where A = Survey unit Area
N = Number of measurements

Once the number of measurements and the grid spacing are determined, a starting point for the survey must be established for each survey unit. This will be performed by selecting a reference point for the survey unit such as the comer of the room and a random number generator providing a random number between 0 and 1 for an initial offset from the reference point in both the x and y coordinates. The random number pair will be multiplied by the calculated grid spacing providing the offset from the reference point for the first grid location.

Upon establishing the fist grid location, the calculated grid spacing will be used to establish a grid system throughout the survey unit. If the survey unit includes the floor, walls and ceiling, the grid is extended to all surfaces from the initial point.

Once gridded, it will verified that the number of grid locations satisfies the calculated number of measurements. If not, then smaller grid spacing will be used to ensure the appropriate number of measurements and samples are obtained.

5.5 Survey Records

The project team will maintain records of surveys in the survey packages for each area according to project procedures. The survey package may include the following records depending upon the survey design and protocols:

- Survey Package Worksheet giving the package identification, survey location information, general survey instructions and any specific survey instructions.
- Survey Unit Diagram of the area to be surveyed as available.
- Photographs of the survey area, as necessary, to show special or unique conditions.
- Printout of laboratory analysis results (if performed).
- Ludlum Model 2350 data files and associated spreadsheets for all radiation survey measurements.

Duratek will use a proprietary computer program to download the contents and survey data from the Data Loggers memory to a database and generate a survey report that presents all raw data, converted data, and information by survey location. The survey technician and supervisor will review these reports for completeness, accuracy, suspect entries and compare the data to the guideline values in Table 3-2.

Any changes to the database tables such as detector efficiency and background, that could affect survey results will require management approval. In addition, changes to data in the primary table will require a written explanation on a change request. The change request will be attached to the survey report and maintained as a pennanent record.

Data and document control will include the maintenance of the raw data files, translated data files (spreadsheets) and documentation of all corrections made to the data. The databases will be backed up on a daily basis.

6.0 MINIMUM DETECTABLE ACTIVITY, MDA

Minimum Detectable Activity (MDA) is defined as the smallest amount or concentration of radioactive material that will yield a net positive count with a 50% probability of falsely interpreting background responses as true activity. The MDA is dependent upon count times, geometry, sample size, detector efficiency background, and for scanning the scanning rate and the efficiency of the surveyor.

The MDAs for direct beta measurements, analyses for removable activity, **and** gamma spectroscopy will be set at 50 % or less of the DCGLs. The MDAs for beta scans and gamma scans will be set equal to or less then the appropriate DCGL. Since the MDAs for scanning will be equal to or less that the appropriate DCGLs, the scanning MDAs will not effect the number of measurements or samples required to evaluate a specific survey unit.

6.1 Direct Measurements

The equation used for calculating the MDA for direct measurements is:

$$MDA = \frac{\frac{2.71}{t_s} + 3.29\sqrt{\frac{R_b}{t_s} + \frac{R_b}{t_b}}}{E\left(\frac{A}{100}\right)}$$

Where:

MDA	=	Minimum Detectable Activity (dpm/100 cm^2)
R_b	=	Background Count Rate (cpm)
t_b	=	Background Count Time (min)
t_s	=	Sample Count Time (min)
A	=	Detector Area (cm^2)
E	=	Detector Efficiency (c/d)

6.2 Beta Scans

The equation used for calculating the MDA for beta scans is:

$$MDA = \frac{d' * \sqrt{b_i} * \frac{60}{i}}{E_i * E_s * \sqrt{p} * \frac{A}{100}}$$

Where:

MDA	=	Minimum Detectable Activity (dpm/100 cm^2)
d'	=	Decision error taken from Table 6-5 of MARSSIM
	=	Observation counting interval (scan speed divided by the detector width)
b_i	=	Background count per observation interval
E_I	=	Detector Efficiency (c/d)
E_s	=	Surface Efficiency (typically around 50% for beta contamination on concrete)
p	=	Surveyor Efficiency (typically 50%)
A	=	Detector Area (cm^2)

6.3 Gamma Scans

$$MDCR_{Surveyor} = \frac{d' * \sqrt{b_i} * \frac{60}{i}}{p}$$

The equation used for calculating the MDA for gamma scans is essentially the same as that for beta scans. However conversion factors are required to convert the $MDCR_{Surveyor}$ in terms of cpm to an activity concentration interms of pCi/g

Where:

$MDCR_{Surveyor}$	=	Minimum Detectable Count Rate (cpm)
d'	=	Decision error taken from Table 6-5 of MARSSIM
i	=	Observation counting interval (scan speed divided by the detector width)
b_i	=	Background count per observation interval
p	=	Surveyor Efficiency (typically 50%)

The first of the conversion factors needed to convert the $MDCR_{Surveyor}$ into an activity concentration is the exposure rate due to a volume of soil contaminated with the radionuclide of interest (depleted uranium). This conversion constant in terms of pCi/g per uR/hr can be derived using a shielding code. The second conversion factor that is needed is one that converts an exposure rate due to the radionuclide of interest to, a count rate for the detector used during the scan, uR/hr per pCi/g.

$$MDA = \left(MDCR_{surveyor}(cpm)\right) * \left(\frac{uR/hr}{cpm}\right)\left(\frac{pCi/g}{uR/hr}\right)$$

Where: MDA = The minimum detectable activity (pCi/g)

7.0 DATA QUALITY ASSESSMENT AND EVALUATION

Once all the surveys are complete, the data will be assessed and evaluated to ensure that the $DCGL_W$ was met. All areas exceeding the $DCGL_W$ will be remediated, scanned and the data point re-surveyed. Once complete, the data will be evaluated following the methodology specified in MARSSIM and this Plan to re-calculate the number of measurements based on the survey standard deviation to ensure that the proper number of measurements was taken. If it is determined that enough data was not collected, the grid size may be reduced and the survey area re-gridded and re-surveyed as appropriate.

Provided an adequate number of measurements were taken and that NO measurements exceed the $DCGL_W$, the survey area/unit meets the requirements for release for unrestricted use and no further statistical tests are required. If there is data in excess of the $DCGL_W$, the area will be decontaminated unless an evaluation is made by the Project Manager showing that it is not necessary. In this case, the data must be statistically evaluated using non-parametric statistics and the elevated measurement evaluated against the $DCGL_{EMC}$.

7.1 Elevated Measurement Comparison

If elevated measurements above the $DCGL_W$ exist, an elevated measurement comparison must be performed in accordance with MARSSIM; otherwise, the area will be decontaminated.

7.2 Statistical Evaluation

If elevated measurements remain, the data must be statistically evaluated using either the Wilcox Rank Sum Test or the Sign Test in accordance with MARSSIM.

8.0 QUALITY ASSURANCE AND QUALITY CONTROL

Duratek's Quality Assurance/Quality Control Programs ensure that all quality and regulatory requirements are satisfied. All activities affecting quality are controlled by procedures and this plan. These documents include the following Quality Control measures as an integral part of the survey process.

8.1 Selection of Personnel

Project management and supervisory personnel are required to have extensive experience with Duratek procedures and be familiar with the requirements of MARSSIM and this Survey and Sampling Plan. Management must have prior experience with the radionuclide(s) of concern and a working knowledge of the instruments used to detect the radionuclides on site. Project management and supervision are required to maintain OSHA safety qualifications as safety is a primary concern of Duratek.

Duratek will select supervisory personnel to direct the survey based upon their experience and familiarity with the survey procedures and processes. Likewise, Health Physics technicians who will perform the surveys will be selected based upon their qualifications and experience.

8.2 Training

All project personnel will receive site-specific training to identify the specific hazards present in the work and survey areas. Training will also include a briefing and review of this Plan, Duratek procedures and the Site Safety and Health Plan.

During site orientation and training, survey personnel will become familiar with site emergency procedures. In the event of an emergency, personnel will act in accordance with all applicable site emergency procedures and the Site Safety and Health Plan.

8.3 Written Procedures

All survey tasks, which are essential to survey data quality, will be controlled by procedures and this plan.

8.4 Instrumentation Selection, Calibration and Operation

Duratek has selected instruments proven to reliably detect the radionuclides present at the facility. Duratek will calibrate instruments or qualified vendors under approved procedures using calibration sources traceable to the National Institute of Standards and Technology (NIST).

All instruments and detectors will be inspected and source checked daily when in use to verify proper calibration. Control charts and/or source check criteria will be established at the beginning of the project for reference.

Procedures for calibration, maintenance, accountability, operation and quality control of radiation detection instruments implement the guidelines established in American National Standard Institute (ANSI) standard ANSI N323-1978 and ANSI N42.17A-1989.

8.5 Survey Documentation

Survey packages will be the primary method of controlling and tracking the hard copy records of survey results. Records of surveys will be documented and maintained in the survey package for each area according to Duratek procedures. Each survey measurement will be identified by the date, technician, instrument type and serial number, detector type and serial number, location code, type of measurement, mode of instrument operation, and Quality Control (QC) sample number, as applicable.

8.6 Chain of Custody

Procedures establish responsibility for the custody of samples from the time of collection until results are obtained. If samples are shipped off site for analysis, they will be accompanied by a chain-of-custody record to track each sample.

8.7 Records Management

Generation, handling and storage of survey data packages are controlled by an approved procedure.

8.8 Duplicate Review of Survey Results

The survey package and survey data from each area will be reviewed by two separate people to verify all documentation is complete and accurate. This will include the surveyor and either the Project Manager or his designee.

8.9 Sample Analysis

Duratek will perform quality assurance and quality control checks on 5% of all sample analyses (except smears). This will consist of the analysis of split and/or duplicate samples. Split samples will be analyzed if an ample amount of material is collected in a sample. The sample will be homogenized and split into two separate samples for analysis. Duplicate analysis will be performed on samples where there was not enough material collected to prepare two separate samples. The same sample will be analyzed twice at different times and different detectors

if possible to check the quality of the analyses.

9.0 SURVEY REPORT

Duratek may begin preparing the Survey Report during the surveys. General information can be drafted early to expedite report preparation when work is completed. The report will contain brief descriptions of the site and the surveys performed, photographs of the survey and sample locations as necessary and survey results in tabular and graphical form.

Duratek will submit a draft report for comment after completing site activities and receiving all sample analyses. The final report will be submitted following resolution of all comments.

10.0 REFERENCES

10.1 NUREG-1575, *Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)*, December 1997

10.2 NUREG-1727, *MNSS Decommissioning Standard Review Plan, September 2000*

10.3 Draft NUREG-1549, *Using Decision Methods for Dose Assessment to Comply with Radiological Criteria for License Termination*

10.4 Federal Register, Volume 63, No. 222, Wednesday, November 18, 1998, pages 64132-64134

10.5 USNRC, DandD code, Version 1.0

10.6 RESRAD BUILD Version 3.0

10.7 RESRAD Version 5.82

10.8 10 CFR20, *Standards for Protection Against Radiation*

10.9 *Decommissioning Plan for Building 611B, Picatinny Arsenal-ARDEC, Duratek,* October 1999

10.10 *Report of Radiological Characterization, Building 611B, ARDEC-Picatinny Arsenal,* GPI, May, 1997

ATTACHMENT A

ATTACHMENT A

Values for N/2 for a Given Relative Shift (Δ/σ) and decision errors α and β when a Contaminant is Present in the Background.

	α=0.01					α=0.025					α=0.05					α=0.1					α=0.25				
	β					β					β					β					B				
	0.01	0.025	0.05	0.1	0.25	0.01	0.025	0.05	0.1	0.25	0.01	0.025	0.05	0.1	0.25	0.01	0.025	0.05	0.1	0.25	0.01	0.025	0.05	0.1	0.25
0.1	5452	4627	3972	3278	2268	4627	3870	3273	2646	1748	3972	3273	2726	2157	1355	3278	2646	2157	1655	964	2268	1748	1355	964	459
0.2	1370	1163	998	824	370	1163	973	823	665	440	998	823	685	542	341	824	665	542	416	243	570	440	341	243	116
0.3	614	521	448	670	256	521	436	369	298	197	448	359	307	243	153	370	298	243	187	109	256	197	153	109	52
0.4	350	297	255	211	146	297	248	210	170	112	255	210	175	139	87	211	170	139	106	62	146	112	87	62	30
0.5	227	193	166	137	95	193	162	137	111	73	166	137	114	90	57	137	111	90	69	41	95	73	57	41	20
0.6	161	137	117	97	67	137	114	97	78	52	117	97	81	64	40	97	78	64	49	29	67	52	40	29	14
0.7	121	103	88	73	51	103	86	73	59	39	88	73	61	48	30	73	59	46	37	22	51	39	30	22	11
0.8	95	81	69	57	40	81	68	57	46	31	69	57	48	38	24	57	46	38	29	17	40	31	24	17	8
0.9	77	66	56	47	32	66	55	46	38	25	56	46	39	31	20	47	38	31	24	14	32	25	20	14	7
1.0	64	55	47	39	27	55	46	39	32	21	47	39	32	26	16	39	32	28	20	12	27	21	16	12	6
1.1	55	47	40	33	23	47	39	33	27	18	40	33	28	22	14	33	27	22	17	10	23	18	14	10	5
1.2	48	41	35	29	20	41	34	29	24	16	35	29	24	19	12	29	24	19	15	9	20	16	12	9	4
1.3	43	36	31	26	18	36	30	26	21	14	31	26	22	17	11	28	21	17	13	8	18	14	11	8	4
1.4	38	32	28	23	16	32	27	23	19	13	28	23	19	15	10	23	19	15	12	7	16	13	10	7	4
1.5	35	30	25	21	15	30	25	21	17	11	25	21	18	14	9	21	17	14	11	7	15	11	9	7	3
1.6	32	27	23	19	14	27	23	19	16	11	23	19	16	13	8	19	16	13	10	6	14	11	8	6	3
1.7	30	25	22	18	13	25	21	18	15	10	22	18	15	12	8	18	15	12	9	6	13	10	8	6	3
1.8	28	24	20	17	12	24	20	17	14	9	20	17	14	11	7	17	14	11	9	5	12	9	7	5	3
1.9	26	22	19	16	11	22	19	16	13	9	19	16	13	11	7	16	13	11	8	5	11	9	7	5	3
2.0	25	21	18	15	11	21	18	15	12	8	18	15	13	10	7	15	12	10	8	5	11	8	7	5	3
2.25	22	19	16	14	10	19	18	14	11	8	16	14	11	9	6	14	11	9	7	4	10	8	6	4	2
2.5	21	18	15	13	9	18	15	13	10	7	15	13	11	9	6	13	10	9	7	4	9	7	6	4	2
2.75	20	17	15	12	9	17	14	12	10	7	15	12	10	8	5	12	10	8	6	4	9	7	5	4	2
3.0	19	16	14	12	8	16	14	12	10	6	14	12	10	8	5	12	10	8	6	4	8	6	5	4	2
3.5	18	16	13	11	8	16	13	11	9	6	13	11	9	8	5	11	9	8	6	4	8	6	5	4	2
4.0	18	15	13	11	8	15	13	11	9	6	13	11	9	7	5	11	9	7	6	4	8	6	5	4	2

ATTACHMENT B

ATTACHMENT B

Values for N for a Given Relative Shift (Δ/σ) and decision errors α and β when a Contaminant is NOT Present in the Background.

	α=0.01					α=0.025					α=0.05					α=0.1					α=0.25				
	β					β					β					β					β				
	0.01	0.025	0.05	0.1	0.25	0.01	0.025	0.05	0.1	0.25	0.01	0.025	0.05	0.1	0.25	0.01	0.025	0.05	0.1	0.25	0.01	0.025	0.05	0.1	0.25
0.1	4095	3476	2984	2463	1704	3476	2907	2459	1989	1313	2984	2459	2048	1620	1018	2463	1989	1620	1244	725	1704	1313	1018	725	345
0.2	1035	879	754	623	431	879	735	622	503	333	754	622	518	410	258	623	503	410	315	184	431	333	258	184	88
0.3	468	398	341	282	195	398	333	281	227	150	341	281	234	185	117	282	227	185	143	83	195	150	117	83	40
0.4	270	230	197	162	113	230	191	162	131	87	197	162	136	107	68	162	131	107	82	48	113	87	68	48	23
0.5	178	152	130	107	75	152	126	107	87	58	130	107	89	71	45	107	87	71	54	33	75	58	45	33	16
0.6	129	110	94	77	54	110	92	77	63	42	94	77	65	52	33	77	63	52	40	23	54	42	33	23	11
0.7	99	83	72	59	41	83	70	59	48	33	72	59	50	40	26	59	48	40	30	18	41	33	26	18	9
0.8	80	68	58	48	34	68	57	48	39	26	58	48	40	32	21	48	39	32	24	15	34	26	21	15	8
0.9	66	57	48	40	28	57	47	40	33	22	48	40	34	27	17	40	33	27	21	12	28	22	17	12	6
1.0	57	48	41	34	24	48	40	34	28	18	41	34	29	23	15	34	28	23	18	11	24	18	15	11	5
1.1	50	42	36	30	21	42	35	30	24	17	36	30	26	21	14	30	24	21	16	10	21	17	14	10	5
1.2	45	38	33	27	20	38	32	27	22	15	33	27	23	18	12	27	22	18	15	9	20	15	12	9	5
1.3	41	35	30	26	17	35	29	24	21	14	30	24	21	17	11	26	21	17	14	8	17	14	11	8	4
1.4	38	33	28	23	16	33	27	23	18	12	28	23	20	16	10	23	18	16	12	8	16	12	10	8	4
1.5	35	30	27	22	15	30	26	22	17	12	27	22	18	15	10	22	17	15	11	8	15	12	10	8	4
1.6	34	29	24	21	15	29	24	21	17	11	24	21	17	14	9	21	17	14	11	6	15	11	9	6	4
1.7	33	28	24	20	14	28	23	20	16	11	24	20	17	14	9	20	16	14	10	6	14	11	9	6	4
1.8	32	27	23	20	14	27	22	20	16	11	23	20	16	12	9	20	16	12	10	6	14	11	9	6	4
1.9	30	26	22	18	14	26	22	18	15	10	22	18	16	12	9	18	15	12	10	6	14	10	9	6	4
2.0	29	26	22	18	12	26	21	18	15	10	22	18	15	12	8	18	15	12	10	6	12	10	8	6	3
2.5	28	23	21	17	12	23	20	17	14	10	21	17	15	11	8	17	14	11	9	5	12	10	8	5	3
3.0	27	23	20	17	12	23	20	17	14	9	20	17	14	11	8	17	14	11	9	5	12	9	8	5	3

ATTACHMENT C

ATTACHMENT C
RESRAD-BUILD Version 3.0 Run

Title : PICITTINY
Input File : site1.inp

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Input Parameters..... 0-1
For Each Time (I) :.....
   Time Specific Parameters..... I-1
   Receptor-Source Dose Summary..... I-2
   Dose by Pathway Detail..... I-3
   Dose by Nuclide Detail..... I-4
Full Summary..... F-1

Title : PICITTINY
Input File : site1.inp

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```

Number of Sources : 1
Number of Receptors: 1
Total Time : 2.500000E+02 days
Fraction Inside : 3.300000E-01

íííííííííí Receptor Information íííííííííí

Receptor	Room	x [m]	y [m]	z [m]	FracTime	Inhalation [m3/day]	Ingestion(Dust) [m2/hr]
1	1	1.000	1.000	1.000	1.000	1.80E+01	1.00E-04

íííí Receptor-Source Shielding Relationship íííí

Receptor	Source	Density [g/cm3]	Thickness [cm]	Material
1	1	2.40E+00	0.00E+00	Concrete

```
            ÍÍÍÍÍÍÍÍ  Building Information  ÍÍÍÍÍÍÍÍ


      Building Air Exchange Rate: 8.00E-01 1/hr


    Height[m]          Air Exchanges [m3/hr]
    Area [m2]
                     ******************************
                     *                            *
                     *                            *
                     *                           <=Q01: 7.20E+01
    H1:    2.500     *            Room  1         *      Q10 :  7.20E+01
                     *   LAMBDA: 8.00E-01         *
   Area  36.000      *                            *
                     *                            *
                     ******************************


      Deposition velocity: 1.00E-02 [m/s]   Resuspension Rate: 5.00E-07 [1/s]
```

íííííííí Source Information íííííííí

Source: 1
Location:: Room : 1 x: 0.00 y: 0.00 z: 0.00[m]
Geometry:: Type: Area Area:3.60E+01 [m2] Direction: x
Pathway ::
Direct Ingestion Rate: 0.000E+00 [1/hr]
Fraction released to air: 1.000E-01
Removable fraction: 1.000E-01
Time to Remove: 3.650E+02 [day]

Radon Release Fraction: 1.000E-01

Contamination::

Nuclide	Concentration [pCi/m2]	Dose Conversion Factors: Ingestion [mrem/pCi]	Inhalation [mrem/pCi]	External (Surface) [mrem/yr/(pCi/m2)]	External (Volume) [mrem/yr/(pCi/m3)]	Submersion [mrem/yr/(pCi/m3)]
U-238	6.820E+01	2.690E-04	1.180E-01	3.530E-06	9.510E-08	1.600E-04
U-235	1.300E+00	2.670E-04	1.230E-01	1.950E-05	4.740E-07	9.030E-04
U-234	3.050E+01	2.830E-04	1.320E-01	8.750E-08	2.520E-10	8.930E-07
PA-231	0.000E+00	1.060E-02	1.280E+00	4.760E-06	1.190E-07	2.010E-04
TH-230	0.000E+00	5.480E-04	3.260E-01	8.780E-08	7.570E-10	2.040E-06
AC-227	0.000E+00	1.480E-02	6.720E+00	4.530E-05	1.260E-06	2.160E-03
RA-226	0.000E+00	1.330E-03	8.600E-03	1.940E-04	7.000E-06	1.040E-02
PB-210	0.000E+00	7.270E-03	2.320E-02	4.140E-07	3.820E-09	1.430E-05

Title : PICITTINY
Input File : site1.inp Evaluation Time: 0.000000 years

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ÍÍÍ       Assessment for Time:  1            ÍÍÍ
ÍÍÍ              Time =0.00E+00 yr            ÍÍÍ
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ÍÍÍÍÍÍÍÍ  Source Information  ÍÍÍÍÍÍÍÍ


Source:  1
        Location::  Room :  1  x:   0.00 y:   0.00  z:   0.00 [m]
        Geometry::  Type: Area        Area:3.60E+01 [m2]  Direction: x
        Pathway ::
             Direct Ingestion Rate:    0.000E+00 [1/hr]
             Fraction released to air: 1.000E-01
             Removable fraction:       0.000E+00
             Time to Remove:           3.650E+02 [day]
```

Contamination::

Nuclide	Concentration [pCi/m2]
U-238	6.586E+01
U-235	1.255E+00
U-234	2.946E+01
PA-231	8.983E-06
TH-230	8.967E-05
AC-227	6.463E-08
RA-226	8.810E-09
PB-210	4.636E-11

RESRAD-BUILD Dose Tables

Source Contributions to Receptor Doses

[mrem]

	Source 1	Total
Receptor 1	1.0E-02	1.0E-02
Total	1.0E-02	1.0E-02

Title : PICITTINY
Input File : site1.inp Evaluation Time: 0.000000 years

Pathway Detail of Doses
ƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒ
[mrem]

Source: 1

Receptor	External	Deposition	Immersion	Inhalation	Radon	Ingestion
1	1.26E-05	1.53E-07	1.56E-09	1.04E-02	1.25E-14	6.18E-05
Total	1.26E-05	1.53E-07	1.56E-09	1.04E-02	1.25E-14	6.18E-05

Nuclide Detail of Doses

[mrem]

Source: 1

Nuclide	Receptor 1	Total
U-238		
U-238	6.87E-03	6.87E-03
U-234	7.45E-09	7.45E-09
TH-230	2.83E-14	2.83E-14
RA-226	7.93E-20	7.93E-20
PB-210	0.00E+00	0.00E+00
U-235		
U-235	1.37E-04	1.37E-04
PA-231	8.70E-09	8.70E-09
AC-227	3.14E-10	3.14E-10
U-234		
U-234	3.43E-03	3.43E-03
TH-230	2.17E-08	2.17E-08
RA-226	1.62E-13	1.62E-13
PB-210	1.43E-15	1.43E-15

Title : PICITTINY
Input File : site1.inp Evaluation Time: 1.00000 years

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íííí       Assessment for Time:  2            íííí
íííí              Time =1.00E+00 yr           íííí
íííííííííííííííííííííííííííííííííííííííííííííííí
íííííííííííííííííííííííííííííííííííííííííííííííí
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íííííííí Source Information íííííííí

Source: 1
Location:: Room : 1 x: 0.00 y: 0.00 z: 0.00 [m]
Geometry:: Type: Area Area:3.60E+01 [m2] Direction: x
Pathway ::
Direct Ingestion Rate: 0.000E+00 [1/hr]
Fraction released to air: 1.000E-01
Removable fraction: 0.000E+00
Time to Remove: 3.650E+02 [day]

Contamination::

Nuclide	Concentration [pCi/m2]
U-238	6.138E+01
U-235	1.170E+00
U-234	2.745E+01
PA-231	3.323E-05
TH-230	3.317E-04
AC-227	7.455E-07
RA-226	1.027E-07
PB-210	1.583E-09

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Title : PICITTINY
Input File : site1.inp Evaluation Time: 1.00000 years

Pathway Detail of Doses
[mrem]

Source: 1

Receptor	External	Deposition	Immersion	Inhalation	Radon	Ingestion
1	1.17E-05	0.00E+00	0.00E+00	0.00E+00	1.46E-13	0.00E+00
Total	1.17E-05	0.00E+00	0.00E+00	0.00E+00	1.46E-13	0.00E+00

Nuclide Detail of Doses
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[mrem]

Source: 1

Nuclide	Receptor 1	Total
U-238		
U-238	1.04E-05	1.04E-05
U-234	2.65E-12	2.65E-12
TH-230	1.13E-17	1.13E-17
RA-226	3.25E-18	3.25E-18
PB-210	0.00E+00	0.00E+00
U-235		
U-235	1.04E-06	1.04E-06
PA-231	8.83E-12	8.83E-12
AC-227	1.58E-12	1.58E-12
U-234		
U-234	3.12E-07	3.12E-07
TH-230	2.66E-12	2.66E-12
RA-226	1.13E-12	1.13E-12
PB-210	5.92E-17	5.92E-17

Title : PICITTINY
Input File : site1.inp Evaluation Time: 2.00000 years

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ÍÍÍ       Assessment for Time:  3            ÍÍÍ
ÍÍÍ             Time =2.00E+00 yr            ÍÍÍ
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ÍÍÍÍÍÍÍÍ  Source Information  ÍÍÍÍÍÍÍÍ


Source:  1
        Location::  Room :  1  x:   0.00 y:   0.00  z:   0.00 [m]
        Geometry::  Type: Area        Area:3.60E+01 [m2]  Direction: x
        Pathway ::
             Direct Ingestion Rate:    0.000E+00 [1/hr]
             Fraction released to air: 1.000E-01
             Removable fraction:       0.000E+00
             Time to Remove:           3.650E+02 [day]
```

Contamination::

Nuclide	Concentration [pCi/m2]
U-238	6.138E+01
U-235	1.170E+00
U-234	2.745E+01
PA-231	5.798E-05
TH-230	5.788E-04
AC-227	2.156E-06
RA-226	2.998E-07
PB-210	7.436E-09

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ÍÍÍ                                                    ÍÍÍ
ÍÍÍ        RESRAD-BUILD Dose Tables                    ÍÍÍ
ÍÍÍ                                                    ÍÍÍ
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Source Contributions to Receptor Doses
ÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ
[mrem]

		Source 1	Total
Receptor	1	1.2E-05	1.2E-05
Total		1.2E-05	1.2E-05

Pathway Detail of Doses
[mrem]

Source: 1

Receptor	External	Deposition	Immersion	Inhalation	Radon	Ingestion
1	1.17E-05	0.00E+00	0.00E+00	0.00E+00	4.27E-13	0.00E+00
Total	1.17E-05	0.00E+00	0.00E+00	0.00E+00	4.27E-13	0.00E+00

Nuclide Detail of Doses

[mrem]

Source: 1

Nuclide	Receptor 1	Total
U-238		
U-238	1.04E-05	1.04E-05
U-234	4.63E-12	4.63E-12
TH-230	3.45E-17	3.45E-17
RA-226	1.64E-17	1.64E-17
PB-210	1.04E-21	1.04E-21
U-235		
U-235	1.04E-06	1.04E-06
PA-231	1.54E-11	1.54E-11
AC-227	4.56E-12	4.56E-12
U-234		
U-234	3.12E-07	3.12E-07
TH-230	4.64E-12	4.64E-12
RA-226	3.31E-12	3.31E-12
PB-210	2.78E-16	2.78E-16

Title : PICITTINY
Input File : site1.inp Evaluation Time: 5.00000 years

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ÍÍÍ       Assessment for Time:  4            ÍÍÍ
ÍÍÍ             Time =5.00E+00 yr            ÍÍÍ
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ÍÍÍÍÍÍÍÍ  Source Information  ÍÍÍÍÍÍÍÍ
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Source: 1
Location:: Room : 1 x: 0.00 y: 0.00 z: 0.00 [m]
Geometry:: Type: Area Area:3.60E+01 [m2] Direction: x
Pathway ::
Direct Ingestion Rate: 0.000E+00 [1/hr]
Fraction released to air: 1.000E-01
Removable fraction: 0.000E+00
Time to Remove: 3.650E+02 [day]

Contamination::

Nuclide	Concentration [pCi/m2]
U-238	6.138E+01
U-235	1.170E+00
U-234	2.745E+01
PA-231	1.322E-04
TH-230	1.320E-03
AC-227	1.069E-05
RA-226	1.533E-06
PB-210	8.206E-08

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ÍÍÍ                                                    ÍÍÍ
ÍÍÍ        RESRAD-BUILD Dose Tables                    ÍÍÍ
ÍÍÍ                                                    ÍÍÍ
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Source Contributions to Receptor Doses
ÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ
[mrem]

	Source 1	Total
Receptor 1	1.2E-05	1.2E-05
Total	1.2E-05	1.2E-05

Pathway Detail of Doses
[mrem]

Source: 1

Receptor	External	Deposition	Immersion	Inhalation	Radon	Ingestion
1	1.17E-05	0.00E+00	0.00E+00	0.00E+00	2.18E-12	0.00E+00
Total	1.17E-05	0.00E+00	0.00E+00	0.00E+00	2.18E-12	0.00E+00

Nuclide Detail of Doses
[mrem]

Source: 1

Nuclide	Receptor 1	Total
U-238		
U-238	1.04E-05	1.04E-05
U-234	1.06E-11	1.06E-11
TH-230	1.79E-16	1.79E-16
RA-226	1.91E-16	1.91E-16
PB-210	2.60E-20	2.60E-20
U-235		
U-235	1.04E-06	1.04E-06
PA-231	3.51E-11	3.51E-11
AC-227	2.26E-11	2.26E-11
U-234		
U-234	3.12E-07	3.12E-07
TH-230	1.06E-11	1.06E-11
RA-226	1.69E-11	1.69E-11
PB-210	3.07E-15	3.07E-15

Title : PICITTINY
Input File : site1.inp Evaluation Time: 10.0000 years

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ÍÍÍ       Assessment for Time:  5            ÍÍÍ
ÍÍÍ             Time =1.00E+01 yr            ÍÍÍ
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ÍÍÍÍÍÍÍÍ  Source Information  ÍÍÍÍÍÍÍÍ
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Source: 1
Location:: Room : 1 x: 0.00 y: 0.00 z: 0.00 [m]
Geometry:: Type: Area Area:3.60E+01 [m2] Direction: x
Pathway ::
Direct Ingestion Rate: 0.000E+00 [1/hr]
Fraction released to air: 1.000E-01
Removable fraction: 0.000E+00
Time to Remove: 3.650E+02 [day]

Contamination::

Nuclide	Concentration [pCi/m2]
U-238	6.138E+01
U-235	1.170E+00
U-234	2.745E+01
PA-231	2.560E-04
TH-230	2.556E-03
AC-227	3.797E-05
RA-226	5.723E-06
PB-210	5.682E-07

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ÍÍÍ                                                ÍÍÍ
ÍÍÍ        RESRAD-BUILD Dose Tables                ÍÍÍ
ÍÍÍ                                                ÍÍÍ
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Source Contributions to Receptor Doses
ÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ
[mrem]

	Source 1	Total
Receptor 1	1.2E-05	1.2E-05
Total	1.2E-05	1.2E-05

Title : PICITTINY
Input File : site1.inp Evaluation Time: 10.0000 years

Pathway Detail of Doses
ÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ
[mrem]

Source: 1

Receptor	External	Deposition	Immersion	Inhalation	Radon	Ingestion
1	1.17E-05	0.00E+00	0.00E+00	0.00E+00	8.15E-12	0.00E+00
Total	1.17E-05	0.00E+00	0.00E+00	0.00E+00	8.15E-12	0.00E+00

Nuclide Detail of Doses

[mrem]

Source: 1

Nuclide	Receptor 1	Total
U-238		
U-238	1.04E-05	1.04E-05
U-234	2.04E-11	2.04E-11
TH-230	6.72E-16	6.72E-16
RA-226	1.38E-15	1.38E-15
PB-210	3.54E-19	3.54E-19
U-235		
U-235	1.04E-06	1.04E-06
PA-231	6.80E-11	6.80E-11
AC-227	8.03E-11	8.03E-11
U-234		
U-234	3.12E-07	3.12E-07
TH-230	2.05E-11	2.05E-11
RA-226	6.31E-11	6.31E-11
PB-210	2.13E-14	2.13E-14

Title : PICITTINY
Input File : site1.inp Evaluation Time: 100.000 years

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ÍÍÍ       Assessment for Time:  6            ÍÍÍ
ÍÍÍ             Time =1.00E+02 yr            ÍÍÍ
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ÍÍÍÍÍÍÍÍ  Source Information  ÍÍÍÍÍÍÍÍ
```

Source: 1
Location:: Room : 1 x: 0.00 y: 0.00 z: 0.00 [m]
Geometry:: Type: Area Area:3.60E+01 [m2] Direction: x
Pathway ::
Direct Ingestion Rate: 0.000E+00 [1/hr]
Fraction released to air: 1.000E-01
Removable fraction: 0.000E+00
Time to Remove: 3.650E+02 [day]

Contamination::

Nuclide	Concentration [pCi/m2]
U-238	6.138E+01
U-235	1.170E+00
U-234	2.746E+01
PA-231	2.481E-03
TH-230	2.479E-02
AC-227	1.738E-03
RA-226	5.311E-04
PB-210	2.956E-04

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ÍÍÍ                                          ÍÍÍ
ÍÍÍ        RESRAD-BUILD Dose Tables          ÍÍÍ
ÍÍÍ                                          ÍÍÍ
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Source Contributions to Receptor Doses
ÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ
[mrem]

	Source 1	Total
Receptor 1	1.2E-05	1.2E-05
Total	1.2E-05	1.2E-05

Pathway Detail of Doses
íííííííííííííííííííííííí
[mrem]

Source: 1

Receptor	External	Deposition	Immersion	Inhalation	Radon	Ingestion
1	1.17E-05	0.00E+00	0.00E+00	0.00E+00	7.56E-10	0.00E+00
Total	1.17E-05	0.00E+00	0.00E+00	0.00E+00	7.56E-10	0.00E+00

Nuclide Detail of Doses

[mrem]

Source: 1

Nuclide	Receptor 1	Total
U-238		
U-238	1.04E-05	1.04E-05
U-234	1.98E-10	1.98E-10
TH-230	6.32E-14	6.32E-14
RA-226	1.25E-12	1.25E-12
PB-210	1.97E-15	1.97E-15
U-235		
U-235	1.04E-06	1.04E-06
PA-231	6.59E-10	6.59E-10
AC-227	3.67E-09	3.67E-09
U-234		
U-234	3.12E-07	3.12E-07
TH-230	1.99E-10	1.99E-10
RA-226	5.85E-09	5.85E-09
PB-210	1.11E-11	1.11E-11

Title : PICITTINY
Input File : site1.inp Evaluation Time: 1000.00 years

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ÍÍÍ       Assessment for Time:  7            ÍÍÍ
ÍÍÍ             Time =1.00E+03 yr            ÍÍÍ
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ÍÍÍÍÍÍÍÍ  Source Information  ÍÍÍÍÍÍÍÍ
```

Source: 1

Location:: Room : 1 x: 0.00 y: 0.00 z: 0.00 [m]
Geometry:: Type: Area Area:3.60E+01 [m2] Direction: x
Pathway ::

Direct Ingestion Rate:	0.000E+00 [1/hr]
Fraction released to air:	1.000E-01
Removable fraction:	0.000E+00
Time to Remove:	3.650E+02 [day]

Contamination::

Nuclide	Concentration [pCi/m2]
U-238	6.138E+01
U-235	1.170E+00
U-234	2.755E+01
PA-231	2.450E-02
TH-230	2.465E-01
AC-227	2.374E-02
RA-226	4.651E-02
PB-210	4.379E-02

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íííí                                          íííí
íííí        RESRAD-BUILD Dose Tables          íííí
íííí                                          íííí
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Source Contributions to Receptor Doses
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[mrem]

	Source 1	Total
Receptor 1	1.2E-05	1.2E-05
Total	1.2E-05	1.2E-05

Pathway Detail of Doses
ÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ
[mrem]

Source: 1

Receptor	External	Deposition	Immersion	Inhalation	Radon	Ingestion
1	1.22E-05	0.00E+00	0.00E+00	0.00E+00	6.62E-08	0.00E+00
Total	1.22E-05	0.00E+00	0.00E+00	0.00E+00	6.62E-08	0.00E+00

Nuclide Detail of Doses

[mrem]

Source: 1

Nuclide	Receptor 1	Total
U-238		
U-238	1.04E-05	1.04E-05
U-234	1.98E-09	1.98E-09
TH-230	6.26E-12	6.26E-12
RA-226	1.12E-09	1.12E-09
PB-210	3.47E-12	3.47E-12
U-235		
U-235	1.04E-06	1.04E-06
PA-231	6.51E-09	6.51E-09
AC-227	5.02E-08	5.02E-08
U-234		
U-234	3.11E-07	3.11E-07
TH-230	1.97E-09	1.97E-09
RA-226	5.12E-07	5.12E-07
PB-210	1.64E-09	1.64E-09

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ÍÍÍ                                                ÍÍÍ
ÍÍÍ     RESRAD-BUILD Dose (Time) Tables            ÍÍÍ
ÍÍÍ                                                ÍÍÍ
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```

Receptor Doses Received for the Exposure Duration
ÍÍ
(mrem)

	Evaluation Time [yr]						
	0.00E+00	1.00E+00	2.00E+00	5.00E+00	1.00E+01	1.00E+02	1.00E+03
1	1.04E-02	1.17E-05	1.17E-05	1.17E-05	1.17E-05	1.17E-05	1.23E-05

Receptor Dose/Yr Averaged Over Exposure Duration
ÍÍ
(mrem/yr)

Evaluation Time [yr]						
0.00E+00	1.00E+00	2.00E+00	5.00E+00	1.00E+01	1.00E+02	1.00E+03
1.53E-02	1.71E-05	1.71E-05	1.71E-05	1.71E-05	1.71E-05	1.80E-05

ATTACHMENT D

ATTACHMENT D

USNRC DandD Code Run

(Residential Scenario, Default Parameters)

Program : DandD Version 1.0 .
Session : Picatinny Guidelines
Description :
DU Surface contamination guidelines

cuted : 10/12/99 at 10:38:07

NRC Report

Residential Input Section

Execution Options
==========
History file will be generated.
Implicit progeny doses will not be included with explicit parent.
Concentration data will be calculated.

