ERRATA SHEET

The Following Corrections and Clarifications Apply to: Corrective Action Decision Document/Closure Report for Corrective Action Unit 482: Area 15 U15a/e Muckpiles and Ponds, Nevada Test Site

DOE Document Number: DOE/NV--1354; 07-DTRA-005

Revision: 0

Original Document Date: May 2007 (Republished September 2009)

This errata sheet was issued under cover letter from DOE on: October 19, 2009

In Appendix E, the Contact (organization/project) on the CAU Use Restriction Information form is listed as NNSA/NSO, Environmental Management. The correct Contact (organization/project) is the NNSA/NSO Federal Industrial Sites Sub-Project Director. The revised CAU Use Restriction Information form is attached.

In addition, the Northeast Corner Northing and Easting coordinates and the Southeast Corner Northing coordinate are incorrect on the CAU Use Restriction Information form and have been corrected on the attached revised form.

CAU Use Restriction Information

CAU Number/Description: CAU 482/Area 15 U15a/e Muckpiles and Ponds

Applicable CAS Numbers/Descriptions: CAS 15-06-01/U15e Muckpile, CAS 15-06-02/U15a Muckpile, and CAS 15-38-01/Area 15 U15a/e Ponds

Contact (organization/project): NNSA/NSO Federal Industrial Sites Sub-Project Director

Surveyed Area (UTM, Zone 11, NAD 27, meters):

UR Points	Northing	Easting
Northwest Corner	4,119,968.33	583,445.38
Northeast Corner	4,119,968.87	583,597.74
East Side Mid Point	4,119,725.63	583,750.96
Southeast Corner	4,119,420.58	583,753.11
Southwest Corner	4,119,420.58	583,660.62
West Side Mid Point	4,119,846.44	583,445.81

Survey Date: 07/27/2004 **Survey Method (GPS, etc):** GPS

Site Monitoring Requirements: Certify that the posting is in place, intact, and readable.

Required Frequency (quarterly, annually?): Annually

If Monitoring Has Started, Indicate last Completion Date: 11/04/2008

Use Restrictions

The future use of any land related to this Corrective Action Unit (CAU), as described by the above surveyed location, is restricted from any DOE or Air Force activity that may alter or modify the containment control as approved by the state and identified in the CAU Closure Report or other CAU documentation unless appropriate concurrence is obtained in advance.

Comments: Americium-241, cesium-137, plutonium-238, and plutonium-239 concentrations that pose an unacceptable risk to human health and environment are present in the U15a Muckpile, the U15a/e Ponds, and the drainage below the U15a Muckpile soil from 0 to 14 feet below ground surface. Therefore, use restrictions have been applied to the surface area from 0 to 150 ft below ground surface over these areas. See the Corrective Action Decision Document/Closure Report for additional information on the condition of the site(s) and any monitoring and/or inspection requirements. Results of the annual inspection will be provided in the annual combined Nevada Test Site Post-Closure Letter Report.

Submitted By: /s/: Kevin Cabble **Date:** 10/19/09

cc with copy of survey map (paper and digital (dgn) formats):

CAU Files (2 copies)

DOE/NV--1354
07-DTRA-005

CORRECTIVE ACTION DECISION DOCUMENT/CLOSURE REPORT FOR CORRECTIVE ACTION UNIT 482: AREA 15 U15a/e MUCKPILES AND PONDS NEVADA TEST SITE

DEFENSE THREAT REDUCTION AGENCY
UNITED STATES OF AMERICA

Controlled Copy No: ________

Revision No.: 0

May 2007
(Republished September 2009)

CORRECTIVE ACTION DECISION DOCUMENT/CLOSURE REPORT FOR CORRECTIVE ACTION UNIT 482: AREA 15 U15a/e MUCKPILES AND PONDS, NEVADA TEST SITE

Prepared by
Defense Threat Reduction Agency
Mercury, Nevada

Controlled Copy No. ____

Revision No.: 0

May 2007
(Republished September 2009)

CORRECTIVE ACTION DECISION DOCUMENT/CLOSURE REPORT FOR CORRECTIVE ACTION UNIT 482: AREA 15 U15a/e MUCKPILES AND PONDS, NEVADA TEST SITE

Approved by: /s/ David C. Loewer for Tiffany Lantow Date: 05/14/2007

Tiffany A. Lantow
Environmental Program Manager
Nevada Operations Office
Defense Threat Reduction Agency

UNCONTROLLED when Printed

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Appendix C – Data Assessment

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Appendix E – Closure Summary

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List of Acronyms and Abbreviations

Ac	Actinium
Am	Americium
ASTM	American Society for Testing and Materials
Bi	Bismuth
bgs	Below ground surface
BN	Bechtel Nevada
CADD/CR	Corrective Action Decision Document/Closure Report
CAI	Corrective Action Investigation
CAIP	Corrective Action Investigation Plan
CAS	Corrective Action Site
CAU	Corrective Action Unit
Co	Cobalt
COC	Contaminant of concern
COPC	Contaminant of potential concern
Cps	Counts per second
Cs	Cesium
CSM	Conceptual site model
DLAPS	Dual Large-Area Plastic Scintillation Detector
DOE	U.S. Department of Energy
DQA	Data quality assessment
DQI	Data quality indicator
DQO	Data quality objective
DRO	Diesel-range organics
DTRA	Defense Threat Reduction Agency
EPA	U.S. Environmental Protection Agency

List of Acronyms and Abbreviations *(continued)*

FAL	Final action level
FFACO	*Federal Facility Agreement and Consent Order*
FSR	Field-screening result
ft	Foot
GPS	Global Positioning System
HPGe	Hyper-pure germanium spectrometer
HWAA	Hazardous waste accumulation area
IDW	Investigation-derived waste
in.	Inch
IT	IT Corporation
K	Potassium
LCS	Laboratory control sample
MDC	Minimum detectable concentration
mg/kg	Milligrams per kilogram
MS	Matrix spike
MSD	Matrix spike duplicate
N/A	Not applicable
NAC	*Nevada Administrative Code*
ND	Nondetect
NDEP	Nevada Division of Environmental Protection
NNSA/NSO	U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office
NRS	*Nevada Revised Statutes*
NTS	Nevada Test Site
PAL	Preliminary action level

List of Acronyms and Abbreviations *(continued)*

Pb	Lead
PCB	Polychlorinated biphenyl
pCi/g	Picocuries per gram
PCOC	Potential contaminant of concern
POC	Performance Objective for the Certification of Nonradioactive Hazardous Waste
PPE	Personal protective equipment
ppm	Parts per million
PRG	Preliminary remediation goal
Pu	Plutonium
QA	Quality assurance
QAPP	Quality Assurance Project Plan
QC	Quality control
RAIS	Risk Assessment Information System
RCRA	*Resource Conservation and Recovery Act*
REOP	Real Estate and Operations Permit
RESRAD	Residual Radioactive
RPD	Relative percent difference
RT	Regulatory threshold
SAPS	Small-Area Plastic Scintillation Detector
Sr	Strontium
SS	Site Supervisor
SSHASP	Site-Specific Health and Safety Plan
SSO	Site Safety Officer
SSTL	Site-specific target level

List of Acronyms and Abbreviations *(continued)*

SVOC	Semivolatile organic compound
Tl	Thallium
TID	Tamper-indicating device
TPH	Total petroleum hydrocarbon
TPH-g	Total petroleum hydrocarbon-gasoline
VOC	Volatile organic compound
yd^3	Cubic yard
μg/kg	Micrograms per kilogram

Executive Summary

This Corrective Action Decision Document /Closure Report (CADD/CR) was prepared by the Defense Threat Reduction Agency (DTRA) for Corrective Action Unit (CAU) 482 U15a/e Muckpiles and Ponds. This CADD/CR is consistent with the requirements of the *Federal Facility Agreement and Consent Order* agreed to by the State of Nevada, the U.S. Department of Energy, and the U.S. Department of Defense. Corrective Action Unit 482 is comprised of three Corrective Action Sites (CASs) and one adjacent area:

- CAS 15-06-01, U15e Muckpile
- CAS 15-06-02, U15a Muckpile
- CAS 15-38-01, Area 15 U15a/e Ponds
- Drainage below the U15a Muckpile

The purpose of this CADD/CR is to provide justification and documentation supporting the recommendation for closure with no further corrective action, by placing use restrictions on the three CASs and the adjacent area of CAU 482. To support this recommendation, a corrective action investigation (CAI) was performed in September 2002. The purpose of the CAI was to fulfill the following data needs as defined during the Data Quality Objective (DQO) process:

- Determine whether contaminants of concern (COCs) are present.
- If COCs are present, determine their nature and extent.
- Provide sufficient information and data to determine appropriate corrective actions.

The CAU 482 dataset from the CAI was evaluated based on the data quality indicator parameters. This evaluation demonstrated the quality and acceptability of the dataset for use in fulfilling the DQO data needs.

Analytes detected during the CAI were evaluated against final action levels (FALs) established in this document. Tier 2 FALS were determined for the hazardous constituents of total petroleum hydrocarbons (TPH)-diesel-range organics (DRO) and the radionuclides americium (Am)-241, cesium (Cs)-137, plutonium (Pu)-238, and Pu-239. The Tier 2 FALs were calculated for the radionuclides using site-specific information. The hazardous constituents of TPH-DRO were compared to the PALs defined in the CAIP, and because none of the preliminary action levels (PALs) were exceeded, the PALs became the FALs. The radionuclide FALs were calculated using the Residual Radioactive (RESRAD) code (version 6.21). The RESRAD calculation determined the activities of all radionuclides that together would sum to an exposure dose of 25 millirem per year to a site receptor (based on their relative abundances at each CAS).

Based on the field investigation, the following contaminants were determined to be present at concentrations exceeding their corresponding FALs:

- CAS 15-06-01 - None.
- CAS 15-06-02 - Cs-137 and Pu-239.
- CAS 15-38-01 - Am-241, Cs-137, Pu-238, and Pu-239.
- Drainage below CAS 15-06-02 - Cs-137 and Pu-239.

Based on the data and risk evaluations, the DQO data needs presented in the Corrective Action Investigation Plan were met, and the data accurately represent the radiological and chemical risk present at CAU 482. Based on the results of the CAI data evaluation, it was determined that closure in place with use restrictions is the appropriate corrective action for CAU 482 and that use restrictions will effectively control exposure to future land users. This is based on the fact that even though the FALs were exceeded in a few samples, this remote, controlled access site poses only limited risk overall to public health and the environment. Given the relatively low levels of contamination present, it would create a greater hazard to worker safety, public health, and the environment to remove the contamination, transport it, and bury it at another location. Therefore, DTRA provides the following recommendations:

- Close COCs in place at CAS 15-06-02, CAS 15-38-01, and the drainage below CAS 15-06-02 with use restrictions.

- No further action for CAU 482.

- A Notice of Completion be issued to DTRA by the Nevada Division of Environmental Protection for closure of CAU 482.

- Move CAU 482 from Appendix III to Appendix IV of the *Federal Facility Agreement and Consent Order*.

1.0 Introduction

This Corrective Action Decision Document/Closure Report (CADD/CR) has been prepared for Corrective Action Unit (CAU) 482, U15a/e Muckpiles and Ponds, Nevada Test Site (NTS). The corrective action proposed in this document complies with the *Federal Facility Agreement and Consent Order* (FFACO) that was agreed to by the State of Nevada, U.S. Department of Energy (DOE), and the U.S. Department of Defense (FFACO, 1996).

The U15a/e Muckpiles and Ponds are identified under FFACO classification as CAU 482, Area 15, U15a/e Muckpiles and Ponds. The CAU consists of three Corrective Action Sites (CASs): 15-06-01, U15e Muckpile; 15-06-02, U15a Muckpile; and 15-38-01 Area 15 U15a/e Ponds. In addition, the drainage below the U15a Muckpile was included in the investigation. The U15a/e Muckpiles and Ponds are located approximately 42 miles north of Mercury in Area 15 of the NTS (Figure 1-1).