Initial Radionuclide Activities

Chain	pCi/gram
234U	30.50
235U	1.30
238U	68.20

Code-Generated Radionuclide Activities

Chain	pCi/gram
234U	3.0500E+001
230Th	0.0000E+000
226Ra	0.0000E+000
222Rn	0.0000E+000
218Po	0.0000E+000
214Pb	0.0000E+000
218At	0.0000E+000
214Bi	0.0000E+000
214Po	0.0000E+000
210Pb	0.0000E+000
210Bi	0.0000E+000
210Po	0.0000E+000
235U	1.3000E+000
231Th	0.0000E+000
231Pa	0.0000E+000
227Ac	0.0000E+000
223Fr	0.0000E+000
227Th	0.0000E+000
223Ra	0.0000E+000
219Rn	0.0000E+000
215Po	0.0000E+000
211Pb	0.0000E+000
211Bi	0.0000E+000
211Po	0.0000E+000
207Tl	0.0000E+000
238U	6.8200E+001

234Th	0.0000E+000
234mPa	0.0000E+000
234Pa	0.0000E+000
234U	0.0000E+000
230Th	0.0000E+000
226Ra	0.0000E+000
222Rn	0.0000E+000
218Po	0.0000E+000
214Pb	0.0000E+000
218At	0.0000E+000
214Bi	0.0000E+000
214Po	0.0000E+000
210Pb	0.0000E+000
210Bi	0.0000E+000
210Po	0.0000E+000

Basic Parameters

Name	Value	Units	Default
'Floor Dust'	0.1599	g/m^2	0.1599
'Unsaturated Zone'	1.2288	m	1.2288
'Layer Porosity'	0.4599	None	0.4599
'Unsaturated Porosity'	0.4599	None	0.4599
'Surface Layer Ratio'	0.1626	None	0.1626
'Unsaturated Ratio'	0.1626	None	0.1626
'Infiltration Rate'	0.2526	m/year	0.2526

Residential Output Section

Maximum Annual TEDE

This scenario started 0.00 year(s) from now
and ran for 1000.00 year(s).

The peak dose of 5.13E+003 TEDE (mrem) occurred 4.00 year(s) after license termination.

Pathway Component of Maximum Annual Dose

Pathway	TEDE (mrem)	Percentage
External	3.28E-001	0.01
Inhalation	5.33E-002	0.00
Agricult.	8.98E+000	0.18
Soil	2.73E-002	0.00
Drinking	1.23E+003	23.96
Irrigated	2.55E+003	49.80
Aquatic	1.34E+003	26.06

Total 5.13E+003 100.00

Radionuclide Component of
Maximum Annual Dose

Radionuclide	TEDE (mrem)	Percentage
234U	1.62E+003	31.52
230Th	3.87E-002	0.00
226Ra	3.35E-005	0.00
222Rn	2.04E-010	0.00
218Po	4.73E-012	0.00
214Pb	1.35E-007	0.00
218At	0.00E+000	0.00
214Bi	7.91E-007	0.00
214Po	4.31E-011	0.00
210Pb	5.29E-006	0.00
210Bi	4.50E-009	0.00
210Po	2.80E-006	0.00
235U	6.47E+001	1.26
231Th	4.07E-001	0.01
231Pa	1.00E-001	0.00
227Ac	4.19E-003	0.00
223Fr	3.65E-008	0.00
227Th	1.40E-005	0.00
223Ra	2.10E-004	0.00
219Rn	1.05E-007	0.00
215Po	3.38E-010	0.00
211Pb	2.66E-007	0.00
211Bi	8.66E-008	0.00
211Po	4.27E-011	0.00
207Tl	6.43E-009	0.00
238U	3.24E+003	63.29
234Th	2.01E+002	3.91
234mPa	1.88E-001	0.00
234Pa	1.12E-001	0.00
Total	5.13E+003	100.00

ATTACHMENT E

ATTACHMENT E

RESRAD Version 5.82 Code Runs

(Residential Scenario, Default Parameters)

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Dose Conversion Factor (and Related) Parameter Summary
File: DOSFAC.BIN

enu	Parameter	Current Value	Default	Parameter Name
-1	Dose conversion factors for inhalation, mrem/pCi:			
-1	Ac-227+D	6.720E+00	6.720E+00	DCF2(1)
-1	Pa-231	1.280E+00	1.280E+00	DCF2(2)
-1	Pb-210+D	2.320E-02	2.320E-02	DCF2(3)
-1	Ra-226+D	8.600E-03	8.600E-03	DCF2(4)
-1	Th-230	3.260E-01	3.260E-01	DCF2(5)
-1	U-234	1.320E-01	1.320E-01	DCF2(6)
-1	U-235+D	1.230E-01	1.230E-01	DCF2(7)
-1	U-238+D	1.180E-01	1.180E-01	DCF2(8)
-1	Dose conversion factors for ingestion, mrem/pCi:			
-1	Ac-227+D	1.480E-02	1.480E-02	DCF3(1)
-1	Pa-231	1.060E-02	1.060E-02	DCF3(2)
-1	Pb-210+D	7.270E-03	7.270E-03	DCF3(3)
-1	Ra-226+D	1.330E-03	1.330E-03	DCF3(4)
-1	Th-230	5.480E-04	5.480E-04	DCF3(5)
-1	U-234	2.830E-04	2.830E-04	DCF3(6)
-1	U-235+D	2.670E-04	2.670E-04	DCF3(7)
-1	U-238+D	2.690E-04	2.690E-04	DCF3(8)
-34	Food transfer factors:			
-34	Ac-227+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(1,1)
-34	Ac-227+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,2)
-34	Ac-227+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,3)
-34				
-34	Pa-231 , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(2,1)
-34	Pa-231 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(2,2)
-34	Pa-231 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(2,3)
-34				
-34	Pb-210+D , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(3,1)
-34	Pb-210+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-04	8.000E-04	RTF(3,2)
-34	Pb-210+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RTF(3,3)
-34				
-34	Ra-226+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(4,1)
-34	Ra-226+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(4,2)
-34	Ra-226+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(4,3)
-34				
-34	Th-230 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(5,1)
-34	Th-230 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(5,2)
-34	Th-230 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(5,3)
-34				
-34	U-234 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(6,1)
-34	U-234 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(6,2)
-34	U-234 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(6,3)
-34				
-34	U-235+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(7,1)
-34	U-235+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(7,2)
-34	U-235+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(7,3)
-34				

Dose Conversion Factor (and Related) Parameter Summary (continued)
File: DOSFAC.BIN

Menu	Parameter	Current Value	Default	Parameter Name
D-34	U-238+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(8,1)
D-34	U-238+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(8,2)
D-34	U-238+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(8,3)
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-5	Ac-227+D , fish	1.500E+01	1.500E+01	BIOFAC(1,1)
D-5	Ac-227+D , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(1,2)
D-5				
D-5	Pa-231 , fish	1.000E+01	1.000E+01	BIOFAC(2,1)
D-5	Pa-231 , crustacea and mollusks	1.100E+02	1.100E+02	BIOFAC(2,2)
D-5				
D-5	Pb-210+D , fish	3.000E+02	3.000E+02	BIOFAC(3,1)
D-5	Pb-210+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(3,2)
D-5				
D-5	Ra-226+D , fish	5.000E+01	5.000E+01	BIOFAC(4,1)
D-5	Ra-226+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(4,2)
D-5				
D-5	Th-230 , fish	1.000E+02	1.000E+02	BIOFAC(5,1)
D-5	Th-230 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(5,2)
D-5				
D-5	U-234 , fish	1.000E+01	1.000E+01	BIOFAC(6,1)
D-5	U-234 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(6,2)
D-5				
D-5	U-235+D , fish	1.000E+01	1.000E+01	BIOFAC(7,1)
D-5	U-235+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(7,2)
D-5				
D-5	U-238+D , fish	1.000E+01	1.000E+01	BIOFAC(8,1)
D-5	U-238+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(8,2)

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+04	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	2.000E+00	2.000E+00	---	THICK0
R011	Length parallel to aquifer flow (m)	1.000E+02	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	3.000E+01	3.000E+01	---	BRDL
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)	4.000E+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	0.000E+00	---	T(9)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g): U-234	3.050E+01	0.000E+00	---	S1(6)
R012	Initial principal radionuclide (pCi/g): U-235	1.300E+00	0.000E+00	---	S1(7)
R012	Initial principal radionuclide (pCi/g): U-238	6.820E+01	0.000E+00	---	S1(8)
R012	Concentration in groundwater (pCi/L): U-234	not used	0.000E+00	---	W1(6)
R012	Concentration in groundwater (pCi/L): U-235	not used	0.000E+00	---	W1(7)
R012	Concentration in groundwater (pCi/L): U-238	not used	0.000E+00	---	W1(8)
R013	Cover depth (m)	0.000E+00	0.000E+00	---	COVER0
R013	Density of cover material (g/cm**3)	not used	1.500E+00	---	DENSCV
R013	Cover depth erosion rate (m/yr)	not used	1.000E-03	---	VCV
R013	Density of contaminated zone (g/cm**3)	1.500E+00	1.500E+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)	1.000E+01	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	5.300E+00	5.300E+00	---	BCZ
R013	Average annual wind speed (m/sec)	2.000E+00	2.000E+00	---	WIND
R013	Humidity in air (g/m**3)	not used	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	5.000E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	1.000E+00	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	2.000E-01	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
R013	Accuracy for water/soil computations	1.000E-03	1.000E-03	---	EPS
R014	Density of saturated zone (g/cm**3)	1.500E+00	1.500E+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)	1.000E+02	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	2.000E-02	2.000E-02	---	HGWT
R014	Saturated zone b parameter	5.300E+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	Well pumping rate (m**3/yr)	2.500E+02	2.500E+02	---	UW

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R015	Number of unsaturated zone strata	1	1	---	NS
R015	Unsat. zone 1, thickness (m)	4.000E+00	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	1.500E+00	1.500E+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	5.300E+00	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCUZ(1)
R016	Distribution coefficients for U-234				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(6)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(6,1
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.319E-03	ALEACH(6)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(6)
R016	Distribution coefficients for U-235				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(7)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(7,1
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(7)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.319E-03	ALEACH(7)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(7)
R016	Distribution coefficients for U-238				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(8)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(8,1
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(8)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.319E-03	ALEACH(8)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(8)
R016	Distribution coefficients for daughter Ac-227				
R016	Contaminated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCC(1)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCU(1,1
R016	Saturated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	8.245E-03	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for daughter Pa-231				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(2)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(2,1
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.319E-03	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)
R016	Distribution coefficients for daughter Pb-210				
R016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCC(3)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCU(3,1
R016	Saturated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.663E-03	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(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 daughter Ra-226				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(4)
R016	Unsaturated zone 1 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(4,1
R016	Saturated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.374E-03	ALEACH(4)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(4)
R016	Distribution coefficients for daughter Th-230				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(5)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(5,1
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.778E-06	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(5)
R017	Inhalation rate (m**3/yr)	8.400E+03	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	1.000E-04	1.000E-04	---	MLINH
R017	Exposure duration	3.000E+01	3.000E+01	---	ED
R017	Shielding factor, inhalation	4.000E-01	4.000E-01	---	SHF3
R017	Shielding factor, external gamma	7.000E-01	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	5.000E-01	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	2.500E-01	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	1.000E+00	1.000E+00	>0 shows circular AREA.	FS
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	not used	5.000E+01	---	RAD_SHAPE(
R017	Outer annular radius (m), ring 2:	not used	7.071E+01	---	RAD_SHAPE(
R017	Outer annular radius (m), ring 3:	not used	0.000E+00	---	RAD_SHAPE(
R017	Outer annular radius (m), ring 4:	not used	0.000E+00	---	RAD_SHAPE(
R017	Outer annular radius (m), ring 5:	not used	0.000E+00	---	RAD_SHAPE(
R017	Outer annular radius (m), ring 6:	not used	0.000E+00	---	RAD_SHAPE(
R017	Outer annular radius (m), ring 7:	not used	0.000E+00	---	RAD_SHAPE(
R017	Outer annular radius (m), ring 8:	not used	0.000E+00	---	RAD_SHAPE(
R017	Outer annular radius (m), ring 9:	not used	0.000E+00	---	RAD_SHAPE(
R017	Outer annular radius (m), ring 10:	not used	0.000E+00	---	RAD_SHAPE(1
R017	Outer annular radius (m), ring 11:	not used	0.000E+00	---	RAD_SHAPE(1
R017	Outer annular radius (m), ring 12:	not used	0.000E+00	---	RAD_SHAPE(1
R017	Fractions of annular areas within AREA:				
R017	Ring 1	not used	1.000E+00	---	FRACA(1)
R017	Ring 2	not used	2.732E-01	---	FRACA(2)
R017	Ring 3	not used	0.000E+00	---	FRACA(3)
R017	Ring 4	not used	0.000E+00	---	FRACA(4)
R017	Ring 5	not used	0.000E+00	---	FRACA(5)
R017	Ring 6	not used	0.000E+00	---	FRACA(6)
R017	Ring 7	not used	0.000E+00	---	FRACA(7)
R017	Ring 8	not used	0.000E+00	---	FRACA(8)
R017	Ring 9	not used	0.000E+00	---	FRACA(9)
R017	Ring 10	not used	0.000E+00	---	FRACA(10)
R017	Ring 11	not used	0.000E+00	---	FRACA(11)
R017	Ring 12	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)

Menu	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	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	5.100E+02	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	1.000E+00	1.000E+00	---	FDW
R018	Contamination fraction of household water	not used	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	1.000E+00	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	1.000E+00	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	5.000E-01	5.000E-01	---	FR9
R018	Contamination fraction of plant food	-1	-1	0.500E+00	FPLANT
R018	Contamination fraction of meat	-1	-1	0.500E+00	FMEAT
R018	Contamination fraction of milk	-1	-1	0.500E+00	FMILK
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	Livestock soil intake (kg/day)	5.000E-01	5.000E-01	---	LSI
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	Household water fraction from ground water	1.000E+00	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	not used	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	1.000E+00	1.000E+00	---	FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	7.000E-01	7.000E-01	---	YV(1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	1.500E+00	1.500E+00	---	YV(2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	1.100E+00	1.100E+00	---	YV(3)
R19B	Growing Season for Non-Leafy (years)	1.700E-01	1.700E-01	---	TE(1)
R19B	Growing Season for Leafy (years)	2.500E-01	2.500E-01	---	TE(2)
R19B	Growing Season for Fodder (years)	8.000E-02	8.000E-02	---	TE(3)
R19B	Translocation Factor for Non-Leafy	1.000E-01	1.000E-01	---	TIV(1)
R19B	Translocation Factor for Leafy	1.000E+00	1.000E+00	---	TIV(2)
R19B	Translocation Factor for Fodder	1.000E+00	1.000E+00	---	TIV(3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	2.500E-01	2.500E-01	---	RDRY(1)
R19B	Dry Foliar Interception Fraction for Leafy	2.500E-01	2.500E-01	---	RDRY(2)
R19B	Dry Foliar Interception Fraction for Fodder	2.500E-01	2.500E-01	---	RDRY(3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	2.500E-01	2.500E-01	---	RWET(1)
R19B	Wet Foliar Interception Fraction for Leafy	2.500E-01	2.500E-01	---	RWET(2)
R19B	Wet Foliar Interception Fraction for Fodder	2.500E-01	2.500E-01	---	RWET(3)
R19B	Weathering Removal Constant for Vegetation	2.000E+01	2.000E+01	---	WLAM
C14	C-12 concentration in water (g/cm**3)	not used	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	not used	9.800E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	---	DMC

Site-Specific Parameter Summary (continued)

:enu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
:14	C-14 evasion flux rate from soil (1/sec)	not used	7.000E-07	---	EVSN
:14	C-12 evasion flux rate from soil (1/sec)	not used	1.000E-10	---	REVSN
:14	Fraction of grain in beef cattle feed	not used	8.000E-01	---	AVFG4
:14	Fraction of grain in milk cow feed	not used	2.000E-01	---	AVFG5
:TOR	Storage times of contaminated foodstuffs (days):				
:TOR	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	---	STOR_T(1)
TOR	Leafy vegetables	1.000E+00	1.000E+00	---	STOR_T(2)
TOR	Milk	1.000E+00	1.000E+00	---	STOR_T(3)
TOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(4)
TOR	Fish	7.000E+00	7.000E+00	---	STOR_T(5)
TOR	Crustacea and mollusks	7.000E+00	7.000E+00	---	STOR_T(6)
TOR	Well water	1.000E+00	1.000E+00	---	STOR_T(7)
TOR	Surface water	1.000E+00	1.000E+00	---	STOR_T(8)
TOR	Livestock fodder	4.500E+01	4.500E+01	---	STOR_T(9)
:021	Thickness of building foundation (m)	not used	1.500E-01	---	FLOOR
:021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	---	DENSFL
:021	Total porosity of the cover material	not used	4.000E-01	---	TPCV
:021	Total porosity of the building foundation	not used	1.000E-01	---	TPFL
:021	Volumetric water content of the cover material	not used	5.000E-02	---	PH2OCV
:021	Volumetric water content of the foundation	not used	3.000E-02	---	PH2OFL
:021	Diffusion coefficient for radon gas (m/sec):				
:021	in cover material	not used	2.000E-06	---	DIFCV
:021	in foundation material	not used	3.000E-07	---	DIFFL
:021	in contaminated zone soil	not used	2.000E-06	---	DIFCZ
:021	Radon vertical dimension of mixing (m)	not used	2.000E+00	---	HMIX
:021	Average building air exchange rate (1/hr)	not used	5.000E-01	---	REXG
:021	Height of the building (room) (m)	not used	2.500E+00	---	HRM
:021	Building interior area factor	not used	0.000E+00	---	FAI
:021	Building depth below ground surface (m)	not used	-1.000E+00	---	DMFL
:021	Emanating power of Rn-222 gas	not used	2.500E-01	---	EMANA(1)
:021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)

Summary of Pathway Selections

Pathway	User Selection
1 -- external gamma	active
2 -- inhalation (w/o radon)	active
3 -- plant ingestion	active
4 -- meat ingestion	active
5 -- milk ingestion	active
6 -- aquatic foods	active
7 -- drinking water	active
8 -- soil ingestion	active
9 -- radon	suppressed
Find peak pathway doses	suppressed

Contaminated Zone Dimensions		Initial Soil Concentrations, pCi/g	
Area:	10000.00 square meters	U-234	3.050E+01
Thickness:	2.00 meters	U-235	1.300E+00
Cover Depth:	0.00 meters	U-238	6.820E+01

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 30 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E+00	4.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
TDOSE(t):	1.401E+01	1.396E+01	1.383E+01	1.356E+01	1.269E+01	1.009E+01	5.359E+00	1.006E+02
M(t):	4.670E-01	4.655E-01	4.609E-01	4.519E-01	4.232E-01	3.364E-01	1.786E-01	3.353E+00

Maximum TDOSE(t): 1.006E+02 mrem/yr at t = 1.000E+03 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 (Inhalation excludes radon)

Radio-	Ground		Inhalation		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
U-234	7.131E-03	0.0005	2.576E-01	0.0184	0.000E+00	0.0000	1.878E+00	0.1341	6.197E-02	0.0044	1.519E-01	0.0108	2.363E-01
U-235	5.621E-01	0.0401	1.023E-02	0.0007	0.000E+00	0.0000	7.553E-02	0.0054	2.492E-03	0.0002	6.110E-03	0.0004	9.502E-03
U-238	5.287E+00	0.3774	5.150E-01	0.0368	0.000E+00	0.0000	3.992E+00	0.2849	1.317E-01	0.0094	3.229E-01	0.0230	5.022E-01
Total	5.856E+00	0.4180	7.829E-01	0.0559	0.000E+00	0.0000	5.946E+00	0.4244	1.962E-01	0.0140	4.810E-01	0.0343	7.480E-01

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 Path
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr
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	2.593E+00
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	6.660E-01
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	1.075E+01
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	1.401E+01

*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+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		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
U-234	7.108E-03	0.0005	2.568E-01	0.0184	0.000E+00	0.0000	1.872E+00	0.1341	6.178E-02	0.0044	1.514E-01	0.0108	2.355E-01
U-235	5.603E-01	0.0401	1.020E-02	0.0007	0.000E+00	0.0000	7.554E-02	0.0054	2.533E-03	0.0002	6.090E-03	0.0004	9.479E-03
U-238	5.269E+00	0.3773	5.133E-01	0.0368	0.000E+00	0.0000	3.979E+00	0.2850	1.313E-01	0.0094	3.219E-01	0.0231	5.006E-01
Total	5.837E+00	0.4180	7.803E-01	0.0559	0.000E+00	0.0000	5.927E+00	0.4244	1.956E-01	0.0140	4.794E-01	0.0343	7.455E-01

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 Path
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr
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	2.585E+00
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	6.641E-01
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	1.072E+01
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	1.396E+01

*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 = 4.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		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
U-234	7.043E-03	0.0005	2.543E-01	0.0184	0.000E+00	0.0000	1.854E+00	0.1341	6.117E-02	0.0044	1.499E-01	0.0108	2.332E-01
U-235	5.547E-01	0.0401	1.011E-02	0.0007	0.000E+00	0.0000	7.556E-02	0.0055	2.669E-03	0.0002	6.030E-03	0.0004	9.411E-03
U-238	5.217E+00	0.3773	5.082E-01	0.0368	0.000E+00	0.0000	3.940E+00	0.2849	1.300E-01	0.0094	3.187E-01	0.0230	4.956E-01
Total	5.779E+00	0.4179	7.726E-01	0.0559	0.000E+00	0.0000	5.869E+00	0.4245	1.938E-01	0.0140	4.747E-01	0.0343	7.382E-01

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 4.000E+00 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Path
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr
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	2.559E+00
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	6.585E-01
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	1.061E+01
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	1.383E+01

*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 (Inhalation excludes radon)

Radio-	Ground		Inhalation		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
U-234	6.936E-03	0.0005	2.493E-01	0.0184	0.000E+00	0.0000	1.817E+00	0.1340	5.996E-02	0.0044	1.470E-01	0.0108	2.286E-01
U-235	5.439E-01	0.0401	9.937E-03	0.0007	0.000E+00	0.0000	7.565E-02	0.0056	2.932E-03	0.0002	5.912E-03	0.0004	9.284E-03
U-238	5.114E+00	0.3772	4.982E-01	0.0367	0.000E+00	0.0000	3.862E+00	0.2849	1.274E-01	0.0094	3.124E-01	0.0230	4.858E-01
Total	5.665E+00	0.4179	7.574E-01	0.0559	0.000E+00	0.0000	5.755E+00	0.4245	1.903E-01	0.0140	4.653E-01	0.0343	7.237E-01

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 Path
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr
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	2.509E+00
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	6.476E-01
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	1.040E+01
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	1.356E+01

*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 (Inhalation excludes radon)

Radio-	Ground		Inhalation		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
U-234	6.778E-03	0.0005	2.334E-01	0.0184	0.000E+00	0.0000	1.701E+00	0.1340	5.612E-02	0.0044	1.375E-01	0.0108	2.140E-01
U-235	5.092E-01	0.0401	9.434E-03	0.0007	0.000E+00	0.0000	7.609E-02	0.0060	3.728E-03	0.0003	5.535E-03	0.0004	8.921E-03
U-238	4.786E+00	0.3770	4.662E-01	0.0367	0.000E+00	0.0000	3.615E+00	0.2847	1.193E-01	0.0094	2.924E-01	0.0230	4.547E-01
Total	5.302E+00	0.4176	7.090E-01	0.0559	0.000E+00	0.0000	5.392E+00	0.4247	1.791E-01	0.0141	4.355E-01	0.0343	6.776E-01

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-	Water		Fish		Radon		Plant		Meat		Milk		All Path
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr
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	2.349E+00
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	6.129E-01
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	9.733E+00
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	1.269E+01

*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 (Inhalation excludes radon)

Radio-	Ground		Inhalation		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
U-234	8.208E-03	0.0008	1.853E-01	0.0184	0.000E+00	0.0000	1.353E+00	0.1340	4.461E-02	0.0044	1.091E-01	0.0108	1.699E-01
U-235	4.050E-01	0.0401	8.044E-03	0.0008	0.000E+00	0.0000	7.645E-02	0.0076	5.689E-03	0.0006	4.400E-03	0.0004	7.899E-03
U-238	3.794E+00	0.3759	3.697E-01	0.0366	0.000E+00	0.0000	2.866E+00	0.2839	9.456E-02	0.0094	2.318E-01	0.0230	3.605E-01
Total	4.207E+00	0.4168	5.630E-01	0.0558	0.000E+00	0.0000	4.295E+00	0.4255	1.449E-01	0.0144	3.453E-01	0.0342	5.383E-01

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 Path
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr
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	1.870E+00
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	5.075E-01
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	7.716E+00
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	1.009E+01

*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 (Inhalation excludes radon)

Radio-	Ground		Inhalation		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
U-234	2.146E-02	0.0040	9.620E-02	0.0179	0.000E+00	0.0000	7.250E-01	0.1353	2.386E-02	0.0045	5.684E-02	0.0106	8.859E-02
U-235	2.107E-01	0.0393	5.059E-03	0.0009	0.000E+00	0.0000	6.368E-02	0.0119	6.939E-03	0.0013	2.286E-03	0.0004	5.362E-03
U-238	1.953E+00	0.3645	1.905E-01	0.0355	0.000E+00	0.0000	1.476E+00	0.2755	4.872E-02	0.0091	1.194E-01	0.0223	1.857E-01
Total	2.185E+00	0.4078	2.917E-01	0.0544	0.000E+00	0.0000	2.265E+00	0.4226	7.952E-02	0.0148	1.786E-01	0.0333	2.797E-01

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 Path
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr
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	1.012E+00
U-235	7.313E-02	0.0136	7.026E-04	0.0001	0.000E+00	0.0000	5.616E-03	0.0010	1.553E-05	0.0000	3.416E-05	0.0000	3.736E-01
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	3.974E+00
Total	7.313E-02	0.0136	7.026E-04	0.0001	0.000E+00	0.0000	5.616E-03	0.0010	1.553E-05	0.0000	3.416E-05	0.0000	5.359E+00

*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 (Inhalation excludes radon)

Radio-	Ground		Inhalation		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
U-234	6.510E-02	0.0006	1.096E-02	0.0001	0.000E+00	0.0000	1.795E-01	0.0018	5.782E-03	0.0001	8.191E-03	0.0001	1.198E-02
U-235	2.140E-02	0.0002	8.078E-04	0.0000	0.000E+00	0.0000	1.450E-02	0.0001	2.041E-03	0.0000	2.309E-04	0.0000	9.658E-04
U-238	1.914E-01	0.0019	1.870E-02	0.0002	0.000E+00	0.0000	1.451E-01	0.0014	4.786E-03	0.0000	1.172E-02	0.0001	1.823E-02
Total	2.779E-01	0.0028	3.047E-02	0.0003	0.000E+00	0.0000	3.391E-01	0.0034	1.261E-02	0.0001	2.015E-02	0.0002	3.118E-02

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 Path
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr
U-234	2.768E+01	0.2751	3.430E-02	0.0003	0.000E+00	0.0000	2.129E+00	0.0212	1.028E-01	0.0010	3.877E-01	0.0039	3.061E+01
U-235	5.112E+00	0.0508	3.230E-02	0.0003	0.000E+00	0.0000	3.932E-01	0.0039	5.377E-02	0.0005	1.703E-02	0.0002	5.648E+00
U-238	5.836E+01	0.5802	6.181E-02	0.0006	0.000E+00	0.0000	4.489E+00	0.0446	2.125E-01	0.0021	8.204E-01	0.0082	6.433E+01
Total	9.115E+01	0.9061	1.284E-01	0.0013	0.000E+00	0.0000	7.012E+00	0.0697	3.690E-01	0.0037	1.225E+00	0.0122	1.006E+02

*Sum of all water independent and dependent pathways.

Dose/Source Ratios Summed Over All Pathways
Parent and Progeny Principal Radionuclide Contributions Indicated

Parent (i)	Product (j)	Branch Fraction*	DSR(j,t) (mrem/yr)/(pCi/g) t= 0.000E+00	1.000E+00	4.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
U-234	U-234	1.000E+00	8.502E-02	8.475E-02	8.391E-02	8.225E-02	7.697E-02	6.100E-02	3.139E-02	9.837E-01
U-234	Th-230	1.000E+00	0.000E+00	7.916E-07	3.077E-06	7.580E-06	2.196E-05	6.535E-05	1.456E-04	2.272E-04
U-234	Ra-226	1.000E+00	0.000E+00	2.123E-08	3.465E-07	2.150E-06	1.862E-05	1.799E-04	1.099E-03	6.711E-03
U-234	Pb-210	1.000E+00	0.000E+00	1.782E-10	9.242E-09	1.303E-07	2.874E-06	6.122E-05	5.447E-04	1.303E-02
U-234	∑DSR(j)		8.502E-02	8.475E-02	8.391E-02	8.226E-02	7.701E-02	6.130E-02	3.318E-02	1.004E+00
U-235	U-235	1.000E+00	5.123E-01	5.106E-01	5.056E-01	4.956E-01	4.638E-01	3.676E-01	1.893E-01	9.464E-01
U-235	Pa-231	1.000E+00	0.000E+00	2.367E-04	9.659E-04	2.381E-03	6.700E-03	1.771E-02	2.730E-02	8.057E-01
U-235	Ac-227	1.000E+00	0.000E+00	2.041E-06	2.771E-05	1.540E-04	1.032E-03	5.057E-03	7.079E-02	2.593E+00
U-235	∑DSR(j)		5.123E-01	5.109E-01	5.066E-01	4.981E-01	4.715E-01	3.904E-01	2.874E-01	4.345E+00
U-238	U-238	1.000E+00	1.576E-01	1.571E-01	1.556E-01	1.525E-01	1.427E-01	1.131E-01	5.824E-02	9.405E-01
U-238	U-234	1.000E+00	0.000E+00	2.403E-07	9.515E-07	2.332E-06	6.546E-06	1.729E-05	2.671E-05	2.793E-03
U-238	Th-230	1.000E+00	0.000E+00	1.155E-12	1.755E-11	1.072E-10	9.192E-10	8.756E-09	5.185E-08	1.789E-07
U-238	Ra-226	1.000E+00	0.000E+00	1.974E-14	1.302E-12	2.022E-11	5.226E-10	1.645E-08	2.813E-07	7.816E-06
U-238	Pb-210	1.000E+00	0.000E+00	1.342E-16	2.696E-14	9.450E-13	6.345E-11	4.721E-09	1.286E-07	2.110E-05
U-238	∑DSR(j)		1.576E-01	1.571E-01	1.556E-01	1.525E-01	1.427E-01	1.131E-01	5.827E-02	9.433E-01

*Branch Fraction is the cumulative factor for the j't principal radionuclide daughter: CUMBRF(j) = BRF(1)*BRF(2)* ... BRF(j).
The DSR includes contributions from associated (half-life ≤ 0.5 yr) daughters.

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 30 mrem/yr

Nuclide (i)	t= 0.000E+00	1.000E+00	4.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
U-234	3.528E+02	3.540E+02	3.575E+02	3.647E+02	3.896E+02	4.894E+02	9.042E+02	2.989E+01
U-235	5.856E+01	5.872E+01	5.922E+01	6.022E+01	6.363E+01	7.685E+01	1.044E+02	6.905E+00
U-238	1.903E+02	1.909E+02	1.928E+02	1.967E+02	2.102E+02	2.652E+02	5.148E+02	3.180E+01

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 = 1.000E+03 years

Nuclide (i)	Initial pCi/g	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
U-234	3.050E+01	1.000E+03	1.004E+00	2.989E+01	1.004E+00	2.989E+01
U-235	1.300E+00	1.000E+03	4.345E+00	6.905E+00	4.345E+00	6.905E+00
U-238	6.820E+01	1.000E+03	9.433E-01	3.180E+01	9.433E-01	3.180E+01

Individual Nuclide Dose Summed Over All Pathways
Parent Nuclide and Branch Fraction Indicated

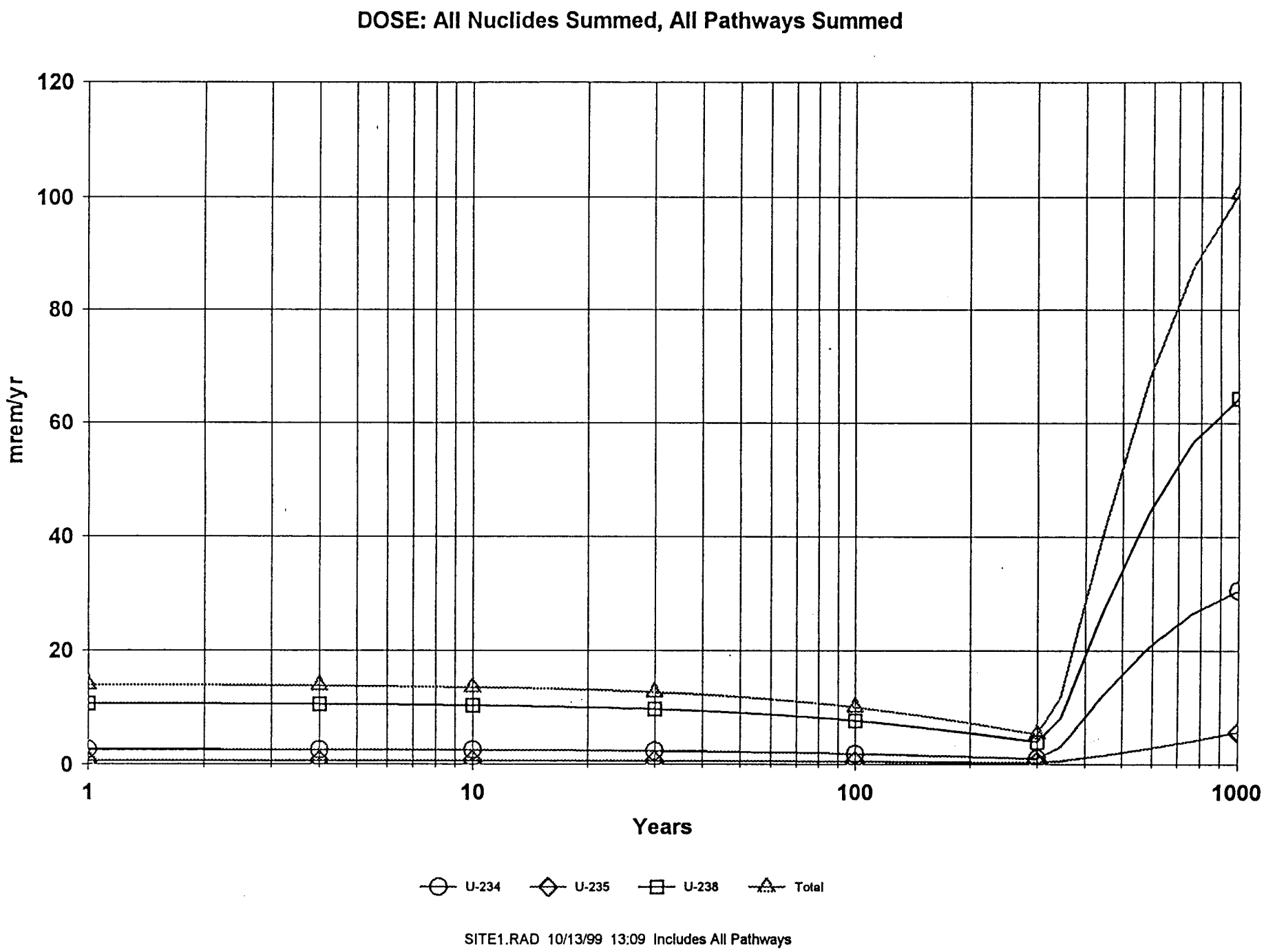
Nuclide (j)	Parent (i)	BRF(i)	DOSE(j,t), mrem/yr t= 0.000E+00	1.000E+00	4.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
U-234	U-234	1.000E+00	2.593E+00	2.585E+00	2.559E+00	2.509E+00	2.347E+00	1.860E+00	9.573E-01	3.000E+01
U-234	U-238	1.000E+00	0.000E+00	1.639E-05	6.489E-05	1.590E-04	4.464E-04	1.180E-03	1.821E-03	1.905E-01
U-234	∑DOSE(j):		2.593E+00	2.585E+00	2.559E+00	2.509E+00	2.348E+00	1.862E+00	9.592E-01	3.019E+01
Th-230	U-234	1.000E+00	0.000E+00	2.415E-05	9.385E-05	2.312E-04	6.696E-04	1.993E-03	4.441E-03	6.928E-03
Th-230	U-238	1.000E+00	0.000E+00	7.879E-11	1.197E-09	7.311E-09	6.269E-08	5.972E-07	3.536E-06	1.220E-05
Th-230	∑DOSE(j):		0.000E+00	2.415E-05	9.385E-05	2.312E-04	6.697E-04	1.994E-03	4.445E-03	6.940E-03
Ra-226	U-234	1.000E+00	0.000E+00	6.476E-07	1.057E-05	6.558E-05	5.680E-04	5.486E-03	3.352E-02	2.047E-01
Ra-226	U-238	1.000E+00	0.000E+00	1.346E-12	8.882E-11	1.379E-09	3.564E-08	1.122E-06	1.919E-05	5.331E-04
Ra-226	∑DOSE(j):		0.000E+00	6.476E-07	1.057E-05	6.558E-05	5.680E-04	5.487E-03	3.354E-02	2.052E-01
Pb-210	U-234	1.000E+00	0.000E+00	5.436E-09	2.819E-07	3.975E-06	8.766E-05	1.867E-03	1.661E-02	3.973E-01
Pb-210	U-238	1.000E+00	0.000E+00	9.151E-15	1.838E-12	6.445E-11	4.327E-09	3.219E-07	8.774E-06	1.439E-03
Pb-210	∑DOSE(j):		0.000E+00	5.436E-09	2.819E-07	3.975E-06	8.767E-05	1.868E-03	1.662E-02	3.988E-01
U-235	U-235	1.000E+00	6.660E-01	6.638E-01	6.572E-01	6.443E-01	6.029E-01	4.779E-01	2.461E-01	1.230E+00
Pa-231	U-235	1.000E+00	0.000E+00	3.077E-04	1.256E-03	3.095E-03	8.710E-03	2.302E-02	3.549E-02	1.047E+00
Ac-227	U-235	1.000E+00	0.000E+00	2.653E-06	3.602E-05	2.002E-04	1.341E-03	6.574E-03	9.202E-02	3.371E+00
U-238	U-238	1.000E+00	1.075E+01	1.072E+01	1.061E+01	1.040E+01	9.732E+00	7.715E+00	3.972E+00	6.414E+01

BRF(i) is the branch fraction of the parent nuclide.

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	BRF(i)	S(j,t), pCi/g t= 0.000E+00	1.000E+00	4.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
U-234	U-234	1.000E+00	3.050E+01	3.040E+01	3.010E+01	2.950E+01	2.761E+01	2.188E+01	1.126E+01	1.100E+00
U-234	U-238	1.000E+00	0.000E+00	1.927E-04	7.632E-04	1.870E-03	5.250E-03	1.387E-02	2.142E-02	6.986E-03
U-234	∑S(j):		3.050E+01	3.040E+01	3.010E+01	2.951E+01	2.761E+01	2.189E+01	1.128E+01	1.107E+00
Th-230	U-234	1.000E+00	0.000E+00	2.741E-04	1.091E-03	2.700E-03	7.838E-03	2.335E-02	5.203E-02	7.898E-02
Th-230	U-238	1.000E+00	0.000E+00	8.683E-10	1.380E-08	8.512E-08	7.330E-07	6.993E-06	4.143E-05	1.324E-04
Th-230	∑S(j):		0.000E+00	2.741E-04	1.091E-03	2.700E-03	7.839E-03	2.335E-02	5.207E-02	7.911E-02
Ra-226	U-234	1.000E+00	0.000E+00	5.935E-08	9.438E-07	5.827E-06	5.035E-05	4.859E-04	2.969E-03	1.023E-02
Ra-226	U-238	1.000E+00	0.000E+00	1.254E-13	7.967E-12	1.227E-10	3.161E-09	9.939E-08	1.699E-06	1.469E-05
Ra-226	∑S(j):		0.000E+00	5.935E-08	9.438E-07	5.827E-06	5.035E-05	4.860E-04	2.970E-03	1.025E-02
Pb-210	U-234	1.000E+00	0.000E+00	6.102E-10	3.794E-08	5.601E-07	1.262E-05	2.708E-04	2.414E-03	9.543E-03
Pb-210	U-238	1.000E+00	0.000E+00	9.666E-16	2.417E-13	8.986E-12	6.206E-10	4.664E-08	1.275E-06	1.346E-05
Pb-210	∑S(j):		0.000E+00	6.102E-10	3.794E-08	5.601E-07	1.262E-05	2.709E-04	2.416E-03	9.556E-03
U-235	U-235	1.000E+00	1.300E+00	1.296E+00	1.283E+00	1.258E+00	1.177E+00	9.328E-01	4.803E-01	4.704E-02
Pa-231	U-235	1.000E+00	0.000E+00	2.741E-05	1.086E-04	2.661E-04	7.467E-04	1.972E-03	3.039E-03	9.848E-04
Ac-227	U-235	1.000E+00	0.000E+00	4.311E-07	6.586E-06	3.760E-05	2.550E-04	1.255E-03	2.394E-03	8.299E-04
U-238	U-238	1.000E+00	6.820E+01	6.797E+01	6.730E+01	6.597E+01	6.174E+01	4.894E+01	2.520E+01	2.468E+00

BRF(i) is the branch fraction of the parent nuclide.


DOSE: All Nuclides Summed, All Pathways Summed
120
100
80
60
40
20
0
mrem/yr
1
10
100
1000
Years
U-234
U-235
U-238
Total
SITE1.RAD 10/13/99 13:09 Includes All Pathways

ATTACHMENT F

ATTACHMENT F

RESRAD Version 5.82 Code Run

(Residential Scenario, Building 611B Site Specific Parameters)

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Dose Conversion Factor (and Related) Parameter Summary
File: DOSFAC.BIN

Menu	Parameter	Current Value	Default	Parameter Name
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	Ac-227+D	6.720E+00	6.720E+00	DCF2(1)
B-1	Pa-231	1.280E+00	1.280E+00	DCF2(2)
B-1	Pb-210+D	2.320E-02	2.320E-02	DCF2(3)
B-1	Ra-226+D	8.600E-03	8.600E-03	DCF2(4)
B-1	Th-230	3.260E-01	3.260E-01	DCF2(5)
B-1	U-234	1.320E-01	1.320E-01	DCF2(6)
B-1	U-235+D	1.230E-01	1.230E-01	DCF2(7)
B-1	U-238+D	1.180E-01	1.180E-01	DCF2(8)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	Ac-227+D	1.480E-02	1.480E-02	DCF3(1)
D-1	Pa-231	1.060E-02	1.060E-02	DCF3(2)
D-1	Pb-210+D	7.270E-03	7.270E-03	DCF3(3)
D-1	Ra-226+D	1.330E-03	1.330E-03	DCF3(4)
D-1	Th-230	5.480E-04	5.480E-04	DCF3(5)
D-1	U-234	2.830E-04	2.830E-04	DCF3(6)
D-1	U-235+D	2.670E-04	2.670E-04	DCF3(7)
D-1	U-238+D	2.690E-04	2.690E-04	DCF3(8)
D-34	Food transfer factors:			
D-34	Ac-227+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(1,1)
D-34	Ac-227+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,2)
D-34	Ac-227+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,3)
D-34				
D-34	Pa-231 , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(2,1)
D-34	Pa-231 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(2,2)
D-34	Pa-231 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(2,3)
D-34				
D-34	Pb-210+D , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(3,1)
D-34	Pb-210+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-04	8.000E-04	RTF(3,2)
D-34	Pb-210+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RTF(3,3)
D-34				
D-34	Ra-226+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(4,1)
D-34	Ra-226+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(4,2)
D-34	Ra-226+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(4,3)
D-34				
D-34	Th-230 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(5,1)
D-34	Th-230 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(5,2)
D-34	Th-230 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(5,3)
D-34				
D-34	U-234 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(6,1)
D-34	U-234 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(6,2)
D-34	U-234 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(6,3)
D-34				
D-34	U-235+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(7,1)
D-34	U-235+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(7,2)
D-34	U-235+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(7,3)
D-34				

Dose Conversion Factor (and Related) Parameter Summary (continued)
File: DOSFAC.BIN

Menu	Parameter	Current Value	Default	Parameter Name
D-34	U-238+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(8,1)
D-34	U-238+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(8,2)
D-34	U-238+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(8,3)
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-5	Ac-227+D , fish	1.500E+01	1.500E+01	BIOFAC(1,1)
D-5	Ac-227+D , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(1,2)
D-5				
D-5	Pa-231 , fish	1.000E+01	1.000E+01	BIOFAC(2,1)
D-5	Pa-231 , crustacea and mollusks	1.100E+02	1.100E+02	BIOFAC(2,2)
D-5				
D-5	Pb-210+D , fish	3.000E+02	3.000E+02	BIOFAC(3,1)
D-5	Pb-210+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(3,2)
D-5				
D-5	Ra-226+D , fish	5.000E+01	5.000E+01	BIOFAC(4,1)
D-5	Ra-226+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(4,2)
D-5				
D-5	Th-230 , fish	1.000E+02	1.000E+02	BIOFAC(5,1)
D-5	Th-230 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(5,2)
D-5				
D-5	U-234 , fish	1.000E+01	1.000E+01	BIOFAC(6,1)
D-5	U-234 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(6,2)
D-5				
D-5	U-235+D , fish	1.000E+01	1.000E+01	BIOFAC(7,1)
D-5	U-235+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(7,2)
D-5				
D-5	U-238+D , fish	1.000E+01	1.000E+01	BIOFAC(8,1)
D-5	U-238+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(8,2)

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) *	4.000E+03	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m) *	2.500E-01	2.000E+00	---	THICK0
R011	Length parallel to aquifer flow (m)	1.000E+02	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	3.000E+01	3.000E+01	---	BRDL
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)	4.000E+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	0.000E+00	---	T(9)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g): U-234	3.050E+01	0.000E+00	---	S1(6)
R012	Initial principal radionuclide (pCi/g): U-235	1.300E+00	0.000E+00	---	S1(7)
R012	Initial principal radionuclide (pCi/g): U-238	6.820E+01	0.000E+00	---	S1(8)
R012	Concentration in groundwater (pCi/L): U-234	not used	0.000E+00	---	W1(6)
R012	Concentration in groundwater (pCi/L): U-235	not used	0.000E+00	---	W1(7)
R012	Concentration in groundwater (pCi/L): U-238	not used	0.000E+00	---	W1(8)
R013	Cover depth (m)	0.000E+00	0.000E+00	---	COVER0
R013	Density of cover material (g/cm**3)	not used	1.500E+00	---	DENSCV
R013	Cover depth erosion rate (m/yr)	not used	1.000E-03	---	VCV
R013	Density of contaminated zone (g/cm**3)	1.500E+00	1.500E+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)	1.000E+01	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	5.300E+00	5.300E+00	---	BCZ
R013	Average annual wind speed (m/sec)	2.000E+00	2.000E+00	---	WIND
R013	Humidity in air (g/m**3)	not used	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	5.000E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	1.000E+00	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	2.000E-01	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
R013	Accuracy for water/soil computations	1.000E-03	1.000E-03	---	EPS
R014	Density of saturated zone (g/cm**3)	1.500E+00	1.500E+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)	1.000E+02	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	2.000E-02	2.000E-02	---	HGWT
R014	Saturated zone b parameter	5.300E+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	Well pumping rate (m**3/yr)	2.500E+02	2.500E+02	---	UW

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R015	Number of unsaturated zone strata	1	1	---	NS
R015	Unsat. zone 1, thickness (m)	4.000E+00	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	1.500E+00	1.500E+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	5.300E+00	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCUZ(1)
R016	Distribution coefficients for U-234				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(6)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(6,1
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.655E-02	ALEACH(6)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(6)
R016	Distribution coefficients for U-235				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(7)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(7,1
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(7)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.655E-02	ALEACH(7)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(7)
R016	Distribution coefficients for U-238				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(8)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(8,1
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(8)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.655E-02	ALEACH(8)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(8)
R016	Distribution coefficients for daughter Ac-227				
R016	Contaminated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCC(1)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCU(1,1
R016	Saturated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	6.596E-02	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for daughter Pa-231				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(2)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(2,1
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.655E-02	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)
R016	Distribution coefficients for daughter Pb-210				
R016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCC(3)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCU(3,1
R016	Saturated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.330E-02	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(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 daughter Ra-226				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(4)
R016	Unsaturated zone 1 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(4,1
R016	Saturated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.899E-02	ALEACH(4)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(4)
R016	Distribution coefficients for daughter Th-230				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(5)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(5,1
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.222E-05	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(5)
R017	Inhalation rate (m**3/yr)	8.400E+03	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	1.000E-04	1.000E-04	---	MLINH
R017	Exposure duration	3.000E+01	3.000E+01	---	ED
R017	Shielding factor, inhalation	4.000E-01	4.000E-01	---	SHF3
R017	Shielding factor, external gamma	7.000E-01	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	5.000E-01	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	2.500E-01	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	1.000E+00	1.000E+00	>0 shows circular AREA.	FS
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	not used	5.000E+01	---	RAD_SHAPE(
R017	Outer annular radius (m), ring 2:	not used	7.071E+01	---	RAD_SHAPE(
R017	Outer annular radius (m), ring 3:	not used	0.000E+00	---	RAD_SHAPE(
R017	Outer annular radius (m), ring 4:	not used	0.000E+00	---	RAD_SHAPE(
R017	Outer annular radius (m), ring 5:	not used	0.000E+00	---	RAD_SHAPE(
R017	Outer annular radius (m), ring 6:	not used	0.000E+00	---	RAD_SHAPE(
R017	Outer annular radius (m), ring 7:	not used	0.000E+00	---	RAD_SHAPE(
R017	Outer annular radius (m), ring 8:	not used	0.000E+00	---	RAD_SHAPE(
R017	Outer annular radius (m), ring 9:	not used	0.000E+00	---	RAD_SHAPE(
R017	Outer annular radius (m), ring 10:	not used	0.000E+00	---	RAD_SHAPE(1
R017	Outer annular radius (m), ring 11:	not used	0.000E+00	---	RAD_SHAPE(1
R017	Outer annular radius (m), ring 12:	not used	0.000E+00	---	RAD_SHAPE(1
R017	Fractions of annular areas within AREA:				
R017	Ring 1	not used	1.000E+00	---	FRACA(1)
R017	Ring 2	not used	2.732E-01	---	FRACA(2)
R017	Ring 3	not used	0.000E+00	---	FRACA(3)
R017	Ring 4	not used	0.000E+00	---	FRACA(4)
R017	Ring 5	not used	0.000E+00	---	FRACA(5)
R017	Ring 6	not used	0.000E+00	---	FRACA(6)
R017	Ring 7	not used	0.000E+00	---	FRACA(7)
R017	Ring 8	not used	0.000E+00	---	FRACA(8)
R017	Ring 9	not used	0.000E+00	---	FRACA(9)
R017	Ring 10	not used	0.000E+00	---	FRACA(10)
R017	Ring 11	not used	0.000E+00	---	FRACA(11)
R017	Ring 12	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)

Menu	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	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	5.100E+02	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	1.000E+00	1.000E+00	---	FDW
R018	Contamination fraction of household water	not used	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	1.000E+00	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	1.000E+00	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	5.000E-01	5.000E-01	---	FR9
R018	Contamination fraction of plant food	-1	-1	0.500E+00	FPLANT
R018	Contamination fraction of meat	-1	-1	0.200E+00	FMEAT
R018	Contamination fraction of milk	-1	-1	0.200E+00	FMILK
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	Livestock soil intake (kg/day)	5.000E-01	5.000E-01	---	LSI
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	Household water fraction from ground water	1.000E+00	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	not used	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	1.000E+00	1.000E+00	---	FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	7.000E-01	7.000E-01	---	YV(1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	1.500E+00	1.500E+00	---	YV(2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	1.100E+00	1.100E+00	---	YV(3)
R19B	Growing Season for Non-Leafy (years)	1.700E-01	1.700E-01	---	TE(1)
R19B	Growing Season for Leafy (years)	2.500E-01	2.500E-01	---	TE(2)
R19B	Growing Season for Fodder (years)	8.000E-02	8.000E-02	---	TE(3)
R19B	Translocation Factor for Non-Leafy	1.000E-01	1.000E-01	---	TIV(1)
R19B	Translocation Factor for Leafy	1.000E+00	1.000E+00	---	TIV(2)
R19B	Translocation Factor for Fodder	1.000E+00	1.000E+00	---	TIV(3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	2.500E-01	2.500E-01	---	RDRY(1)
R19B	Dry Foliar Interception Fraction for Leafy	2.500E-01	2.500E-01	---	RDRY(2)
R19B	Dry Foliar Interception Fraction for Fodder	2.500E-01	2.500E-01	---	RDRY(3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	2.500E-01	2.500E-01	---	RWET(1)
R19B	Wet Foliar Interception Fraction for Leafy	2.500E-01	2.500E-01	---	RWET(2)
R19B	Wet Foliar Interception Fraction for Fodder	2.500E-01	2.500E-01	---	RWET(3)
R19B	Weathering Removal Constant for Vegetation	2.000E+01	2.000E+01	---	WLAM
C14	C-12 concentration in water (g/cm**3)	not used	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	not used	9.800E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	---	DMC

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
C14	C-14 evasion flux rate from soil (1/sec)	not used	7.000E-07	---	EVSN
C14	C-12 evasion flux rate from soil (1/sec)	not used	1.000E-10	---	REVSN
C14	Fraction of grain in beef cattle feed	not used	8.000E-01	---	AVFG4
C14	Fraction of grain in milk cow feed	not used	2.000E-01	---	AVFG5
STOR	Storage times of contaminated foodstuffs (days):				
STOR	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	---	STOR_T(1)
STOR	Leafy vegetables	1.000E+00	1.000E+00	---	STOR_T(2)
STOR	Milk	1.000E+00	1.000E+00	---	STOR_T(3)
STOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(4)
STOR	Fish	7.000E+00	7.000E+00	---	STOR_T(5)
STOR	Crustacea and mollusks	7.000E+00	7.000E+00	---	STOR_T(6)
STOR	Well water	1.000E+00	1.000E+00	---	STOR_T(7)
STOR	Surface water	1.000E+00	1.000E+00	---	STOR_T(8)
STOR	Livestock fodder	4.500E+01	4.500E+01	---	STOR_T(9)
R021	Thickness of building foundation (m)	not used	1.500E-01	---	FLOOR
R021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	---	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV
R021	Total porosity of the building foundation	not used	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	not used	3.000E-02	---	PH2OFL
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	not used	2.000E-06	---	DIFCV
R021	in foundation material	not used	3.000E-07	---	DIFFL
R021	in contaminated zone soil	not used	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	not used	2.000E+00	---	HMIX
R021	Average building air exchange rate (1/hr)	not used	5.000E-01	---	REXG
R021	Height of the building (room) (m)	not used	2.500E+00	---	HRM
R021	Building interior area factor	not used	0.000E+00	---	FAI
R021	Building depth below ground surface (m)	not used	-1.000E+00	---	DMFL
R021	Emanating power of Rn-222 gas	not used	2.500E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)

Summary of Pathway Selections

Pathway	User Selection
1 -- external gamma	active
2 -- inhalation (w/o radon)	active
3 -- plant ingestion	active
4 -- meat ingestion	active
5 -- milk ingestion	active
6 -- aquatic foods	active
7 -- drinking water	active
8 -- soil ingestion	active
9 -- radon	suppressed
Find peak pathway doses	suppressed

Contaminated Zone Dimensions	
Area:	4000.00 square meters
Thickness:	0.25 meters
Cover Depth:	0.00 meters

Initial Soil Concentrations, pCi/g	
U-234	3.050E+01
U-235	1.300E+00
U-238	6.820E+01

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 30 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E+00	4.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
TDOSE(t):	9.102E+00	8.857E+00	8.157E+00	6.918E+00	3.990E+00	5.673E-01	4.052E-02	1.344E+01
M(t):	3.034E-01	2.952E-01	2.719E-01	2.306E-01	1.330E-01	1.891E-02	1.351E-03	4.480E-01

Maximum TDOSE(t): 1.344E+01 mrem/yr at t = 1.000E+03 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 (Inhalation excludes radon)

Radio-	Ground		Inhalation		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
U-234	7.003E-03	0.0008	2.344E-01	0.0258	0.000E+00	0.0000	5.223E-01	0.0574	2.025E-02	0.0022	5.131E-02	0.0056	2.363E-01
U-235	5.619E-01	0.0617	9.312E-03	0.0010	0.000E+00	0.0000	2.100E-02	0.0023	8.142E-04	0.0001	2.063E-03	0.0002	9.502E-03
U-238	5.192E+00	0.5705	4.686E-01	0.0515	0.000E+00	0.0000	1.110E+00	0.1220	4.303E-02	0.0047	1.091E-01	0.0120	5.022E-01
Total	5.761E+00	0.6330	7.124E-01	0.0783	0.000E+00	0.0000	1.653E+00	0.1817	6.409E-02	0.0070	1.624E-01	0.0178	7.480E-01

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 Path
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr
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	1.072E+00
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	6.046E-01
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	7.425E+00
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	9.102E+00

*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+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		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
U-234	6.820E-03	0.0008	2.283E-01	0.0258	0.000E+00	0.0000	5.071E-01	0.0573	1.974E-02	0.0022	4.997E-02	0.0056	2.301E-01
U-235	5.472E-01	0.0618	9.070E-03	0.0010	0.000E+00	0.0000	2.046E-02	0.0023	8.054E-04	0.0001	2.009E-03	0.0002	9.261E-03
U-238	5.055E+00	0.5707	4.564E-01	0.0515	0.000E+00	0.0000	1.078E+00	0.1217	4.197E-02	0.0047	1.062E-01	0.0120	4.891E-01
Total	5.609E+00	0.6333	6.937E-01	0.0783	0.000E+00	0.0000	1.606E+00	0.1813	6.251E-02	0.0071	1.582E-01	0.0179	7.284E-01

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 Path
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr
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	1.042E+00
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	5.888E-01
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	7.226E+00
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	8.857E+00

*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 = 4.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		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
U-234	6.303E-03	0.0008	2.108E-01	0.0258	0.000E+00	0.0000	4.627E-01	0.0567	1.821E-02	0.0022	4.610E-02	0.0057	2.125E-01
U-235	5.053E-01	0.0619	8.383E-03	0.0010	0.000E+00	0.0000	1.886E-02	0.0023	7.771E-04	0.0001	1.854E-03	0.0002	8.575E-03
U-238	4.664E+00	0.5717	4.214E-01	0.0517	0.000E+00	0.0000	9.834E-01	0.1206	3.871E-02	0.0047	9.799E-02	0.0120	4.516E-01
Total	5.175E+00	0.6344	6.406E-01	0.0785	0.000E+00	0.0000	1.465E+00	0.1796	5.770E-02	0.0071	1.459E-01	0.0179	6.727E-01

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 4.000E+00 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Path
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr
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	9.566E-01
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	5.437E-01
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	6.657E+00
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	8.157E+00

*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 (Inhalation excludes radon)

Radio-	Ground		Inhalation		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
U-234	5.402E-03	0.0008	1.798E-01	0.0260	0.000E+00	0.0000	3.850E-01	0.0556	1.550E-02	0.0022	3.924E-02	0.0057	1.812E-01
U-235	4.308E-01	0.0623	7.166E-03	0.0010	0.000E+00	0.0000	1.602E-02	0.0023	7.190E-04	0.0001	1.578E-03	0.0002	7.358E-03
U-238	3.970E+00	0.5738	3.594E-01	0.0519	0.000E+00	0.0000	8.182E-01	0.1183	3.294E-02	0.0048	8.342E-02	0.0121	3.851E-01
Total	4.406E+00	0.6368	5.463E-01	0.0790	0.000E+00	0.0000	1.219E+00	0.1762	4.916E-02	0.0071	1.242E-01	0.0180	5.737E-01

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 Path
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr
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	8.061E-01
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	4.636E-01
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	5.649E+00
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	6.918E+00

*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 (Inhalation excludes radon)

Radio-	Ground		Inhalation		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
U-234	3.366E-03	0.0008	1.058E-01	0.0265	0.000E+00	0.0000	2.076E-01	0.0520	9.052E-03	0.0023	2.294E-02	0.0057	1.066E-01
U-235	2.530E-01	0.0634	4.264E-03	0.0011	0.000E+00	0.0000	9.262E-03	0.0023	5.301E-04	0.0001	9.231E-04	0.0002	4.432E-03
U-238	2.315E+00	0.5803	2.113E-01	0.0530	0.000E+00	0.0000	4.411E-01	0.1105	1.924E-02	0.0048	4.877E-02	0.0122	2.265E-01
Total	2.572E+00	0.6446	3.214E-01	0.0805	0.000E+00	0.0000	6.579E-01	0.1649	2.882E-02	0.0072	7.264E-02	0.0182	3.375E-01

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-	Water		Fish		Radon		Plant		Meat		Milk		All Path
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr
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	4.554E-01
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	2.724E-01
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+00
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	3.990E+00

*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 (Inhalation excludes radon)

adio-	Ground		Inhalation		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
-234	1.335E-03	0.0024	1.665E-02	0.0294	0.000E+00	0.0000	2.235E-02	0.0394	1.385E-03	0.0024	3.509E-03	0.0062	1.677E-02
-235	3.849E-02	0.0678	6.978E-04	0.0012	0.000E+00	0.0000	1.225E-03	0.0022	1.349E-04	0.0002	1.412E-04	0.0002	7.539E-04
-238	3.383E-01	0.5964	3.295E-02	0.0581	0.000E+00	0.0000	4.693E-02	0.0827	2.926E-03	0.0052	7.451E-03	0.0131	3.531E-02
otal	3.782E-01	0.6666	5.030E-02	0.0887	0.000E+00	0.0000	7.050E-02	0.1243	4.446E-03	0.0078	1.110E-02	0.0196	5.283E-02

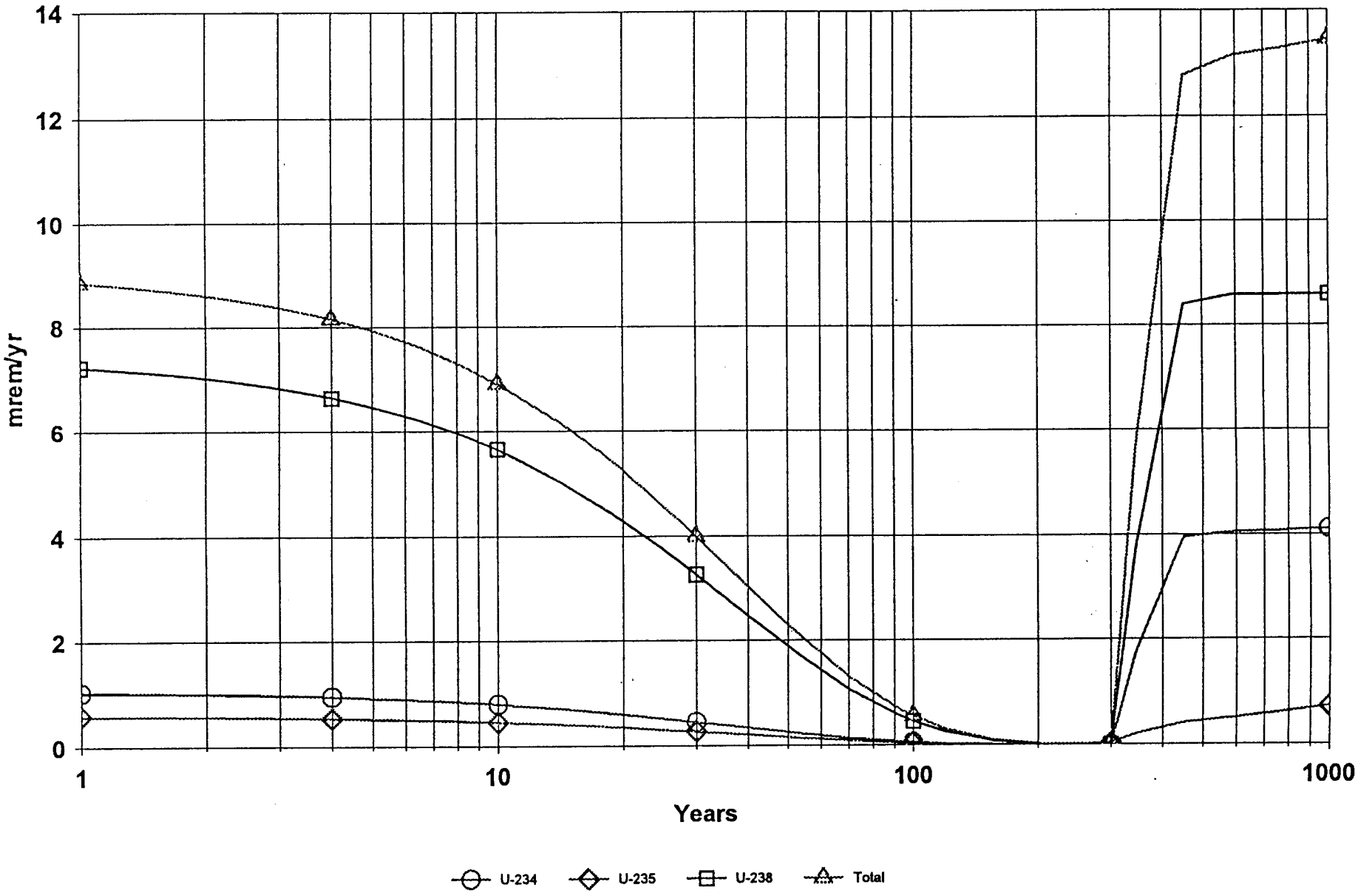
Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Water Dependent Pathways

adio-	Water		Fish		Radon		Plant		Meat		Milk		All Path
uclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr
-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	6.200E-02
-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	4.144E-02
-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	4.639E-01
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	5.673E-01

Sum of all water independent and dependent pathways.

DOSE: All Nuclides Summed, All Pathways Summed



Site1.RAD 10/13/99 12:46 Includes All 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 (Inhalation excludes radon)

Radio-	Ground		Inhalation		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
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
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
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
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

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 Path
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr
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
U-235	3.749E-02	0.9251	1.441E-04	0.0036	0.000E+00	0.0000	2.879E-03	0.0710	3.183E-06	0.0001	7.005E-06	0.0002	4.052E-02
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
Total	3.749E-02	0.9251	1.441E-04	0.0036	0.000E+00	0.0000	2.879E-03	0.0710	3.183E-06	0.0001	7.005E-06	0.0002	4.052E-02

*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 (Inhalation excludes radon)

Radio-	Ground		Inhalation		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
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
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
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
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

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 Path
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr
U-234	3.783E+00	0.2815	1.993E-03	0.0001	0.000E+00	0.0000	2.911E-01	0.0217	5.669E-03	0.0004	2.117E-02	0.0016	4.103E+00
U-235	6.784E-01	0.0505	1.693E-03	0.0001	0.000E+00	0.0000	5.219E-02	0.0039	2.922E-03	0.0002	9.228E-04	0.0001	7.361E-01
U-238	7.930E+00	0.5901	3.360E-03	0.0003	0.000E+00	0.0000	6.100E-01	0.0454	1.155E-02	0.0009	4.459E-02	0.0033	8.600E+00
Total	1.239E+01	0.9221	7.047E-03	0.0005	0.000E+00	0.0000	9.533E-01	0.0709	2.014E-02	0.0015	6.669E-02	0.0050	1.344E+01

*Sum of all water independent and dependent pathways.

Dose/Source Ratios Summed Over All Pathways
Parent and Progeny Principal Radionuclide Contributions Indicated

Parent (i)	Product (j)	Branch Fraction*	DSR(j,t) (mrem/yr)/(pCi/g) t= 0.000E+00	1.000E+00	4.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
U-234	U-234	1.000E+00	3.513E-02	3.417E-02	3.136E-02	2.643E-02	1.491E-02	1.984E-03	0.000E+00	1.319E-01
U-234	Th-230	1.000E+00	0.000E+00	4.358E-07	1.651E-06	3.786E-06	8.705E-06	1.354E-05	0.000E+00	1.147E-06
U-234	Ra-226	1.000E+00	0.000E+00	1.422E-08	2.187E-07	1.243E-06	8.147E-06	3.175E-05	0.000E+00	5.582E-04
U-234	Pb-210	1.000E+00	0.000E+00	5.077E-11	2.550E-09	3.278E-08	5.234E-07	3.625E-06	0.000E+00	2.088E-03
U-234	∑DSR(j)		3.513E-02	3.417E-02	3.137E-02	2.643E-02	1.493E-02	2.033E-03	0.000E+00	1.345E-01
U-235	U-235	1.000E+00	4.651E-01	4.528E-01	4.180E-01	3.560E-01	2.084E-01	3.138E-02	0.000E+00	1.248E-01
U-235	Pa-231	1.000E+00	0.000E+00	6.977E-05	2.612E-04	5.488E-04	9.081E-04	3.592E-04	0.000E+00	1.051E-01
U-235	Ac-227	1.000E+00	0.000E+00	9.888E-07	1.277E-05	5.846E-05	2.056E-04	1.389E-04	3.117E-02	3.364E-01
U-235	∑DSR(j)		4.651E-01	4.529E-01	4.182E-01	3.566E-01	2.096E-01	3.188E-02	3.117E-02	5.663E-01
U-238	U-238	1.000E+00	1.089E-01	1.060E-01	9.761E-02	8.282E-02	4.783E-02	6.801E-03	0.000E+00	1.257E-01
U-238	U-234	1.000E+00	0.000E+00	9.686E-08	3.557E-07	7.492E-07	1.268E-06	5.625E-07	0.000E+00	3.744E-04
U-238	Th-230	1.000E+00	0.000E+00	6.243E-13	9.230E-12	5.137E-11	3.217E-10	1.156E-09	0.000E+00	2.298E-09
U-238	Ra-226	1.000E+00	0.000E+00	1.332E-14	8.161E-13	1.141E-11	2.116E-10	2.188E-09	0.000E+00	9.262E-07
U-238	Pb-210	1.000E+00	0.000E+00	3.797E-17	7.355E-15	2.324E-13	1.082E-11	2.200E-10	0.000E+00	3.401E-06
U-238	∑DSR(j)		1.089E-01	1.060E-01	9.761E-02	8.282E-02	4.783E-02	6.802E-03	0.000E+00	1.261E-01

*Branch Fraction is the cumulative factor for the j't principal radionuclide daughter: CUMBRF(j) = BRF(1)*BRF(2)* ... BRF(j).
The DSR includes contributions from associated (half-life ≤ 0.5 yr) daughters.

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 30 mrem/yr

Nuclide (i)	t= 0.000E+00	1.000E+00	4.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
U-234	8.539E+02	8.780E+02	9.565E+02	1.135E+03	2.009E+03	1.476E+04	*6.245E+09	2.230E+02
U-235	6.451E+01	6.624E+01	7.173E+01	8.412E+01	1.432E+02	9.412E+02	9.625E+02	5.298E+01
U-238	2.755E+02	2.831E+02	3.073E+02	3.622E+02	6.272E+02	4.410E+03	*3.360E+05	2.379E+02

*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 = 1.000E+03 years

Nuclide (i)	Initial pCi/g	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
U-234	3.050E+01	1.000E+03	1.345E-01	2.230E+02	1.345E-01	2.230E+02
U-235	1.300E+00	1.000E+03	5.663E-01	5.298E+01	5.663E-01	5.298E+01
U-238	6.820E+01	1.000E+03	1.261E-01	2.379E+02	1.261E-01	2.379E+02

Individual Nuclide Dose Summed Over All Pathways
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	BRF(i)	DOSE(j,t), mrem/yr t= 0.000E+00	1.000E+00	4.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
U-234	U-234	1.000E+00	1.072E+00	1.042E+00	9.566E-01	8.060E-01	4.549E-01	6.051E-02	0.000E+00	4.023E+00
U-234	U-238	1.000E+00	0.000E+00	6.606E-06	2.426E-05	5.109E-05	8.651E-05	3.836E-05	0.000E+00	2.554E-02
U-234	∑DOSE(j):		1.072E+00	1.042E+00	9.566E-01	8.060E-01	4.549E-01	6.054E-02	0.000E+00	4.048E+00
Th-230	U-234	1.000E+00	0.000E+00	1.329E-05	5.035E-05	1.155E-04	2.655E-04	4.130E-04	0.000E+00	3.499E-05
Th-230	U-238	1.000E+00	0.000E+00	4.258E-11	6.295E-10	3.503E-09	2.194E-08	7.885E-08	0.000E+00	1.567E-07
Th-230	∑DOSE(j):		0.000E+00	1.329E-05	5.035E-05	1.155E-04	2.655E-04	4.130E-04	0.000E+00	3.514E-05
Ra-226	U-234	1.000E+00	0.000E+00	4.336E-07	6.670E-06	3.790E-05	2.485E-04	9.685E-04	0.000E+00	1.703E-02
Ra-226	U-238	1.000E+00	0.000E+00	9.084E-13	5.566E-11	7.779E-10	1.443E-08	1.493E-07	0.000E+00	6.317E-05
Ra-226	∑DOSE(j):		0.000E+00	4.336E-07	6.670E-06	3.790E-05	2.485E-04	9.686E-04	0.000E+00	1.709E-02
Pb-210	U-234	1.000E+00	0.000E+00	1.549E-09	7.777E-08	9.998E-07	1.596E-05	1.106E-04	0.000E+00	6.370E-02
Pb-210	U-238	1.000E+00	0.000E+00	2.589E-15	5.016E-13	1.585E-11	7.379E-10	1.500E-08	0.000E+00	2.319E-04
Pb-210	∑DOSE(j):		0.000E+00	1.549E-09	7.777E-08	9.999E-07	1.596E-05	1.106E-04	0.000E+00	6.393E-02
U-235	U-235	1.000E+00	6.046E-01	5.887E-01	5.433E-01	4.628E-01	2.710E-01	4.079E-02	0.000E+00	1.622E-01
Pa-231	U-235	1.000E+00	0.000E+00	9.071E-05	3.395E-04	7.134E-04	1.180E-03	4.670E-04	0.000E+00	1.367E-01
Ac-227	U-235	1.000E+00	0.000E+00	1.285E-06	1.660E-05	7.599E-05	2.673E-04	1.806E-04	4.052E-02	4.373E-01
U-238	U-238	1.000E+00	7.425E+00	7.226E+00	6.657E+00	5.649E+00	3.262E+00	4.639E-01	0.000E+00	8.574E+00

BRF(i) is the branch fraction of the parent nuclide.