This CADD/CR describes the corrective action that is selected as a result of the investigation activities and the rationale for its selection. The rationale consists of a justification for closure in place with use restrictions in accordance with Sections IV.8 and IV.11 of the FFACO (1996).

1.1 Purpose

The purpose of this CADD/CR is to provide justification for the closure of CAU 482 with no further action based on the results of the corrective action investigation (CAI). The CAI was conducted in accordance with the *Corrective Action Investigation Plan* (CAIP) *for Corrective Action Unit 482: Area 15 U15a/e Muckpiles and Ponds, Nevada Test Site* (DTRA, 2002), which provides additional information relating to the history, planning, and scope of the investigation.

The U15a Shaft was used for two nuclear weapons effects tests between 1962 and 1966, and the U15e Shaft was used for one test in 1965. The Muckpiles contain an estimated 160,333 cubic yards (yd^3) of material consisting primarily of mining debris (rock) generated during excavation of the underground facilities; construction/re-entry debris comprise the remainder of the Muckpiles. The Ponds contain approximately 80 yd^3 of fine-grained sediment. The drainage below the U15a Muckpile for a distance of about 1,000 feet (ft) was also included in the CAI.

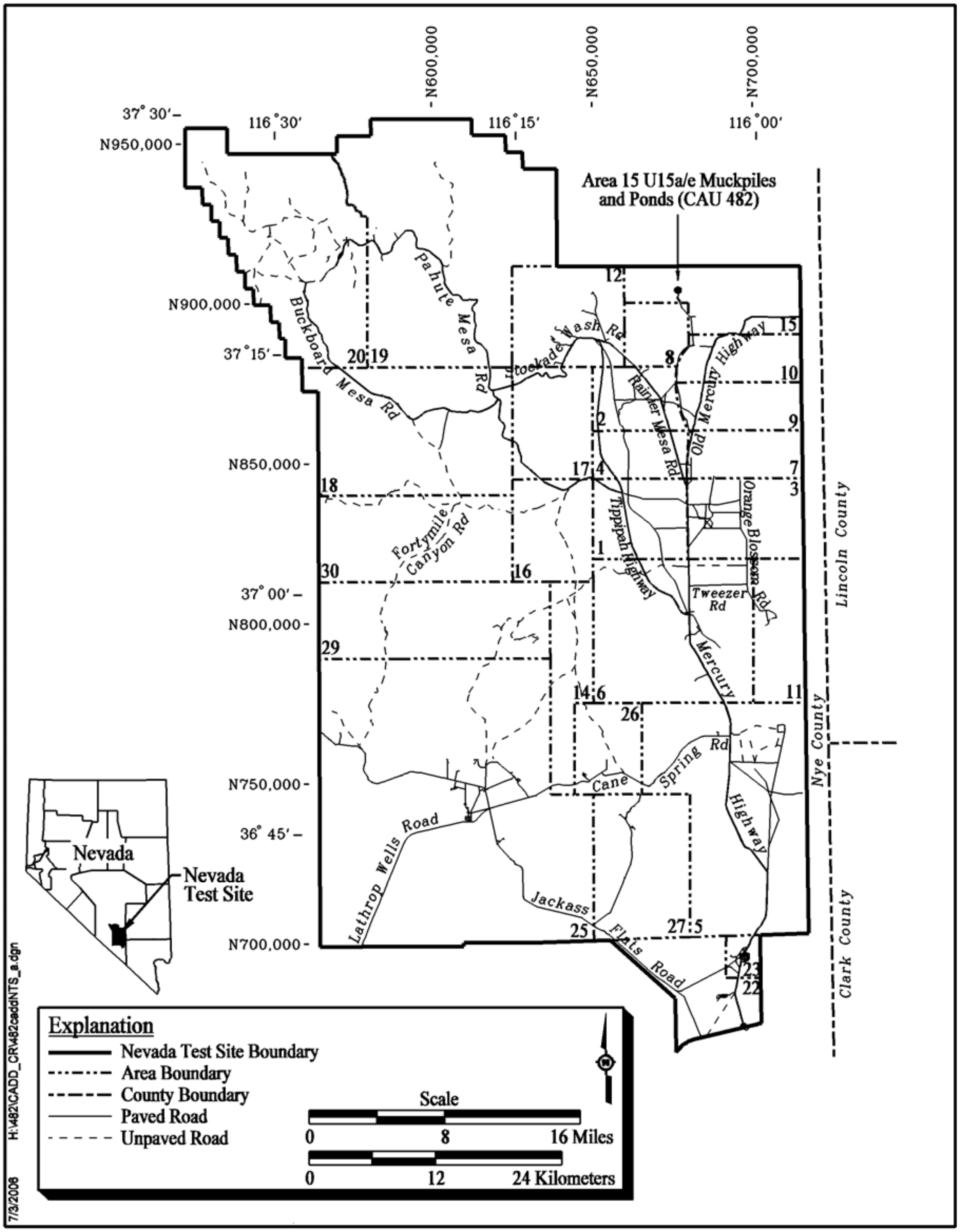

Figure 1-1

U15a/e Muckpiles and Ponds Location Map, Area 15, Nevada Test Site

1.2 Scope

The scope of this CADD/CR is to justify and recommend that no further corrective action is required at CAU 482, Area 15 U15a/e Muckpiles and Ponds. To achieve this scope, the following actions were implemented:

- Evaluation of current site conditions, including the nature and extent of contaminants of concern (COCs).
- Closure in place with use restrictions to prevent exposure of industrial and construction workers to unacceptable risks.

1.3 CADD/CR Contents

This CADD/CR is divided into the following sections:

- Section 1.0 – Introduction: Summary of the purpose, scope, and contents of this CADD/CR.
- Section 2.0 – CAI Summary: Summarizes the investigation field activities, the results of the investigation, and the data quality objective (DQO) assessment.
- Section 3.0 – Recommendation: States why no further action is required.
- Section 4.0 – References: A list of all documents referenced in the CADD/CR.
- Appendix A: Corrective Action Investigation Results.
- Appendix B: Data Quality Objectives Process for CAU 482, Area 15 U15a/e Muckpiles and Ponds.
- Appendix C: Data Assessment.
- Appendix D: Risk Assessment for CAU 482.

All work was performed in accordance with the following documents:

- *Corrective Action Investigation Plan for Corrective Action Unit 482: Area 15 U15a/e Muckpiles and Ponds, Nevada Test Site*, Rev. 0 (DTRA, 2002)
- *Industrial Sites Quality Assurance Project Plan* (QAPP), Rev. 3 (NNSA/NV, 2002)
- *Federal Facility Agreement and Consent Order* (FFACO, 1996)

- *ITLV Site-Specific Health and Safety Plan, Corrective Action Unit 482: Area 15 U15a/e Muckpiles and Ponds, Nevada Test Site*, Rev. 0 (IT, 2002)

The DQOs identified in the CAIP are as follows:

- Determine whether contaminants of concern (COCs) are present.
- If COCs are present, determine their nature and extent. Obtain sufficient information to evaluate potential corrective action alternatives.

The data quality indicators (DQIs) as defined in the Industrial Sites QAPP (NNSA/NV, 2002) were achieved and the DQOs established in the CAIP were met.

2.0 Corrective Action Investigation Summary

The following sections describe and summarize the results of the CAI activities conducted at CAU 482. For detailed CAI results, refer to Appendix A.

2.1 Investigation Activities

From September 12 through 24, 2002, CAI activities were performed at the U15a/e Muckpiles and Ponds as set forth in the CAIP (DTRA, 2002). The purpose of the CAI was to determine whether or not the U15a/e Muckpiles and Ponds and/or the underlying native soils have been impacted by contaminants of potential concern (COPCs) at concentrations that exceed regulatory limits, and to provide sufficient information and data to develop appropriate corrective action strategies for the Muckpiles and Ponds. As outlined in the CAIP (DTRA, 2002), the following tasks were performed:

- **Driveover and walkover radiological surveys** –Before beginning drilling and sampling, driveover and walkover radiological surveys were conducted to identify surface and near-surface areas with elevated readings. The driveover survey was conducted on the Muckpiles, and the walkover surveys were conducted in the Ponds and in the drainage.

- **Sampling of the Muckpiles contents and underlying native soils (CAS 15-06-01 and CAS 15-06-02)** – Sixteen randomly located boreholes were drilled to characterize the subsurface of the Muckpiles (from ground surface into native soil). The random locations were selected by gridding the Muckpile with a 10-by-10-ft grid and numbering the grid squares. A random number generator was then used to select the grid locations to be sampled. In each borehole, two samples were collected, one from a random depth that was calculated based on the total muckpile thickness at the boring location and one from the bottom of the borehole (2 to 5 ft below the muckpile/native soil contact). Field screening of the borehole cores for volatile organic compounds (VOCs) and elevated radiological readings provided guidance for additional sampling locations, and provided additional characterization information on which to base corrective action decisions. A continuous core was extracted from each borehole, field screened, and sampled. Thirty-eight environmental samples were collected and submitted to an off-site analytical laboratory to be analyzed for VOCs, semivolatile organic compounds (SVOCs), *Resource Conservation and Recovery Act* (RCRA) metals, total petroleum hydrocarbons (TPH)-diesel-range organics (DRO), and radionuclides. Seventeen of these samples were from the native materials beneath the Muckpiles, and the other 21 were collected from the Muckpiles materials.

- **Surface/shallow subsurface sampling (CAS 15-06-02)** – Boreholes were drilled at four biased locations to characterize the surface/shallow subsurface of the U15a Muckpile (less than 5 ft). The continuous core from each borehole was field screened for VOCs and elevated radiological readings, and the portion of the core with the highest field-screening results (FSRs) were collected for laboratory analysis. When no portion of the core exhibited elevated FSRs, the interval between 0.5 and 1.5 ft was sampled. Four samples were collected and submitted for VOCs, SVOCs, RCRA metals, TPH-DRO, and radionuclide analysis.

- **Sampling of Ponds (CAS 15-38-01) –** Six soil samples were collected from the Ponds area. Three were randomly located, and three were selected based on elevated Fiddler gamma scintillator readings. Sample depths ranged from 0 to 21 inches (in.) in the Ponds. The samples were analyzed for SVOCs, RCRA metals, TPH-DRO, and radionuclides.

- **Surface soil sampling using hand tools (the drainage south of CAS 15-06-02) –** Seventeen environmental samples were collected from 14 locations to characterize these areas. Eleven of the locations were randomly selected, and three were biased. The random locations were selected as described above. Sampling in this area consisted of collecting soil samples in 6-in. lifts. Sample depths ranged from the surface to 18 in. below ground surface (bgs). One or two samples were collected from each location, depending on FSRs.

- **Background sampling –** Three background sample locations were identified; one was drilled to 5 ft and two were excavated to a depth of 18 in. using hand tools to collect background native soil samples. Samples were collected from the 6- to 18-in. interval; field-screened; and submitted to the off-site laboratory for radionuclide, RCRA metals, and TPH-DRO analysis.

The conceptual site model (CSM) postulated that the majority of the Muckpiles do not contain COPCs, and if any COPCs are present, they are probably isolated. The areas most likely to be affected are the areas where petroleum compounds were used for tunnel equipment maintenance activities, possibly resulting in releases to the surface and shallow subsurface (0 to 5 ft) soils. These releases, if present, were anticipated to have limited lateral and vertical extent. The CSM also stated that it is possible, but unlikely, that the native soil beneath the Muckpiles and Ponds has been impacted by downward migration of COPCs. The results of the CAI showed that there is localized contamination with petroleum compounds in the U15a Muckpile. A single sample had a concentration exceeding the regulatory limit for DRO. Radionuclide COPCs are present in the U15a Muckpiles, Ponds, and drainage. The CAI also proved that the contaminants are not leaching into the native materials below the Muckpiles but they are being transported down the drainage in stormwater runoff. Based on these facts, the CSM is shown to be valid.