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	BRF(i)	S(j,t), pCi/g t= 0.000E+00	1.000E+00	4.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
U-234	U-234	1.000E+00	3.050E+01	2.970E+01	2.743E+01	2.339E+01	1.375E+01	2.143E+00	1.058E-02	8.938E-11
U-234	U-238	1.000E+00	0.000E+00	1.883E-04	6.954E-04	1.483E-03	2.615E-03	1.359E-03	2.012E-05	5.674E-13
U-234	∑S(j):		3.050E+01	2.970E+01	2.743E+01	2.339E+01	1.375E+01	2.144E+00	1.060E-02	8.994E-11
Th-230	U-234	1.000E+00	0.000E+00	2.709E-04	1.042E-03	2.411E-03	5.675E-03	9.592E-03	1.025E-02	1.003E-02
Th-230	U-238	1.000E+00	0.000E+00	8.550E-10	1.298E-08	7.304E-08	4.688E-07	1.831E-06	2.443E-06	2.398E-06
Th-230	∑S(j):		0.000E+00	2.709E-04	1.042E-03	2.411E-03	5.675E-03	9.593E-03	1.025E-02	1.004E-02
Ra-226	U-234	1.000E+00	0.000E+00	5.857E-08	8.952E-07	5.110E-06	3.428E-05	1.514E-04	2.268E-04	2.241E-04
Ra-226	U-238	1.000E+00	0.000E+00	1.234E-13	7.481E-12	1.049E-10	1.991E-09	2.333E-08	5.316E-08	5.357E-08
Ra-226	∑S(j):		0.000E+00	5.857E-08	8.952E-07	5.110E-06	3.428E-05	1.514E-04	2.268E-04	2.242E-04
Pb-210	U-234	1.000E+00	0.000E+00	6.024E-10	3.604E-08	4.928E-07	8.640E-06	8.282E-05	1.578E-04	1.571E-04
Pb-210	U-238	1.000E+00	0.000E+00	9.542E-16	2.277E-13	7.742E-12	3.982E-10	1.123E-08	3.658E-08	3.754E-08
Pb-210	∑S(j):		0.000E+00	6.024E-10	3.604E-08	4.928E-07	8.641E-06	8.283E-05	1.578E-04	1.571E-04
U-235	U-235	1.000E+00	1.300E+00	1.266E+00	1.169E+00	9.968E-01	5.861E-01	9.136E-02	4.512E-04	3.820E-12
Pa-231	U-235	1.000E+00	0.000E+00	2.678E-05	9.893E-05	2.109E-04	3.719E-04	1.931E-04	2.855E-06	7.998E-14
Ac-227	U-235	1.000E+00	0.000E+00	4.164E-07	5.741E-06	2.684E-05	9.762E-05	7.419E-05	1.216E-06	3.524E-14
U-238	U-238	1.000E+00	6.820E+01	6.641E+01	6.133E+01	5.230E+01	3.075E+01	4.793E+00	2.367E-02	2.004E-10

BRF(i) is the branch fraction of the parent nuclide.

Duratek, Inc.

FINAL SURVEY REPORT

for the

TACOM – ARDEC PICATINNY ARSENAL

BUILDING 611B

October 2004

Duratek™

Commercial Projects
1009 Commerce Park Drive, Suite 100
Oak Ridge, TN 37830

AMSRD-AAR-QES-C 28 Feb 2006

MEMORANDUM FOR FILE

SUBJECT: CORRECTIVE CHANGES FOR THE DURATEK FINAL SURVEY REPORT for the TACOM – ARDEC PICATINNY ARSENAL BUILDING 611B October 2004.

1. Reference: Final Survey Report for the TACOM-ARDEC Picatinny Arsenal Building 611B October 2004"

2. Please find below a resubmission of the corrective changes, made in January 2005, that need to be incorporated into the report referenced in paragraph 1 above, prior to submitting to the Nuclear Regulatory Commission for continued review.

2.1 Page 1 of 31. Section 1.0, Fourth line. Change Amendment number from 21 to 26. (See attached License Number SUB 348, Amendment 26, Condition Number 15.

2.2 Page 1 of 31. Site Description. Add the term bunker after the word trough since the word bunker is used on page 26 of 31, section 3.8.9.

2.3 Page 4 of 31. Radionuclides of Concern, Second Line. Include "Derived Concentration Guideline Level before DCGL.

2.4 Page 4 of 31. Radionuclides of Concern, Second Line. Identify the energy of Technitium-99 (347 KeV) and identify the beta particles emitted you allude to during the decay of depleted uranium Th-234 (0.103 MeV and 0.193 MeV) and protactinium-234m (2.29 MeV) in this paragraph.

2.5 Page 5 of 31. Section 2.0 DERIVED CONCENTRATION GUIDELINE VALUES. Second paragraph, First line, should read "The NRC approved derivation of DCGL's for building 611B and surrounding areas is found in the attached amended license number SUB-348 amendment No. 26 and the Final Survey Plan for this work.

2.6 Page 6 of 31. Section 3.0, Second line. Change Amendment number from 21 to 26. (See attached License Number SUB 348, Amendment 26, Condition Number 15.

2.7 Page 8 of 31. Section 3.1.2 Sources. Clarify the use of Th-230 and Cs-137 in addition to Tc-99 which was the only source mentioned on page 4 of 31.

2.8 Page 8 of 31. Section 3.2. Off Site Sample Analysis. Third line. Insert (UST) after underground storage tank.

2.9 Page 10 of 31. Section 3.4. Tenth line. Should read: prepare a report to support amending the SUB-348 license for the removal of the Building 611B Testing facility from regulatory control.

AMSRD-AAR-QES-C 28 Feb 2006

SUBJECT: CORRECTIVE CHANGES FOR THE DURATEK FINAL SURVEY REPORT for the TACOM – ARDEC PICATINNY ARSENAL BUILDING 611B October 2004.

2.10 Page 11 of 31. Section 3.5.2, Training. First paragraph, Third line, delete "and the" at the end of the line.

2.11 Page 15 of 31. Section 3.7.2. Direct Beta Measurements. Last line. Should read ....are documented in ATTACHMENT B of this Final Survey Report.

2.12 Page 15 of 31. Section 3.7.4. Soil Sampling. First sentence. Add from the open land areas surrounding building 611B and trough/bunker.

2.13 Page 15 of 31. Section 3.8. Sixth line. Should read. Grid sizes which varied from 4ft x 4 ft to 25 ft x 25 ft were based.....

2.14 Page 16 of 31. Section 3.8.1, General Survey Instructions, Item 3), Include the attachment in parenthesis showing the data recorded from the 100% beta scans mentioned here, on page 17 of 31 General Survey Instructions, Item 3), on page 18 of 31 General Survey Instructions, item 1), on page 21 of 31 General Survey Instructions, item 3), Page 22 of 31, General Survey Instructions item 3) and those from the 25% beta scan on page 20 of 31General Survey Instructions, item 3), Page 23 of 31, General Survey Instructions, Item 5), Page 25 of 31 General Survey Instructions, Item 3), and page 26 of 31. item 3.

2.15 Page 16 of 31. Section 3.8.1, General Survey Instructions, Item 8). Change the term "below" to above to reference the location codes.

2.16 Page 18 of 31. Section 3.8.2. General Survey Instructions, Item 5) Second paragraph, Add "by" after the term multiplied.

2.17 Page 19 of 31. Section 3.8.3. General Survey Instructions, Item 1). Third line. Add ...a 15 cm^2 pancake detector.

2.18 Page 21 of 31. Section 3.8.5. General Survey Instructions. Item 6) Second line add the letter "s" to surface.

2.19 Page 24 of 31. Section 3.8.8, Historical Information, Fourth line, change "with in" to within.

2.20 Page 24 of 31. Section 3.8.8, Historical Information. Second Paragraph. Second line. Change the term "sever" to seven or several whichever is applicable.

2.21 Page 24 of 31. Section 3.8.8, Historical Information, Third paragraph, Last line. Change the term "rated" to related which appears to be more applicable.

2.22 Page 25 of 31. Section 3.8.8, Historical Information. Item 2). Third paragraph. Include the rationale for not collecting samples from other sampling locations within that grid beyond the three pre-selected unavailable sampling locations.

AMSRD-AAR-QES-C 28 Feb 2006

SUBJECT: CORRECTIVE CHANGES FOR THE DURATEK FINAL SURVEY REPORT for the TACOM – ARDEC PICATINNY ARSENAL BUILDING 611B October 2004.

2.23 Page 25 of 31. Section 3.8.8, Historical Information. Item 1). Mentions 25 foot grids without defining it by length or width in contrast to Page 26 of 31 Item 7) which is more specific by mentioning 10 meter by 10 meter grids. Be consistent throughout your report and use the later version.

2.24 Page 25 of 31. Section 3.8.8, Historical Information. Item 4) and Item 5). Clarify the difference between biased sampling locations (5 uR above background), locations containing residual activity, elevated activities (5uR above background) and systematic locations. The terms as configured tend to be confusing and ambiguous.

2.25 Page 26 of 31. Section 3.8.9. Heading. Add: trough in parenthesis after bunker.

2.26 Page 26 of 31. Section 3.8.9. Area Description. First paragraph, Fifth line. Add: .....at the opposite end of the trough.

2.27 Page 27 of 31. Section 4. SURVEY RESULTS. First Line. Delete the words "are provided" after the word unit.

2.28Page 30 of 31. Table 4-8. Add a footnote which defines UST as the underground storage tank.

2.29 Page 1 of 31. Section 1.2. Site History. Third line. Add: ...testing. From 1959 to 1979 there were no records available to substantiate the use/non-use of the facility.

2.30 Page 23 of 31. General Survey Instructions. Item 4. Delete the letter "s" at the end of the term measurements.

2.31 Page 27 of 31. Section 4.0 Survey Results. Sixth line. Add 186 pCi/g of U-238 (DU)

3. The point of contact for information concerning the aforementioned is JOSEPH A. FABIANO.

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RECEIVED 26 OCTOBER 2004
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FINAL SURVEY REPORT

for the

TACOM – ARDEC
PICATINNY ARSENAL
BUILDING 611B

October 2004

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ATTACHMENTS

Attachment A Photo Essay
Attachment B Direct Beta Activity Measurement
Attachment C Removable Beta and Alpha Activity
Attachment D Off Site Sample Analysis Results

1.0 SITE INFORMATION

Building 611B is licensed to the US Army Tank Automotive Command (TACOM) - Armament Research, Development and Engineering Center (ARDEC) at the Picatinny Arsenal in New Jersey under the NRC Radioactive Materials License Number SUB-348, Amendment No. 21. The purpose of this final survey report is to document the survey protocols and subsequent data analyses used to demonstrate that Building 611B and the surrounding grounds meet the criteria established for release for unrestricted use. This report should provide documentation that can be submitted to the NRC to allow the buildings and surrounding grounds to be removed from the Army's Radioactive Material License. The license itself is not being terminated since it authorizes the use/storage of radioactive materials at several facilities at the Picatinny Arsenal.

Change: A

endi

1.1 Site Description

Building 611B is centrally situated in a fenced area of approximately 40,000 ft^2. The building is a single-story structure of about 1,100 ft^2 containing two test-firing ranges, one of which was a depleted uranium (DU) range while the other was designated a non-DU range. The DU range is a concrete tube about 9.33 feet in diameter and 31.75 feet long. The walls of the non-DU range are constructed of concrete; the floors are concrete and tile; and the roof is a steel, hemispherical structure that is approximately 6 feet wide, 8 feet high, and 59 feet long. Other buildings include an instrument room/foyer and indoor storage area. Adjacent to building 611B was an outdoor storage area/gazebo (removed during remediation) and two movable electrical storage shelters. During remedial activities a concrete trough extending beyond the non DU tunnel and two target boxes were identified for inclusion in the final survey.

Change Trough to Bunker

A diagram of the Building and the surrounding area is provided as Figure 1-1.

1.2 Site History

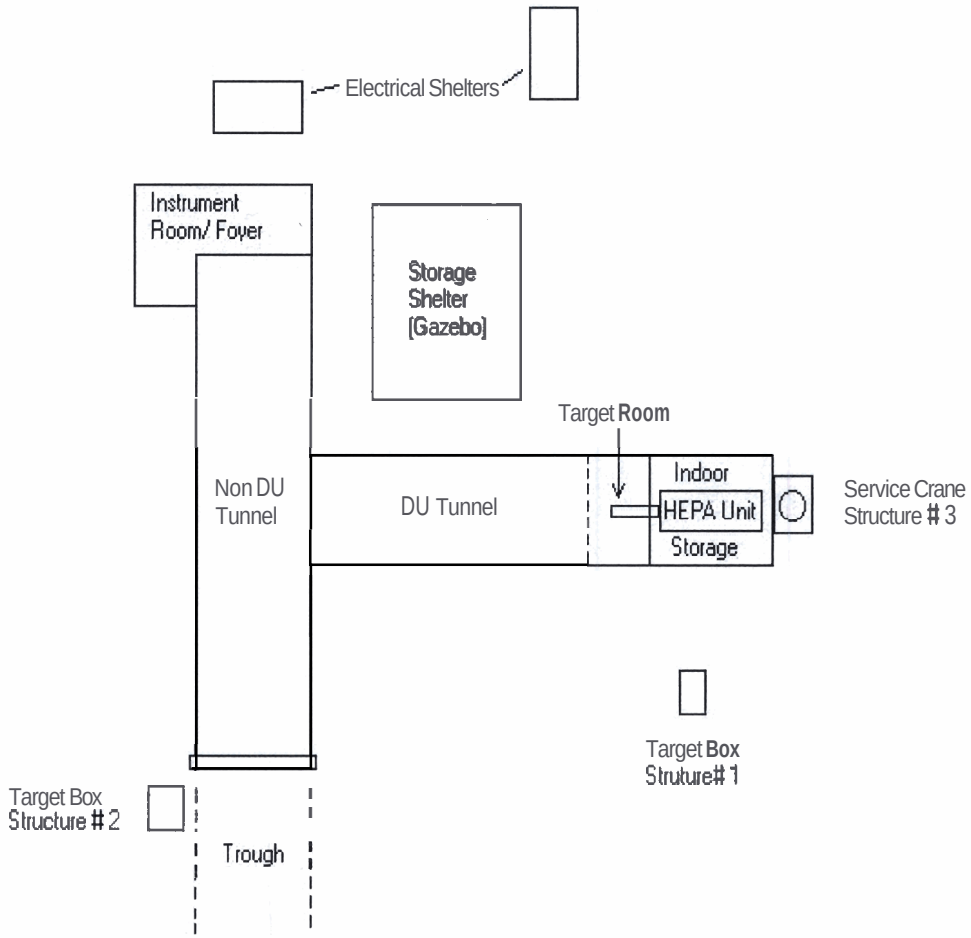
Building 611B was designed for testing of munitions and contained only non-radioactive munitions until approximately 1959 when an east-west tunnel was added to the existing structure for DU munitions testing. The site has not been used for DU munitions testing since approximately 1985.

testing. From 1959 to 1979 there were no records available to substantiate the use / non-use of the facility.

Depleted uranium use within Building 611B consisted of limited DU firing within the confines of the firing range and target room of the building. The target room was ventilated through a High Efficiency Particulate Air (HEPA) filtered ventilation system. This system discharged cycled air after four stages of filtration to an area above the storage room located at the end of the firing range/target room.

There has been limited migration of DU from the active use areas of Building 611B to adjacent soils and areas within the facility. DU migration was identified in the characterization report where activity was identified in the soil around the building at the access points, on the interior structural surfaces of the building and areas around the building runoff locations.

Figure 1-1
Building 611B Layout



1.3 Radionuclides of Concern

The radionuclides of concern within Building 611B and surrounding structures and in the surrounding soils are those associated with depleted uranium. Depleted uranium consists of three naturally occurring, long-lived uranium isotopes, uranium-234, uranium-235, and uranium-238. As compared to naturally occurring uranium, depleted uranium contains less uranium-234 and uranium-235. The relative fi-actions, in terms of activity concentrations, of the three long lived uranium isotopes in the depleted uranium used at the Picatinny Arsenal are:

- U-234 0.305
- U-235 0.013
- U-238 0.682

The half lives of uranium-234, uranium-235, and uranium-238 are 2.44E5 years, 7.04E8 years, and 4.47E9 years respectively. Uranium-238 and uranium-234 are both members of the uranium decay chain and will eventually reach equilibrium. However the time required to reach equilibrium is measured in millenniums. Due to the half lives involved, the relative ratios of the three uranium isotopes in depleted uranium will remain essentially constant.

While uranium-234 and uranium-238 are both members of the uranium decay chain, uranium-235 is a member of the actinium decay chain. Table 1-1 shows the first several radionuclides of the uranium decay chain and Table 1-2 shows the first several members of the actinium decay chain.

Table 1-1
Uranium Decay Chain
(partial)

Nuclide	Half Life	Major Radiations Energies (MeV) and intensities (%)		
		Alpha	Beta	Gamma
U-238	4.51E9 years	5.15 MeV 25% 4.20 MeV 75%		
Th-234	2.41E1 days		0.103 MeV 21% 0.193 MeV 79%	0.063MeV 3.5% 0.93 MeV 4.0%
Pa-234m*	1.17E0 min		2.29 MeV 98%	0.765 MeV 0.3% 1.001 MeV 0.6%
U-234	2.27E5 years	4.72 MeV 28% 4.77 MeV 72%		0.053 MeV 0.2%
Th-230	8.0E4 years	4.62 MeV 24% 4.68 Mev 76%		0.068 MeV 0.6% 0.142 MeV 0.1%

In the above table the fact that Pa-234m undergoes an isomeric transition to its ground state approximately 0.16 % of the time is ignored.

Table 1-2
Actinium Decay Chain
(partial)

Nuclide	Half Life	Major Radiations Energies (MeV) and intensities (%)		
		Alpha	Beta	Gamma
U-235	7.04E8 years	4.37 MeV 18% 4.40 MeV 57% 4.58 MeV 8%		0.143 Mev 11% 0.185 MeV 54% 0.204 MeV 5%
Th-231	2.55E1 hours		0.140 MeV 45% 0.220 MeV 15% 0.305 MeV 40%	0.026 MeV 2% 0.084 MeV 10%
Pa-231	3.28E4 years	4.95 MeV 22% 5.01 MeV 24% 5.02 MeV 23%		0.027 MeV 6% 0.29 MeV 6%

Derived Concentration Guide Level (DCGL)

Technitium-99 (347 KeV)

Beta particles emitted during the Decay of depleted uranium:
234-Th 0.103 MeV and 0.193 MeV
234m-Protactinium (2.29 MeV)

Based on the relative fractions of the radionuclides associated with depleted uranium and their decay chains compliance with the DCGL for building surfaces was evaluated based on direct beta measurements collected using a detector calibrated using Tc-99. The use of a detector calibrated using Tc-99 is conservative considering the energy and yields of the beta particles emitted during the decay of depleted uranium. Compliance with the DCGL for soil was demonstrated using gamma spectroscopy. The gamma spectral analysis measurement was of Th-234, a short-lived daughter of U-238. However since U-238 accounts for only 68.2 % of the activity associated with depleted uranium, the limit for Th-234 in soil was set at 68.2 % of the DCGL for depleted uranium in soil.

1.4 Remedial Activities

Remedial activities were performed prior to final status survey. The remedial actions included

- Removal of the outdoor storage area/gazebo
- Removal of miscellaneous piles of decayed wood adjacent to building 611B
- Removal of the underground storage tank
- Removal of potentially contaminated soil from in front of the entrance to building 611B and entrance to inside storage area
- Removal of asbestos containing tiles from the floor of building 611B
- Removal of the HEPA ventilation system located on top of the indoor storage area
- Removal of miscellaneous items from within building 611B and the two electrical storage shelters

- Removal of electrical conduit and drain lines from within building 611B
- Removal of the gun stand from within the DU tunnel

  Removal of the target room at the end of the DU tunnel
- Removal of the stairs leading into the instrument room/foyer

  Characterization1remedial action surveys within building 611B
- Characterization samples of the soils surrounding building 611B
- Jack hammering, scabbling, vacuuming, wiping, etc. of surfaces within building 611B
- Removal of steel plating from within building 611B

NRC approved derivation of DCGL's for building 611B and surrounding areas is found in the attached amended license and the Final Survey Plan for this work

2.0 DERIVED CONCENTRATION GUIDELINE VALUES

Subpart E to 10 CFR 20 provides the criteria for release for unrestricted use. It states that the total effective dose equivalent (TEDE) to a member of a critical group, due to residual contamination that is distinguishable from background, shall not exceed 25 mrem/yr and that the residual contamination levels are reduced to levels that are as low as reasonably achievable (ALARA). In order to demonstrate compliance with the criteria for release for unrestricted use, DCGLs were calculated. Since residual contamination was present within Building 611B and in the surrounding soil, DCGLs for both building surfaces and soil were calculated. The DCGLs relate activity concentrations on building surfaces (dpm/100 cm^2) and in soil (pCi/g) to the TEDE of 25 mrem/yr.

Second paragraph 1st line should read:

The NRC approved derivation of DCGL's for B611B and surrounding areas is found in the attached amended License Number SUB-348 Amendment No. 26 and the Final Survey Plan for this work

The derivation of DCGLS for building 611B and surrounding areas is found in the Final Survey Plan for this work. Table 2-1 summarizes the depleted uranium DCGLs for Building 611B. The primary DCGL for building surfaces is 5,500 dpm/100 cm^2. This DCGL is total activity as evaluated using direct beta measurements. In deriving this DCGL it was assumed that the removable activity fraction was less than 10 %. Therefore a secondary DCGL, in terms of removable activity, of 550 dpm/100 cm^2 is also specified for building surfaces.

The DCGL for depleted uranium in soil is 186 pCi/g. This DCGL is the sum of the activity concentrations of the three uranium radionuclides. In order to allow for the use of gamma spectral analysis of soil samples in demonstrating compliance with the DCGL, the DCGL for depleted uranium in soil was equated using the Th-234 activity concentration. Th-234 is the short lived daughter ($t_{1/2}$ = 24.1 days) of U-238 and under all practical applications is in equilibrium with U-238. Since U-238 accounts for 68.2 % of the uranium activity in depleted uranium the DCGL for depleted uranium can be shown to be equivalent to approximately 125 pCi/g of Th-234.

Table 2-1
Derived Concentration Guideline Levels
For Depleted Uranium

Building 611B Surfaces and Surrounding Soils DCGLs	
Building Surface Contamination	5,500 dpm/100 cm^2 (total) 550 dpm/100 cm^2 (removable)
Soil Contamination	186 pCi/g (depleted uranium) 125 pCi/g (Th-234)

3.0 SURVEY DESIGN AND IMPLEMENTATION

Change Amendment No.21 to Amendment No 26

The purpose of the survey was to collect sufficient survey data to remove Building 611B from Radioactive Material License SUB-348, Amendment 21 and the NRC license application. The project team performed surveys according to project specific Duratek procedures, the survey plan and specific work package instructions. The survey included the following:

- Survey instrumentation was set up and source checked to ensure proper operation.
- The Project Manger/Supervisor performed preliminary inspections of the areas to identify specific survey requirements.
- The Project Manager/Supervisor developed survey packages for the survey units.
- The project team marked grids in the survey units.
- The project team obtained survey measurements using appropriately calibrated instruments. Daily source and background checks were performed before and after each day's work.
- Direct survey data collected during the project was downloaded from the survey instrument into a database for storage and processing.
- The Project Manager reviewed the completed survey packages to ensure that all required surveys had been performed.
- The Project Manager reviewed the survey results to identify any areas exceeding the specified release criteria.

3.1 Instrumentation and Selection

Selection and use of survey instrumentation ensured sensitivities were sufficient to detect the identified radionuclides at the minimum detection requirements. Table 3-1 provides a list of the instruments, types of radiations detected and calibration sources used.

Duratek used the Ludlum Model 2350-1 Data Logger with a variety of detectors for direct measurements of beta surface activity as well as exposure rate measurements. The Data Logger is a portable microprocessor computer based counting instrument capable of operation with NaI(Tl) gamma scintillation, gas-flow proportional, GM and ZnS scintillation detectors.

Calibration labels showing the instrument identification number, calibration date and calibration due date are attached to all portable field instruments.

3.1.2 Sources

All sources used for calibration or efficiency determinations for the survey were representative of the instrument's response to the identified radionuclides and are traceable to NIST. The sources, used during the surveys included Tc-99, Th-230, and Cs-137.

Health Physics Technicians controlled radioactive sources used for instrument response checks and efficiency determination. Sources were stored securely and signed out when needed in the field.

3.2 Off Site Sample Analysis

Eberline Services, Inc Laboratory in Oak Ridge, TN was used to analyze soil samples from the environment, samples of the pit after removal of the underground storage tank and a sample of sludge taken from the tank. The samples were analyzed by gamma spectroscopy for uranium series radionuclides and the results for Th-234 were used to evaluate compliance with the DCGLs.

3.3 Minimum Detectable Activities

Minimum Detectable Activity (MDA) is defined as the smallest amount or concentration of radioactive material that will yield a net positive count with a 5% probability of falsely interpreting background responses as true activity. The MDA is dependent upon count times, geometry, sample size, detector efficiency background, and for scanning the scanning rate and the efficiency of the surveyor.

The MDAs for direct beta measurements, analyses for removable activity, and gamma spectroscopy were set at 50 % or less of the DCGLs. The MDAs for beta scans and gamma scans were set equal to or less then the appropriate DCGL. Since the MDAs for scanning were equal to or less that the appropriate DCGLs, the scanning MDAs did not affect the number of measurements or samples required to evaluate a specific survey unit.

3.3.1 Direct Measurement MDA

The equation used for calculating the MDA for direct measurements is:

$$MDA = \frac{\frac{2.71}{t_s} + 3.29\sqrt{\frac{R_b}{t_s} + \frac{R_b}{t_b}}}{E\left(\frac{A}{100}\right)}$$

Where:	MDA	=	Minimum Detectable Activity (dpm/100 cm^2)
	R_b	=	Background Count Rate (cpm)
	t_b	=	Background Count Time (min)
	t_s	=	Sample Count Time (min)
	A	=	Detector Area (cm^2)
	E	=	Detector Efficiency (c/d)

3.3.2 Beta Scan MDA

The equation used for calculating the MDA for beta scans is:

$$MDA = \frac{d' * \sqrt{b_i} * \frac{60}{i}}{E_i * E_s * \sqrt{p} * \frac{A}{100}}$$

Where:	MDA	=	Minimum Detectable Activity (dpm/100 cm^2)
	d'	=	Decision error taken from Table 6-5 of MARSSIM
	i	=	Observation counting interval (scan speed divided by the detector width)
	b_i	=	Background count per observation interval
	E_I	=	Detector Efficiency (c/d)
	E_s	=	Surface Efficiency (typically around 50% for beta contamination on concrete)
	p	=	Surveyor Efficiency (typically 50%)
	A	=	Detector Area (m^2)

3.3.3 Gamma Scan MDA

The equation used for calculating the MDA for gamma scans is essentially the same as that for beta scans. However conversion factors are required to convert the $MDCR_{Surveyor}$ in terms of cpm to an activity concentration in terms of pCi/g.

$$MDCR_{Surveyor} = \frac{d' * \sqrt{b_i} * \frac{60}{i}}{P}$$

Where:	$MDCR_{Surveyor}$	=	Minimum Detectable Count Rate (cpm)
	d'	=	Decision error taken from Table 6-5 of MARSSIM

i	=	Observation counting interval (scan speed divided by the detector width)
b_i	=	Background count per observation interval
p	=	Surveyor Efficiency (typically 50%)

The first of the conversion factors needed to convert the $MDCR_{Surveyor}$ into an activity concentration is the exposure rate due to a volume of soil contaminated with the radionuclide of interest (depleted uranium). This conversion constant in terms of pCi/g per uR/hr can be derived using a shielding code. The second conversion factor that is needed is one that converts an exposure rate due to the radionuclide of interest to a count rate for the detector used during the scan, uR/hr per pCi/g.

$$MDA = \left(MDCR_{surveyor}(cpm)\right) * \left(\frac{uR/hr}{cpm}\right)\left(\frac{pCi/g}{uR/hr}\right)$$

Where: MDA = The minimum detectable activity (pCi/g)

3.4 Data Quality Objectives

To ensure the proper release of the facility, the objectives of this survey we.

- Select appropriate instrumentation to adequately detect the radionuclides of concern,
- Establish proper count times and measurement MDAs (Minimum Detectable Activities) to verify that the release criteria are met,
- Perform surveys to verify the radiological status of the facility,
- Ensure that personnel exposure from residual contamination is less than 25 mrem/year to an individual based on the intended use of the facility
- Statistically evaluate the data to ensure that sufficient data is collected to prepare a report supporting the removal of the facility from the Radioactive Materials License.

10th line should read Prepare a report to support amending the SUB-348 License for the removal of B611B Testing facility from Regulatory Control.

Surveys were based on the guidance in NUREG-1575, Multi-Agency Radiation *Survey* and Site Investigation Manual (MARSSIM), and included measurements for direct surface activity, removable activity, soil samples and exposure rates.

3.5 Quality Assurance and Quality Control

Duratek's Quality Assurance/Quality Control Programs ensured that all quality and regulatory requirements were satisfied. All activities affecting quality were controlled by procedures and the survey plan. These documents included the following Quality Control measures as part of the survey process.

3.5.1 Selection of Personnel

Project management and supervisory personnel were required to have extensive experience with Duratek procedures and be familiar with the requirements of MARSSIM and the survey plan. Management had extensive experience with the radionuclide(s) of concern and a working knowledge of the instruments used to detect the radionuclides on site. Project management and supervision maintained OSHA safety qualifications.

Duratek selected supervisory personnel to direct the survey based upon their experience and familiarity with the survey procedures and processes. Likewise, Health Physics technicians who perform the final status surveys were selected based upon their qualifications and experience.

3.5.2 Training

All project personnel received site-specific training to identify the specific hazards present in the work and survey units. Training also included a briefing and review of the Plan, Duratek procedures and the project hazards and the protocols for final status surveys.

Delete: and the

During site orientation and training, survey personnel were familiarized with site emergency procedures. In the event of an emergency, personnel were instructed to act in accordance with all applicable site emergency procedures and the Site Safety and Health Plan.

3.5.3 Written Procedures

Survey tasks essential to survey data quality, were controlled by procedures and this plan.

3.5.4 Instrumentation Selection, Calibration and Operation

Duratek has selected instruments proven to reliably detect the radionuclides present at the facility. Duratek calibrations of the instruments and vendor calibrated instruments were controlled by approved procedures using calibration sources traceable to the National Institute of Standards and Technology (NIST). Vendors used for calibration and off site analysis were approved by the Duratek approved vendor program.

All instruments and detectors were inspected and source checked daily when in use to verify proper operation. Control charts and/or source check criteria were established at the beginning of the project for reference.

Procedures for calibration, maintenance, accountability, operation and quality control of radiation detection instruments implement the

guidelines established in American National Standard Institute (ANSI) standard ANSI N323-1978 and ANSI N42.17A-1989.

3.5.5 Survey Documentation

Survey packages were the primary method of controlling and tracking the hard copy records of survey results. Records of surveys were documented and maintained in the survey package for each area according to Duratek procedures. Each survey measurement was identified by the date, technician, instrument type and serial number, detector type and serial number, location code, type of measurement, mode of instrument operation, and Quality Control (QC) sample number, as applicable.

3.5.6 Chain of Custody

Procedures established responsibility for the custody of samples from the time of collection until results were obtained. Samples shipped off site for analysis were accompanied by a chain-of-custody record to track each sample.

3.5.7 Records Management

Generation, handling and storage of survey data packages were controlled by an approved procedure.

3.5.8 Duplicate Review of Survey Results

The survey package and survey data from each area were reviewed by two people to verify documentation was complete and accurate. This review included the surveyor and either the Project Manager or his designee.

3.5.9 Sample Analysis

Quality assurance and quality control checks were performed on 5% of all sample analyses (except smears). This consisted of the analysis of split (duplicate) samples. The sample was homogenized and split into two separate samples for analysis.

3.6 Survey Unit Classification

Survey units are discrete areas, consisting of building surfaces or land areas, of a specific size and shape for which separate decisions relative to the DCGL,s are made. Survey units are defined based on the site's history, potential for residual contamination, and physical characteristics. All impacted areas were divided into survey units. Impacted areas are those areas that had a potential of being contaminated. Non-impacted areas are areas that did not have a potential for being contaminated and are not surveyed as part of the final survey.

Survey units are classified as Classl, 2, or **3.** A Class 1 survey unit is a survey unit that has or had prior to remediation contamination levels approaching or exceeding the DCGL. A Class 2 survey unit is a survey unit that does not have contamination approaching or exceeding the DCGL. Typically Class 2 survey units are not remediated. If remediation is required the survey unit is reclassified as Class 1. **A** class **3** survey unit is a survey unit that is not expected to contain contamination or is expected to contain contamination at a fraction (< 10 %) of the DCGL.

Survey units are limited in size to ensure adequate survey coverage. The size limits are specified in the following Table.

Table 3-1
Survey Unit Classification

Survey Unit Classification	Size Limit, m^2
Class 1	
Building Surfaces	< 100
Land Areas	< 2,000
Class 2	
Building Surfaces	<1,000
Land Areas	< 10,000
Class 3	
Building Surfaces	No limit
Land Areas	No limit

Based on the data presented in reference 6.7, and surveys that were performed during remediation, the DCGL for building surfaces and the size of Building 611B all of the survey units within the building were classified as Class 1. The building exterior and any remaining structures on the surrounding grounds were classified as Class 2. Based on the DCGL for soils and Reference 6.7, the grounds surrounding Building 611B were classified as Class 2.
Classifying the building exterior, remaining structures, and grounds as Class 2 reduced the required survey frequency, especially that associated with scanning. This aided greatly in dealing with the unexploded ordinance concerns surrounding Building 611B.

Table 3-2 shows the survey units and their classification.

Table 3-2
Building 611B and Surrounding Areas and Buildings
Suwey Units and Package Numbers

Package Identification Number	Location Description	Area Classification
01	DU tunnel	Impacted - Class 1
02	Non DU Tunnel	Impacted - class 1
03	Foyer and Instrument Room	Impacted - Class 1
04	Building Exteriors	Impacted - Class 2
05	Storage Room	Impacted - Class 1
06	Electrical Storage Shelters Interior	Impacted - Class 1
07	Electrical Storage Shelters Exterior	Impacted - Class 2
08	Open Land Areas	Impacted - Class 2
09	Bunker Beyond the Non DU Tunnel	Impacted - Class 2

3.7 Survey Protocols/Requirements

The final status survey of the building consisted of beta scans, fixed beta measurements, and smears for gross alpha and gross beta analysis. The survey of the facility grounds consisted of gamma scans and soil sampling for gamma spectroscopy analysis. Surveys were performed as follows:

3.7.1 Surface Scans

Beta Scans

For class 1 survey units, beta scans were performed over 100% of the accessible building surfaces (interior) and the roof using a gas-flow proportional detector while listening to the audible output of the instrument. For class 2 survey units, beta scans were performed over approximately 50% of the accessible building surfaces. Areas of elevated activity were identified for further investigation and potential decontamination. Any area exceeding the $DCGL_W$ was identified and decontaminated. Scan speeds were established such that contamination at levels of approximately 50% of the $DCGL_W$ were detected.

Gamma Scans

Gamma scans were performed on the open land areas surrounding Building 611B. As a minimum, 25% of the open land areas were scanned. A NaI(Tl) gamma scintillation detector was used with the Ludlum Model 2350 to help identify any areas of residual contamination in the soil or the building interior. The detector was moved in a serpentine manner in close proximity with the ground while listening to the audible output of the instrument. Areas where a noticeable increase in the count rate was determined were flagged for further investigation and/or sampling.

3.7.2 Direct Beta Measurements

Last Line. Should read;

.....are documented in Attachment B of this Final Survey Report

Direct beta measurement were taken on the structural surfaces of Building 611B within each survey unit. The number of measurements and spacing was determined in accordance with MARSSIM and Reference 6.6 and are documented in the survey package.

3.7.3 Removable Activity Measurements

Smears were taken at each direct measurement location for gross alpha and gross beta analysis.

3.7.4 Soil Sampling

First Sentence: ADD:

From the open land Areas surrounding B611B and trough/ Bunker

Surface (0-15 cm) soil samples were collected from the open land areas surrounding building 611B. The number of samples and their spacing was determined in accordance with MARSSIM and Reference 6.6 and are documented in the survey package instructions.

3.8 Survey Package Development

Sixth Line. Should read:

Grid sizes which varied from 4 ft x 4 ft to 25 ft x 25 ft were based.....

For each survey unit, the project team developed a package, or portfolio, by performing a walk-down and preparing a worksheet/tracking sheet outlining the general survey instructions, location codes, and any specific survey instructions for any abnormal conditions within the survey unit. Completion and review signature blocks were used to track the progress of the surveys.
All survey units were gridded. Grid sizes were based on the size of the survey unit and the desired number of measurements. The desired number of measurements were conservatively set for each survey unit based on characterization/remedial surveys and guidelines contained in the survey plan (reference 6.6).

During the survey, the project team updated the survey package(s) with the survey data and results of any special surveys or sample analyses performed. The survey packages, the area description, historical information (including remediation), and general survey instructions are summarized in the sections that follow. The text is in the future tense as it describes what was to be done.

3.8.1 Package 01 - DU Tunnel - Impacted Class 1

Area Description

The survey unit consists of the interior surface of the DU Tunnel. The DU Tunnel is a concrete pipe approximately 9.33 feet in diameter and 31.75 feet in length. The inner surface of the DU Tunnel is approximately 931 ft^2 (86.5 m^2).

Historical Information

The DU Tunnel was used to test DU projectiles and required extensive remediation. The Target Room and a portion of the tunnel adjacent to the Target Room were removed. The remaining section of the DU tunnel was remediated using jack hammers and needle guns. The floor of the DU Tunnel was covered with an asbestos containing floor tile which had to be removed by a licensed asbestos contractor prior to performing the radiological remediation.

General Survey Instructions

(Impacted – Class 1):

1) Grid the interior surface of the DU Tunnel using 5 foot grids
2) Prepare a map or drawing of the survey unit showing the grid layout.
3) Perform a 100% beta scan of accessible surfaces within the tunnel by holding the detector approximately ½ inch fi-om the surface being scanned and moving the detector approximately 1 detector's width per second. Set the 2350 for a count time of 1 min and log the results of the scan so that the results can be downloaded. Where appropriate (cracks, irregular surfaces, etc.) ensure that the scans are performed with a 15 cm^2 detector.

See pp 27 of 31 – 30 of 31, Appendix B and Appendix C for Direct Beta Activity Measurements, Removable Beta Activity Measurement and Removable Beta and Alpha Activity

4) Collect a direct beta measurement at locations identified during the scan as having residual activity. If activity in excess of the DCGL (5,500 dpm/100 cm^2) is identified remediate the affected area.
5) Mark thd systematic measurement location within each grid using the following X,Y coordinates determined using a random number generator provided by the HP 32S II Calculator. The calculator generates random numbers between 0.00 and 1.00. The first random number is multiplied by 5 to give the X coordinate and the second random number is multiplied by 5 to give the Y coordinate

   R = 0.314, X = 1.58’ R = 0.722, Y = 3.61’

6) Obtain a direct beta measurement at each measurement location. The count time should be sufficient (>30 sec) to achieve an MDA of less than 2,000 dpm/100 cm^2). Mark the actual measurement location with a paint pencil or equivalent and denote the measurement location on a map or drawing of the survey unit.
7) Obtain 1 smear at each measurement location. Each smear should be analyzed for both alpha and beta activity. Wait approximately 24 hours before analyzing the smears.
8) Use the location codes provided below when taking fixed readings.

3.8.2 Package 02 – Non DU Tunnel - Impacted Class 1

Area Description

The survey unit consists of the interior surface of the Non DU Tunnel. The Non DU Tunnel is a concrete structure approximately 6 feet wide and 59 feet in length. The height of the walls increases gradually from a height of 5 feet to approximately 8 feet. The cylindrical roof of the Non DU Tunnel is made of metal. To facilitate the final survey of the Non DU Tunnel, three separate survey units will be established: one for the floor, one for the walls, and one for the ceiling. The floor of the Non DU Tunnel is approximately 413 ft^2 (38 m^2). The walls of the Non DU Tunnel are approximately 875 ft^2 (81.3 m^2). The ceiling of the Non DU Tunnel is approximately 708 ft^2 (65.78 m^2).

Historical Information

The Non DU Tunnel was used to test non DU projectiles and support operations within the DU Tunnel. The DU Tunnel opened into the Non DU Tunnel allowing for cross contamination. The Non DU Tunnel required remediation. Remediation consisted of jack hammering, needle guns, scrubbing, and vacuuming. The floor of the Non DU Tunnel was covered with asbestos containing floor tile that had to be removed by a licensed asbestos contractor prior to performing the radiological remediation.

General Survey Instructions

(Impacted – Class 1):

1) Grid the interior surfaces of the Non DU Tunnel. The walls will be gridded using 5 foot grids. The floor will be gridded using 6 foot by 4 foot grids. The ceiling will also be gridded using 6 foot by 4 foot grids.
2) Prepare a map or drawing of each survey unit showing the grid layout.
3) Perform a 100% beta scan of accessible surfaces within the tunnel by holding the detector approximately ½ inch from the surface being scanned and moving the detector approximately 1 detector's width per second. Set the 2350 for a count time of 1 min and log the results of the scan so that the results can be downloaded. Where appropriate (cracks, irregular surfaces, etc.) ensure that the scans are performed with a 15 cm^2 detector.
4) Collect a direct beta measurements at areas identified during the scan as having residual activity. If activity in excess of the DCGL (5,500 cm^2) is identified remediate the affected area.
5) Mark the systematic measurement location within each grid using the following X,Y coordinates determined using a random number generator provided by the HP 32S II Calculator. The calculator

See pp 27 of 31 – 30 of 31 Appendix B And Appendix C for Direct Beta Activity Measurements, Removable Beta Activity Measurement and Removable Beta and Alpha Activity

generates random numbers between 0.00 and 1.00. For the walls the first random number is multiplied by 5 to give the X coordinate and the second random number by 5 to give the Y coordinate.

R = 0.518, X = 2.6' R = 0.119, Y = 0.6'

ADD: by 4

For the floor and the ceiling the first random number is multiplied 4 to give the X coordinate and the second random number by 6 to give the Y coordinate.

R = 0.715, X = 2.86' R = 0.911, Y = 5.47'

6) Obtain a direct beta measurement at each measurement location. The count time should be sufficient (>30 sec) to achieve an MDA of less than 2,000 dpm/100 cm^2). Mark the actual measurement location with a paint pencil or equivalent and denote the measurement location on a map or drawing of the survey unit.

7) Obtain 1 smear at each measurement location. Each smear should be analyzed for both alpha and beta activity. Wait approximately 24 hours before analyzing the smears.

3.8.3 Package 03 – Foyer and Instrument Room - Impacted Class 1

Area Description

The survey unit consists of the Foyer and Instrument Room. The Foyer is approximately 4.6 feet wide, 8.33 feet long, and 10 feet high. The Instrument Room is approximately 8 feet wide, 19 feet long, and 10 feet high. The total surface area within the Foyer and Instrument Room is approximately 1,179 ft^2 (109 m^2). The floor of the foyer and Instrument Room is concrete. The walls of the Foyer and Instrument Room are a combination of concrete and wood. The ceiling of the Foyer and Instrument Room is constructed of sheet-rock

Historical Information

The floor of the Foyer and Instrument Room was covered with asbestos containing floor tile which had to be removed by a licensed asbestos contractor prior to performing the radiological remediation. Remediation activities within the Foyer and Instrument Room consisted of vacuuming and wiping.

General Survey Instructions

(Impacted – Class 1):

See pp 27 of 31 – 30 of 31 Appendix B And Appendix C for Direct Beta Activity Measurements, Removable Beta Activity Measurement and Removable Beta and Alpha Activity

1) Perform a 100% beta scan of accessible surfaces within the tunnel by holding the detector approximately ½ inch from the surface being scanned and moving the detector approximately 1 detector's width per second. Set the 2350 for a count time of 1 minute and

log the results of the scan so that the results can be downloaded. Where appropriate (cracks, irregular surfaces, etc.) ensure that the scans are performed with a 15 cm^2 detector.

2) Collect a direct beta measurement at locations identified during the scan as having residual activity. If activity in excess of the DCGL is identified remediate the affected area.

3) Grid the interior surfaces of the Foyer and Instrument Room using 5 foot grids.

4) Prepare a map or drawing of the survey unit showing the grid layout.

5) Mark the systematic measurement location within each grid using the following X,Y coordinates determined using a random number generator provided by the HP 32S II Calculator. The calculator generates random numbers between 0.00 and 1.00. The first random number is multiplied by 5 to give the X coordinate and the second random number is multiplied by 5 to give the Y coordinate.

R = 0.156, X = .78' R = 0.562, Y = 2.81'

6) Obtain a direct beta measurement at each measurement location. The count time should be sufficient (>30 sec) to achieve an MDA of less than 2,000 dpm/100 cm^2). Mark the actual measurement location with a paint pencil or equivalent and denote the measurement location on a map or drawing of the survey unit.

7) Obtain 1 smear at each measurement location. Each smear should be analyzed for both alpha and beta activity. Wait approximately 24 hours before analyzing the smears.

3.8.4 Package 04 – Building Exteriors - Impacted Class 2

Area Description

The survey unit consists of the exterior surfaces of the DU Tunnel, the Non DU Tunnel, the Instrument Room, and the Foyer. Also included in this survey unit is the concrete footer in front of the door into the Foyer. The roof of the Instrument Room and the Foyer is covered with plastic sheeting. This sheeting was added to the roof following the end of DU testing within the DU Tunnel

Historical Information

The exterior surfaces of the DU Tunnel, the Non DU Tunnel, the Instrument Room, and the Foyer did not require remediation. The stairs leading into the Foyer were removed to allow access to the soil below and to allow remediation of the concrete footer supporting the stairs. The concrete footer was remediated using a jack hammer.

General Survey Instructions

(Impacted – Class 1):

See pp 27 of 31 – 30 of 31 Appendix B And Appendix C for Direct Beta Activity Measurements, Removable Beta Activity Measurement and Removable Beta and Alpha Activity

1) Grid the surfaces of the building's exterior using 6 foot grids. Due to the size of the concrete footer in front of the door into the Foyer it will not require gridding.
2) Prepare a map or drawing of the survey unit showing the grid layout.
3) Perform a 25% beta scan of the accessible surfaces on the building's exterior and on the concrete footer in front of the door into the Foyer by holding the detector approximately ½ inch from the surface being scanned and moving the detector approximately 1 detector's width per second. Set the 2350 for a count time of 1 min and log the results of the scan so that the results can be downloaded. Where appropriate (cracks, irregular surfaces, etc.) ensure that the scans are performed with a 15 cm^2 detector
4) Collect a direct beta measurements at areas identified during the scan as having residual activity. If activity in excess of the DCGL (5,500 dpm/100 cm^2) is identified remediate the affected area.
5) Mark the systematic measurement location within each grid using the following X,Y coordinates determined using a random number generator provided by the HP 32S II Calculator. The calculator generates random numbers between 0.00 and 1.00. The first random number is multiplied by 6 to give the X coordinate and the second random number is multiplied by 6 to give the Y coordinate.

R = 0.797, X = 4.78' R = 0.562, Y = 3.37'

6) Mark three random measurement location on the concrete footer in front of the door into the Foyer.
7) Obtain a direct beta measurement at each measurement location. The count time should be sufficient (>30 sec) to achieve an MDA of less than 2,000 dpm/100 cm^2). Mark the actual measurement location with a paint pencil or equivalent and denote the measurement location on a map or drawing of the survey unit.
8) Obtain 1 smear at each measurement location. Each smear should be analyzed for both alpha and beta activity. Wait approximately 24 hours before analyzing the smears.

3.8.5 Package 05 – Indoor Storage Area - Impacted Class 1

Area Description

The survey unit consists of the remaining surfaces associated with the indoor storage area. Also included in this survey package is the crane adjacent to the indoor storage area, the metal structure behind the indoor storage area and the metal structure adjacent to the bunker beyond the Non DU Tunnel. The remaining surfaces associated with the indoor storage area consists of a concrete slab measuring 14.5 feet by 7.8 feet, two metal plates measuring 14.5 feet by 6.0 feet and one metal plate measuring 7.8 feet by 6.0 feet. Since both surfaces of the metal plates are to be surveyed, the surface area of the remaining surfaces of the

indoor storage area is approximately 555 ft^2 (51.5 m^2). It is estimated that the two metal structures will add less than 100 ft^2 (9.3 m^2) to the total surface area.

Historical Information

The indoor storage area was used to store radioactive materials. The HEPA filtration system for the DU Tunnel was mounted on the roof of the indoor storage area. The HEPA filtration system, the roof of the indoor storage area and one wall were removed during remediation.

General Survey Instructions

(Impacted – Class 1):

1) Grid the surfaces of the indoor storage area using 3 foot grids. Due to the size of the crane and the two metal structures they will not require gridding.
2) Prepare a map or drawing of the survey unit showing the grid layout.
3) Perform a 100% beta scan of accessible surfaces on the remaining surfaces of the indoor storage area, the crane, and the two metal structures by holding the detector approximately ½ inch from the surface being scanned and moving the detector approximately 1 detector's width per second. Set the 2350 for a count time of 1 min and log the results of the scan so that the results can be downloaded. Where appropriate (cracks, irregular surfaces, etc.) ensure that the scans are performed with a 15 cm^2 detector.

See pp 27 of 31 – 30 of 31 Appendix B And Appendix C for Direct Beta Activity Measurements, Removable Beta Activity Measurement and Removable Beta and Alpha Activity

4) Collect a direct beta measurements at areas identified during the scan as having residual activity. If activity in excess of the DCGL (5,500 dpm/100 cm^2) is identified remediate the affected area.
5) Mark the systematic measurement location within each grid using the following X,Y coordinates determined using a random number generator provided by the HP 32S II Calculator. The calculator generates random numbers between 0.00 and 1.00. The first random number is multiplied by 3 to give the X coordinate and the second random number is multiplied by 3 to give the Y coordinate.

R = 0.306, X = .92’ R = 0.276, Y = 0.83’

6) Mark ~~one~~ random measurement location on each of the accessible surfaces of the two metal structures. Mark 3 random measurement locations on the crane.
7) Obtain a direct beta measurement at each measurement location. The count time should be sufficient (>30 sec) to achieve an MDA of less than 2,000 dpm/100 cm^2). Mark the actual measurement location with a paint pencil or equivalent and denote the measurement location on a map or drawing of the survey unit.

8) Obtain 1 smear at each measurement location. Each smear should be analyzed for both alpha and beta activity. Wait approximately 24 hours before analyzing the smears.

3.8.6 Package 06 – Interior of Metal (Electrical) Storage Containers - Impacted Class 1

Area Description

The survey unit consists of the interior surfaces of the two metal storage containers located outside of Building 611B. Each storage container is approximately 12 feet long, 7.25 feet wide, and 6.67 feet high. The interior surface area of each container is approximately 430.8 ft^2 (40.0 m^2).

Historical Information

One if not both of the metal storage containers were used to store radioactive materials. Neither container required remediation, other than removing the stored material which was wrapped in plastic or stored in plastic bags.

General Survey Instructions

(Impacted – Class 1):

1) Grid the interior surfaces of the metal storage containers using 4 foot grids.
2) Prepare a map or drawing of each survey unit showing the grid layout.
3) Perform a 100% beta scan of accessible surfaces within the metal storage containers by holding the detector approximately ½ inch from the surface being scanned and moving the detector approximately 1 detector's width per second. Set the 2350 for a count time of 1 min and log the results of the scan so that the results can be downloaded. Where appropriate (cracks, irregular surfaces, etc.) ensure that the scans are performed with a 15 cm^2 detector.
4) Collect a direct beta measurements at areas identified during the scan as having residual activity. If activity in excess of the DCGL (5,500 cm^2) is identified remediate the affected area.
5) Mark the systematic measurement location within each grid using the following X,Y coordinates determined using a random number generator provided by the HP 32S II Calculator. The calculator generates random numbers between 0.00 and 1.00. The first random number is multiplied by 4 to give the X coordinate and the second random number by 4 to give the Y coordinate.

See pp 27 of 31 – 30 of 31 Appendix B And Appendix C for Direct Beta Activity Measurements, Removable Beta Activity Measurement and Removable Beta and Alpha Activity

R = 0.079, X = 0.32’ R = 0.4159, Y = 1.66’

6) Obtain a direct beta measurement at each measurement location. The count time should be sufficient (>30 sec) to achieve an MDA of less than 2,000 dpm/100 cm^2). Mark the actual measurement location with a paint pencil or equivalent and denote the measurement location on a map or drawing of the survey unit.

7) Obtain 1 smear at each measurement location. Each smear should be analyzed for both alpha and beta activity. Wait approximately 24 hours before analyzing the smears.

3.8.7 Package 07 – Exterior of Metal (Electrical) Storage Containers - Impacted Class 1

Area Description

The survey unit consists of the exterior surfaces of the two metal storage containers located outside of Building 611B. Each storage container is approximately 12 feet long, 7.25 feet wide, and 6.67 feet high. The exterior surface area of each container is approximately 430.8 ft^2 (40.0 m^2).

Historical Information

At least one if not both of the Metal Storage Containers were used to store radioactive materials. Neither container required remediation.

General Survey Instructions

(Impacted – Class 2):

1) Grid the exterior surfaces of the metal storage containers using 4 foot grids.

2) Prepare a map or drawing of each survey unit showing the grid layout.

3) Perform a 25% beta scan of accessible surfaces on the metal storage containers by holding the detector approximately ½ inch from the surface being scanned and moving the detector approximately 1 detector's width per second. Set the 2350 for a count time of 1 min and log the results of the scan so that the results can be downloaded. Where appropriate (cracks, irregular surfaces, etc.) ensure that the scans are performed with a 15 cm^2 detector.

See pp 27 of 31 – 30 of 31 Appendix B And Appendix C for Direct Beta Activity Measurements, Removable Beta Activity Measurement and Removable Beta and Alpha Activity

4) Collect a direct beta measurements at areas identified during the scan as having residual activity. If activity in excess of the DCGL (5,500 crn^2) is identified remediate the affected area.

5) Mark the systematic measurement location within each grid using the following X,Y coordinates determined using a random number generator provided by the HP 32S II Calculator. The calculator generates random numbers between 0.00 and 1.00. The first random number is multiplied by 4 to give the X coordinate and the second random number by 4 to give the Y coordinate.

R = 0.245, X = 0.98’ R = 0.965, Y = 3.86’

6) Obtain a direct beta measurement at each measurement location. The count time should be sufficient (>30 sec) to achieve an MDA of less than 2,000 dpm/100 cm^2). Mark the actual measurement location with a paint pencil or equivalent and denote the measurement location on a map or drawing of the survey unit.

7) Obtain 1 smear at each measurement location. Each smear should be analyzed for both alpha and beta activity. Wait approximately 24 hours before analyzing the smears.

3.8.8 Package 08 – Open Land Areas - Impacted Class 2

Area Description

The survey unit consists of the open land areas surrounding Building 611 B. The survey unit is uneven, irregularly shaped, and extremely rocky. The area behind building 611B is littered with UXO (unexploded ordinances). The area to be included in the survey consists of approximately 2,400 m^2.

Historical Information

Building 611B was used to test DU projectiles. The Target Room (removed during building remediation) exhausted through a HEPA filtration system (removed during building remediation) on the roof of the Indoor Storage Area. There were reports of several fires within the filter banks and the subsequent spread of DU contamination to the environment. There was also evidence of DU contamination being spread to the environment through the door to the Indoor Storage Area and the Door to the Foyer.

CHANGE sever TO seven

No contamination levels in excess of the DCGL for soil was identified. However [redacted] cubic yards of soil was removed from in front of the two doors in order to maintain residual radioactivity ALARA.

During the remediation of Building 611B an underground storage tank was removed. The underground storage tank was located adjacent to the Instrument Room/Foyer. The tank was removed intact and there was no evidence that the tank had leaked. Immediately following the tank removal, soil samples were collected from the bottom of the excavation and from the excavated soil. The excavation was then back filled due to concerns rated to the stability of Building 611B.

CHANGE rated TO related

General Survey Instructions

(Impacted – Class 1):

1) Grid area around Building 611B into 25 foot grids centered at the down slope intersection of the DU and Non DU Tunnels.
2) Mark the systematic sampling location within each grid using the following X,Y coordinates determined using a random number generator provided by the HP 32S II Calculator. The calculator generates random numbers between 0.00 and 1.00. The first random number is multiplied by 25 to give the X coordinate and the second random number is multiplied by 25 to give the Y coordinate. Three sets of X,Y coordinates are provided for use in cases where the first or second sampling location is not accessible.

R = 0.29, X = 7.37'
R = 0.04, Y = 1.03' X,Y (7.37',1.03')

R = 0.28, X =7.12'
R = 0.79, Y = 19.67' X,Y (7.12', 1.03')

R = 0.04, X = 1.02'
R = 0.87, Y = 21.78' X,Y (1.02', 21.78')

The origin for the X,Y coordinates will be in the southwest corner of each grid.

Use the first available sampling location (X,Y coordinate). If none of the three sampling locations are available do not collect a sample from that grid. Document which systematic sampling location was used in each of the grids.

A minimum of 20 systematic sampling locations should be identified. If this is not the case notify the Project Manager.

3) Perform a 25% gamma scan of the open land areas surrounding building 611B by holding the detector approximately 6 inches from the surface being scanned and moving the detector in a serpentine pattern at a rate of approximately ½ meter per second. Set the 2350 for a count time of 1 min and log the results of the scan so that the results can be downloaded. Scan approximately 25% of the open land area within each grid and mark areas of elevated activity (5 uR above background) as a biased sampling location. Document the location of each biased sampling location.
4) Collect 1 surface (0-6 inches) soil sample from each systematic and biased sampling location.
5) Collect a biased surface soil sample (0-6 inches) at locations identified during the scan as having residual activity.
6) Based on existing characterization data determine the minimum number of sample locations in accordance with the guidance

contained in the Final Survey Plan. If more than 20 sample locations are required notify the Project Manager.

7) The grid spacing should allow for approximately 24 grids of equal size through out the survey unit. It is expected that there will be twenty-four 10 meter by 10 meter grids established.
8) Prepare a map or drawing of the survey unit showing the grid layout.
9) Once gridded a random number generator will be used to determine the x and y offsets in order to locate the appropriate sampling location in each grid.
10) Collect a surface soil sample (0-6 inches) at each sampling location. Mark the actual sampling location with a flag or stake and denote the sampling location on a map or drawing of the survey unit.
11) Ensure that the samples are labeled, and that the chain of custody records are completed.

3.8.9 Package 04 – Bunker Beyond the Non DU Tunnel - Impacted Class 2

Bunker/trough

Area Description

The survey unit consists of the surfaces of the concrete bunker beyond the Non DU Tunnel. It consists of two concrete walls approximately 56 feet in length. The height of the walls varies with the terrain from approximately 12 feet at the end of the Non DU Tunnel to only several inches at the opposite end. Portions of the wall appear to be buried. The interior of the bunker contains a significant amount of debris/organic matter.

Historical Information

There is no information concerning the bunker. It appears that at one time that it was covered and may have been used to test non DU rounds.

General Survey Instructions

(Impacted – Class 1):

1) Grid the surfaces of the bunker using 3 foot grids.
2) Prepare a map or drawing of the survey unit showing the grid layout.
3) Perform a 25% beta scan of the accessible surfaces on the bunker by holding the detector approximately ½ inch from the surface being scanned and moving the detector approximately 1 detector's width per second. Set the 2350 for a count time of 1 min and log the results of the scan so that the results can be downloaded. Where appropriate (cracks, irregular surfaces, etc.) ensure that the scans are performed with a 15 cm^2 detector.

See pp 27 of 31 – 30 of 31 Appendix B And Appendix C for Direct Beta Activity Measurements, Removable Beta Activity Measurement and Removable Beta and Alpha Activity

4) Collect a direct beta measurements at areas identified during the scan as having residual activity. If activity in excess of the DCGL (5,500 dpm/100 cm^2) is identified remediate the affected area.

5) Mark the systematic measurement location within each grid using the following X,Y coordinates determined using a random number generator provided by the HP 32S II Calculator. The calculator generates random numbers between 0.00 and 1.00. The first random number is multiplied by 3 to give the X coordinate and the second random number is multiplied by 3 to give the Y coordinate.

R = 0.898, X = 2.70' R = 0.122, Y = 0.07'

6) Obtain a direct beta measurement at each measurement location. The count time should be sufficient (>30 sec) to achieve an MDA of less than 2,000 dpm/100 cm^2. Mark the actual measurement location with a paint pencil or equivalent and denote the measurement location on a map or drawing of the survey unit.

7) Obtain 1 smear at each measurement location. Each smear should be analyzed for both alpha and beta activity. Wait approximately 24 hours before analyzing the smears.

4.0 SURVEY RESULTS

Delete are provided

Summary results of the final status surveys ~~are~~ provided for each survey unit are provided in Tables 4-1 through 4-9. All direct beta measurements are provided in Attachment B. Removable alpha and beta smear measurements are provided in Attachment C. Off site sample analysis results for Th-234 (U-238) activity concentrations are shown in Attachment D. All results were well below the DCGLs of 5500 dpm/100 cm^2 for total activity, 550 dpm/100 cm^2 for removable activity, and 125 pCi/g of Th-234 activity in soils.

ADD:

186 pCi/g of U-238 (DU)

Table 4-1
Summary Results Suwey Package 01
DU Tunnel – Impacted Class 1

Measurement Type	Number	Mean dpm/100cm^2	Maximum dpm/100cm^2	Standard Deviation dpm/100cm^2
Direct Beta	34	1136	3000*	707
Removable Beta	33	15	103	28
Removable Alpha	33	3	22	5

* One measurement was initially 7238 dpm/100 cm^2. The area was decontaminated and resurveyed.

Table 4-2
Summary Results Survey Package 02
Non DU Tunnel – Impacted Class I

Measurement Type	Number	Mean dpm/100cm^2	Maximum dpm/100cm^2	Standard Deviation dpm/100cm^2
Direct Beta	86	604	1686	443
Removable Beta	88	7	77	26
Removable Alpha	88	0	8	2

Table 4-3
Summary Results Survey Package 03
Foyer and Instrument Room – Impacted Class 1

Measurement Type	Number	Mean dpm/100cm^2	Maximum dpm/100cm^2	Standard Deviation dpm/100cm^2
Direct Beta	54	324	952	254
Removable Beta	53	7	56	22
Removable Alpha	53	-1	8	2

Table 4-4
Summary Results Survey Package 04
Building Exteriors – Impacted Class 2

Measurement Type	Number	Mean dpm/100cm^2	Maximum dpm/100cm^2	Standard Deviation dpm/100cm^2
Direct Beta DU Tunnel Exterior	18	316	615	183
Direct Beta Instrument Room/Foyer Exterior	16	320	639	149
Direct Beta Non DU Tunnel Room and Instrument Room/Foyer Roof	25	204	933	434
Direct Beta Non DU Tunnel Exterior	20	825	1353	246
Removable Beta	82	-7	50	28
Removable Alpha	82	0	10	3

Table 4-5
Summary Results Survey Package 05
Storage Room and Structures – Impacted Class 1

Measurement Type	Number	Mean dpm/100cm^2	Maximum dpm/100cm^2	Standard Deviation dpm/100cm^2
Direct Beta Storage Room	72	302	2203	646
Direct Beta Structure 1 (target box behind storage room)	12	-99	203	233
Direct Beta Structure 2 (target box adjacent to bunker)	12	91	734	280
Direct Beta Structure 3 (crane)	4	-182	-154	23
Removable Beta	98	1	81	25
Removable Alpha	98	0	5	1

Table 4-6
Summary Results Survey Package 06
Electrical Storage Shelters Interior – Impacted Class 1

Measurement Type	Number	Mean dpm/100cm^2	Maximum dpm/100cm^2	Standard Deviation dpm/100cm^2
Direct Beta Shelter 1	16	-8	135	114
Direct Beta Shelter 2	16	53	452	196
Removable Beta	32	-16	29	25
Removable Alpha	32	-1	2	1

Table 4-7
Summary Results Survey Package 07
Electrical Storage Shelters Exterior – Impacted Class 2

Measurement Type	Number	Mean dpm/100cm^2	Maximum dpm/100cm^2	Standard Deviation dpm/100cm^2
Direct Beta Shelter 1	14	53	532	212
Direct Beta Shelter 2	13	-87	63	79
Removable Beta	26	-14	50	31
Removable Alpha	26	0	7	2

Table 4-8
Summary Results Survey Package 08
Open Land Areas – Impacted Class 2

Area	Number	Mean (pCi/g)	Maximum (pCi/g)	Standard Deviation (pCi/g)
UST Pit U-238 (Th-234) activity in soil	10	0.69	1.65	0.58
Open Land Areas U-238 (Th-234) sample activity	28	0.95	5.01	1.16

Table 4-9
Summary Results Survey Package 09
Bunker Beyond the Non DU Tunnel – Impacted Class 2

Measurement Type	Number	Mean dpm/100cm^2	Maximum dpm/100cm^2	Standard Deviation dpm/100cm^2
Direct Beta Bunker Interior	80	572	2194	240
Direct Beta Bunker Exterior	59	501	829	179
Removable Beta	135	-7	55	21
Removable Alpha	135	0	7	2

5.0 CONCLUSION

The final status survey measurements demonstrate that all analysis results are less than the DCGLs established for Building 611B. The measurement results were conservative in that none of the direct beta measurements or soil sample analysis results were corrected for background. None of the individual survey results in any survey unit exceeded the DCGLs. Therefore, none of the survey results required analysis using the non parametric statistics (Sign P test, Wilcoxon Rank Sum test) described in reference 6.1 and 6.6.

6.0 REFERENCES

6.1 NUREG-1575, Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), December 1997

6.2 NUREG-1727, MNSS Decommissioning Standard Review Plan, September 2000

6.3 Draft NUREG-1549, Using Decision Methods for Dose Assessment to Comply with Radiological Criteria for License Termination

6.4 Federal Register, Volume 63, No. 222, Wednesday, November 18, 1998, pages 64132-64134

6.5 10 CFR20, Standards for Protection Against Radiation

6.6 Final Survey Plan for the TACOM - ARDEC, Picatinny Arsenal Building 611B, Revision 1 Duratek, January 2002

6.7 Decommissioning Plan for Building 611B, Picatinny Arsenal-ARDEC, Duratek, October 1999

6.8 Report of Radiological Characterization, Building 611B, ARDEC-Picatinny Arsenal, GPI, May, 1997

Attachment A

Photo Essay

Foyer Entrance

Electrical Panel Outside Foyer

Outdoor Storage Area (Gazebo)

Outdoor Storage Area (Gazebo)

Underground Storage Tank

Electrical Storage Shelter

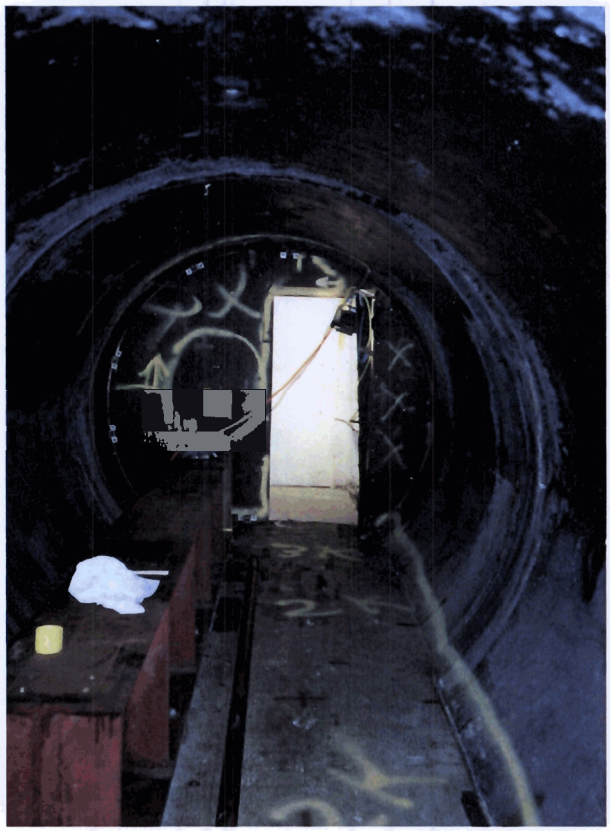
DU Tunnel (forground)

HEPA Unit Above Indoor Storage Area

Indoor Storage Area

Indoor Storage Area/DU Tunnel HEPA Unit

DU Tunnel Looking Toward Target Room

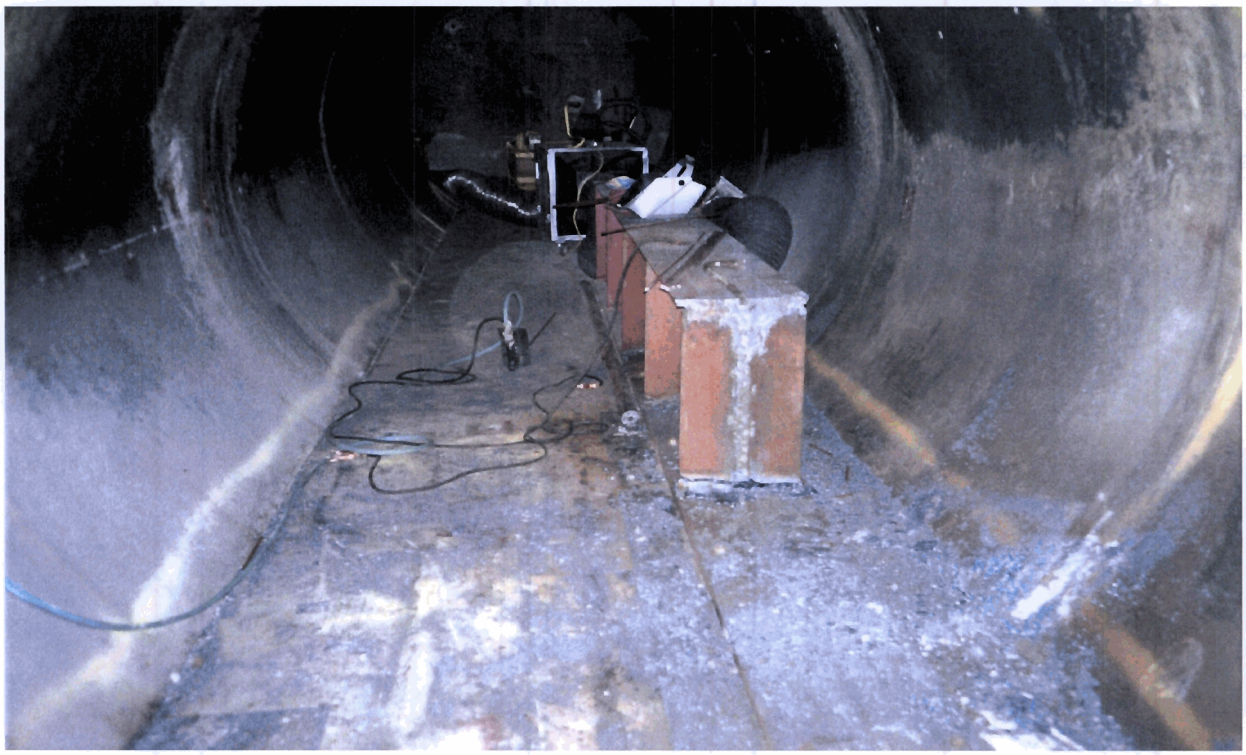


Indoor Storage Area Looking Toward Target Room

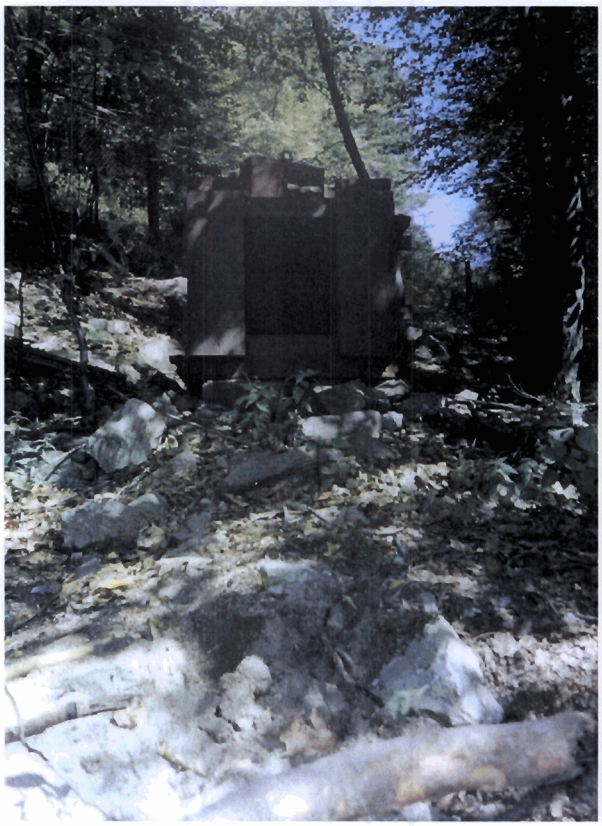
DU Tunnel Following Removal of Target Room

DU Tunnel Following Removal of Target Room

Gun Stand Within DU Tunnel



Structure #1 (Behind DU Tunnel)



Trough at the End of the Non DU Tunnel

Structure #3 (Crane)

Attachment B

Direct Beta Activity Measurement

Attachment B
Direct Beta Activity Measurements

Location	M2350 Serial #	Detector Serial #	Date	Logged counts	Count Time (sec)	Count Type	Efficiency	Background cpm	Activity dpm/100cm^2	MDA dpm/100cm^2
DU Tunnel										
P611BDUF01	98648	133988	9/19/2003	272	30	FLDCT	0.200	244	1190	317
P611BDUF01	98648	133988	9/19/2003	178	30	FLDCT	0.200	244	444	317
P611BDUF01	98648	133988	9/19/2003	148	30	FLDCT	0.200	244	206	317
P611BDUF01	98648	133988	9/19/2003	257	30	FLDCT	0.200	244	1071	317
P611BDUF01	98648	133988	9/19/2003	268	30	FLDCT	0.200	244	1159	317
P611BDUF01	98648	133988	9/19/2003	169	30	FLDCT	0.200	244	373	317
P611BDUF01	98648	133988	9/19/2003	177	30	FLDCT	0.200	244	437	317
P611BDUF01	98648	133988	9/19/2003	500	30	FLDCT	0.200	244	3000	317
P611BDUF01	98648	133988	9/19/2003	243	30	FLDCT	0.200	244	960	317
P611BDUF01	98648	133988	9/19/2003	234	30	FLDCT	0.200	244	889	317
P611BDUF01	98648	133988	9/19/2003	247	30	FLDCT	0.200	244	992	317
P611BDUF01	98648	133988	9/19/2003	268	30	FLDCT	0.200	244	1159	317
P611BDUF01	98648	133988	9/19/2003	168	30	FLDCT	0.200	244	365	317
P611BDUF01	98648	133988	9/19/2003	207	30	FLDCT	0.200	244	675	317
P611BDUF01	98648	133988	9/19/2003	186	30	FLDCT	0.200	244	508	317
P611BDUF01	98648	133988	9/19/2003	322	30	FLDCT	0.200	244	1587	317
P611BDUF01	98648	133988	9/19/2003	195	30	FLDCT	0.200	244	579	317
P611BDUF01	98648	133988	9/19/2003	243	30	FLDCT	0.200	244	960	317
P611BDUF01	98648	133988	9/19/2003	182	30	FLDCT	0.200	244	476	317
P611BDUF01	98648	133988	9/19/2003	476	30	FLDCT	0.200	244	2810	317
P611BDUF01	98648	133988	9/19/2003	464	30	FLDCT	0.200	244	2714	317
P611BDUF01	98648	133988	9/19/2003	216	30	FLDCT	0.200	244	746	317
P611BDUF01	98648	133988	9/19/2003	289	30	FLDCT	0.200	244	1325	317
P611BDUF01	98648	133988	9/19/2003	217	30	FLDCT	0.200	244	754	317
P611BDUF01	98648	133988	9/19/2003	236	30	FLDCT	0.200	244	905	317
P611BDUF01	98648	133988	9/19/2003	328	30	FLDCT	0.200	244	1635	317
P611BDUF01	98648	133988	9/19/2003	386	30	FLDCT	0.200	244	2095	317
P611BDUF01	98648	133988	9/19/2003	233	30	FLDCT	0.200	244	881	317
P611BDUF01	98648	133988	9/19/2003	302	30	FLDCT	0.200	244	1429	317
P611BDUF01	98648	133988	9/19/2003	279	30	FLDCT	0.200	244	1246	317
P611BDUF01	98648	133988	9/19/2003	301	30	FLDCT	0.200	244	1421	317
P611BDUF01	98648	133988	9/19/2003	375	30	FLDCT	0.200	244	2008	317