2.2 Results

The following is a summary of the data obtained during the CAI.

2.2.1 Summary of Analytical Data

The CAI analytical results (Appendix A) indicate the following:

- No VOCs or SVOCs were detected in any of the samples collected during this investigation at concentrations that exceeded the action levels outlined in the CAIP (DTRA, 2002).

- Diesel-range organics were detected in one muck sample from the U15a Muckpile in a concentration that exceeded the action level of 100 milligrams/kilogram (mg/kg) (NAC, 1996b).

- Radionuclide results were compared to soil samples taken from undisturbed locations in the western and southwestern United States and to the screening levels of the *Nevada Test Site Performance Objective for the Certification of Nonradioactive Hazardous Waste* (POC) (BN, 1995). Actinium (Ac)-228, bismuth (Bi)-214, lead (Pb)-212, Pb-214, potassium (K)-40, and thallium (Tl)-208 were detected in all of the areas sampled, including the background samples, but the concentrations did not exceed background. In addition, these isotopes are naturally occurring and are not produced during weapons testing.

- Sixteen of the samples from the muck in U15a Muckpile had concentrations of cesium (Cs)-137 exceeding background and POC values. Some of the most contaminated samples in this set also had concentrations of other man-made radionuclides that exceeded background levels for other man-made radionuclides. The POCs were also exceeded in some of these samples. Eight samples had elevated concentrations of strontium (Sr)-90, one had cobalt (Co)-60, two had plutonium (Pu)-238, and three had Pu-239.

- Subsequent to the issuance of the CAIP, approval was received from the Nevada Division of Environment Protection (NDEP) to use the risk-based approach for developing final action levels (FALs) to evaluate the contaminant concentrations. Comparing the results to the FALs showed the following: two samples exceeded the FAL for americium (Am)-241, one from the drainage and one from the Ponds; eight samples exceeded for Cs-137, six from the U15a-Muckpile, one from the drainage, and one from the ponds; three exceeded for Pu-238, one from the U15a-Muckpile, one from the drainage, and one from the Ponds; and four exceeded for Pu-239, two from the U15a Muckpile, one from the drainage, and one from the Ponds.

- No samples of the native material from under the U15a Muckpile had concentrations of man-made radionuclides that exceeded background or POC levels.

- No samples of the muck or native material in the U15e Muckpile had concentrations of man-made radionuclides that exceeded background or POC levels.

- All six samples from the Ponds had concentrations of Pu-239 that exceeded background, and all but one exceeded the POC. The Pu-238 and Sr-90 concentrations were above background and/or the POC in five samples, and four of the samples exceeded background and POC levels for Am-241 and Cs-137.

- Nine of the drainage samples exceeded background and POC levels for Cs-137. Five drainage samples exceeded background and/or POC for Pu-238 and Pu-239, and two for Am-241. One sample contained Co-60, which exceeded background. Three samples exceeded both the background and POC levels for Sr-90.

Based on these results, the nature and extent of contamination at CAU 482 has been adequately characterized.

2.2.1.1 U15e Muckpile (CAS 15-06-01)

None of the chemical constituents were detected above the preliminary action levels (PALs), so the PALs were identified as the FALs for those constituents. The maximum concentration of each detected chemical contaminant at this CAS is listed in Table 2-1.

Table 2-1
Maximum Reported Chemical Values for CAS 15-06-01

Contaminant of Concern	Results	Sample Number	Depth (ft bgs)	Final Action Level	Units
U15e Muckpile					
Arsenic	1.2	482ES16A4.5	4-5	23	mg/kg
Barium	91	482ES16A4.5	4-5	67,000	mg/kg
Chromium	1.7	482ES16A4.5	4-5	450	mg/kg
Lead	0.97	482ES16A4.5	4-5	750	mg/kg
Mercury	0.0066	482ES16A4.5	4-5	310	mg/kg
Selenium	0.42	482ES16A01	0.5-1.5	5,100	mg/kg
Acetone	20	482ES16A4.5	4-5	6,000,000	µg/kg
Methylene Chloride	3.5	482ES1503	2.5-3.5	21,000	µg/kg

ft bgs = Feet below ground surface
mg/kg = Milligrams per kilogram

No radionuclides were detected at concentrations above their PALs. The maximum concentration of each detected radiological contaminant at this CAS is listed in Table 2-2.

Table 2-2
Maximum Reported Radiological Values for CAS 15-06-01

Contaminant of Concern	Results	Sample Number	Depth (ft bgs)	Final Action Level	Units
U15e Muckpile					
Actinium-228	0.86	482ES16A4.5	4-5	15	pCi/g
Bismuth-214	0.56	482ES16A4.5	4-5	15	pCi/g
Cesium-137	0.69	482ES16A01	0.5-1.5	7.3	pCi/g
Lead-212	0.85	482ES16A4.5	4-5	15	pCi/g
Lead-214	0.54	482ES16A4.5	4-5	15	pCi/g
Thallium-208	0.33	482ES16A4.5	4-5	15	pCi/g

ft bgs = Feet below ground surface
pCi/g = Picocuries per gram

2.2.1.2 U15a Muckpile (CAS 15-06-02)

During the CAI, TPH-DRO was found above the PAL of 100 mg/kg in one soil sample, so it was moved into a Tier 2 evaluation. The Tier 2 evaluation involved evaluating the individual hazardous constituents of TPH-DRO as prescribed in the American Society for Testing and Materials (ASTM) procedure Section 6.4.3, “Use of Total Petroleum Hydrocarbon Measurements” (ASTM, 1995). The Tier 2 evaluation (Appendix D) determined that none of the hazardous constituents of TPH-DRO exceeded their PALs; therefore, for those chemical constituents, the PALs are identified as the FALs.

None of the chemical constituents exceeded their PALs as identified in the CAIP (DTRA, 2002), so the PALs are identified as the FALs. The maximum concentration of each detected chemical contaminant at this CAS is listed in Table 2-3.

Table 2-3
Maximum Reported Chemical Values for CAS 15-06-02
(Page 1 of 2)

Contaminant of Concern	Results	Sample Number	Depth (ft bgs)	Final Action Level	Units
U15a Muckpile					
Arsenic	15	482AS1412	11.5-12.5	23	mg/kg
Barium	230	482AS1316	15.5-16.5	67,000	mg/kg
Cadmium	2.9	482AS110.5	10-11	450	mg/kg
Chromium	30	482AS1412	11.5-12.5	450	mg/kg
Lead	57	482AS101.5	1-2	750	mg/kg

Table 2-3
Maximum Reported Chemical Values for CAS 15-06-02
(Page 2 of 2)

Contaminant of Concern	Results	Sample Number	Depth (ft bgs)	Final Action Level	Units
Selenium	1.1	482AS1201	0.5-1.5	5,100	mg/kg
Silver	1.5	482AS023.5	3-4	5,100	mg/kg
Diesel-Range Organics	**510**	482AS101.5	1-2	**100**	mg/kg
Acetone	48	482AS0103	2.5-3.5	54,000,000	µg/kg
Benzo(A)Pyrene	340	482AB020.5	0-1	210	µg/kg
Benzo(B)Fluoranthene	340	482AB020.5	0-1	2,100	µg/kg
Benzo(K)Fluoranthene	340	482AB020.5	0-1	21,000	µg/kg
Bis(2-Ethylhexyl)Phthalate	310	482AS0118	17.5-18.5	120,000	µg/kg
Benzo(A,H)Anthracene	340	482AB020.5	0-1	210	µg/kg
Ideno(1,2,3-CD)Pyrene	340	482AB020.5	0-1	2,100	µg/kg
2-Butanone	11	482AS0103	2.5-3.5	27,000,000	µg/kg
Methylene Chloride	44	482AB030.5	0-1	21,000	µg/kg
Toluene	3.6	482AS0103	2.5-3.5	520,000	µg/kg

ft bgs = Feet below ground surface
mg/kg = Milligrams per kilogram
µg/kg = Micrograms per kilogram

The radionuclide Cs-137 was detected at concentrations above the PAL (7.3 picocuries per gram [pCi/g]) in 13 of the 23 environmental samples collected and Pu-239 was detected above the PAL (7.62 pCi/g) in one of the 23 environmental samples analyzed, so they were moved to a Tier 2 evaluation. The Tier 2 evaluation was completed using the Residual Radioactive (RESRAD) model and computer code to determine the site-specific FALs for Cs-137 and Pu-239. No other radionuclides exceeded their PALs as defined in the CAIP (DTRA, 2002), so the PALs for those radionuclides are identified as the FALs. The maximum concentration of each detected radiological contaminant at this CAS is listed in Table 2-4.

Table 2-4
Maximum Reported Radiological Values for CAS 15-06-02

Contaminant of Concern	Results	Sample Number	Depth (ft bgs)	Final Action Level	Units
U15a Muckpile					
Actinium-228	1.26	482AS1316	15.5-16.5	15	pCi/g
Bismuth-214	1.71	482AS059.5	9-10	15	pCi/g
Cobalt-60	0.123	482AB040.5	0-1	1.61	pCi/g
Cesium-137	**3,050**	482AS04A13	12.5-13.5	**273.99**[1]	pCi/g
Lead-212	1.33	482AS1407	6.5-7.5	15	pCi/g
Lead-214	1.49	482AS059.5	9-10	15	pCi/g
Plutonium-238	1.28	482AB040.5	0-1	7.78	pCi/g
Plutonium-239	**7.7**	482AS040.5	0-1	**4.24**[1]	pCi/g
Strontium-90	66	482AB040.5	0-1	503	pCi/g
Thallium-208	0.5	482AS1407	6.5-7.5	15	pCi/g

[1] Tier 2 FAL

ft bgs = Feet below ground surface
pCi/g = Picocuries per gram

2.2.1.3 Area 15 U15a/e Ponds (CAS 15-38-01)

None of the chemical constituents exceeded their PALs as identified in the CAIP (DTRA, 2002), so the PALs were identified as the FALs. The maximum concentration of each detected chemical contaminant at this CAS and its FAL are listed in Table 2-5.

Table 2-5
Maximum Reported Chemical Values for CAS 15-38-01

Contaminant of Concern	Results	Sample Number	Depth (ft bgs)	Final Action Level	Units
Area 15 U15a/e Ponds					
Arsenic	6.7	482PSS220	0-1	23	mg/kg
Barium	140	482PSS220	0-1	67,000	mg/kg
Cadmium	3.5	482PSS606	0-1	450	mg/kg
Chromium	12	482PSS606	0-1	450	mg/kg
Lead	39	482PSS606	0-1	800	mg/kg
Mercury	0.051	482PSS220	0-1	310	mg/kg
Diesel-Range Organics	10	482PSS220	0-1	100	mg/kg

ft bgs = Feet below ground surface
mg/kg - Milligrams per kilogram

For the radionuclides, Am-241, Cs-137, Pu-238, and Pu-239 were detected at concentrations above their PALs (7.62, 7.3, 7.78, and 7.62 pCi/g, respectively) in one of the six environmental samples analyzed, so they were moved to a Tier 2 evaluation. No other radionuclides exceeded their PALs, so the PALs for those radionuclides are identified as the FALs. The maximum concentration of each detected radiological contaminant at this CAS is listed in Table 2-6.