Attachment B
Direct Beta Activity Measurements

Location	M2350 Serial #	Detector Serial #	Date	Logged counts	Count Time (sec)	Count Type	Efficiency	Background cpm	Activity dpm/100cm^2	MDA dpm/100cm^2
P611BDUF01	98648	133988	9/19/2003	269	30	FLDCT	0.200	244	1167	317
P611BDUF01	98648	133988	9/20/2003	185	30	FLDCT	0.210	246	469	303

Summary: DU Tunnel
(Survey Package 01)

Number	**34**	
Mean	**1136**	**dpm/100cm^2**
Maximum	**3000**	**dpm/100cm^2**
Standard Deviation	**707**	**dpm/100cm^2**

Attachment B
Direct Beta Activity Measurements

Location	M2350 Serial #	Detector Serial #	Date	Logged counts	Count Time (sec)	Count Type	Efficiency	Background cpm	Activity dpm/100cm^2	MDA dpm/100cm^2
Non DU Tunnel										
P611BNDC01	82958	95523	9/20/2003	137	30	FLDCT	0.217	261	48	302
P611BNDC01	82958	95523	9/20/2003	138	30	FLDCT	0.217	261	55	302
P611BNDC01	82958	95523	9/20/2003	130	30	FLDCT	0.217	261	-4	302
P611BNDC01	82958	95523	9/20/2003	137	30	FLDCT	0.217	261	48	302
P611BNDC01	82958	95523	9/20/2003	143	30	FLDCT	0.217	261	91	302
P611BNDC01	82958	95523	9/20/2003	148	30	FLDCT	0.217	261	128	302
P611BNDC01	82958	95523	9/20/2003	130	30	FLDCT	0.217	261	-4	302
P611BNDC01	82958	95523	9/20/2003	96	30	FLDCT	0.217	261	-252	302
P611BNDC01	82958	95523	9/20/2003	155	30	FLDCT	0.217	261	179	302
P611BNDC01	82958	95523	9/20/2003	156	30	FLDCT	0.217	261	187	302
P611BNDC01	82958	95523	9/20/2003	162	30	FLDCT	0.217	261	230	302
P611BNDC01	82958	95523	9/20/2003	140	30	FLDCT	0.217	261	69	302
P611BNDC01	82958	95523	9/20/2003	137	30	FLDCT	0.217	261	48	302
P611BNDC01	82958	95523	9/20/2003	145	30	FLDCT	0.217	261	106	302
P611BNDC01	82958	95523	9/20/2003	167	30	FLDCT	0.217	261	267	302
P611BNDC01	82958	95523	9/20/2003	123	30	FLDCT	0.217	261	-55	302
P611BNDC01	82958	95523	9/20/2003	146	30	FLDCT	0.217	261	113	302
P611BNDC01	82958	95523	9/20/2003	139	30	FLDCT	0.217	261	62	302
P611BNDC01	82958	95523	9/20/2003	148	30	FLDCT	0.217	261	128	302
P611BNDC01	82958	95523	9/20/2003	142	30	FLDCT	0.217	261	84	302
P611BNDC01	82958	95523	9/20/2003	147	30	FLDCT	0.217	261	121	302
P611BNDC01	82958	95523	9/20/2003	162	30	FLDCT	0.217	261	230	302
P611BNDC01	82958	95523	9/20/2003	120	30	FLDCT	0.217	261	-77	302
P611BNDC01	82958	95523	9/20/2003	146	30	FLDCT	0.217	261	113	302
P611BNDC01	82958	95523	9/20/2003	130	30	FLDCT	0.217	261	-4	302
P611BNDC01	82958	95523	9/20/2003	145	30	FLDCT	0.217	261	106	302
P611BNDC01	82958	95523	9/20/2003	168	30	FLDCT	0.217	261	274	302
P611BNDF01	82958	95523	9/20/2003	254	30	FLDCT	0.217	261	903	302
P611BNDF01	82958	95523	9/20/2003	213	30	FLDCT	0.217	261	603	302
P611BNDF01	82958	95523	9/20/2003	214	30	FLDCT	0.217	261	611	302
P611BNDF01	82958	95523	9/20/2003	213	30	FLDCT	0.217	261	603	302
P611BNDF01	82958	95523	9/20/2003	226	30	FLDCT	0.217	261	699	302

Attachment B
Direct Beta Activity Measurements

Location	M2350 Serial #	Detector Serial #	Date	Logged counts	Count Time (sec)	Count Type	Efficiency	Background cpm	Activity dpm/100cm^2	MDA dpm/100cm^2
P611BNDF01	82958	95523	9/20/2003	271	30	FLDCT	0.217	261	1028	302
P611BNDF01	82958	95523	9/20/2003	246	30	FLDCT	0.217	261	845	302
P611BNDF01	82958	95523	9/20/2003	359	30	FLDCT	0.217	261	1671	302
P611BNDF01	82958	95523	9/20/2003	260	30	FLDCT	0.217	261	947	302
P611BNDF01	82958	95523	9/20/2003	321	30	FLDCT	0.217	261	1393	302
P611BNDF01	82958	95523	9/20/2003	351	30	FLDCT	0.217	261	1613	302
P611BNDF01	82958	95523	9/20/2003	254	30	FLDCT	0.217	261	903	302
P611BNDF01	82958	95523	9/20/2003	361	30	FLDCT	0.217	261	1686	302
P611BNDF01	82958	95523	9/20/2003	270	30	FLDCT	0.217	261	1020	302
P611BNDF01	82958	95523	9/20/2003	232	30	FLDCT	0.217	261	742	302
P611BNDW01	82958	95523	9/20/2003	256	30	FLDCT	0.217	261	918	302
P611BNDW01	82958	95523	9/20/2003	190	30	FLDCT	0.217	261	435	302
P611BNDW01	82958	95523	9/20/2003	204	30	FLDCT	0.217	261	538	302
P611BNDW01	82958	95523	9/20/2003	255	30	FLDCT	0.217	261	911	302
P611BNDW01	82958	95523	9/20/2003	255	30	FLDCT	0.217	261	911	302
P611BNDW01	82958	95523	9/20/2003	252	30	FLDCT	0.217	261	889	302
P611BNDW01	82958	95523	9/20/2003	241	30	FLDCT	0.217	261	808	302
P611BNDW01	82958	95523	9/20/2003	270	30	FLDCT	0.217	261	1020	302
P611BNDW01	82958	95523	9/20/2003	249	30	FLDCT	0.217	261	867	302
P611BNDW01	82958	95523	9/20/2003	226	30	FLDCT	0.217	261	699	302
P611BNDW01	82958	95523	9/20/2003	206	30	FLDCT	0.217	261	552	302
P611BNDW01	82958	95523	9/20/2003	241	30	FLDCT	0.217	261	808	302
P611BNDW01	82958	95523	9/20/2003	265	30	FLDCT	0.217	261	984	302
P611BNDW01	82958	95523	9/20/2003	277	30	FLDCT	0.217	261	1072	302
P611BNDW01	82958	95523	9/20/2003	231	30	FLDCT	0.217	261	735	302
P611BNDW01	82958	95523	9/20/2003	226	30	FLDCT	0.217	261	699	302
P611BNDW01	82958	95523	9/20/2003	245	30	FLDCT	0.217	261	838	302
P611BNDW01	82958	95523	9/20/2003	256	30	FLDCT	0.217	261	918	302
P611BNDW01	82958	95523	9/20/2003	252	30	FLDCT	0.217	261	889	302
P611BNDW01	82958	95523	9/20/2003	292	30	FLDCT	0.217	261	1181	302
P611BNDW01	82958	95523	9/20/2003	201	30	FLDCT	0.217	261	516	302
P611BNDW01	82958	95523	9/20/2003	172	30	FLDCT	0.217	261	304	302
P611BNDW01	82958	95523	9/20/2003	186	30	FLDCT	0.217	261	406	302

Attachment B
Direct Beta Activity Measurements

Location	M2350 Serial #	Detector Serial #	Date	Logged counts	Count Time (sec)	Count Type	Efficiency	Background cpm	Activity dpm/100cm^2	MDA dpm/100cm^2
P611BNDW01	82958	95523	9/20/2003	243	30	FLDCT	0.217	261	823	302
P611BNDW01	82958	95523	9/20/2003	185	30	FLDCT	0.217	261	399	302
P611BNDW01	82958	95523	9/20/2003	326	30	FLDCT	0.217	261	1430	302
P611BNDW01	82958	95523	9/20/2003	211	30	FLDCT	0.217	261	589	302
P611BNDW01	82958	95523	9/20/2003	265	30	FLDCT	0.217	261	984	302
P611BNDW01	82958	95523	9/20/2003	257	30	FLDCT	0.217	261	925	302
P611BNDW01	82958	95523	9/20/2003	272	30	FLDCT	0.217	261	1035	302
P611BNDW01	82958	95523	9/20/2003	233	30	FLDCT	0.217	261	750	302
P611BNDW01	82958	95523	9/20/2003	190	30	FLDCT	0.217	261	435	302
P611BNDW01	82958	95523	9/20/2003	296	30	FLDCT	0.217	261	1211	302
P611BNDW01	82958	95523	9/20/2003	239	30	FLDCT	0.217	261	794	302
P611BNDW01	82958	95523	9/20/2003	256	30	FLDCT	0.217	261	918	302
P611BNDW01	82958	95523	9/20/2003	252	30	FLDCT	0.217	261	889	302
P611BNDW01	82958	95523	9/20/2003	215	30	FLDCT	0.217	261	618	302
P611BNDW01	82958	95523	9/20/2003	254	30	FLDCT	0.217	261	903	302
P611BNDW01	82958	95523	9/20/2003	310	30	FLDCT	0.217	261	1313	302
P611BNDW01	82958	95523	9/20/2003	202	30	FLDCT	0.217	261	523	302
P611BNDW01	82958	95523	9/20/2003	208	30	FLDCT	0.217	261	567	302
P611BNDW01	82958	95523	9/20/2003	204	30	FLDCT	0.217	261	538	302
P611BNDW01	82958	95523	9/20/2003	207	30	FLDCT	0.217	261	560	302
P611BNDW01	82958	95523	9/20/2003	166	30	FLDCT	0.217	261	260	302

Summary: Non DU Tunnel
(Survey Package 02)

Number	**86**	
Mean	**604**	**dpm/100cm^2**
Maximum	**1686**	**dpm/100cm^2**
Standard Deviation	**443**	**dpm/100cm^2**

Attachment B
Direct Beta Activity Measurements

Location	M2350 Serial #	Detector Serial #	Date	Logged counts	Count Time (sec)	Count Type	Efficiency	Background cpm	Activity dpm/100cm^2	MDA dpm/100cm^2
Foyer and Instrument Room										
P611BIRC01	82958	95523	9/21/2003	118	30	FLDCT	0.210	236	0	297
P611BIRC01	82958	95523	9/21/2003	119	30	FLDCT	0.210	236	8	297
P611BIRC02	82958	95523	9/21/2003	137	30	FLDCT	0.210	236	144	297
P611BIRC02	82958	95523	9/21/2003	156	30	FLDCT	0.210	236	287	297
P611BIRC02	82958	95523	9/21/2003	131	30	FLDCT	0.210	236	98	297
P611BIRC02	82958	95523	9/21/2003	133	30	FLDCT	0.210	236	113	297
P611BIRC02	82958	95523	9/21/2003	157	30	FLDCT	0.210	236	295	297
P611BIRC02	82958	95523	9/21/2003	154	30	FLDCT	0.210	236	272	297
P611BIRC02	82958	95523	9/21/2003	148	30	FLDCT	0.210	236	227	297
P611BIRC02	82958	95523	9/21/2003	156	30	FLDCT	0.210	236	287	297
P611BIRF01	82958	95523	9/21/2003	226	30	FLDCT	0.210	236	816	297
P611BIRF01	82958	95523	9/21/2003	244	30	FLDCT	0.210	236	952	297
P611BIRF02	82958	95523	9/21/2003	213	30	FLDCT	0.210	236	718	297
P611BIRF02	82958	95523	9/21/2003	206	30	FLDCT	0.210	236	665	297
P611BIRF02	82958	95523	9/21/2003	205	30	FLDCT	0.210	236	658	297
P611BIRF02	82958	95523	9/21/2003	221	30	FLDCT	0.210	236	779	297
P611BIRF02	82958	95523	9/21/2003	220	30	FLDCT	0.210	236	771	297
P611BIRF02	82958	95523	9/21/2003	195	30	FLDCT	0.210	236	582	297
P611BIRF02	82958	95523	9/21/2003	206	30	FLDCT	0.210	236	665	297
P611BIRF02	82958	95523	9/21/2003	206	30	FLDCT	0.210	236	665	297
P611BIRW01	82958	95523	9/21/2003	105	30	FLDCT	0.210	236	-98	297
P611BIRW01	82958	95523	9/21/2003	164	30	FLDCT	0.210	236	348	297
P611BIRW01	82958	95523	9/21/2003	99	30	FLDCT	0.210	236	-144	297
P611BIRW01	82958	95523	9/21/2003	111	30	FLDCT	0.210	236	-53	297
P611BIRW01	82958	95523	9/21/2003	107	30	FLDCT	0.210	236	-83	297
P611BIRW01	82958	95523	9/21/2003	113	30	FLDCT	0.210	236	-38	297
P611BIRW01	82958	95523	9/21/2003	121	30	FLDCT	0.210	236	23	297
P611BIRW01	82958	95523	9/21/2003	158	30	FLDCT	0.210	236	302	297
P611BIRW01	82958	95523	9/21/2003	168	30	FLDCT	0.210	236	378	297
P611BIRW01	82958	95523	9/21/2003	141	30	FLDCT	0.210	236	174	297
P611BIRW01	82958	95523	9/21/2003	152	30	FLDCT	0.210	236	257	297
P611BIRW01	82958	95523	9/21/2003	148	30	FLDCT	0.210	236	227	297

Attachment B
Direct Beta Activity Measurements

Location	M2350 Serial #	Detector Serial #	Date	Logged counts	Count Time (sec)	Count Type	Efficiency	Background cpm	Activity dpm/100cm^2	MDA dpm/100cm^2
P611BIRW02	82958	95523	9/21/2003	130	30	FLDCT	0.210	236	91	297
P611BIRW02	82958	95523	9/21/2003	157	30	FLDCT	0.210	236	295	297
P611BIRW02	82958	95523	9/21/2003	148	30	FLDCT	0.210	236	227	297
P611BIRW02	82958	95523	9/21/2003	180	30	FLDCT	0.210	236	469	297
P611BIRW02	82958	95523	9/21/2003	163	30	FLDCT	0.210	236	340	297
P611BIRW02	82958	95523	9/21/2003	151	30	FLDCT	0.210	236	249	297
P611BIRW02	82958	95523	9/21/2003	152	30	FLDCT	0.210	236	257	297
P611BIRW02	82958	95523	9/21/2003	163	30	FLDCT	0.210	236	340	297
P611BIRW02	82958	95523	9/21/2003	162	30	FLDCT	0.210	236	333	297
P611BIRW02	82958	95523	9/21/2003	172	30	FLDCT	0.210	236	408	297
P611BIRW02	82958	95523	9/21/2003	147	30	FLDCT	0.210	236	219	297
P611BIRW02	82958	95523	9/21/2003	127	30	FLDCT	0.210	236	68	297
P611BIRW02	82958	95523	9/21/2003	156	30	FLDCT	0.210	236	287	297
P611BIRW02	82958	95523	9/21/2003	159	30	FLDCT	0.210	236	310	297
P611BIRW02	82958	95523	9/21/2003	193	30	FLDCT	0.210	236	567	297
P611BIRW02	82958	95523	9/21/2003	179	30	FLDCT	0.210	236	461	297
P611BIRW02	82958	95523	9/21/2003	205	30	FLDCT	0.210	236	658	297
P611BIRW02	82958	95523	9/21/2003	152	30	FLDCT	0.210	236	257	297
P611BIRW02	82958	95523	9/21/2003	169	30	FLDCT	0.210	236	385	297
P611BIRW02	82958	95523	9/21/2003	172	30	FLDCT	0.210	236	408	297
P611BIRW02	82958	95523	9/21/2003	156	30	FLDCT	0.210	236	287	297
P611BIRW02	82958	95523	9/21/2003	159	30	FLDCT	0.210	236	310	297

Summary: Foyer and Instrument Room
(Survey Package 03)

Number	**54**	
Mean	**324**	**dpm/100cm^2**
Maximum	**952**	**dpm/100cm^2**
Standard Deviation	**254**	**dpm/100cm^2**

Attachment B
Direct Beta Activity Measurements

Location	M2350 Serial #	Detector Serial #	Date	Logged counts	Count Time (sec)	Count Type	Efficiency	Background cpm	Activity dpm/100cm^2	MDA dpm/100cm^2
Building Exteriors: DU Tunnel Exterior										
P611BDUTEX	82958	95523	9/22/2003	111	30	FLDCT	0.200	197	99	287
P611BDUTEX	82958	95523	9/22/2003	176	30	FLDCT	0.200	197	615	287
P611BDUTEX	82958	95523	9/22/2003	130	30	FLDCT	0.200	197	250	287
P611BDUTEX	82958	95523	9/22/2003	134	30	FLDCT	0.200	197	282	287
P611BDUTEX	82958	95523	9/22/2003	152	30	FLDCT	0.200	197	425	287
P611BDUTEX	82958	95523	9/22/2003	172	30	FLDCT	0.200	197	583	287
P611BDUTEX	82958	95523	9/22/2003	163	30	FLDCT	0.200	197	512	287
P611BDUTEX	82958	95523	9/22/2003	131	30	FLDCT	0.200	197	258	287
P611BDUTEX	82958	95523	9/22/2003	148	30	FLDCT	0.200	197	393	287
P611BDUTEX	82958	95523	9/22/2003	169	30	FLDCT	0.200	197	560	287
P611BDUTEX	82958	95523	9/22/2003	163	30	FLDCT	0.200	197	512	287
P611BDUTEX	82958	95523	9/22/2003	117	30	FLDCT	0.200	197	147	287
P611BDUTEX	82958	95523	9/22/2003	119	30	FLDCT	0.200	197	163	287
P611BDUTEX	82958	95523	9/22/2003	113	30	FLDCT	0.200	197	115	287
P611BDUTEX	82958	95523	9/22/2003	106	30	FLDCT	0.200	197	60	287
P611BDUTEX	82958	95523	9/22/2003	126	30	FLDCT	0.200	197	218	287
P611BDUTEX	82958	95523	9/22/2003	143	30	FLDCT	0.200	197	353	287
P611BDUTEX	82958	95523	9/22/2003	117	30	FLDCT	0.200	197	147	287

Summary: Building Exteriors- DU Tunnel Exterior
(Survey Package 04)

Number	**18**	
Mean	**316**	**dpm/100cm^2**
Maximum	**615**	**dpm/100cm^2**
Standard Deviation	**183**	**dpm/100cm^2**

Attachment B
Direct Beta Activity Measurements

Location	M2350 Serial #	Detector Serial #	Date	Logged counts	Count Time (sec)	Count Type	Efficiency	Background cpm	Activity dpm/100cm^2	MDA dpm/100cm^2
Building Exteriors: Instrument Room Exterior										
P611BINTEX	82958	95523	9/22/2003	179	30	FLDCT	0.200	197	639	287
P611BINTEX	82958	95523	9/22/2003	140	30	FLDCT	0.200	197	329	287
P611BINTEX	82958	95523	9/22/2003	152	30	FLDCT	0.200	197	425	287
P611BINTEX	82958	95523	9/22/2003	166	30	FLDCT	0.200	197	536	287
P611BINTEX	82958	95523	9/22/2003	148	30	FLDCT	0.200	197	393	287
P611BINTEX	82958	95523	9/22/2003	140	30	FLDCT	0.200	197	329	287
P611BINTEX	82958	95523	9/22/2003	130	30	FLDCT	0.200	197	250	287
P611BINTEX	82958	95523	9/22/2003	147	30	FLDCT	0.200	197	385	287
P611BINTEX	82958	95523	9/22/2003	147	30	FLDCT	0.200	197	385	287
P611BINTEX	82958	95523	9/22/2003	133	30	FLDCT	0.200	197	274	287
P611BINTEX	82958	95523	9/22/2003	135	30	FLDCT	0.200	197	290	287
P611BINTEX	82958	95523	9/22/2003	125	30	FLDCT	0.200	197	210	287
P611BINTEX	82958	95523	9/22/2003	130	30	FLDCT	0.200	197	250	287
P611BINTEX	82958	95523	9/22/2003	138	30	FLDCT	0.200	197	313	287
P611BINTEX	82958	95523	9/22/2003	104	30	FLDCT	0.200	197	44	287
P611BINTEX	82958	95523	9/22/2003	108	30	FLDCT	0.200	197	75	287

Summary: Building Exteriors - Instrument Room Exterior
(Survey Package 04)

Number	**16**	
Mean	**320**	**dpm/100cm^2**
Maximum	**639**	**dpm/100cm^2**
Standard Deviation	**149**	**dpm/100cm^2**

Attachment B
Direct Beta Activity Measurements

Location	M2350 Serial #	Detector Serial #	Date	Logged counts	Count Time (sec)	Count Type	Efficiency	Background cpm	Activity dpm/100cm^2	MDA dpm/100cm^2
Building Exteriors: Non DU Tunnel Roof and Instrument Room Roof										
P611BNDR01	82958	95523	9/22/2003	196	30	FLDCT	0.200	197	774	287
P611BNDR01	82958	95523	9/22/2003	209	30	FLDCT	0.200	197	877	287
P611BNDR01	82958	95523	9/22/2003	216	30	FLDCT	0.200	197	933	287
P611BNDR01	82958	95523	9/22/2003	189	30	FLDCT	0.200	197	718	287
P611BNDR01	82958	95523	9/22/2003	195	30	FLDCT	0.200	197	766	287
P611BNDR01	82958	95523	9/22/2003	105	30	FLDCT	0.200	197	52	287
P611BNDR01	82958	95523	9/22/2003	87	30	FLDCT	0.200	197	-91	287
P611BNDR01	82958	95523	9/22/2003	69	30	FLDCT	0.200	197	-234	287
P611BNDR01	82958	95523	9/22/2003	73	30	FLDCT	0.200	197	-202	287
P611BNDR01	82958	95523	9/22/2003	84	30	FLDCT	0.200	197	-115	287
P611BNDR01	82958	95523	9/22/2003	65	30	FLDCT	0.200	197	-266	287
P611BNDR01	82958	95523	9/22/2003	69	30	FLDCT	0.200	197	-234	287
P611BNDR01	82958	95523	9/22/2003	60	30	FLDCT	0.200	197	-306	287
P611BNDR01	82958	95523	9/22/2003	67	30	FLDCT	0.200	197	-250	287
P611BNDR01	82958	95523	9/22/2003	64	30	FLDCT	0.200	197	-274	287
P611BNDR01	82958	95523	9/22/2003	77	30	FLDCT	0.200	197	-171	287
P611BNDR01	82958	95523	9/22/2003	80	30	FLDCT	0.200	197	-147	287
P611BNDR01	82958	95523	9/22/2003	102	30	FLDCT	0.200	197	28	287
P611BNDR01	82958	95523	9/22/2003	124	30	FLDCT	0.200	197	202	287
P611BNDR01	82958	95523	9/22/2003	129	30	FLDCT	0.200	197	242	287
P611BNDR01	82958	95523	9/22/2003	179	30	FLDCT	0.200	197	639	287
P611BNDR01	82958	95523	9/22/2003	160	30	FLDCT	0.200	197	488	287
P611BNDR01	82958	95523	9/22/2003	167	30	FLDCT	0.200	197	544	287
P611BNDR01	82958	95523	9/22/2003	158	30	FLDCT	0.200	197	472	287
P611BNDR01	82958	95523	9/22/2003	182	30	FLDCT	0.200	197	663	287

Summary: Building Exteriors - Non DU Tunnel Roof
(Survey Package 04)

Number	**25**	
Mean	**204**	**dpm/100cm^2**
Maximum	**933**	**dpm/100cm^2**
Standard Deviation	**434**	**dpm/100cm^2**

Attachment B
Direct Beta Activity Measurements

Location	M2350 Serial #	Detector Serial #	Date	Logged counts	Count Time (sec)	Count Type	Efficiency	Background cpm	Activity dpm/100cm^2	MDA dpm/100cm^2
Building Exteriors: Non DU Tunnel										
P611BNDUEX	82958	95523	9/22/2003	223	30	FLDCT	0.200	197	988	287
P611BNDUEX	82958	95523	9/22/2003	255	30	FLDCT	0.200	197	1242	287
P611BNDUEX	82958	95523	9/22/2003	212	30	FLDCT	0.200	197	901	287
P611BNDUEX	82958	95523	9/22/2003	185	30	FLDCT	0.200	197	687	287
P611BNDUEX	82958	95523	9/22/2003	226	30	FLDCT	0.200	197	1012	287
P611BNDUEX	82958	95523	9/22/2003	215	30	FLDCT	0.200	197	925	287
P611BNDUEX	82958	95523	9/22/2003	194	30	FLDCT	0.200	197	758	287
P611BNDUEX	82958	95523	9/22/2003	168	30	FLDCT	0.200	197	552	287
P611BNDUEX	82958	95523	9/22/2003	203	30	FLDCT	0.200	197	829	287
P611BNDUEX	82958	95523	9/22/2003	145	30	FLDCT	0.200	197	369	287
P611BNDUEX	82958	95523	9/22/2003	139	30	FLDCT	0.200	197	321	287
P611BNDUEX	82958	95523	9/22/2003	211	30	FLDCT	0.200	197	893	287
P611BNDUEX	82958	95523	9/22/2003	269	30	FLDCT	0.200	197	1353	287
P611BNDUEX	82958	95523	9/22/2003	213	30	FLDCT	0.200	197	909	287
P611BNDUEX	82958	95523	9/22/2003	215	30	FLDCT	0.200	197	925	287
P611BNDUEX	82958	95523	9/22/2003	189	30	FLDCT	0.200	197	718	287
P611BNDUEX	82958	95523	9/22/2003	201	30	FLDCT	0.200	197	813	287
P611BNDUEX	82958	95523	9/22/2003	183	30	FLDCT	0.200	197	671	287
P611BNDUEX	82958	95523	9/22/2003	202	30	FLDCT	0.200	197	821	287
P611BNDUEX	82958	95523	9/22/2003	201	30	FLDCT	0.200	197	813	287

Summary: Building Exteriors - Non DU Tunnel
(Survey Package 04)

Number	**20**	
Mean	**825**	**dpm/100cm^2**
Maximum	**1353**	**dpm/100cm^2**
Standard Deviation	**246**	**dpm/100cm^2**

Attachment B
Direct Beta Activity Measurements

Location	M2350 Serial #	Detector Serial #	Date	Logged counts	Count Time (sec)	Count Type	Efficiency	Background cpm	Activity dpm/100cm^2	MDA dpm/100cm^2
Storage Room										
P611BSRF01	98648	133988	9/21/2003	298	30	FLDCT	0.227	194	1405	251
P611BSRF01	98648	133988	9/21/2003	288	30	FLDCT	0.227	194	1336	251
P611BSRF01	98648	133988	9/21/2003	345	30	FLDCT	0.227	194	1734	251
P611BSRF01	98648	133988	9/21/2003	336	30	FLDCT	0.227	194	1671	251
P611BSRF01	98648	133988	9/21/2003	272	30	FLDCT	0.227	194	1224	251
P611BSRF01	98648	133988	9/21/2003	403	30	FLDCT	0.227	194	2140	251
P611BSRF01	98648	133988	9/21/2003	299	30	FLDCT	0.227	194	1412	251
P611BSRF01	98648	133988	9/21/2003	297	30	FLDCT	0.227	194	1399	251
P611BSRF01	98648	133988	9/21/2003	325	30	FLDCT	0.227	194	1594	251
P611BSRF01	98648	133988	9/21/2003	207	30	FLDCT	0.227	194	769	251
P611BSRF01	98648	133988	9/21/2003	217	30	FLDCT	0.227	194	839	251
P611BSRF01	98648	133988	9/21/2003	400	30	FLDCT	0.227	194	2119	251
P611BSRF01	98648	133988	9/21/2003	211	30	FLDCT	0.227	194	797	251
P611BSRF01	98648	133988	9/21/2003	211	30	FLDCT	0.227	194	797	251
P611BSRF01	98648	133988	9/21/2003	412	30	FLDCT	0.227	194	2203	251
P611BSRW01	98648	133988	9/21/2003	97	30	FLDCT	0.227	194	0	251
P611BSRW01	98648	133988	9/21/2003	89	30	FLDCT	0.227	194	-56	251
P611BSRW01	98648	133988	9/21/2003	104	30	FLDCT	0.227	194	49	251
P611BSRW01	98648	133988	9/21/2003	99	30	FLDCT	0.227	194	14	251
P611BSRW01	98648	133988	9/21/2003	116	30	FLDCT	0.227	194	133	251
P611BSRW01	98648	133988	9/21/2003	109	30	FLDCT	0.227	194	84	251
P611BSRW01	98648	133988	9/21/2003	134	30	FLDCT	0.227	194	259	251
P611BSRW01	98648	133988	9/21/2003	190	30	FLDCT	0.227	194	650	251
P611BSRW01	98648	133988	9/21/2003	81	30	FLDCT	0.227	194	-112	251
P611BSRW01	98648	133988	9/21/2003	75	30	FLDCT	0.227	194	-154	251
P611BSRW01	98648	133988	9/21/2003	85	30	FLDCT	0.227	194	-84	251
P611BSRW01	98648	133988	9/21/2003	77	30	FLDCT	0.227	194	-140	251
P611BSRW01	98648	133988	9/21/2003	83	30	FLDCT	0.227	194	-98	251
P611BSRW01	98648	133988	9/21/2003	69	30	FLDCT	0.227	194	-196	251
P611BSRW01	98648	133988	9/21/2003	82	30	FLDCT	0.227	194	-105	251
P611BSRW01	98648	133988	9/21/2003	95	30	FLDCT	0.227	194	-14	251
P611BSRW01	98648	133988	9/21/2003	79	30	FLDCT	0.227	194	-126	251

Attachment B
Direct Beta Activity Measurements

Location	M2350 Serial #	Detector Serial #	Date	Logged counts	Count Time (sec)	Count Type	Efficiency	Background cpm	Activity dpm/100cm^2	MDA dpm/100cm^2
P611BSRW01	98648	133988	9/21/2003	87	30	FLDCT	0.227	194	-70	251
P611BSRW01	98648	133988	9/21/2003	85	30	FLDCT	0.227	194	-84	251
P611BSRW01	98648	133988	9/21/2003	92	30	FLDCT	0.227	194	-35	251
P611BSRW01	98648	133988	9/21/2003	151	30	FLDCT	0.227	194	378	251
P611BSRW01	98648	133988	9/21/2003	232	30	FLDCT	0.227	194	944	251
P611BSRW01	98648	133988	9/21/2003	100	30	FLDCT	0.227	194	21	251
P611BSRW01	98648	133988	9/21/2003	76	30	FLDCT	0.227	194	-147	251
P611BSRW01	98648	133988	9/21/2003	78	30	FLDCT	0.227	194	-133	251
P611BSRW01	98648	133988	9/21/2003	72	30	FLDCT	0.227	194	-175	251
P611BSRW01	98648	133988	9/21/2003	62	30	FLDCT	0.227	194	-245	251
P611BSRW02	98648	133988	9/21/2003	63	30	FLDCT	0.227	194	-238	251
P611BSRW02	98648	133988	9/21/2003	91	30	FLDCT	0.227	194	-42	251
P611BSRW02	98648	133988	9/21/2003	95	30	FLDCT	0.227	194	-14	251
P611BSRW02	98648	133988	9/21/2003	85	30	FLDCT	0.227	194	-84	251
P611BSRW02	98648	133988	9/21/2003	81	30	FLDCT	0.227	194	-112	251
P611BSRW02	98648	133988	9/21/2003	99	30	FLDCT	0.227	194	14	251
P611BSRW02	98648	133988	9/21/2003	92	30	FLDCT	0.227	194	-35	251
P611BSRW02	98648	133988	9/21/2003	101	30	FLDCT	0.227	194	28	251
P611BSRW02	98648	133988	9/21/2003	98	30	FLDCT	0.227	194	7	251
P611BSRW02	98648	133988	9/21/2003	117	30	FLDCT	0.227	194	140	251
P611BSRW02	98648	133988	9/21/2003	114	30	FLDCT	0.227	194	119	251
P611BSRW02	98648	133988	9/21/2003	94	30	FLDCT	0.227	194	-21	251
P611BSRW02	98648	133988	9/21/2003	133	30	FLDCT	0.227	194	252	251
P611BSRW02	98648	133988	9/21/2003	119	30	FLDCT	0.227	194	154	251
P611BSRW02	98648	133988	9/21/2003	108	30	FLDCT	0.227	194	77	251
P611BSRW02	98648	133988	9/21/2003	86	30	FLDCT	0.227	194	-77	251
P611BSRW02	98648	133988	9/21/2003	93	30	FLDCT	0.227	194	-28	251
P611BSRW02	98648	133988	9/21/2003	118	30	FLDCT	0.227	194	147	251
P611BSRW02	98648	133988	9/21/2003	105	30	FLDCT	0.227	194	56	251
P611BSRW02	98648	133988	9/21/2003	93	30	FLDCT	0.227	194	-28	251
P611BSRW02	98648	133988	9/21/2003	90	30	FLDCT	0.227	194	-49	251
P611BSRW02	98648	133988	9/21/2003	96	30	FLDCT	0.227	194	-7	251
P611BSRW02	98648	133988	9/21/2003	94	30	FLDCT	0.227	194	-21	251

Attachment B
Direct Beta Activity Measurements

Location	M2350 Serial #	Detector Serial #	Date	Logged counts	Count Time (sec)	Count Type	Efficiency	Background cpm	Activity dpm/100cm^2	MDA dpm/100cm^2
P611BSRW02	98648	133988	9/21/2003	83	30	FLDCT	0.227	194	-98	251
P611BSRW02	98648	133988	9/21/2003	95	30	FLDCT	0.227	194	-14	251
P611BSRW02	98648	133988	9/21/2003	94	30	FLDCT	0.227	194	-21	251
P611BSRW02	98648	133988	9/21/2003	88	30	FLDCT	0.227	194	-63	251
P611BSRW02	98648	133988	9/21/2003	80	30	FLDCT	0.227	194	-119	251
P611BSRW02	98648	133988	9/21/2003	85	30	FLDCT	0.227	194	-84	251
P611BSRW02	98648	133988	9/21/2003	81	30	FLDCT	0.227	194	-112	251

Summary: Storage Room
(Survey Package 05)

Number	**72**	
Mean	**302**	**dpm/100cm^2**
Maximum	**2203**	**dpm/100cm^2**
Standard Deviation	**646**	**dpm/100cm^2**

Attachment B
Direct Beta Activity Measurements

Location	M2350 Serial #	Detector Serial #	Date	Logged counts	Count Time (sec)	Count Type	Efficiency	Background cpm	Activity dpm/100cm^2	MDA dpm/100cm^2
Structure 1: Structure Behind Indoor Storage Room										
P611BTBS01	98648	133988	9/21/2003	123	30	FLDCT	0.227	194	182	251
P611BTBS01	98648	133988	9/21/2003	79	30	FLDCT	0.227	194	-126	251
P611BTBS01	98648	133988	9/21/2003	120	30	FLDCT	0.227	194	161	251
P611BTBS01	98648	133988	9/21/2003	78	30	FLDCT	0.227	194	-133	251
P611BTBS01	98648	133988	9/21/2003	116	30	FLDCT	0.227	194	133	251
P611BTBS01	98648	133988	9/21/2003	126	30	FLDCT	0.227	194	203	251
P611BTBS01	98648	133988	9/21/2003	104	30	FLDCT	0.227	194	49	251
P611BTBS01	98648	133988	9/21/2003	52	30	FLDCT	0.227	194	-315	251
P611BTBS01	98648	133988	9/21/2003	43	30	FLDCT	0.227	194	-378	251
P611BTBS01	98648	133988	9/21/2003	60	30	FLDCT	0.227	194	-259	251
P611BTBS01	98648	133988	9/21/2003	43	30	FLDCT	0.227	194	-378	251
P611BTBS01	98648	133988	9/21/2003	50	30	FLDCT	0.227	194	-329	251

Summary: Structure 1 - Structure Behind Indoor Storage Room
(Survey Package 05)

Number	**12**	
Mean	**-99**	**dpm/100cm^2**
Maximum	**203**	**dpm/100cm^2**
Standard Deviation	**233**	**dpm/100cm^2**

Attachment B
Direct Beta Activity Measurements

Location	M2350 Serial #	Detector Serial #	Date	Logged counts	Count Time (sec)	Count Type	Efficiency	Background cpm	Activity dpm/100cm^2	MDA dpm/100cm^2
Structure 2: Structure Adjacent to Bunker										
P611BTBS02	98648	133988	9/21/2003	202	30	FLDCT	0.227	194	734	251
P611BTBS02	98648	133988	9/21/2003	179	30	FLDCT	0.227	194	573	251
P611BTBS02	98648	133988	9/21/2003	72	30	FLDCT	0.227	194	-175	251
P611BTBS02	98648	133988	9/21/2003	92	30	FLDCT	0.227	194	-35	251
P611BTBS02	98648	133988	9/21/2003	105	30	FLDCT	0.227	194	56	251
P611BTBS02	98648	133988	9/21/2003	119	30	FLDCT	0.227	194	154	251
P611BTBS02	98648	133988	9/21/2003	101	30	FLDCT	0.227	194	28	251
P611BTBS02	98648	133988	9/21/2003	107	30	FLDCT	0.227	194	70	251
P611BTBS02	98648	133988	9/21/2003	81	30	FLDCT	0.227	194	-112	251
P611BTBS02	98648	133988	9/21/2003	92	30	FLDCT	0.227	194	-35	251
P611BTBS02	98648	133988	9/21/2003	89	30	FLDCT	0.227	194	-56	251
P611BTBS02	98648	133988	9/21/2003	82	30	FLDCT	0.227	194	-105	251