Table 2-6
Maximum Reported Radiological Values for CAS 15-38-01

Contaminant of Concern	Results	Sample Number	Depth (ft bgs)	Final Action Level	Units
Area 15 U15a/e Ponds					
Actinium-228	1.14	482PSS404	0 - 1	5	pCi/g
Americium-241	182	482PSS606	0 - 1	51.88 [1]	pCi/g
Bismuth-214	0.6	482PSS306	0 - 1	5	pCi/g
Cesium-137	830	482PSS606	0 - 1	236.58 [1]	pCi/g
Lead-212	1.16	482PSS220	0 - 1	5	pCi/g
Lead-214	0.56	482PSS506	0 - 1	5	pCi/g
Plutonium-238	18.3	482PSS606	0 - 1	5.22 [1]	pCi/g
Plutonium-239	1,000	482PSS606	0 - 1	285.03 [1]	pCi/g
Strontium-90	65	482PSS404	0 - 1	503	pCi/g
Thallium-208	0.29	482PSS306	0-1	5	pCi/g

[1] Tier 2 FAL

ft bgs = Feet below ground surface
pCi/g = Picocuries per gram

2.2.1.4 Drainage Below the U15a Muckpile

None of the chemical constituents exceeded their PALs as identified in the CAIP (DTRA, 2002), so the PALs were identified as the FALs. The maximum concentration of each detected chemical contaminant at this CAS and its FAL are listed in Table 2-7.

Table 2-7
Maximum Reported Chemical Values for the Drainage Below CAS 15-06-02

Contaminant of Concern	Results	Sample Number	Depth (ft bgs)	Final Action Level	Units
Drainage					
Arsenic	4.8	482DR03C	0-1	23	mg/kg
Barium	220	482DR0106	0-1	67,000	mg/kg
Cadmium	0.61	482DR0506	0-1	450	mg/kg
Chromium	8.2	482DR03C	0-1	450	mg/kg
Lead	34	482DR03C	0-1	800	mg/kg
Selenium	1.8	482DR02A06	0-1	5,100	mg/kg
Mercury	0.024	482DR0806	0-1	310	mg/kg
Diesel-Range Organics	97	482DR02A06	0-1	100	mg/kg
Benzo(a)anthracene	190	482DR0406	0-1	2,100	μg/kg
Benzo(a)pyrene	210	482DR0406	0-1	210	μg/kg
Benzo(b)fluoranthene	360	482DR0406	0-1	2,100	μg/kg
Benzo(k)fluoranthene	110	482DR0406	0-1	21,000	μg/kg
Chrysene	290	482DR0406	0-1	210,000	μg/kg
Di-N-Butylphthalate	58	482DR0406	0-1	62,000,000	μg/kg
Fluoranthene	160	482DR0406	0-1	22,000,000	μg/kg
Indeno(1,2,3-cd)pyrene	130	482DR0406	0-1	2,100	μg/kg
Pyrene	260	482DR0406	0-1	29,000,000	μg/kg

ft bgs = Feet below ground surface
mg/kg = Milligrams per kilogram
μg/kg = Micrograms per kilogram

For the radionuclides, Cs-137 and Pu-239 were detected at concentrations above their PALs (7.3 and 7.62 pCi/g respectively) in one of the 21 environmental samples analyzed, so they were moved to a Tier 2 evaluation. No other radionuclides exceeded their PALs, so the PALs for those radionuclides are identified as the FALs. The maximum concentration of each detected radiological contaminant at this CAS is listed in Table 2-8. The sampling showed that migration of the radionuclides in storm water runoff is occurring but it is confined by the drainage below the U15a Muckpile.

Table 2-8
Maximum Reported Radiological Values for the Drainage Below CAS 15-06-02

Contaminant of Concern	Results	Sample Number	Depth (ft bgs)	Final Action Level	Units
Drainage					
Actinium-228	1.27	482DR0606	0 - 1	5	pCi/g
Americium-241	3.1	482DR03C	0 - 1	7.62	pCi/g
Bismuth-214	1.07	482DB30.5	0 - 1	5	pCi/g
Cobalt-60	0.323	482DR03C	0-1	1.61	pCi/g
Cesium-137	**472**	482DR03C	0 - 1	**272.27** [1]	pCi/g
Lead-212	1.17	482DR0806	0 - 1	5	pCi/g
Lead-214	1	482DR20.5	0 - 1	5	pCi/g
Plutonium-238	3.96	482DR03C	0 - 1	7.78	pCi/g
Plutonium-239	**23.3**	482DR03C	0 - 1	**13.44** [1]	pCi/g
Strontium-90	43.8	482DR03C	0 - 1	503	pCi/g
Thallium-90	0.46	482DR0806	0 - 1	5	pCi/g

[1] Tier 2 FAL

ft bgs = Feet below ground surface
pCi/g = Picocuries per gram

2.2.2 Data Assessment Summary

The data quality assessment (DQA) is presented in Appendix C and includes an evaluation of the DQIs to determine the degree of acceptability and usability of the reported data in the decision-making process. The DQO process ensures that the right type, quality, and quantity of data will be available to support the resolution of those decisions at an appropriate level of confidence. Using both the DQO and DQA processes helps ensure that DQO decisions are sound and defensible.

The DQA process as presented in Appendix C is comprised of the following steps:

- Step 1 – Review DQOs and Sampling Design.
- Step 2 – Conduct a Preliminary Data Review.
- Step 3 – Select the Test.
- Step 4 – Verify the Assumptions.
- Step 5 – Draw Conclusions from the Data.

Sample locations that support the presence and/or extent of contamination at each CAS are shown in Appendix A. Based on the results of the DQA presented in Appendix C, the DQO requirements have been met, and the close in place corrective action alternative was selected as the closure alternative at CAU 482 (U15a/e Muckpiles and Ponds). The DQA also determined that information generated during the investigation supports the CSM assumptions, and the data collected support the intended use in the decision-making process.

2.3 Justification for No Further Action

No further action is justified based on an evaluation of risk (see Appendix D) to ensure protection of the public and the environment in accordance with *Nevada Administrative Code* (NAC) 445A (NAC, 2003a), feasibility, and cost effectiveness. The corrective action was determined from DQO decision statements based on a comparison of the analyte concentrations detected in CAI soil samples to the FALs defined in Section 2.3.1. Because the extent of the COCs is limited and the CAI demonstrated that there is no vertical migration through the Muckpiles into the native material below, and the lateral migration of COCs is confined by the drainage, the corrective action to close in place with administrative controls is justified at all three CASs and the drainage. Appendix D presents an evaluation of risk associated with the recommended closure alternative.

2.3.1 Final Action Levels

The CAU 482 FALs are risk-based cleanup goals that, if met, will ensure that each release site will not pose an unacceptable risk to human health and the environment and that the conditions at each site are in compliance with all applicable laws and regulations. The process described in this section to define and determine the FALs conforms to NAC Section 445A.227 (NAC, 2003a), which lists the requirements for sites with soil contamination. For the evaluation of corrective actions, NAC Section 445A.22705 (NAC, 2003c) requires the use of ASTM Method E 1739-95 to “conduct an evaluation of the site, based on the risk it poses to public health and the environment, to determine the necessary remediation standards (i.e., FALs) or to establish that corrective action is not necessary.”

The ASTM procedure (ASTM, 1995) defines three tiers (or levels) of evaluation involving increasingly sophisticated analyses as follows.

Tier 1 Evaluation **–** Sample results from source areas (highest concentrations) are compared to action levels based on generic (non-site-specific) conditions (i.e., the PALs established in the CAIP). The FALs may then be established as the Tier 1 action levels, or the FALs may be calculated using a Tier 2 evaluation.

***Tier 2 Evaluation* –** Conducted by calculating Tier 2 site-specific target levels (SSTLs) using site-specific information as inputs to the same or similar methodology used to calculate Tier 1 action levels. The Tier 2 SSTLs are then compared to individual sample results from reasonable points of exposure (as opposed to the source areas as is done in Tier 1) on a point-by-point basis. Total TPH concentrations are not used for risk-based decisions under Tier 2 or Tier 3. Rather, the individual hazardous constituents in TPH will be compared to their SSTLs.

Alternatively, the Tier 2 risk-based corrective action process SSTLs may be compared to the predicted concentration or activity of the contaminant at the point of exposure based on attenuation from the source using relatively simplistic mathematical models. Points of exposure are defined as those locations at which an individual or population may come in contact with a COC originating from a CAS. If a Tier 2 evaluation is conducted, the calculations used to derive the SSTLs and the contaminant attenuation calculations will be provided as an appendix to the investigation report. If remediation to Tier 2 SSTLs is not practical, a Tier 3 evaluation may be conducted.

***Tier 3 Evaluation* –** Conducted by calculating Tier 3 SSTLs on the basis of more sophisticated risk analyses using methodologies described in ASTM method E 1739-95 that consider site-, pathway-, and receptor-specific parameters. Tier 3 evaluation is much more complex than Tiers 1 and 2, because it may include additional site characterization, probabilistic evaluations, and sophisticated chemical fate/transport models. The Tier 3 SSTLs are then compared to the upper 95 percent confidence limit of the mean of sample results from reasonable points of exposure (as opposed to individual sample results as is done in Tier 2). Contaminant concentrations exceeding Tier 3 SSTLs require corrective action. If a Tier 3 evaluation is conducted, the calculations used to derive the SSTLs and the upper confidence limit of the means will be provided as an appendix to the investigation report.

A Tier 1 evaluation was conducted for all COPCs to determine whether contaminant levels satisfy the criteria for a quick regulatory closure or warrant a more site-specific assessment. This was accomplished by comparing individual source area contaminant concentration results to the Tier 1 actions levels (the PALs established in the CAIP).

The constituents detected at CAU 482 that exceeded Tier 1 action levels were:

- TPH-DRO at CAS 15-06-02
- Am-241 at CAS 15-38-01
- Cs-137 at CAS 15-06-02, CAS 15-38-01, and the drainage

- Pu-238 at CAS 15-38-01
- Pu-239 at CAS 15-06-02, CAS 15-38-01, and the drainage

The concentration of all constituents not listed above, were below Tier 1 action levels and the corresponding PALs were established as the Tier 1 FALs. The constituents that exceeded Tier 1 action levels were moved to a Tier 2 evaluation.

The Tier 2 evaluation of TPH-DRO compared the concentrations of the individual hazardous constituents of TPH-DRO to the Tier 1 action levels in the sample that exceeded for TPH-DRO. None of the hazardous constituent concentrations exceeded their Tier 1 action level (Table 2-9) so site-specific action levels were not calculated. The PALs were established as the FALs for the hazardous constituents in TPH-DRO at CAU 482. The FALs are presented in Table 2-10. Additional details of the Tier 2 evaluation are provided in Appendix D.

Table 2-9
Tier 2 SSTLs and CAU 482 Results for Hazardous Constituents of Diesel
(Page 1 of 2)

CAS No.	Common Name	SSTL (mg/kg)	Maximum Reported Value (mg/kg)
108-67-8	1,3,5-Trimethylbenzene	70	ND
91-57-6	2-Methylnaphthalene[a]	175,000	ND
120-12-7	Anthracene	100,000	ND
71-43-2	Benzene	2.1	ND
56-55-3	Benzo(a)anthracene	1.4	ND
50-32-8	Benzo(a)pyrene	0.21	ND
205-99-2	Benzo(b)Fluoranthene	2.1	0.36
191-24-2	Benzo(g,h,i)Perylene	29,000	ND
207-08-9	Benzo(k)Fluoranthene	21	ND
218-01-9	Chrysene	210	ND
100-41-4	Ethylbenzene	400	ND
206-44-0	Fluoranthene	22,000	ND
86-73-7	Fluorene	26,000	ND
91-20-3	Naphthalene	190	ND
104-51-8	N-Butylbenzene	240	ND
103-65-1	N-Propylbenzene	240	ND

Table 2-9
Tier 2 SSTLs and CAU 482 Results for Hazardous Constituents of Diesel
(Page 2 of 2)

CAS No.	Common Name	SSTL (mg/kg)	Maximum Reported Value (mg/kg)
85-01-8	Phenanthrene	100,000	ND
129-00-0	Pyrene	29,000	ND
108-88-3	Toluene	520	ND
1330-20-7	Total Xylene[b]	420	ND

[a] Uses PRG for naphthalene as surrogate
[b] Total of m-, o-, and p-xylenes

CAS = Chemical Abstracts Service
mg/kg = Milligrams per kilograms
ND = Nondetect
SSTL = Site-specific target level

None of the chemical constituents exceeded their PALs, so a Tier 2 evaluation was not conducted. The PALs were established as the FALs for the chemical constituents.

The Tier 2 evaluation for the radionuclides was conducted by entering site-specific radionuclide information and physical characteristics of the site into the RESRAD program to calculate the site-specific action levels. This calculated the site-specific activities needed to sum to an exposure dose of 25 millirem per year to a site receptor. These calculated activities were established as the FALs for each radionuclide at each CAS that exceeded a Tier 1 action level. The Tier 2 calculated FALs are presented in Table 2-10. Additional details of the Tier 2 evaluation are provided in Appendix D.

Table 2-10
Final Action Levels
(Page 1 of 2)

COPCs	Tier 1 FALs	Tier 2 FALs	Tier 3 FALs
VOCs	PALs	N/A	N/A
SVOCs	PALs	N/A	N/A
RCRA metals	PALs	N/A	N/A
TPH-DRO	Tier 2	TPH-DRO hazardous constituents PALs	N/A

Table 2-10
Final Action Levels
(Page 2 of 2)

COPCs	Tier 1 FALs	Tier 2 FALs	Tier 3 FALs
Radionuclides	PALs except as listed under Tier 2	**CAS 15-06-02** Cs-137 273.99 pCi/g Pu-239 4.24 pCi/g **CAS 15-38-01** Am-241 51.88 pCi/g Cs-137 236.58 pCi/g Pu-238 5.22 pCi/g Pu-239 285.03 pCi/g **Drainage** Cs-137 272.27 pCi/g Pu-239 13.44 pCi/g	N/A

N/A = Not applicable

3.0 Recommendations

The data generated by the CAI show that the FALs were exceeded for radionuclides in CAS 15-06-02, CAS 15-38-01, and the drainage. Although FALs were exceeded at CAU 482, closure in place with use restrictions is the best option for closing the site. This is based on the fact that even though the FALs were exceeded in a few samples, this remote, controlled access site poses only limited risk overall to public health and the environment. Given the relatively low levels of contamination present, it would create a greater hazard to worker safety, public health, and the environment to remove the contamination, transport it, and bury it at another location. To be conservative, CAS 15-06-02, CAS 15-38-01, and the drainage will be use restricted from the surface to a depth 150 ft bgs. The future use of CAU 482 will be restricted from any activity that will alter or modify the containment controls unless concurrence is obtained from NDEP. Because removal of the contaminants within the Muckpiles, Ponds, and drainage is not practical and would create greater risk, the close in place with administrative controls corrective action alternative is appropriate. It will prevent inadvertent contact with the COCs, and meets all applicable state and federal regulations for closure of the site.

An annual post-closure inspection is associated with the use restriction to certify that markers and postings are in place, intact, and readable. Results of these inspections will be provided in the annual Post Closure Inspection and Monitoring Report.

In conclusion, DTRA requests that NDEP issue a Notice of Completion for this CAU and approval to move the CAU from Appendix III to Appendix IV of the FFACO.

4.0 References

ASTM, see American Society for Testing and Materials.

American Society for Testing and Materials. 1995. *Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites/American Society for Testing and Materials*, ASTM E 1739-95 (Reapproved 2002). Philadelphia, PA.

BN, see Bechtel Nevada.

Bechtel Nevada. 1995. *Nevada Test Site Performance Objective for Certification of Nonradioactive Hazardous Waste*, Rev. 0, G-E11/96.01. Las Vegas, NV.

DTRA, see Defense Threat Reduction Agency.

Defense Threat Reduction Agency. 2002. *Corrective Action Investigation Plan for Corrective Action Unit 482: Area 15 U15a/e Muckpiles and Ponds, Nevada Test Site*, Rev. 0. Prepared by ITLV. Las Vegas, NV.

FFACO, see *Federal Facility Agreement and Consent Order*.

Federal Facility Agreement and Consent Order. 1996 (as amended). Agreed to by the State of Nevada, the U.S. Department of Energy, and the U.S. Department of Defense.

IT, see IT Corporation.

IT Corporation. 2002. *Site-Specific Health and Safety Plan, Corrective Action Unit 482: Area 15 U15a/e Muckpiles and Ponds, Nevada Test Site*, Rev. 0. ITLV. Las Vegas, NV.

NAC, see Nevada Administrative Code.

NNSA/NV, see U.S. Department of Energy, National Nuclear Security Administration Nevada Operations Office.

Nevada Administrative Code. 2003a. NAC 445A, "Water Controls." Carson City, NV.

Nevada Administrative Code. 2003b. NAC 445A.2272, "Contamination of Soil: Establishment of Action Levels." Carson City, NV.

Nevada Administrative Code. 2003c. NAC 445A.22705, "Contamination of Soil: Evaluation of Site by Owner or Operator; Review of Evaluation by Division." Carson City, NV.

U.S. Department of Energy, National Nuclear Security Administration Nevada Operations Office. 2002. *Industrial Sites Quality Assurance Project Plan, Nevada Test Site, Nevada, DOE/NV--372*, Rev. 3. Las Vegas, NV.

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Appendix A

Corrective Action Investigation Report for CAU 482 Area 15, U15a/e Muckpiles and Ponds, NTS

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Executive Summary

The Corrective Action Investigation (CAI) of the 15a/e Muckpiles and Ponds, identified under the *Federal Facility Agreement and Consent Order* (FFACO, 1996) classification as Corrective Action Unit 482, consists of three Corrective Action Sites (CASs): U15a Muckpile (15-06-02), U15e Muckpile (15-06-01), and the Area 15 U15a/e Ponds (15-38-01). The four activities completed during the CAI were a driveover radiological survey, a walkover radiological survey, rotosonic drilling and soil sampling, and surface soil sampling.

In January 2002, IT Corporation personnel conducted driveover and walkover radiological surveys of the U15a/e Muckpiles and Ponds and the drainage below the muckpiles and ponds. These surveys showed elevated radiation levels in the two upper ponds and on the west side and around the toe of the U15a Muckpile. The surveys did not show any elevated radiation levels in the drainage below the ponds; however, elevated levels were found in the drainage below the U15a Muckpile. The elevated levels are continuous for about 400 feet (ft) below the muckpile and intermittent to about 1,050 ft.

The next stage of the investigation consisted of rotosonic drilling to collect soil samples from within and beneath the muckpiles in CASs 15-06-02 and 15-06-01. This was conducted over nine work days between September 12 and 24, 2002. The first borehole was drilled at a background location as a dry run to evaluate the drilling and sampling process. Subsequently, 22 boreholes were drilled into and through the muckpile to characterize the surface of the muckpile, the subsurface muckpile material, and the native material under the muckpile. A total of 348 ft were drilled in 23 boreholes ranging from 4.5 to 36.0 ft deep. One to three samples were collected from each borehole. During the rotosonic drilling, 42 environmental samples were collected. These included 16 subsurface muckpile “Z depth” samples, 17 native material samples, and nine biased samples. Four of the biased samples were collected from biased borehole locations, and five were collected from borehole intervals with elevated beta or volatile compounds identified by field screening measurements. Two duplicate and two matrix spike (MS)/matrix spike duplicate (MSD) soil samples were collected for quality control purposes. Twenty-one quality control water samples were collected (two equipment rinsate samples, two field blank samples, and 17 trip blanks). Two samples of source water from the water storage tank were collected to confirm the quality of the water used for decontamination. All soil and water samples were sent to Paragon Analytics, Inc., for analysis. Analyses performed included volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), total petroleum hydrocarbons (TPH)-diesel-range organics (DRO), total *Resource Conservation and Recovery Act* (RCRA) metals, and radionuclides.

The last stage of the CAI consisted of using hand tools to collect soil samples at CAS 15-38-01 (U15a/e Ponds), in the drainage below CAS 15-06-02 (U15a Muckpile), and at the two remaining undisturbed background locations around the muckpile. Surface soil sampling was conducted over three work days between September 25 and 30, 2002. Sampling at CAS 15-38-01 consisted of sampling the soil in the ponds. Six (three biased and three random) locations were selected to characterize the soil in the ponds. Sample depths ranged from 0 to 21 inches (in.). One sample was collected from each pond location, for a total of six pond samples.

Sampling in the extended area downgradient from the U15a Muckpile consisted of collecting soil samples in 6-in. lifts. Seventeen environmental samples were taken from the 14 (three biased and 11 random) locations selected to characterize the drainage. Sample depths ranged from the surface to 18 in. below ground surface. One or two samples were collected from each location, depending on field-screening results. At the background locations, one sample was collected from 0.5 to 1.5 ft deep. Quality control soil samples from the drainage included two duplicate samples and two MS/MSD samples. Other quality control samples included one equipment rinsate sample and two field blanks. All soil and water samples were sent to Paragon Analytics, Inc., to be analyzed for total RCRA metals and radionuclides.

Some RCRA metals and radionuclides were detected in the background samples. The RCRA metals and radionuclides were detected in soil samples from the two muckpiles, the native soil from under the muckpiles, the drainage, and the ponds. Volatile organic compounds were detected in native and muckpile soil, and SVOCs were detected in samples from the U15a Muckpile and the drainage. Total petroleum hydrocarbons were detected in samples from the U15a Muckpile, the ponds, and the drainage.

During the CAI, 14 drums of investigation-derived waste were accumulated: six drums of rinsate and eight drums of personal protective equipment (PPE) and plastic. The environmental sample analytical results were used to make the waste determination that none of the drums were considered to contain hazardous waste. Seven drums of PPE and plastic, and all six of the drums of rinsate were disposed of as sanitary waste. One drum of PPE and plastic was disposed of as low-level radioactive waste.

The lessons learned exercise for the Area 15 U15a/e Muckpiles and Ponds field work was divided into three sections. Immediately following drilling the first background hole, the dry run was evaluated in detail. Next, the first lessons learned meeting was held on September 16, 2002, and covered the activities associated with the first half of the drilling. The second lessons learned meeting was held on September 25, 2002, and covered the remainder of the drilling and sampling activities completed as of that date. Both the "did well" and the "do better" centered around the pre-field planning. The things that were done well were thought out before mobilization to the field. Most of the items that needed to be improved could have been improved through better execution of the planning that took place before mobilization.

A.1.0 Introduction

The Corrective Action Investigation (CAI) of the U15a/e Muckpiles and Ponds was conducted in accordance with the *Federal Facility Agreement and Consent Order* (FFACO) (1996) that was agreed to by the U.S. Department of Defense, Defense Special Weapons Agency (predecessor to the Defense Threat Reduction Agency [DTRA]); the U.S. Department of Energy, Nevada Operations Office; and the Nevada Division of Environmental Protection. The investigation was controlled and guided by the Corrective Action Unit (CAU) 482 Corrective Action Investigation Plan (CAIP) (DTRA, 2002a), Field Instruction (DTRA, 2002b) (which referenced the operational checklists), and the site-specific health and safety plan (SSHASP) (IT, 2002). The Area 15 U15a/e Muckpiles and Ponds is identified in the FFACO as CAU 482, with three Corrective Action Sites (CASs): U15a Muckpile (15-06-02), U15e Muckpile (15-06-01), the Area 15 U15a/e Ponds (15-38-01). In addition, the drainage below the U15a Muckpile was characterized even though it was not listed as part of CAU 482. The U15a/e Muckpiles and Ponds is an inactive industrial waste site. This report presents a summary of the field activities and the data collected during the field effort.