Summary: Structure 2 - Structure Adjacent to Bunker
(Survey Package 05)

Number	**12**	
Mean	**91**	**dpm/100cm^2**
Maximum	**734**	**dpm/100cm^2**
Standard Deviation	**280**	**dpm/100cm^2**

Attachment B
Direct Beta Activity Measurements

Location	M2350 Serial #	Detector Serial #	Date	Logged counts	Count Time (sec)	Count Type	Efficiency	Background cpm	Activity dpm/100cm^2	MDA dpm/100cm^2
Structure 3: Crane										
P611BSRS03	98648	133988	9/21/2003	75	30	FLDCT	0.227	194	-154	251
P611BSRS03	98648	133988	9/21/2003	71	30	FLDCT	0.227	194	-182	251
P611BSRS03	98648	133988	9/21/2003	71	30	FLDCT	0.227	194	-182	251
P611BSRS03	98648	133988	9/21/2003	67	30	FLDCT	0.227	194	-210	251

Summary: Structure 3 - Crane
(Survey Package 05)

Number	4	
Mean	-182	**dpm/100cm^2**
Maximum	-154	**dpm/100cm^2**
Standard Deviation	23	**dpm/100cm^2**

Attachment B
Direct Beta Activity Measurements

Location	M2350 Serial #	Detector Serial #	Date	Logged counts	Count Time (sec)	Count Type	Efficiency	Background cpm	Activity dpm/100cm^2	MDA dpm/100cm^2
Electrical Storage Shelter 1 Interior										
P611BES1IN	82958	95523	9/24/2003	96	30	FLDCT	0.200	200	-32	289
P611BES1IN	82958	95523	9/24/2003	85	30	FLDCT	0.200	200	-119	289
P611BES1IN	82958	95523	9/24/2003	98	30	FLDCT	0.200	200	-16	289
P611BES1IN	82958	95523	9/24/2003	101	30	FLDCT	0.200	200	8	289
P611BES1IN	82958	95523	9/24/2003	112	30	FLDCT	0.200	200	95	289
P611BES1IN	82958	95523	9/24/2003	96	30	FLDCT	0.200	200	-32	289
P611BES1IN	82958	95523	9/24/2003	70	30	FLDCT	0.200	200	-238	289
P611BES1IN	82958	95523	9/24/2003	101	30	FLDCT	0.200	200	8	289
P611BES1IN	82958	95523	9/24/2003	89	30	FLDCT	0.200	200	-87	289
P611BES1IN	82958	95523	9/24/2003	72	30	FLDCT	0.200	200	-222	289
P611BES1IN	82958	95523	9/24/2003	117	30	FLDCT	0.200	200	135	289
P611BES1IN	82958	95523	9/24/2003	117	30	FLDCT	0.200	200	135	289
P611BES1IN	82958	95523	9/24/2003	113	30	FLDCT	0.200	200	103	289
P611BES1IN	82958	95523	9/24/2003	102	30	FLDCT	0.200	200	16	289
P611BES1IN	82958	95523	9/24/2003	104	30	FLDCT	0.200	200	32	289
P611BES1IN	82958	95523	9/24/2003	111	30	FLDCT	0.200	200	87	289

Summary: Electrical Storage Shelter 1 Interior
(Survey Package 06)

Number	**16**	
Mean	**-8**	**dpm/100cm^2**
Maximum	**135**	**dpm/100cm^2**
Standard Dev	**114**	**dpm/100cm^2**

Attachment B
Direct Beta Activity Measurements

Location	M2350 Serial #	Detector Serial #	Date	Logged counts	Count Time (sec)	Count Type	Efficiency	Background cpm	Activity dpm/100cm^2	MDA dpm/100cm^2
Electrical Storage Shelter 2 Interior										
P611BES2IN	82958	95523	9/24/2003	97	30	FLDCT	0.200	200	-24	289
P611BES2IN	82958	95523	9/24/2003	81	30	FLDCT	0.200	200	-151	289
P611BES2IN	82958	95523	9/24/2003	93	30	FLDCT	0.200	200	-56	289
P611BES2IN	82958	95523	9/24/2003	92	30	FLDCT	0.200	200	-63	289
P611BES2IN	82958	95523	9/24/2003	102	30	FLDCT	0.200	200	16	289
P611BES2IN	82958	95523	9/24/2003	95	30	FLDCT	0.200	200	-40	289
P611BES2IN	82958	95523	9/24/2003	100	30	FLDCT	0.200	200	0	289
P611BES2IN	82958	95523	9/24/2003	82	30	FLDCT	0.200	200	-143	289
P611BES2IN	82958	95523	9/24/2003	74	30	FLDCT	0.200	200	-206	289
P611BES2IN	82958	95523	9/24/2003	90	30	FLDCT	0.200	200	-79	289
P611BES2IN	82958	95523	9/24/2003	125	30	FLDCT	0.200	200	198	289
P611BES2IN	82958	95523	9/24/2003	157	30	FLDCT	0.200	200	452	289
P611BES2IN	82958	95523	9/24/2003	152	30	FLDCT	0.200	200	413	289
P611BES2IN	82958	95523	9/24/2003	114	30	FLDCT	0.200	200	111	289
P611BES2IN	82958	95523	9/24/2003	131	30	FLDCT	0.200	200	246	289
P611BES2IN	82958	95523	9/24/2003	122	30	FLDCT	0.200	200	175	289

Summary: Electrical Storage Shelter 2 Interior
(Survey Package 06)

Number	**16**	
Mean	**53**	**dpm/100cm^2**
Maximum	**452**	**dpm/100cm^2**
Standard Deviation	**196**	**dpm/100cm^2**

Attachment B
Direct Beta Activity Measurements

Location	M2350 Serial #	Detector Serial #	Date	Logged counts	Count Time (sec)	Count Type	Efficiency	Background cpm	Activity dpm/100cm^2	MDA dpm/100cm^2
Electrical Storage Shelter 1 Exterior										
P611BES1EX	82958	95523	9/23/2003	89	30	FLDCT	0.200	200	-87	289
P611BES1EX	82958	95523	9/23/2003	93	30	FLDCT	0.200	200	-56	289
P611BES1EX	82958	95523	9/23/2003	105	30	FLDCT	0.200	200	40	289
P611BES1EX	82958	95523	9/23/2003	97	30	FLDCT	0.200	200	-24	289
P611BES1EX	82958	95523	9/23/2003	105	30	FLDCT	0.200	200	40	289
P611BES1EX	82958	95523	9/23/2003	93	30	FLDCT	0.200	200	-56	289
P611BES1EX	82958	95523	9/23/2003	79	30	FLDCT	0.200	200	-167	289
P611BES1EX	82958	95523	9/23/2003	66	30	FLDCT	0.200	200	-270	289
P611BES1EX	82958	95523	9/23/2003	127	30	FLDCT	0.200	200	214	289
P611BES1EX	82958	95523	9/23/2003	96	30	FLDCT	0.200	200	-32	289
P611BES1EX	82958	95523	9/23/2003	104	30	FLDCT	0.200	200	32	289
P611BES1EX	82958	95523	9/23/2003	167	30	FLDCT	0.200	200	532	289
P611BES1EX	82958	95523	9/23/2003	145	30	FLDCT	0.200	200	357	289
P611BES1EX	82958	95523	9/23/2003	128	30	FLDCT	0.200	200	222	289

Summary: Electrical Storage Shelter 1 Exterior
(Survey Package 07)

Number	**14**	
Mean	**53**	**dpm/100cm^2**
Maximum	**532**	**dpm/100cm^2**
Standard Deviation	**212**	**dpm/100cm^2**

Attachment B
Direct Beta Activity Measurements

Location	M2350 Serial #	Detector Serial #	Date	Logged counts	Count Time (sec)	Count Type	Efficiency	Background cpm	Activity dpm/100cm^2	MDA dpm/100cm^2
Electrical Storage Shelter 2 Exterior										
P611BES2EX	82958	95523	9/23/2003	106	30	FLDCT	0.200	200	48	289
P611BES2EX	82958	95523	9/23/2003	88	30	FLDCT	0.200	200	-95	289
P611BES2EX	82958	95523	9/23/2003	94	30	FLDCT	0.200	200	-48	289
P611BES2EX	82958	95523	9/23/2003	75	30	FLDCT	0.200	200	-198	289
P611BES2EX	82958	95523	9/23/2003	108	30	FLDCT	0.200	200	63	289
P611BES2EX	82958	95523	9/23/2003	85	30	FLDCT	0.200	200	-119	289
P611BES2EX	82958	95523	9/23/2003	79	30	FLDCT	0.200	200	-167	289
P611BES2EX	82958	95523	9/23/2003	95	30	FLDCT	0.200	200	-40	289
P611BES2EX	82958	95523	9/23/2003	90	30	FLDCT	0.200	200	-79	289
P611BES2EX	82958	95523	9/23/2003	82	30	FLDCT	0.200	200	-143	289
P611BES2EX	82958	95523	9/23/2003	89	30	FLDCT	0.200	200	-87	289
P611BES2EX	82958	95523	9/23/2003	79	30	FLDCT	0.200	200	-167	289
P611BES2EX	82958	95523	9/23/2003	88	30	FLDCT	0.200	200	-95	289

Electrical Storage Shelter 2 Exterior
(Survey Package 07)

Number	**13**	
Mean	**-87**	**dpm/100cm^2**
Maximum	**63**	**dpm/100cm^2**
Standard Deviation	**79**	**dpm/100cm^2**

Attachment B
Direct Beta Activity Measurements

Location	M2350 Serial #	Detector Serial #	Date	Logged counts	Count Time (sec)	Count Type	Efficiency	Background cpm	Activity dpm/100cm^2	MDA dpm/100cm^2
Bunker Beyond the Non DU Tunnel Interior										
P611BBUNIN	98648	133988	9/22/2003	181	30	FLDCT	0.200	237	496	313
P611BBUNIN	98648	133988	9/22/2003	170	30	FLDCT	0.200	237	409	313
P611BBUNIN	98648	133988	9/22/2003	170	30	FLDCT	0.200	237	409	313
P611BBUNIN	98648	133988	9/22/2003	166	30	FLDCT	0.200	237	377	313
P611BBUNIN	98648	133988	9/22/2003	156	30	FLDCT	0.200	237	298	313
P611BBUNIN	98648	133988	9/22/2003	173	30	FLDCT	0.200	237	433	313
P611BBUNIN	98648	133988	9/22/2003	171	30	FLDCT	0.200	237	417	313
P611BBUNIN	98648	133988	9/22/2003	196	30	FLDCT	0.200	237	615	313
P611BBUNIN	98648	133988	9/22/2003	174	30	FLDCT	0.200	237	440	313
P611BBUNIN	98648	133988	9/22/2003	187	30	FLDCT	0.200	237	544	313
P611BBUNIN	98648	133988	9/22/2003	184	30	FLDCT	0.200	237	520	313
P611BBUNIN	98648	133988	9/22/2003	167	30	FLDCT	0.200	237	385	313
P611BBUNIN	98648	133988	9/22/2003	188	30	FLDCT	0.200	237	552	313
P611BBUNIN	98648	133988	9/22/2003	160	30	FLDCT	0.200	237	329	313
P611BBUNIN	98648	133988	9/22/2003	163	30	FLDCT	0.200	237	353	313
P611BBUNIN	98648	133988	9/22/2003	158	30	FLDCT	0.200	237	313	313
P611BBUNIN	98648	133988	9/22/2003	167	30	FLDCT	0.200	237	385	313
P611BBUNIN	98648	133988	9/22/2003	157	30	FLDCT	0.200	237	306	313
P611BBUNIN	98648	133988	9/22/2003	179	30	FLDCT	0.200	237	480	313
P611BBUNIN	98648	133988	9/22/2003	176	30	FLDCT	0.200	237	456	313
P611BBUNIN	98648	133988	9/22/2003	173	30	FLDCT	0.200	237	433	313
P611BBUNIN	98648	133988	9/22/2003	186	30	FLDCT	0.200	237	536	313
P611BBUNIN	98648	133988	9/22/2003	178	30	FLDCT	0.200	237	472	313
P611BBUNIN	98648	133988	9/22/2003	177	30	FLDCT	0.200	237	464	313
P611BBUNIN	98648	133988	9/22/2003	174	30	FLDCT	0.200	237	440	313
P611BBUNIN	98648	133988	9/22/2003	184	30	FLDCT	0.200	237	520	313
P611BBUNIN	98648	133988	9/22/2003	176	30	FLDCT	0.200	237	456	313
P611BBUNIN	98648	133988	9/22/2003	198	30	FLDCT	0.200	237	631	313
P611BBUNIN	98648	133988	9/22/2003	199	30	FLDCT	0.200	237	639	313
P611BBUNIN	98648	133988	9/22/2003	204	30	FLDCT	0.200	237	679	313
P611BBUNIN	98648	133988	9/22/2003	164	30	FLDCT	0.200	237	361	313
P611BBUNIN	98648	133988	9/22/2003	198	30	FLDCT	0.200	237	631	313

Attachment B
Direct Beta Activity Measurements

Location	M2350 Serial #	Detector Serial #	Date	Logged counts	Count Time (sec)	Count Type	Efficiency	Background cpm	Activity dpm/100cm^2	MDA dpm/100cm^2
P611BBUNIN	98648	133988	9/22/2003	178	30	FLDCT	0.200	237	472	313
P611BBUNIN	98648	133988	9/22/2003	174	30	FLDCT	0.200	237	440	313
P611BBUNIN	98648	133988	9/22/2003	206	30	FLDCT	0.200	237	694	313
P611BBUNIN	98648	133988	9/22/2003	195	30	FLDCT	0.200	237	607	313
P611BBUNIN	98648	133988	9/22/2003	159	30	FLDCT	0.200	237	321	313
P611BBUNIN	98648	133988	9/22/2003	181	30	FLDCT	0.200	237	496	313
P611BBUNIN	98648	133988	9/22/2003	157	30	FLDCT	0.200	237	306	313
P611BBUNIN	98648	133988	9/22/2003	177	30	FLDCT	0.200	237	464	313
P611BBUNIN	98648	133988	9/22/2003	182	30	FLDCT	0.200	237	504	313
P611BBUNIN	98648	133988	9/22/2003	182	30	FLDCT	0.200	237	504	313
P611BBUNIN	98648	133988	9/22/2003	395	30	FLDCT	0.200	237	2194	313
P611BBUNIN	98648	133988	9/22/2003	197	30	FLDCT	0.200	237	623	313
P611BBUNIN	98648	133988	9/22/2003	173	30	FLDCT	0.200	237	433	313
P611BBUNIN	98648	133988	9/22/2003	171	30	FLDCT	0.200	237	417	313
P611BBUNIN	98648	133988	9/22/2003	187	30	FLDCT	0.200	237	544	313
P611BBUNIN	98648	133988	9/22/2003	189	30	FLDCT	0.200	237	560	313
P611BBUNIN	98648	133988	9/22/2003	176	30	FLDCT	0.200	237	456	313
P611BBUNIN	98648	133988	9/22/2003	178	30	FLDCT	0.200	237	472	313
P611BBUNIN	98648	133988	9/22/2003	188	30	FLDCT	0.200	237	552	313
P611BBUNIN	98648	133988	9/22/2003	187	30	FLDCT	0.200	237	544	313
P611BBUNIN	98648	133988	9/22/2003	170	30	FLDCT	0.200	237	409	313
P611BBUNIN	98648	133988	9/22/2003	198	30	FLDCT	0.200	237	631	313
P611BBUNIN	98648	133988	9/22/2003	215	30	FLDCT	0.200	237	766	313
P611BBUNIN	98648	133988	9/22/2003	180	30	FLDCT	0.200	237	488	313
P611BBUNIN	98648	133988	9/22/2003	212	30	FLDCT	0.200	237	742	313
P611BBUNIN	98648	133988	9/22/2003	206	30	FLDCT	0.200	237	694	313
P611BBUNIN	98648	133988	9/22/2003	212	30	FLDCT	0.200	237	742	313
P611BBUNIN	98648	133988	9/22/2003	184	30	FLDCT	0.200	237	520	313
P611BBUNIN	98648	133988	9/22/2003	174	30	FLDCT	0.200	237	440	313
P611BBUNIN	98648	133988	9/22/2003	226	30	FLDCT	0.200	237	853	313
P611BBUNIN	98648	133988	9/22/2003	200	30	FLDCT	0.200	237	647	313
P611BBUNIN	98648	133988	9/22/2003	232	30	FLDCT	0.200	237	901	313
P611BBUNIN	98648	133988	9/22/2003	224	30	FLDCT	0.200	237	837	313

Attachment B
Direct Beta Activity Measurements

Location	M2350 Serial #	Detector Serial #	Date	Logged counts	Count Time (sec)	Count Type	Efficiency	Background cpm	Activity dpm/100cm^2	MDA dpm/100cm^2
P611BBUNIN	98648	133988	9/22/2003	209	30	FLDCT	0.200	237	718	313
P611BBUNIN	98648	133988	9/22/2003	201	30	FLDCT	0.200	237	655	313
P611BBUNIN	98648	133988	9/22/2003	189	30	FLDCT	0.200	237	560	313
P611BBUNIN	98648	133988	9/22/2003	185	30	FLDCT	0.200	237	528	313
P611BBUNIN	98648	133988	9/22/2003	233	30	FLDCT	0.200	237	909	313
P611BBUNIN	98648	133988	9/22/2003	211	30	FLDCT	0.200	237	734	313
P611BBUNIN	98648	133988	9/22/2003	224	30	FLDCT	0.200	237	837	313
P611BBUNIN	98648	133988	9/22/2003	202	30	FLDCT	0.200	237	663	313
P611BBUNIN	98648	133988	9/22/2003	194	30	FLDCT	0.200	237	599	313
P611BBUNIN	98648	133988	9/22/2003	213	30	FLDCT	0.200	237	750	313
P611BBUNIN	98648	133988	9/22/2003	212	30	FLDCT	0.200	237	742	313
P611BBUNIN	98648	133988	9/22/2003	214	30	FLDCT	0.200	237	758	313
P611BBUNIN	98648	133988	9/22/2003	208	30	FLDCT	0.200	237	710	313
P611BBUNIN	98648	133988	9/22/2003	190	30	FLDCT	0.200	237	567	313
P611BBUNIN	98648	133988	9/22/2003	237	30	FLDCT	0.200	237	940	313

Summary: Bunker Beyond the Non DU Tunnel Interior
(Survey Package 09)

Number	**80**	
Mean	**572**	**dpm/100cm^2**
Maximum	**2194**	**dpm/100cm^2**
Standard Deviation	**240**	**dpm/100cm^2**

Attachment B
Direct Beta Activity Measurements

Location	M2350 Serial #	Detector Serial #	Date	Logged counts	Count Time (sec)	Count Type	Efficiency	Background cpm	Activity dpm/100cm^2	MDA dpm/100cm^2
Bunker Beyond the Non DU Tunnel Exterior										
P611BBUNEX	98648	133988	9/22/2003	367	60	FLDCT	0.2	237	516	222
P611BBUNEX	98648	133988	9/22/2003	342	60	FLDCT	0.2	237	417	222
P611BBUNEX	98648	133988	9/22/2003	331	60	FLDCT	0.2	237	373	222
P611BBUNEX	98648	133988	9/22/2003	358	60	FLDCT	0.2	237	480	222
P611BBUNEX	98648	133988	9/22/2003	373	60	FLDCT	0.2	237	540	222
P611BBUNEX	98648	133988	9/22/2003	321	60	FLDCT	0.2	237	333	222
P611BBUNEX	98648	133988	9/22/2003	186	30	FLDCT	0.200	237	536	313
P611BBUNEX	98648	133988	9/22/2003	172	30	FLDCT	0.200	237	425	313
P611BBUNEX	98648	133988	9/22/2003	176	30	FLDCT	0.200	237	456	313
P611BBUNEX	98648	133988	9/22/2003	172	30	FLDCT	0.200	237	425	313
P611BBUNEX	98648	133988	9/22/2003	149	30	FLDCT	0.200	237	242	313
P611BBUNEX	98648	133988	9/22/2003	136	30	FLDCT	0.200	237	139	313
P611BBUNEX	98648	133988	9/22/2003	151	30	FLDCT	0.200	237	258	313
P611BBUNEX	98648	133988	9/22/2003	177	30	FLDCT	0.200	237	464	313
P611BBUNEX	98648	133988	9/22/2003	187	30	FLDCT	0.200	237	544	313
P611BBUNEX	98648	133988	9/22/2003	181	30	FLDCT	0.200	237	496	313
P611BBUNEX	98648	133988	9/22/2003	179	30	FLDCT	0.200	237	480	313
P611BBUNEX	98648	133988	9/22/2003	175	30	FLDCT	0.200	237	448	313
P611BBUNEX	98648	133988	9/22/2003	214	30	FLDCT	0.200	237	758	313
P611BBUNEX	98648	133988	9/22/2003	187	30	FLDCT	0.200	237	544	313
P611BBUNEX	98648	133988	9/22/2003	173	30	FLDCT	0.200	237	433	313
P611BBUNEX	98648	133988	9/22/2003	212	30	FLDCT	0.200	237	742	313
P611BBUNEX	98648	133988	9/22/2003	190	30	FLDCT	0.200	237	567	313
P611BBUNEX	98648	133988	9/22/2003	195	30	FLDCT	0.200	237	607	313
P611BBUNEX	98648	133988	9/22/2003	223	30	FLDCT	0.200	237	829	313
P611BBUNEX	98648	133988	9/22/2003	148	30	FLDCT	0.200	237	234	313
P611BBUNEX	98648	133988	9/22/2003	167	30	FLDCT	0.200	237	385	313
P611BBUNEX	98648	133988	9/22/2003	177	30	FLDCT	0.200	237	464	313
P611BBUNEX	98648	133988	9/22/2003	163	30	FLDCT	0.200	237	353	313
P611BBUNEX	98648	133988	9/22/2003	139	30	FLDCT	0.200	237	163	313
P611BBUNEX	98648	133988	9/22/2003	142	30	FLDCT	0.200	237	187	313

Attachment B
Direct Beta Activity Measurements

Location	M2350 Serial #	Detector Serial #	Date	Logged counts	Count Time (sec)	Count Type	Efficiency	Background cpm	Activity dpm/100cm^2	MDA dpm/100cm^2
P611BBUNEX	98648	133988	9/22/2003	166	30	FLDCT	0.200	237	377	313
P611BBUNEX	98648	133988	9/22/2003	172	30	FLDCT	0.200	237	425	313
P611BBUNEX	98648	133988	9/22/2003	177	30	FLDCT	0.200	237	464	313
P611BBUNEX	98648	133988	9/22/2003	210	30	FLDCT	0.200	237	726	313
P611BBUNEX	98648	133988	9/22/2003	211	30	FLDCT	0.200	237	734	313
P611BBUNEX	98648	133988	9/22/2003	198	30	FLDCT	0.200	237	631	313
P611BBUNEX	98648	133988	9/22/2003	175	30	FLDCT	0.200	237	448	313
P611BBUNEX	98648	133988	9/22/2003	220	30	FLDCT	0.200	237	806	313
P611BBUNEX	98648	133988	9/22/2003	210	30	FLDCT	0.200	237	726	313
P611BBUNEX	98648	133988	9/22/2003	220	30	FLDCT	0.200	237	806	313
P611BBUNEX	98648	133988	9/22/2003	180	30	FLDCT	0.200	237	488	313
P611BBUNEX	98648	133988	9/22/2003	189	30	FLDCT	0.200	237	560	313
P611BBUNEX	98648	133988	9/22/2003	214	30	FLDCT	0.200	237	758	313
P611BBUNEX	98648	133988	9/22/2003	198	30	FLDCT	0.200	237	631	313
P611BBUNEX	98648	133988	9/22/2003	175	30	FLDCT	0.200	237	448	313
P611BBUNEX	98648	133988	9/22/2003	114	30	FLDCT	0.200	237	-36	313
P611BBUNEX	98648	133988	9/22/2003	171	30	FLDCT	0.200	237	417	313
P611BBUNEX	98648	133988	9/22/2003	172	30	FLDCT	0.200	237	425	313
P611BBUNEX	98648	133988	9/22/2003	181	30	FLDCT	0.200	237	496	313
P611BBUNEX	98648	133988	9/22/2003	194	30	FLDCT	0.200	237	599	313
P611BBUNEX	98648	133988	9/22/2003	193	30	FLDCT	0.200	237	591	313
P611BBUNEX	98648	133988	9/22/2003	194	30	FLDCT	0.200	237	599	313
P611BBUNEX	98648	133988	9/22/2003	173	30	FLDCT	0.200	237	433	313
P611BBUNEX	98648	133988	9/22/2003	188	30	FLDCT	0.200	237	552	313
P611BBUNEX	98648	133988	9/22/2003	216	30	FLDCT	0.200	237	774	313
P611BBUNEX	98648	133988	9/22/2003	210	30	FLDCT	0.200	237	726	313
P611BBUNEX	98648	133988	9/22/2003	179	30	FLDCT	0.200	237	480	313
P611BBUNEX	98648	133988	9/22/2003	196	30	FLDCT	0.200	237	615	313

Summary: Bunker Beyond the Non DU Tunnel Exterior
(Survey Package 09)

Number	**59**	
Mean	**501**	**dpm/100cm^2**
Maximum	**829**	**dpm/100cm^2**
Standard Deviation	**179**	**dpm/100cm^2**

Attachment C

Removable Beta and Alpha Activity

Attacnment C
Removable Alpha and Beta Activity

DU Tunnel - Package 1

BETA ACTIVITY

Instrument Type	BC-4
Serial Number	816
Calibration Due Date	5/27/2004
Efficiency (cpd)	0.234
BKG Count Time (min)	20
BKG (cpm)	26
Sample Count Time (min)	1
MDA (dpm/100 cm^2)	85

Number	Location	Gross Counts counts	Activity dpm/100 cm^2
1	DUTF01A	23	-13
3	DUTF01C	40	60
4	DUTF01D	31	21
5	DUTF01E	27	4
1	DUTW01A	34	34
2	DUTW01A	32	26
3	DUTW01A	32	26
4	DUTW01A	31	21
1	DUTW01B	29	13
2	DUTW01B	23	-13
3	DUTW01B	22	-17
4	DUTW01B	37	47
1	DUTW01C	23	-13
2	DUTW01C	28	9
3	DUTW01C	32	26
4	DUTW01C	25	-4
1	DUTW01D	30	17
2	DUTW01D	43	73
3	DUTW01D	24	-9
4	DUTW01D	27	4

ALPHA ACTIVITY

Instrument Type	SAC-4
Serial Number	1169
Calibration Due Date	5/27/2004
Efficiency (cpd)	0.34
BKG Count Time (min)	20
BKG (cpm)	0.4
Sample Count Time (min)	1
MDA (dpm/100 cm^2)	14

Number	Location	Gross Counts counts	Activity dpm/100 cm^2
1	DUTF01A	0	-1
3	DUTF01C	1	2
4	DUTF01D	0	-1
5	DUTF01E	0	-1
1	DUTW01A	0	-1
2	DUTW01A	1	2
3	DUTW01A	1	2
4	DUTW01A	0	-1
1	DUTW01B	1	2
2	DUTW01B	2	5
3	DUTW01B	2	5
4	DUTW01B	1	2
1	DUTW01C	1	2
2	DUTW01C	0	-1
3	DUTW01C	1	2
4	DUTW01C	2	5
1	DUTW01D	0	-1
2	DUTW01D	3	8
3	DUTW01D	0	-1
4	DUTW01D	0	-1

Attachment C
Removable Alpha and Beta Activity

Number	Location	Gross Counts counts	Activity dpm/100 cm^2
1	DUTW01E	27	4
2	DUTW01E	31	21
3	DUTW01E	22	-17
4	DUTW01E	29	13
1	DUTW01F	50	103
2	DUTW01F	32	26
3	DUTW01F	27	4
4	DUTW01F	34	34
5	DUTW01F	30	17
1	DUTW01G	20	-26
2	DUTW01G	21	-21
3	DUTW01G	26	0
4	DUTW01G	28	9
		NUM	**33**
		MEAN	**15**
		MAX	**103**
		STDEV	**28**

Number	Location	Gross Counts counts	Activity dpm/100 cm^2
1	DUTW01E	1	2
2	DUTW01E	4	11
3	DUTW01E	1	2
4	DUTW01E	4	11
1	DUTW01F	8	22
2	DUTW01F	1	2
3	DUTW01F	0	-1
4	DUTW01F	2	5
5	DUTW01F	1	2
1	DUTW01G	1	2
2	DUTW01G	1	2
3	DUTW01G	1	2
4	DUTW01G	1	2
		NUM	**33**
		MEAN	**3**
		MAX	**22**
		STDEV	**5**

Attachment C
Removable Alpha and Beta Activity

Non DU Tunnel - Package 2

BETA ACTIVITY

Instrument Type	BC-4
Serial Number	816
Calibration Due Date	5/27/2004
Efficiency (cpd)	0.234
BKG Count Time (min)	20
BKG (cpm)	26
Sample Count Time (min)	1
MDA (dpm/100 cm^2)	85

Number	Location	Gross Counts counts	Activity dpm/100 cm^2
1	NonDUTF01	23	-13
2	NonDUTF01	38	
3	NonDUTF01	28	9
4	NonDUTF01	27	4
5	NonDUTF01	33	30
6	NonDUTF01	28	9
7	NonDUTF01	29	13
8	NonDUTF01	25	-4
9	NonDUTF01	27	4
10	NonDUTF01	26	0
11	NonDUTF01	27	4
12	NonDUTF01	22	-17
13	NonDUTF01	29	13
14	NonDUTF01	24	-9
15	NonDUTF01	26	0
1	NonDUTW01A	28	9
2	NonDUTW01A	34	34
3	NonDUTW01A	32	26

ALPHA ACTIVITY

Instrument Type	SAC-4
Serial Number	1169
Calibration Due Date	5/27/2004
Efficiency (cpd)	0.34
BKG Count Time (min)	20
BKG (cpm)	0.4
Sample Count Time (min)	1
MDA (dpm/100 cm^2)	14

Number	Location	Gross Counts counts	Activity dpm/100 cm^2
1	NonDUTF01	1	2
2	NonDUTF01	0	
3	NonDUTF01	0	-1
4	NonDUTF01	0	-1
5	NonDUTF01	0	-1
6	NonDUTF01	0	-1
7	NonDUTF01	1	2
8	NonDUTF01	0	-1
9	NonDUTF01	0	-1
10	NonDUTF01	0	-1
11	NonDUTF01	0	-1
12	NonDUTF01	0	-1
13	NonDUTF01	2	5
14	NonDUTF01	0	-1
15	NonDUTF01	0	-1
1	NonDUTW01A	0	-1
2	NonDUTW01A	0	-1
3	NonDUTW01A	0	-1

Attachment C
Removable Alpha and Beta Activity

Number	Location	Gross Counts counts	Activity dpm/100 cm^2
4	NonDUTW01A	34	34
5	NonDUTW01A	29	13
6	NonDUTW01A	25	-4
7	NonDUTW01A	35	38
8	NonDUTW01A	19	-30
9	NonDUTW01A	18	-34
10	NonDUTW01A	31	21
11	NonDUTW01A	17	-38
12	NonDUTW01A	31	21
13	NonDUTW01A	28	9
14	NonDUTW01A	22	-17
15	NonDUTW01A	26	0
16	NonDUTW01A	35	38
17	NonDUTW01A	27	4
18	NonDUTW01A	30	17
19	NonDUTW01A	31	21
20	NonDUTW01A	30	17
21	NonDUTW01A	16	-43
22	NonDUTW01A	31	21
23	NonDUTW01A	30	17
24	NonDUTW01A	29	13
25	NonDUTW01A	27	4
26	NonDUTW01A	31	21
6	NonDUTW01B	27	4
7	NonDUTW01B	23	-13
8	NonDUTW01B	28	9
9	NonDUTW01B	34	34
10	NonDUTW01B	32	26
11	NonDUTW01B	20	-26
12	NonDUTW01B	19	-30
13	NonDUTW01B	13	-56
14	NonDUTW01B	36	43
15	NonDUTW01B	22	-17
16	NonDUTW01B	20	-26
17	NonDUTW01B	25	-4

Number	Location	Gross Counts counts	Activity dpm/100 cm^2
4	NonDUTW01A	0	-1
5	NonDUTW01A	0	-1
6	NonDUTW01A	0	-1
7	NonDUTW01A	0	-1
8	NonDUTW01A	0	-1
9	NonDUTW01A	0	-1
10	NonDUTW01A	0	-1
11	NonDUTW01A	0	-1
12	NonDUTW01A	0	-1
13	NonDUTW01A	1	2
14	NonDUTW01A	1	2
15	NonDUTW01A	0	-1
16	NonDUTW01A	1	2
17	NonDUTW01A	0	-1
18	NonDUTW01A	0	-1
19	NonDUTW01A	0	-1
20	NonDUTW01A	1	2
21	NonDUTW01A	0	-1
22	NonDUTW01A	0	-1
23	NonDUTW01A	0	-1
24	NonDUTW01A	0	-1
25	NonDUTW01A	0	-1
26	NonDUTW01A	0	-1
6	NonDUTW01B	1	2
7	NonDUTW01B	0	-1
8	NonDUTW01B	1	2
9	NonDUTW01B	2	5
10	NonDUTW01B	0	-1
11	NonDUTW01B	2	5
12	NonDUTW01B	0	-1
13	NonDUTW01B	1	2
14	NonDUTW01B	1	2
15	NonDUTW01B	0	-1
16	NonDUTW01B	1	2
17	NonDUTW01B	1	2

Attachment C
Removable Alpha and Beta Activity

Number	Location	Gross Counts counts	Activity dpm/100 cm^2
18	NonDUTW01B	35	38
19	NonDUTW01B	34	34
20	NonDUTW01B	31	21
23	NonDUTW01B	44	77
24	NonDUTW01B	40	60
25	NonDUTW01B	31	21
26	NonDUTW01B	22	-17
27	NonDUTW01B	36	43
4	NonDUTC01A	24	-9
5	NonDUTC01A	18	-34
6	NonDUTC01A	21	-21
7	NonDUTC01A	15	-47
8	NonDUTC01A	28	9
9	NonDUTC01A	17	-38
10	NonDUTC01A	39	56
11	NonDUTC01A	26	0
12	NonDUTC01A	39	56
13	NonDUTC01A	30	17
14	NonDUTC01A	25	-4
15	NonDUTC01A	27	4
16	NonDUTC01B	29	13
1	NonDUTC01B	20	-26
2	NonDUTC01B	36	43
3	NonDUTC01B	31	21
4	NonDUTC01B	26	0
5	NonDUTC01B	22	-17
6	NonDUTC01B	31	21
7	NonDUTC01B	30	17
8	NonDUTC01B	19	-30
9	NonDUTC01B	22	-17
10	NonDUTC01B	25	-4
11	NonDUTC01B	36	43
12	NonDUTC01B	21	-21

Number	Location	Gross Counts counts	Activity dpm/100 cm^2
18	NonDUTW01B	0	-1
19	NonDUTW01B	0	-1
20	NonDUTW01B	3	8
23	NonDUTW01B	0	-1
24	NonDUTW01B	0	-1
25	NonDUTW01B	0	-1
26	NonDUTW01B	0	-1
27	NonDUTW01B	1	2
4	NonDUTC01A	0	-1
5	NonDUTC01A	0	-1
6	NonDUTC01A	1	2
7	NonDUTC01A	0	-1
8	NonDUTC01A	1	2
9	NonDUTC01A	0	-1
10	NonDUTC01A	1	2
11	NonDUTC01A	2	5
12	NonDUTC01A	2	5
13	NonDUTC01A	0	-1
14	NonDUTC01A	0	-1
15	NonDUTC01A	0	-1
16	NonDUTC01B	1	2
1	NonDUTC01B	0	-1
2	NonDUTC01B	0	-1
3	NonDUTC01B	1	2
4	NonDUTC01B	1	2
5	NonDUTC01B	1	2
6	NonDUTC01B	1	2
7	NonDUTC01B	1	2
8	NonDUTC01B	2	5
9	NonDUTC01B	0	-1
10	NonDUTC01B	0	-1
11	NonDUTC01B	1	2
12	NonDUTC01B	0	-1

Attachment C
Removable Alpha and Beta Activity

Number	Location	Gross Counts counts	Activity dpm/100 cm^2
13	NonDUTC01B	35	38
14	NonDUTC01B	27	4
15	NonDUTC01B	35	38
		NUM	**88**
		MEAN	**7**
		MAX	**77**
		STDEV	**26**

Number	Location	Gross Counts counts	Activity dpm/100 cm^2
13	NonDUTC01B	2	5
14	NonDUTC01B	0	-1
15	NonDUTC01B	1	2
		NUM	**88**
		MEAN	**0**
		MAX	**8**
		STDEV	**2**

Attachment C
Removable Alpha and Beta Activity

Foyer and Instrument Room - Package 3

BETA ACTIVITY

Instrument Type	BC-4
Serial Number	816
Calibration Due Date	5/27/2004
Efficiency (cpd)	0.234
BKG Count Time (min)	20
BKG (cpm)	26
Sample Count Time (min)	1
MDA (dpm/100 cm^2)	85

Number	Location	Gross Counts counts	Activity dpm/100 cm^2
1	INF02A	29	13
2	INF02A	18	
3	INF02A	38	51
4	INF02A	29	13
1	INF02B	20	-26
2	INF02B	29	13
3	INF02B	17	-38
4	INF02B	25	-4
1	INF01A	30	17
2	INF01B	22	-17
1	INC01A	19	-30
2	INC01B	26	0
1	INW02A	35	38
2	INW02A	24	-9
3	INW02A	27	4
4	INW02A	39	56
5	INW02A	26	0
6	INW02A	25	-4

ALPHA ACTIVITY

Instrument Type	SAC-4
Serial Number	1169
Calibration Due Date	5/27/2004
Efficiency (cpd)	0.34
BKG Count Time (min)	20
BKG (cpm)	0.4
Sample Count Time (min)	1
MDA (dpm/100 cm^2)	14

Number	Location	Gross Counts counts	Activity dpm/100 cm^2
1	INF02A	0	-1
2	INF02A	0	
3	INF02A	0	-1
4	INF02A	3	8
1	INF02B	0	-1
2	INF02B	1	2
3	INF02B	1	2
4	INF02B	0	-1
1	INF01A	0	-1
2	INF01B	0	-1
1	INC01A	0	-1
2	INC01B	0	-1
1	INW02A	0	-1
2	INW02A	0	-1
3	INW02A	0	-1
4	INW02A	0	-1
5	INW02A	0	-1
6	INW02A	0	-1