Section A.1.0 of this report is the introduction which includes a description of the purpose and scope of the project. Section A.2.0 is the project description. Section A.3.0 covers the muckpile investigation and provides a description of the sample collection activities and locations. Section A.4.0 is a summary of the sample analytical results. Section A.5.0 provides a description of the waste management activities. Section A.6.0 covers the health and safety aspects of the project. Section A.7.0 covers the lessons learned during the project, and Section A.8.0 lists the references. Attachments A through C provide copies of the field and laboratory data.

A.1.1 Purpose

The purpose of the Area 15 U15a/e Muckpiles and Ponds CAI was to determine whether the U15a/e Muckpiles and Ponds and/or underlying native soils have been impacted by contaminants of potential concern (COPCs) at concentrations that exceed regulatory limits. The data collected during the field effort, which are presented in this report, will enable DTRA to make informed decisions about the future use or closure of the muckpile site. The muckpiles consist primarily of mining debris (rock) with minor amounts of cementitious mixtures, miscellaneous construction debris, and reentry material generated during tunnel excavation and construction in support of weapons effects testing. Due to the unregulated disposal activities commonly associated with early muckpile operations, a characterization was conducted to achieve the following goals:

- Determine whether identified COPCs (both chemical and radiological constituents) are present within or beneath the muckpiles, ponds, and/or drainage.
- Provide sufficient information and data to develop appropriate corrective action strategies for the muckpiles and ponds. These strategies will be evaluated in the Corrective Action Decision Document.

A.1.2 Scope of Work

The scope of the U15a/e Muckpiles and Ponds investigation included the following:

- Conduct radiological surveys using field-screening instruments to locate areas of elevated radiation throughout the CASs.
- Drill boreholes using the dry rotosonic drilling method to collect subsurface environmental soil samples for laboratory analysis.
- Log the drill cores to describe soil characteristics, identify the muckpile/native material contact, and document the presence or absence of COPCs.
- Conduct field screening for health and safety monitoring and to identify the presence of COPCs.
- Use hand tools to collect drainage and pond soil samples for laboratory analyses.

The drilling and sampling locations for dry rotosonic drilling were randomly selected using a stratified random sampling approach as described in Chapter 5 of *Statistical Methods for Environmental Pollution Monitoring* (Gilbert, 1987). Biased locations for surface and subsurface samples were selected based on the results of the driveover and walkover surveys.

A.2.0 Project Description

The U15a/e Muckpiles and Ponds, CAU 482, is located approximately 42 miles north of Mercury in Area 15 of the Nevada Test Site (Figure A.2-1). Corrective Action Unit 482 includes three CASs: 15-06-01, 15-06-02, and 15-38-01 (Figure A.2-2). The U15a Shaft was used for nuclear weapons effects tests between 1962 and 1966, and the U15e Shaft was used for testing in 1965. Following each test, reentry mining generated rock debris and construction wastes such as cabling, scrap metal, and cementitious mixtures which became part of the muckpiles. The muckpiles are estimated to contain approximately 160,333 cubic yards of mining and reentry debris. Only a small fraction of this material is thought to be reentry debris.

A.2.1 Slope Stability Analysis

Given the site conditions and proposed operating parameters, a slope stability analysis was not prepared for the U15a/e Muckpiles. The decision was made to apply modified work restrictions based on the analysis performed for the N-Tunnel drilling. Because the muckpiles are substantially smaller than those of N-Tunnel, the restriction used was that drilling would not be conducted within 25 feet (ft) of the edge of the benches.

A.2.2 Surface Radiological Surveys

Before drilling and sampling commenced, driveover and walkover radiological surveys were conducted to identify surface and near surface areas with elevated readings. The driveover survey was conducted on the muckpiles using a Dual Large-Area Plastic Scintillation Detector (DLAPS), and the walkover surveys were conducted in the ponds and in the drainage directly south of U15a Muckpile using a Small-Area Plastic Scintillation Detector (SAPS).

A.2.3 Deep Borehole Locations

The borehole locations were identified by coordinates which were randomly selected using a stratified random sampling design (Gilbert, 1987). The drilling locations were limited based on the borehole’s proximity to the edge of the muckpile. Before drilling operations commenced, IT Corporation (IT) scientists used a Trimble Global Positioning System (GPS) total station surveying instrument to locate the boreholes on the muckpile at the randomly selected coordinates. Locations for 64 boreholes were staked. This included the 16 primary holes and 3 alternate locations for every primary location. A list of the primary and alternate borehole locations is provided in Table A.2-1.

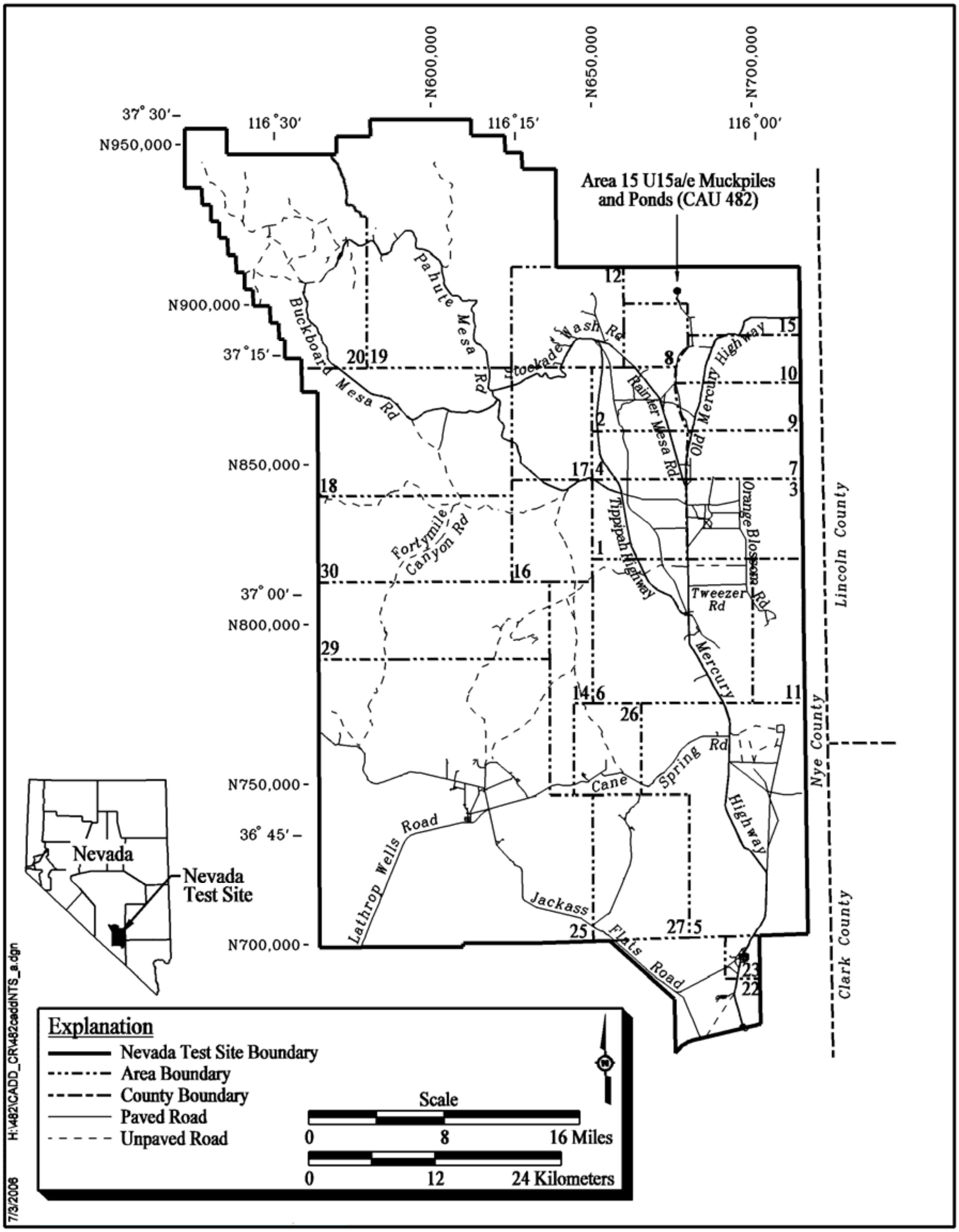


Figure A.2-1

Area 15 U15a/e Muckpiles and Ponds Location Map, Nevada Test Site

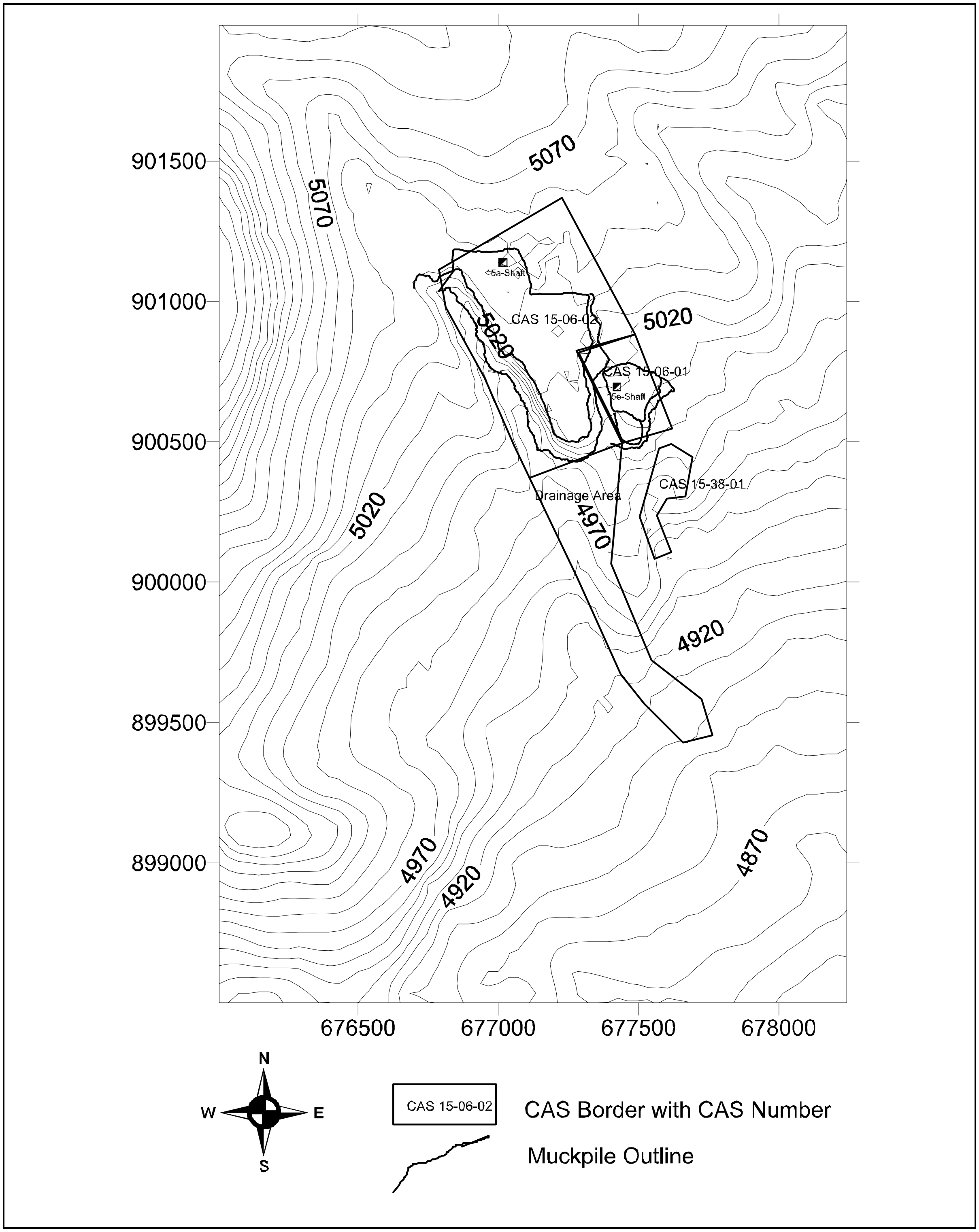


Figure A.2-2
CAU 482 CAS Location Map

Table A.2-1
Random Borehole Locations

Borehole #	Easting	Northing	Borehole #	Easting	Northing
Primary Locations			**Alternate A Locations**		
1	677,017	900,882	1A	677,109	900,828
2	677,074	900,920	2A	677,007	901,038
3	677,118	900,932	3A	677,122	900,840
4	676,094	900,878	4A	677,003	900,916
5	677,132	900,878	5A	677,071	900,835
6	676,988	901,066	6A	677,102	900,938
7	677,274	900,852	7A	677,154	900,927
8	677,145	900,894	8A	677,276	900,673
9	676,966	901,006	9A	677,042	900,960
10	676,988	900,998	10A	677,007	900,995
11	677,041	900,945	11A	676,985	900,945
12	676,983	900,961	12A	677,021	900,996
13	677,228	900,549	13A	677,246	900,547
14	677,282	900,599	14A	677,278	900,568
15	677,493	900,653	15A	677,455	900,529
16	677,400	900,717	16A	677,489	900,661
Alternate B Locations			**Alternate C Locations**		
1B	676,968	901,072	1C	677,083	900970
2B	677,054	901,099	2C	677,119	900,850
3B	676,995	901,120	3C	677,042	900,889
4B	677,077	900,937	4C	676,960	901,054
5B	676,975	901,024	5C	677,078	900,813
6B	677,063	900,835	6C	677,064	900,857
7B	677,153	900,896	7C	677,267	900,678
8B	677,173	900,814	8C	677,155	900,955
9B	676,969	901,004	9C	677,050	900,946
10B	677,067	901,010	10C	676,976	901,003
11B	676,967	900,985	11C	677,051	900,950
12B	676,987	900,996	12C	677,050	901,018
13B	677,295	900,594	13C	677,222	900,556
14B	677,204	900,613	14C	677,266	900,541
15B	677,525	900,737	15C	677,410	900,719
16B	677,436	900,546	16C	677,433	900,544

A.2.4 Shallow Borehole Locations

In addition to the deep boreholes, four shallow borehole locations were identified. These locations were identified after drilling started on the deep boreholes. The locations were picked based on elevated radioactivity readings as measured during the driveover and walkover radiological surveys. After completion of the drilling, the location of each shallow borehole was surveyed using the Trimble GPS surveying instrument.

A.2.5 Other Sample Locations

After completion of the drilling activities, other soil samples were collected using hand tools. Background samples were collected at biased locations in undisturbed areas outside the muckpile, and biased and random locations were sampled in the ponds (CAS 15-38-01) and in the drainage below the U15a Muckpile. The random samples were selected using the same methodology as for the borehole locations and are listed in Table A.2-2. The biased samples were selected based on the results of the driveover and walkover survey.

A.2.6 Checklists

To increase the efficiency and completeness of the field effort, checklists originally developed for the N-Tunnel work and revised based on comments and observations from the T-Tunnel and 16a-Tunnel field efforts and lessons learned, were used at U15a/e Muckpiles and Ponds to track each step of the individual field tasks. A further modification was made at the start of field activities to assign two persons to be responsible for completing each checklist. Table A.2-3 contains a list of the checklists, as well as details of when and how often each checklist is to be used. Fifteen checklists were used during the project to ensure all of the required work activities were completed.

Table A.2-2
Random Soil Sample Locations
(Page 1 of 2)

Sample #	Easting	Northing	Sample #	Easting	Northing
Primary Locations			**Alternate A Locations**		
S1	677,200	900,247	S1A	677,081	900,606
S2	677,076	900,600	S2A	677,172	900,259
S3	677,279	900,453	S3A	677,205	900,376
S4	677,225	900,442	S4A	677,176	900,360

Table A.2-2
Random Soil Sample Locations
(Page 2 of 2)

Sample #	Easting	Northing	Sample #	Easting	Northing
Primary Locations			**Alternate A Locations**		
S5	677,149	900,432	S5A	677,161	900,388
S6	677,304	900,371	S6A	677,302	900,450
S7	677,196	900,378	S7A	677,152	900,381
S8	677,223	900,365	S8A	677,222	900,368
S9	677,307	900,234	S9A	677,308	900,098
S10	677,289	900,213	S10A	677,273	900,185
S11	677,290	900,128	S11A	677,301	900,284
P1	677,624	900,445	P1A	677,609	900,427
P2	677,594	900,334	P2A	677,578	900,340
P3	677,524	900,241	P3A	677,534	900,247
Alternate B Locations			**Alternate C Locations**		
S1B	677,240	900,137	S1C	677,000	900,710
S2B	677,498	899,675	S2C	676,824	901,009
S3B	677,153	900,368	S3C	677,366	900,392
S4B	677,305	900,424	S4C	677,196	900,444
S5B	677,369	900,378	S5C	677,245	900,367
S6B	677,314	900,420	S6C	677,210	900,386
S7B	677,215	900,431	S7C	677,150	900,374
S8B	677,335	900,367	S8C	677,184	900,443
S9B	677,264	900,245	S9C	677,309	900,302
S10B	677,306	900,201	S10C	677,264	900,305
S11B	677,270	900,135	S11C	677,291	900,169
P1B	677,613	900,433	P1C	677,637	900,419
P2B	677,583	900,354	P2C	677,562	900,354
P3B	677,528	900,266	P3C	677,519	900,271

Table A.2-3
Checklists
(Page 1 of 2)

Checklist	Purpose	Primary Responsible Person	Frequency
Site Visitor/Worker Initial Entry	Ensure that all personnel visiting or working on the site have read and signed all of the required documents, have provided proof that they have the required training and medical monitoring, and have turned in their bioassay.	IT Site Supervisor	One for each new person to come on site
Waste Management Prefield	Ensure that all appropriate documentation has been prepared and issued and everything is ready to properly handle all waste streams generated at the site.	IT Waste Management Coordinator	Once, before mobilization
RCT - Initial	Ensure necessary documentation is in place and has been reviewed and signed, and that required monitoring instruments are available and operational. These tasks mitigate the potential for personnel exposure.	Site RCT	Once at the beginning of the project
Health & Safety Pre-Field and Mobilization	Ensure all documents and required forms have been prepared, are available, that all facilities have been notified, that all personnel have the required training and certifications, that all H&S monitoring equipment is available and operational, and that all H&S supplies are available at the site. This will mitigate potential exposures to personnel and reduce the risk of accidents.	IT Site Safety Officer	Once, before and during mobilization to the field
Mobilization	Ensure that the site is ready for the field activities, that all documentation is in place, and that equipment and supplies are available on site.	IT Site Supervisor	Once, before field work begins
Rig Geologist	Ensure the hole is properly field screened and logged, all required information is entered on the borehole log, and that the hole is properly abandoned and marked.	DTRA Representative	One for each borehole
Drill Rig Safety Inspection	Ensure the drill rig meets all required safety standards to mitigate possible personnel injury resulting from faulty or worn equipment, and/or inadequate safety devices.	IT Site Supervisor and/or IT Rig Geologist and IT Site Safety Officer	Once before the start of field work
Drilling	Ensure the right hole is being drilled, the core is handled properly, equipment is properly deconned, and the hole is properly abandoned.	DTRA Representative	One for each borehole

Table A.2-3
Checklists
(Page 2 of 2)

Checklist	Purpose	Primary Responsible Person	Frequency
Sampling	Ensure all supplies are ready for the day's sampling, that the samples are collected and handled properly, that required quality assurance/quality control samples are collected, and that all paperwork is completed correctly.	IT Sampler	One per day, starting in the morning
Decontamination (DTRA)	Ensure that all drilling and sampling equipment is properly decontaminated.	DTRA Representative	One before each new borehole
Decontamination (IT)	Ensure adequate decon equipment and supplies are available for the day, that deconned equipment is properly handled and screened if contamination is encountered, and that the rinsate and any sediment generated is properly handled.	IT Rig Geologist and/or IT Sampler	Once each day decon is done, starting in the morning
RCT Daily	Ensure equipment is operational, there is adequate PPE, and that monitoring information is collected and disseminated as required.	Site RCT	Daily at the beginning of the shift
Health and Safety Periodic Inspection	Ensure safety equipment is available and up to date, that all postings are current, and that monitoring results are being disseminated to the workers.	IT Site Safety Officer	Once each week
Quality Assurance/Quality Control	Ensure activities are being conducted and documented in accordance with approved plans and procedures.	IT Site Supervisor	Random
Waste Management - Nevada Test Site Waste Acceptance Criteria	Ensure all documentation has been prepared for handling any radiologically contaminated material that was generated.	IT Waste Management	Once, after analytical results are received
Demobilization	Ensure the site is properly closed, all equipment and supplies have been removed from the site, all facilities have been notified of the end of field work, and all site generated records are filed properly.	IT Site Supervisor	Once, at the end of the field work
Waste Management - Hazardous Waste Removal	Ensure all documentation has been prepared for handling any chemically contaminated material that was generated.	IT Waste Management	Once, after the end of the field work
Waste & Data Management - Post	Ensure all analytical data from the field effort is properly reviewed, entered in ITEMS and filed in central files.	IT Waste Management	Once after the end of the field work

A.3.0 Muckpile Investigation

The CAI of the U15a/e Muckpiles and Ponds was conducted over 14 work days between September 10 and 30, 2002. The driveover radiological survey was conducted on March 12. The drillers mobilized to the site on September 10. Drilling commenced on September 12 and continued to September 24, when the drillers demobilized. Soil sampling (using hand tools) in the drainage started on September 24, 2002. Sampling was completed September 26 and the job site was demobilized on September 30. During the project, variable winds and lightning warnings caused slight delays. On September 16, the site set-up was rearranged because of the wind direction.

A.3.1 Work Packages

The DTRA is the primary Real Estate and Operations Permit (REOP) holder (REOP Number DTRA-0032-00) and is responsible for safety at the site. Four Work Packages were prepared by IT and approved by DTRA allowing the work to be conducted under the DTRA REOP. Work Package Shaw-15a/e-01 covered the driveover and walkover surveys and collection of background samples for project planning purposes. Work Package Shaw-15a/e-03 covered mobilization and demobilization from the site. Work Package Shaw-15a/e-02 covered all activities involved in the muckpile characterization. Work Package Shaw-15a/e-04 covered the waste management activities, which continued after the field work was completed. All visitors coming on site had to check in with the Facility Manager Representative, the Site Supervisor (SS), or the Site Safety Officer (SSO) to receive a site-specific health and safety briefing and the tailgate safety briefing before being allowed on site.

Before field work commenced, a Nevada Test Site Operations Schedule form was filled out and sent to the Site Operations Center and Bechtel Nevada (BN) to advise them of the changes.

A.3.2 Surface Radiological Surveys

The walkover radiological surveys were conducted on January 23, 24, 25, and 26, 2002. The driveover radiological surveys were conducted on January 21 and 25, 2002. Results from both the walkover and driveover surveys are shown in Figure A.3-1.