Attachment C
Removable Alpha and Beta Activity

Number	Location	Gross Counts counts	Activity dpm/100 cm^2	Number	Location	Gross Counts counts	Activity dpm/100 cm^2
7	INW02A	25	-4	7	INW02A	1	2
8	INW02A	22	-17	8	INW02A	0	-1
9	INW02A	31	21	9	INW02A	0	-1
10	INW02A	34	34	10	INW02A	0	-1
11	INW02A	31	21	11	INW02A	0	-1
1	INW02B	27	4	1	INW02B	2	5
2	INW02B	22	-17	2	INW02B	0	-1
3	INW02B	31	21	3	INW02B	0	-1
4	INW02B	23	-13	4	INW02B	0	-1
5	INW02B	29	13	5	INW02B	0	-1
6	INW02B	24	-9	6	INW02B	0	-1
7	INW02B	25	-4	7	INW02B	0	-1
8	INW02B	31	21	8	INW02B	0	-1
9	INW02B	24	-9	9	INW02B	0	-1
10	INW02B	25	-4	10	INW02B	0	-1
11	INW02B	29	13	11	INW02B	0	-1
1	INC02A	26	0	1	INC02A	0	-1
2	INC02A	28	9	2	INC02A	1	2
3	INC02A	21	-21	3	INC02A	1	2
4	INC02A	30	17	4	INC02A	0	-1
1	INC02B	31	21	1	INC02B	0	-1
2	INC02B	23	-13	2	INC02B	0	-1
3	INC02B	29	13	3	INC02B	0	-1
4	INC02B	25	-4	4	INC02B	0	-1
1	INW01A	33	30	1	INW01A	0	-1
2	INW01A	24	-9	2	INW01A	0	-1
3	INW01A	36	43	3	INW01A	0	-1
4	INW01A	32	26	4	INW01A	0	-1
5	INW01A	30	17	5	INW01A	1	2
6	INW01A	32	26	6	INW01A	0	-1
1	INW01B	22	-17	1	INW01B	0	-1
2	INW01B	25	-4	2	INW01B	0	-1
3	INW01B	23	-13	3	INW01B	0	-1

Attachment C
Removable Alpha and Beta Activity

Number	Location	Gross Counts counts	Activity dpm/100 cm^2
4	INW01B	32	26
5	INW01B	39	56
6	INW01B	34	34
		NUM	**53**
		MEAN	**7**
		MAX	**56**
		STDEV	**22**

Number	Location	Gross Counts counts	Activity dpm/100 cm^2
4	INW01B	0	-1
5	INW01B	0	-1
6	INW01B	0	-1
		NUM	**53**
		MEAN	**-1**
		MAX	**8**
		STDEV	**2**

Attachment C
Removable Alpha and Beta Activity

Building Exteriors - Package Number 4

BETA ACTIVITY

Instrument Type	BC-4
Serial Number	849
Calibration Due Date	3/15/2004
Efficiency (cpd)	0.19
BKG Count Time (min)	20
BKG (cpm)	30.5
Sample Count Time (min)	1
MDA (dpm/100 cm^2)	112

Number	Location	Gross Counts counts	Activity dpm/100 cm^2
1	Inst Bldg RowA	33	13
2	Inst Bldg RowA	24	-34
3	Inst Bldg RowA	35	24
4	Inst Bldg RowA	37	34
5	Inst Bldg RowA	21	-50
6	Inst Bldg RowA	29	-8
7	Inst Bldg RowA	30	-3
8	Inst Bldg RowA	19	-61
1	Inst Bldg RowB	20	-55
2	Inst Bldg RowB	17	-71
3	Inst Bldg RowB	27	-18
4	Inst Bldg RowB	31	3
5	Inst Bldg RowB	28	-13
6	Inst Bldg RowB	26	-24
7	Inst Bldg RowB	25	-29
8	Inst Bldg RowB	30	-3
1	Inst Bldg Roof	29	-8
2	Inst Bldg Roof	34	18
3	Inst Bldg Roof	35	24
4	Inst Bldg Roof	33	13

ALPHA ACTIVITY

Instrument Type	SAC-4
Serial Number	1163
Calibration Due Date	3/15/2004
Efficiency (cpd)	0.371
BKG Count Time (min)	20
BKG (cpm)	0.4
Sample Count Time (min)	1
MDA (dpm/100 cm^2)	13

Number	Location	Gross Counts counts	Activity dpm/100 cm^2
1	Inst Bldg RowA	1	2
2	Inst Bldg RowA	0	-1
3	Inst Bldg RowA	0	-1
4	Inst Bldg RowA	3	7
5	Inst Bldg RowA	1	2
6	Inst Bldg RowA	4	10
7	Inst Bldg RowA	1	2
8	Inst Bldg RowA	1	2
1	Inst Bldg RowB	0	-1
2	Inst Bldg RowB	0	-1
3	Inst Bldg RowB	1	2
4	Inst Bldg RowB	0	-1
5	Inst Bldg RowB	0	-1
6	Inst Bldg RowB	0	-1
7	Inst Bldg RowB	0	-1
8	Inst Bldg RowB	0	-1
1	Inst Bldg Roof	0	-1
2	Inst Bldg Roof	0	-1
3	Inst Bldg Roof	4	10
4	Inst Bldg Roof	0	-1

Attachment C
Removable Alpha and Beta Activity

Number	Location	Gross Counts counts	Activity dpm/100 cm^2
5	Inst Bldg Roof	31	3
7	NonDUTW01A	33	13
8	NonDUTW01A	20	-55
9	NonDUTW01A	30	-3
10	NonDUTW01A	32	8
11	NonDUTW01A	33	13
12	NonDUTW01A	31	3
13	NonDUTW01A	33	13
14	NonDUTW01A	36	29
1	NonDUTW01B	21	-50
2	NonDUTW01B	30	-3
3	NonDUTW01B	28	-13
4	NonDUTW01B	34	18
5	NonDUTW01B	26	-24
6	NonDUTW01B	19	-61
7	NonDUTW01B	30	-3
8	NonDUTW01B	33	13
9	NonDUTW01B	23	-39
10	NonDUTW01B	30	-3
11	NonDUTW01B	22	-45
12	NonDUTW01B	32	8
13	NonDUTW01B	40	50
14	NonDUTW01B	19	-61
15	NonDUTW01B	20	-55
16	NonDUTW01B	37	34
17	NonDUTW01B	25	-29
18	NonDUTW01B	39	45
1	NonDUTR01A	32	8
2	NonDUTR01A	37	34
3	NonDUTR01A	25	-29
4	NonDUTR01A	26	-24
5	NonDUTR01A	40	50
6	NonDUTR01A	38	39
7	NonDUTR01A	25	-29
8	NonDUTR01A	26	-24

Number	Location	Gross Counts counts	Activity dpm/100 cm^2
5	Inst Bldg Roof	0	-1
7	NonDUTW01A	1	2
8	NonDUTW01A	0	-1
9	NonDUTW01A	1	2
10	NonDUTW01A	0	-1
11	NonDUTW01A	0	-1
12	NonDUTW01A	1	2
13	NonDUTW01A	0	-1
14	NonDUTW01A	1	2
1	NonDUTW01B	1	2
2	NonDUTW01B	0	-1
3	NonDUTW01B	1	2
4	NonDUTW01B	0	-1
5	NonDUTW01B	0	-1
6	NonDUTW01B	3	7
7	NonDUTW01B	0	-1
8	NonDUTW01B	0	-1
9	NonDUTW01B	1	2
10	NonDUTW01B	0	-1
11	NonDUTW01B	0	-1
12	NonDUTW01B	0	-1
13	NonDUTW01B	0	-1
14	NonDUTW01B	0	-1
15	NonDUTW01B	0	-1
16	NonDUTW01B	0	-1
17	NonDUTW01B	0	-1
18	NonDUTW01B	0	-1
1	NonDUTR01A	1	2
2	NonDUTR01A	0	-1
3	NonDUTR01A	0	-1
4	NonDUTR01A	0	-1
5	NonDUTR01A	0	-1
6	NonDUTR01A	1	2
7	NonDUTR01A	1	2
8	NonDUTR01A	0	-1

Attachment C
Removable Alpha and Beta Activity

Number	Location	Gross Counts counts	Activity dpm/100 cm^2
9	NonDUTR01A	29	-8
10	NonDUTR01A	28	-13
1	NonDUTR01B	28	-13
2	NonDUTR01B	30	-3
3	NonDUTR01B	25	-29
4	NonDUTR01B	36	29
5	NonDUTR01B	38	39
6	NonDUTR01B	30	-3
7	NonDUTR01B	28	-13
8	NonDUTR01B	32	8
9	NonDUTR01B	28	-13
10	NonDUTR01B	29	-8
1	DUTEXA	23	-39
2	DUTEXA	29	-8
3	DUTEXA	29	-8
1	DUTEXB	28	-13
2	DUTEXB	27	-18
3	DUTEXB	31	3
1	DUTEXC	33	13
2	DUTEXC	36	29
3	DUTEXC	27	-18
1	DUTEXD	30	-3
2	DUTEXD	22	-45
3	DUTEXD	27	-18
1	DUTEXE	32	8
2	DUTEXE	31	3
3	DUTEXE	27	-18
		NUM	**82**
		MEAN	**-7**
		MAX	**50**
		STDEV	**28**

Number	Location	Gross Counts counts	Activity dpm/100 cm^2
9	NonDUTR01A	1	2
10	NonDUTR01A	0	-1
1	NonDUTR01B	0	-1
2	NonDUTR01B	0	-1
3	NonDUTR01B	0	-1
4	NonDUTR01B	2	4
5	NonDUTR01B	2	4
6	NonDUTR01B	2	4
7	NonDUTR01B	1	2
8	NonDUTR01B	2	4
9	NonDUTR01B	0	-1
10	NonDUTR01B	1	2
1	DUTEXA	1	2
2	DUTEXA	0	-1
3	DUTEXA	0	-1
1	DUTEXB	0	-1
2	DUTEXB	0	-1
3	DUTEXB	0	-1
1	DUTEXC	0	-1
2	DUTEXC	3	7
3	DUTEXC	0	-1
1	DUTEXD	0	-1
2	DUTEXD	0	-1
3	DUTEXD	1	2
1	DUTEXE	0	-1
2	DUTEXE	0	-1
3	DUTEXE	0	-1
		NUM	**82**
		MEAN	**0**
		MAX	**10**
		STDEV	**3**

Attachment C
Removable Alpha and Beta Activity

Storage Room and Structures - Package 5

BETA ACTIVITY

Instrument Type	BC-4
Serial Number	816
Calibration Due Date	5/27/2004
Efficiency (cpd)	0.234
BKG Count Time (min)	20
BKG (cpm)	26
Sample Count Time (min)	1
MDA (dpm/100 cm^2)	85

Number	Location	Gross Counts counts	Activity dpm/100 cm^2
1	SRS03	34	34
1	SRSO3	34	-9
2	SRSO3	24	-9
3	SRSO3	25	-4
4	SRSO3	37	47
5	SRSO3	29	13
1	SRS02/IS	20	-26
2	SRS02/IS	34	34
3	SRS02/IS	22	-17
4	SRS02/IS	22	-17
1	SRS02/OS	25	-4
2	SRS02/OS	22	-17
3	SRS02/OS	28	9
4	SRS02/OS	40	60
0	TBS01/OS	25	-4
2	TBS01/OS	29	13
3	TBS01/OS	28	9

ALPHA ACTIVITY

Instrument Type	SAC-4
Serial Number	1169
Calibration Due Date	5/27/2004
Efficiency (cpd)	0.34
BKG Count Time (min)	20
BKG (cpm)	0.4
Sample Count Time (min)	1
MDA (dpm/100 cm^2)	14

Number	Location	Gross Counts counts	Activity dpm/100 cm^2
1	SRS03	0	-1
1	SRSO3	0	-1
2	SRSO3	0	-1
3	SRSO3	0	-1
4	SRSO3	0	-1
5	SRSO3	0	-1
1	SRS02/IS	0	-1
2	SRS02/IS	0	-1
3	SRS02/IS	0	-1
4	SRS02/IS	1	2
1	SRS02/OS	1	2
2	SRS02/OS	0	-1
3	SRS02/OS	0	-1
4	SRS02/OS	0	-1
0	TBS01/OS	0	-1
2	TBS01/OS	0	-1
3	TBS01/OS	0	-1

Attachment C
Removable Alpha and Beta Activity

Number	Location	Gross Counts counts	Activity dpm/100 cm^2	Number	Location	Gross Counts counts	Activity dpm/100 cm^2
4	TBS01/OS	19	-30	4	TBS01/OS	1	2
5	TBS01/OS	26	0	5	TBS01/OS	0	-1
6	TBS01/IS	25	-4	6	TBS01/IS	0	-1
7	TBS01/IS	23	-13	7	TBS01/IS	1	2
8	TBS01/IS	33	30	8	TBS01/IS	0	-1
9	TBS01/IS	31	21	9	TBS01/IS	0	-1
10	TBS01/IS	26	0	10	TBS01/IS	0	-1
11	TBS01/IS	27	4	11	TBS01/IS	0	-1
1	SRF0I A1	27	4	1	SRFOI A1	0	-1
2	SRF0I A2	27	4	2	SRFOI A2	0	-1
3	SRF0I A3	25	-4	3	SRFOI A3	1	2
4	SRF01B1	25	-4	4	SRF01B1	0	-1
5	SRF01B2	24	-9	5	SRF01B2	0	-1
6	SRF01B3	24	-9	6	SRF01B3	0	-1
7	SRF01C1	30	17	7	SRF01C1	0	-1
8	SRF01C2	23	-13	8	SRF01C2	0	-1
9	SRF01C3	27	4	9	SRF01C3	0	-1
10	SRF01 D1	19	-30	10	SRF01 D1	0	-1
11	SRF01 D2	26	0	11	SRF01 D2	0	-1
12	SRF01 D3	17	-38	12	SRF01 D3	0	-1
13	SRF01 E1	21	-21	13	SRF01 E1	1	2
14	SRF01 E2	23	-13	14	SRF01 E2	0	-1
15	SRF01 E3	24	-9	15	SRF01 E3	0	-1
1	SRW01A	25	-4	1	SRW01A	0	-1
2	SRW01A	29	13	2	SRW01A	1	2
3	SRW01A	17	-38	3	SRW01A	0	-1
4	SRW01A	26	0	4	SRW01A	1	2
5	SRW01A	28	9	5	SRW01A	1	2
6	SRW01A	25	-4	6	SRW01A	0	-1
7	SRW01A	26	0	7	SRW01A	0	-1
8	SRW01A	22	-17	8	SRW01A	0	-1
9	SRW01A	28	9	9	SRW01A	0	-1
10	SRW01A	29	13	10	SRW01A	0	-1

Attachment C
Removable Alpha and Beta Activity

Number	Location	Gross Counts counts	Activity dpm/100 cm^2	Number	Location	Gross Counts counts	Activity dpm/100 cm^2
11	SRW01A	23	-13	11	SRW01A	0	-1
12	SRW01A	16	-43	12	SRW01A	0	-1
13	SRW01A	20	-26	13	SRW01A	2	5
1	SRW01B	37	47	1	SRW01B	0	-1
2	SRW01B	26	0	2	SRW01B	0	-1
3	SRW01B	34	34	3	SRW01B	0	-1
4	SRW01B	33	30	4	SRW01B	1	2
5	SRW01B	45	81	5	SRW01B	0	-1
6	SRW01B	24	-9	6	SRW01B	1	2
7	SRW01B	33	30	7	SRW01B	0	-1
8	SRW01B	32	26	8	SRW01B	2	5
9	SRW01B	25	-4	9	SRW01B	1	2
10	SRW01B	24	-9	10	SRW01B	0	-1
11	SRW01B	2	-103	11	SRW01B	0	-1
12	SRW01B	20	-26	12	SRW01B	1	2
13	SRW01B	26	0	13	SRW01B	1	2
1	SRW02A O/S	29	13	1	SRW02A O/S	0	-1
2	SRW02A O/S	21	-21	2	SRW02A O/S	0	-1
3	SRW02A O/S	28	9	3	SRW02A O/S	0	-1
4	SRW02A O/S	30	17	4	SRW02A O/S	0	-1
5	SRW02A O/S	25	-4	5	SRW02A O/S	0	-1
6	SRW02A O/S	26	0	6	SRW02A O/S	1	2
7	SRW02A O/S	28	9	7	SRW02A O/S	0	-1
8	SRW02A O/S	30	17	8	SRW02A O/S	0	-1
9	SRW02A O/S	32	26	9	SRW02A O/S	0	-1
10	SRW02A O/S	29	13	10	SRW02A O/S	0	-1
11	SRW02A O/S	18	-34	11	SRW02A O/S	0	-1
12	SRW02A O/S	27	4	12	SRW02A O/S	0	-1
13	SRW02A O/S	32	26	13	SRW02A O/S	1	2
14	SRW02A O/S	27	4	14	SRW02A O/S	1	2
15	SRW02A O/S	23	-13	15	SRW02A O/S	0	-1
16	SRW02A O/S	34	34	16	SRW02A O/S	0	-1
1	SRW02B O/S	24	-9	1	SRW02B O/S	0	-1
2	SRW02B O/S	25	-4	2	SRW02B O/S	0	-1
3	SRW02B O/S	18	-34	3	SRW02B O/S	1	2

Attachment C
Removable Alpha and Beta Activity

Number	Location	Gross Counts counts	Activity dpm/100 cm^2
4	SRW02B O/S	29	13
5	SRW02B O/S	17	-38
6	SRW02B O/S	19	-30
7	SRW02B O/S	25	-4
8	SRW02B O/S	37	47
9	SRW02B O/S	25	-4
10	SRW02B O/S	25	-4
11	SRW02B O/S	35	38
12	SRW02B O/S	33	30
13	SRW02B O/S	25	-4
14	SRW02B O/S	26	0
15	SRW02B O/S	28	9
16	SRW02B O/S	28	9
		NUM	**98**
		MEAN	**1**
		MAX	**81**
		STDEV	**25**

Number	Location	Gross Counts counts	Activity dpm/100 cm^2
4	SRW02B O/S	0	-1
5	SRW02B O/S	1	2
6	SRW02B O/S	0	-1
7	SRW02B O/S	0	-1
8	SRW02B O/S	0	-1
9	SRW02B O/S	1	2
10	SRW02B O/S	1	2
11	SRW02B O/S	0	-1
12	SRW02B O/S	0	-1
13	SRW02B O/S	1	2
14	SRW02B O/S	0	-1
15	SRW02B O/S	0	-1
16	SRW02B O/S	0	-1
		NUM	**98**
		MEAN	**0**
		MAX	**5**
		STDEV	**1**

Attachment C
Removable Alpha and Beta Activity

Interior Of Electrical Storage Shelters - Package Number 6

BETA ACTIVITY

Instrument Type	BC-4
Serial Number	849
Calibration Due Date	3/15/2004
Efficiency (cpd)	0.19
BKG Count Time (min)	20
BKG (cpm)	30.5
Sample Count Time (min)	1
MDA (dpm/100 cm^2)	112

Number	Location	Gross Counts counts	Activity dpm/100 cm^2
1	ES1INW01	27	-18
2	ES1INW01	33	13
3	ES1INW02	28	-13
4	ES1INW02	21	-50
5	ES1INW02	22	-45
6	ES1INW03	25	-29
7	ES1INW03	26	-24
8	ES1INW04	23	-39
9	ES1INW04	31	3
10	ES1INW04	29	-8
11	ES1INF01	28	-13
12	ES1INF01	27	-18
13	ES1INF01	31	3
14	ES1INC01	34	18
15	ES1INC01	31	3
16	ES1INC01	27	-18
1	ES2INW01	19	-61
2	ES2INW01	22	-45
3	ES2INW02	24	-34

ALPHA ACTIVITY

Instrument Type	SAC-4
Serial Number	1163
Calibration Due Date	3/15/2004
Efficiency (cpd)	0.371
BKG Count Time (min)	20
BKG (cpm)	0.4
Sample Count Time (min)	1
MDA (dpm/100 cm^2)	13

Number	Location	Gross Counts counts	Activity dpm/100 cm^2
1	ES1INW01	0	-1
2	ES1INW01	0	-1
3	ES1INW02	0	-1
4	ES1INW02	0	-1
5	ES1INW02	0	-1
6	ES1INW03	0	-1
7	ES1INW03	0	-1
8	ES1INW04	1	2
9	ES1INW04	1	2
10	ES1INW04	0	-1
11	ES1INF01	0	-1
12	ES1INF01	0	-1
13	ES1INF01	0	-1
14	ES1INC01	0	-1
15	ES1INC01	0	-1
16	ES1INC01	0	-1
1	ES2INW01	0	-1
2	ES2INW01	0	-1
3	ES2INW02	0	-1

Attachment C
Removable Alpha and Beta Activity

Number	Location	Gross Counts counts	Activity dpm/100 cm^2
4	ES2INW02	26	-24
5	ES2INW02	30	-3
6	ES2INW03	15	-82
7	ES2INW03	33	13
8	ES2INW04	29	-8
9	ES2INW04	32	8
10	ES2INW04	26	-24
11	ES2INF01	24	-34
12	ES2INF01	36	29
13	ES2INF01	33	13
14	ES2INC01	30	-3
15	ES2INC01	28	-13
16	ES2INC01	31	3
		NUM	**32**
		MEAN	**-16**
		MAX	**29**
		STDEV	**25**

Number	Location	Gross Counts counts	Activity dpm/100 cm^2
4	ES2INW02	0	-1
5	ES2INW02	0	-1
6	ES2INW03	0	-1
7	ES2INW03	1	2
8	ES2INW04	1	2
9	ES2INW04	0	-1
10	ES2INW04	0	-1
11	ES2INF01	0	-1
12	ES2INF01	0	-1
13	ES2INF01	0	-1
14	ES2INC01	0	-1
15	ES2INC01	0	-1
16	ES2INC01	0	-1
		NUM	**32**
		MEAN	**-1**
		MAX	**2**
		STDEV	**1**

Attachment C
Removable Alpha and Beta Activity

Exterior Of Electrical Storage Shelters - Package Number 7

BETA ACTIVITY

Instrument Type	BC-4
Serial Number	849
Calibration Due Date	3/15/2004
Efficiency (cpd)	0.19
BKG Count Time (min)	20
BKG (cpm)	30.5
Sample Count Time (min)	1
MDA (dpm/100 cm^2)	112

Number	Location	Gross Counts counts	Activity dpm/100 cm^2
1	ES1EXW01	40	50
2	ES1EXW01	23	-39
3	ES1EXW02	28	-13
4	ES1EXW02	22	-45
5	ES1EXW02	26	-24
6	ES1EXW03	39	45
7	ES1EXW03	25	-29
8	ES1EXW04	28	-13
9	ES1EXW04	17	-71
10	ES1EXW04	29	-8
11	ES1EXC01	22	-45
12	ES1EXC01	33	13
13	ES1EXC01	19	-61
1	ES2EXW01	30	-3
2	ES2EXW01	22	-45
3	ES2EXW02	37	34
4	ES2EXW02	26	-24
5	ES2EXW02	30	-3
6	ES2EXW03	28	-13

ALPHA ACTIVITY

Instrument Type	SAC-4
Serial Number	1163
Calibration Due Date	3/15/2004
Efficiency (cpd)	0.371
BKG Count Time (min)	20
BKG (cpm)	0.4
Sample Count Time (min)	1
MDA (dpm/100 cm^2)	13

Number	Location	Gross Counts counts	Activity dpm/100 cm^2
1	ES1EXW01	0	-1
2	ES1EXW01	0	-1
3	ES1EXW02	0	-1
4	ES1EXW02	1	2
5	ES1EXW02	3	7
6	ES1EXW03	2	4
7	ES1EXW03	0	-1
8	ES1EXW04	0	-1
9	ES1EXW04	2	4
10	ES1EXW04	1	2
11	ES1EXC01	0	-1
12	ES1EXC01	1	2
13	ES1EXC01	0	-1
1	ES2EXW01	1	2
2	ES2EXW01	0	-1
3	ES2EXW02	0	-1
4	ES2EXW02	0	-1
5	ES2EXW02	0	-1
6	ES2EXW03	0	-1

Attachment C
Removable Alpha and Beta Activity

Number	Location	Gross Counts counts	Activity dpm/100 cm^2
7	ES2EXW03	30	-3
8	ES2EXW04	33	13
9	ES2EXW04	30	-3
10	ES2EXW04	19	-61
11	ES2EXC01	29	-8
12	ES2EXC01	25	-29
13	ES2EXC01	33	13
		NUM	**26**
		MEAN	**-14**
		MAX	**50**
		STDEV	**31**

Number	Location	Gross Counts counts	Activity dpm/100 cm^2
7	ES2EXW03	0	-1
8	ES2EXW04	0	-1
9	ES2EXW04	2	4
10	ES2EXW04	0	-1
11	ES2EXC01	0	-1
12	ES2EXC01	1	2
13	ES2EXC01	0	-1
		NUM	**26**
		MEAN	**0**
		MAX	**7**
		STDEV	**2**

Attachment C
Removable Alpha and Beta Activity

Bunker Beyond Non DU Tunnel - Package Number 9

BETA ACTIVITY

Instrument Type	BC-4
Serial Number	816
Calibration Due Date	5/27/2004
Efficiency (cpd)	0.234
BKG Count Time (min)	20
BKG (cpm)	26
Sample Count Time (min)	1
MDA (dpm/100 cm^2)	85

Number	Location	Gross Counts counts	Activity dpm/100 cm^2
1	BUNEXA	14	-51
2	BUNEXA	21	-21
3	BUNEXA	30	17
4	BUNEXA	27	4
5	BUNEXA	33	30
6	BUNEXA	21	-21
7	BUNEXA	26	0
1	BUNEXW01B	24	-9
2	BUNEXW01B	28	9
3	BUNEXW01B	32	26
4	BUNEXW01B	24	-9
5	BUNEXW01B	23	-13
6	BUNEXW01B	23	-13
7	BUNEXW01B	22	-17
8	BUNEXW01B	15	-47
9	BUNEXW01B	32	26
10	BUNEXW01B	25	-4
11	BUNEXW01B	22	-17
12	BUNEXW01B	20	-26
13	BUNEXW01B	24	-9

ALPHA ACTIVITY

Instrument Type	SAC-4
Serial Number	1169
Calibration Due Date	5/27/2004
Efficiency (cpd)	0.34
BKG Count Time (min)	20
BKG (cpm)	0.4
Sample Count Time (min)	1
MDA (dpm/100 cm^2)	14

Number	Location	Gross Counts counts	Activity dpm/100 cm^2
1	BUNEXA	1	2
2	BUNEXA	0	-1
3	BUNEXA	1	2
4	BUNEXA	0	-1
5	BUNEXA	0	-1
6	BUNEXA	1	2
7	BUNEXA	1	2
1	BUNEXW01B	0	-1
2	BUNEXW01B	0	-1
3	BUNEXW01B	0	-1
4	BUNEXW01B	0	-1
5	BUNEXW01B	0	-1
6	BUNEXW01B	0	-1
7	BUNEXW01B	0	-1
8	BUNEXW01B	1	2
9	BUNEXW01B	1	2
10	BUNEXW01B	2	5
11	BUNEXW01B	1	2
12	BUNEXW01B	0	-1
13	BUNEXW01B	1	2

Attachment C
Removable Alpha and Beta Activity

Number	Location	Gross Counts counts	Activity dpm/100 cm^2	Number	Location	Gross Counts counts	Activity dpm/100 cm^2
15	BUNINW01A	26	0	15	BUNINW01A	0	-1
18	BUNINW01A	19	-30	18	BUNINW01A	0	-1
19	BUNINW01A	22	-17	19	BUNINW01A	0	-1
20	BUNINW01A	28	9	20	BUNINW01A	0	-1
21	BUNINW01A	25	-4	21	BUNINW01A	0	-1
22	BUNINW01A	30	17	22	BUNINW01A	1	2
7	BUNINW01B	21	-21	7	BUNINW01B	0	-1
8	BUNINW01B	23	-13	8	BUNINW01B	0	-1
9	BUNINW01B	25	-4	9	BUNINW01B	1	2
10	BUNINW01B	17	-38	10	BUNINW01B	0	-1
11	BUNINW01B	31	21	11	BUNINW01B	0	-1
12	BUNINW01B	28	9	12	BUNINW01B	1	2
13	BUNINW01B	28	9	13	BUNINW01B	0	-1
14	BUNINW01B	22	-17	14	BUNINW01B	0	-1
15	BUNINW01B	20	-26	15	BUNINW01B	1	2
16	BUNINW01B	26	0	16	BUNINW01B	1	2
17	BUNINW01B	25	-4	17	BUNINW01B	0	-1
28	BUNINW01B	31	21	28	BUNINW01B	0	-1
29	BUNINW01B	19	-30	29	BUNINW01B	0	-1
30	BUNINW01B	22	-17	30	BUNINW01B	1	2
31	BUNINW01B	28	9	31	BUNINW01B	1	2
21	BUNINW01C	26	0	21	BUNINW01C	0	-1
22	BUNINW01C	30	17	22	BUNINW01C	0	-1
23	BUNINW01C	18	-34	23	BUNINW01C	0	-1
24	BUNINW01C	20	-26	24	BUNINW01C	0	-1
25	BUNINW01C	24	-9	25	BUNINW01C	1	2
26	BUNINW01C	16	-43	26	BUNINW01C	0	-1
27	BUNINW01C	26	0	27	BUNINW01C	0	-1
28	BUNINW01C	29	13	28	BUNINW01C	1	2
29	BUNINW01C	32	26	29	BUNINW01C	0	-1
30	BUNINW01C	20	-26	30	BUNINW01C	0	-1
21	BUNINW01D	22	-17	21	BUNINW01D	0	-1
22	BUNINW01D	20	-26	22	BUNINW01D	0	-1
21	BUNINW01E	26	0	21	BUNINW01E	0	-1
22	BUNINW01E	21	-21	22	BUNINW01E	1	2

Attachment C
Removable Alpha and Beta Activity

Instrument Type	BC-4
Serial Number	849
Calibration Due Date	3/15/2004
Efficiency (cpd)	0.19
BKG Count Time (min)	20
BKG (cpm)	30.5
Sample Count Time (min)	1
MDA (dpm/100 cm^2)	112

Number	Location	Gross Counts counts	Activity dpm/100 cm^2
1	BUNEXA	28	-13
2	BUNEXA	37	34
3	BUNEXA	39	45
4	BUNEXA	29	-8
5	BUNEXA	22	-45
6	BUNEXA	28	-13
7	BUNEXA	28	-13
8	BUNEXA	19	-61
9	BUNEXA	26	-24
18	BUNINB	21	-50
19	BUNINB	41	55
20	BUNINB	32	8
21	BUNINB	32	8
22	BUNINB	26	-24
23	BUNINB	33	13
24	BUNINB	26	-24
25	BUNINB	26	-24
26	BUNINB	30	-3
27	BUNINB	26	-24
1	BUNINC	30	-3
2	BUNINC	31	3
3	BUNINC	31	3
4	BUNINC	27	-18
5	BUNINC	25	-29
6	BUNINC	23	-39

Instrument Type	SAC-4
Serial Number	1163
Calibration Due Date	3/15/2004
Efficiency (cpd)	0.371
BKG Count Time (min)	20
BKG (cpm)	0.4
Sample Count Time (min)	1
MDA (dpm/100 cm^2)	13

Number	Location	Gross Counts counts	Activity dpm/100 cm^2
1	BUNEXA	0	-1
2	BUNEXA	0	-1
3	BUNEXA	0	-1
4	BUNEXA	0	-1
5	BUNEXA	0	-1
6	BUNEXA	0	-1
7	BUNEXA	3	7
8	BUNEXA	0	-1
9	BUNEXA	0	-1
18	BUNINB	1	2
19	BUNINB	0	-1
20	BUNINB	0	-1
21	BUNINB	0	-1
22	BUNINB	0	-1
23	BUNINB	0	-1
24	BUNINB	0	-1
25	BUNINB	0	-1
26	BUNINB	0	-1
27	BUNINB	0	-1
1	BUNINC	0	-1
2	BUNINC	0	-1
3	BUNINC	0	-1
4	BUNINC	0	-1
5	BUNINC	0	-1
6	BUNINC	0	-1

Attachment C
Removable Alpha and Beta Activity

Number	Location	Gross Counts counts	Activity dpm/100 cm^2	Number	Location	Gross Counts counts	Activity dpm/100 cm^2
7	BUNINC	37	34	7	BUNINC	0	-1
8	BUNINC	26	-24	8	BUNINC	0	-1
9	BUNINC	25	-29	9	BUNINC	0	-1
10	BUNINC	22	-45	10	BUNINC	0	-1
11	BUNINC	29	-8	11	BUNINC	0	-1
12	BUNINC	27	-18	12	BUNINC	0	-1
13	BUNINC	32	8	13	BUNINC	0	-1
14	BUNINC	26	-24	14	BUNINC	0	-1
15	BUNINC	25	-29	15	BUNINC	0	-1
16	BUNINC	28	-13	16	BUNINC	0	-1
17	BUNINC	31	3	17	BUNINC	0	-1
18	BUNINC	22	-45	18	BUNINC	0	-1
19	BUNINC	29	-8	19	BUNINC	0	-1
20	BUNINC	23	-39	20	BUNINC	0	-1
31	BUNINC	26	-24	31	BUNINC	2	4
32	BUNINC	31	3	32	BUNINC	0	-1
33	BUNINC	23	-39	33	BUNINC	0	-1
34	BUNINC	25	-29	34	BUNINC	0	-1
35	BUNINC	24	-34	35	BUNINC	1	2
36	BUNINC	28	-13	36	BUNINC	1	2
37	BUNINC	31	3	37	BUNINC	1	2
38	BUNINC	29	-8	38	BUNINC	0	-1
		NUM	**135**			**NUM**	**135**
		MEAN	**-7**			**MEAN**	**0**
		MAX	**55**			**MAX**	**7**
		STDEV	**21**			**STDEV**	**2**

Attachment D

Off Site Sample Analysis Results

Attachment D
Off Site Sample Analysis Results (Th-234 Activity Concentration) for Final Survey

Sample Date	Sample ID	Th-234 pCi/g	Uncertainty pCi/g	MDA pCi/g
9/18/2003	Grid #A-1	2.12E+00	1.70E+00	1.21E+00
9/18/2003	Grid #A-2	2.01E-01	7.27E-01	1.31E+00
9/18/2003	Grid #A-3	2.66E-01	1.18E+00	2.22E+00
9/18/2003	Grid #A-4	2.16E+00	1.58E+00	1.61E+00
9/17/2003	Grid #A-5	7.62E-01	7.44E-01	1.26E+00
9/17/2003	Grid #A-6	2.84E-01	9.07E-01	1.60E+00
9/17/2003	Grid #A-7	2.05E+00	1.17E+00	1.48E+00
9/17/2003	Grid #A-8	-4.56E-01	1.00E+00	1.70E+00
9/17/2003	Grid #A-9	1.30E+00	1.33E+00	1.31E+00
9/17/2003	Grid #A-10	2.86E-01	1.08E+00	1.94E+00
9/18/2003	Grid #B-1	1.38E+00	1.46E+00	1.28E+00
9/18/2003	Grid #B-2	4.21E-01	6.99E-01	1.24E+00
9/18/2003	Grid #B-3	1.99E+00	1.87E+00	1.72E+00
9/18/2003	Grid #B-4	2.40E-01	1.05E+00	1.80E+00
9/18/2003	Grid #B-5	5.01E+00	1.98E+00	1.55E+00
9/17/2003	Grid #B-7	1.89E-01	9.57E-01	1.69E+00
9/17/2003	Grid #B-8	7.57E-01	7.99E-01	1.45E+00
9/17/2003	Grid #B-9	-4.36E-01	9.36E-01	1.58E+00
9/17/2003	Grid #B-10	2.76E-01	7.53E-01	1.37E+00
9/18/2003	Grid #C-1	2.64E+00	1.37E+00	1.47E+00
9/18/2003	Grid #C-2	8.41E-01	1.70E+00	3.00E+00
9/18/2003	Grid #C-3	6.42E-01	1.35E+00	2.38E+00
9/18/2003	Grid #C-4	1.90E+00	1.62E+00	1.17E+00
9/18/2003	Grid #C-5	3.97E-01	7.27E-01	1.30E+00
9/17/2003	Grid #C-7	1.23E+00	1.31E+00	2.31E+00
9/17/2003	Grid #C-8	-1.42E-01	1.12E+00	1.93E+00
9/17/2003	Grid #C-9	4.19E-01	7.98E-01	1.45E+00
9/17/2003	Grid #C-10	-1.11E-01	7.38E-01	1.30E+00
	Number	**28**		
	Mean	**9.50E-01**	**pCi/g**	
	Maximum	**5.01E+00**	**pCi/g**	
	Standard Deviation	**1.16E+00**	**pCi/g**	

Attachment D
Off Site Sample Analysis Results (Th-234 Activity Concentration) for Final Survey

Sample Date	Sample ID	Th-234 pCi/g	Uncertainty pCi/g	MDA pCi/g
8/22/2003	Pit 01	-9.72E-02	8.87E-01	1.56E+00
8/22/2003	Pit 02	1.65E+00	1.62E+00	1.75E+00
8/22/2003	Pit 03	7.42E-01	1.06E+00	1.90E+00
8/22/2003	Pit 04	3.72E-01	9.24E-01	1.61E+00
8/22/2003	Pit 05	2.91E-01	1.21E+00	2.16E+00
8/22/2003	Pit 06	-4.40E-02	1.04E+00	1.78E+00
8/22/2003	Pit 07	9.87E-01	9.70E-01	1.72E+00
8/22/2003	Pit 08	6.82E-01	1.07E+00	1.88E+00
8/22/2003	Pit 09	1.40E+00	1.15E+00	1.65E+00
8/22/2003	Pit 10	9.40E-01	9.06E-01	1.66E+00
	Number	**10**		
	Mean	**6.92E-01**	**pCi/g**	
	Maximum	**1.65E+00**	**pCi/g**	
	Standard Deviation	**5.77E-01**	**pCi/g**	