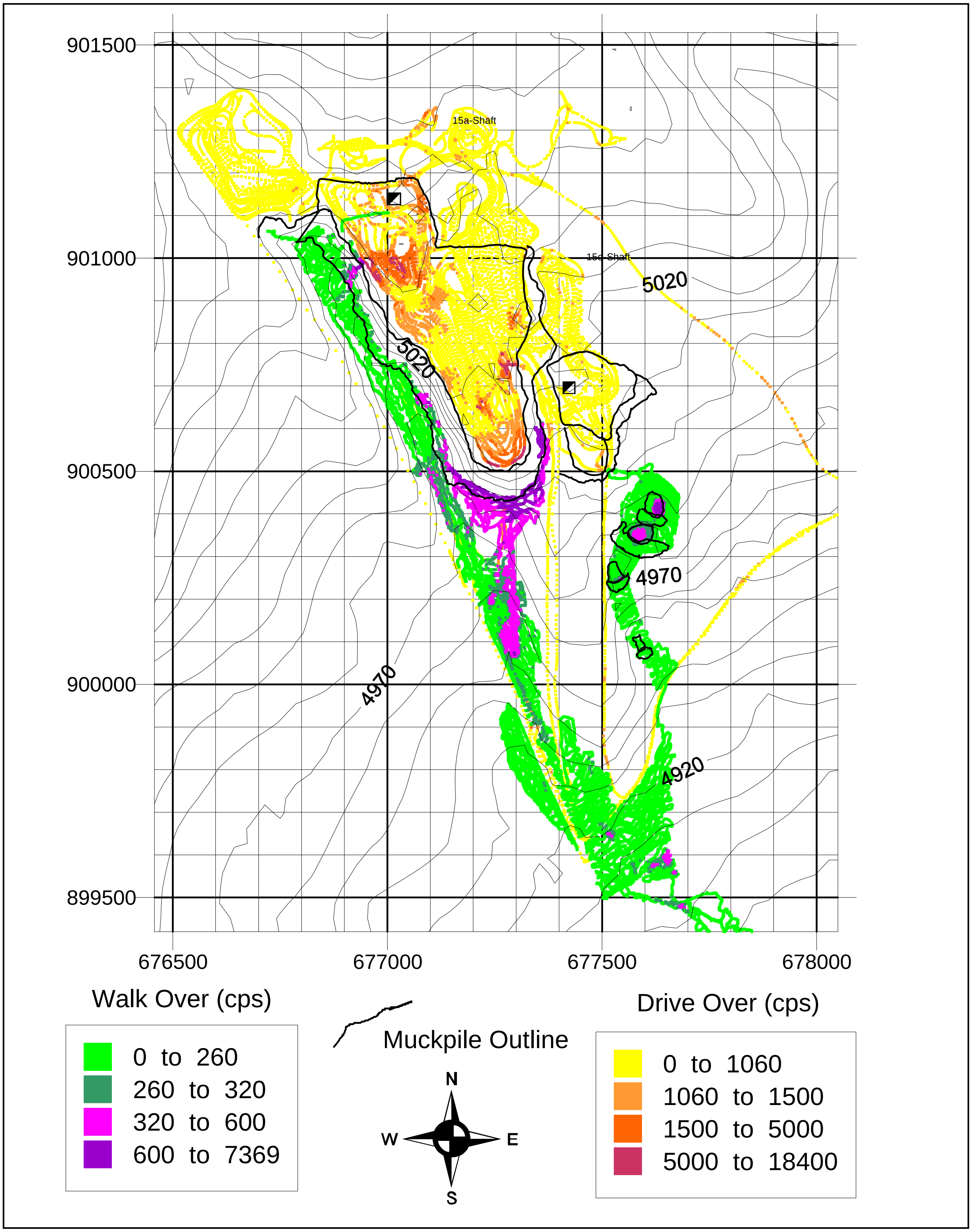


Figure A.3-1

CAU 482 Driveover and Walkover Radiological Survey

The driveover radiological survey of the muckpiles was conducted by towing a DLAPS Detector Model VRM-3, with a TSA Model SC-755 Controller, and a Trimble Pathfinder Pro XRS^{TM} GPS receiver with a $TSC1^{TM}$ data logger with a four-wheel-drive vehicle. Each radiological measurement was taken with the DLAPS detector and recorded on the TSC1 data logger. Each point was then stored with its related GPS location measurement in a combined file. Approximately 8 acres were surveyed and a total of 14,109 beta/gamma measurements were recorded. The highest beta/gamma measurement detected was 18,399 counts per second (cps) at Nevada State Plane coordinates E676,974.6, N900,958. As a result of the DLAPS survey, four locations with the highest detected radioactivity were chosen for the muckpile surface characterization samples. These sample locations were designated as SH-01 through SH-04. The map showing the results of the driveover and walkover radiological soil surveys of the muckpiles, ponds, and drainage is provided in Figure A.3-1.

The walkover radiological survey was conducted by walking over the drainage and ponds with a SAPS Detector Model 8204, with a TSA Model SC-755 Controller, and a Trimble Pathfinder Pro XRS^{TM} GPS receiver with a $TSC1^{TM}$ data logger. Each radiological measurement was taken with the SAPS detector and recorded on the TSC1 data logger and stored with its related GPS measurement in a combined file. Approximately 5 acres were surveyed and a total of 27,991 gamma measurements were recorded. The highest gamma measurement detected was 7,368 cps at Nevada State Plane coordinates E676,941.4, N900,986.4. As a result of the SAPS survey, three locations in the ponds and three locations in the drainage with the highest detected radioactivity were chosen for biased characterization sampling. The biased pond sample locations were designated PB-01 through PB-03, and the biased drainage locations were designated DB1 through DB3.

A.3.3 Muckpile Surface Samples (0 to 5 ft); CASs 15-06-02 and 15-06-01

Shallow soil sampling consisted of drilling boreholes 5 ft into the muckpile using the rotosonic drill rig and collecting a soil sample. A total of 20 ft of rotosonic drilling was completed in 4 boreholes to characterize the muckpile surface. All of the borehole and sample locations are shown on Figure A.3-2. The shallow boreholes were selected based on anomalous radiation readings as measured with the DLAPS during the driveover radiological survey (see Figure 3-1). These locations were designated as SH-01 through SH-04.

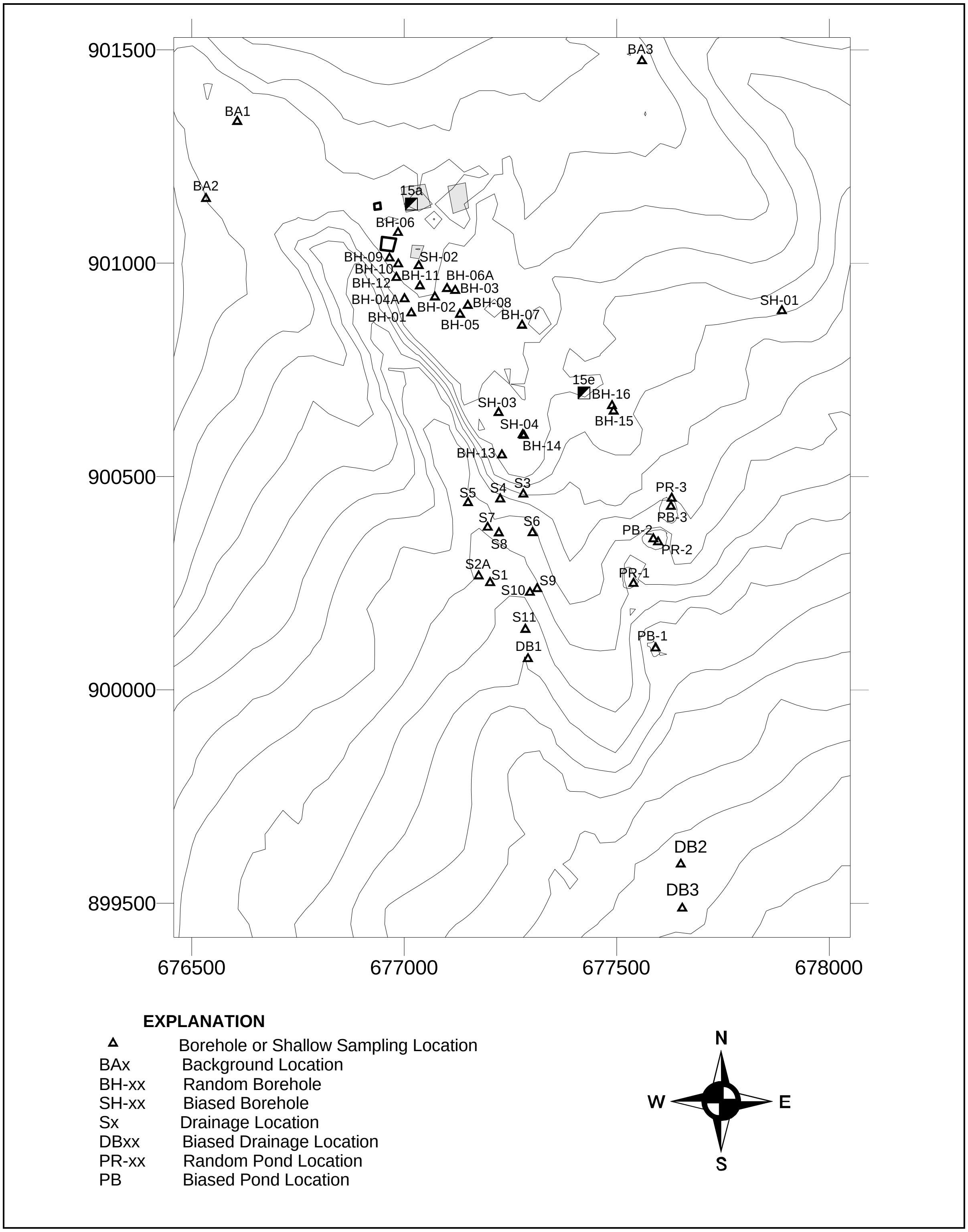


Figure A.3-2

As-Built Borehole and Sampling Locations

One soil sample was collected from each borehole. The sample was collected from the section of core with the highest field screening hit or, if there were no field screening hits, the sample was collected near the top of the borehole. The sample from SH-01 was collected from the 4- to 5-ft interval, and the samples from the other three biased surface sample locations were collected from the 0- to 1-ft interval.

A total of four environmental soil samples were collected to characterize the muckpile surface. The soil samples were sent to an off-site laboratory to be analyzed for VOCs, SVOCs, TPH-DRO, total RCRA metals, and radionuclides. The samples were archived so that once the results were received and evaluated, 25 percent of the samples could be analyzed for strontium-90 and isotopic plutonium for waste management purposes.

A.3.4 Muckpile Subsurface (>5 ft) and Native Soil Samples; CASs 15-06-02 and 15-06-01

Deep soil sampling consisted of drilling boreholes through the muckpile into the native material underneath using the rotosonic drilling method. If the native material was alluvial in nature, the borehole was advanced 5 ft into the native material. If the native material was bedrock, the borehole was only advanced 2 ft into the native material or until refusal. A total of 305.5 ft of drilling was completed in 17 boreholes to characterize the muckpile and the native material beneath the muckpiles (Figure A.3-2). These boreholes were designated as BH-01 through BH-16. The boreholes were drilled to depths ranging from 3.5 ft to 35.5 ft.

Two soil samples were collected from each borehole (Table A.3-1), one at a randomly selected depth (the z-depth) and one from the bottom of the borehole. Additional samples were collected from sections of core where field screening indicated elevated alpha, beta, gamma, or PID levels. A total of 23 environmental soil samples were collected to characterize the muckpile, and 16 environmental soil samples were collected to characterize the native material underneath the muckpile. All of the soil samples were sent to an off-site laboratory to be analyzed for VOCs, SVOCs, TPH-DRO, total RCRA metals, and radionuclides. Archived samples were retained for the analysis of strontium-90 and isotopic plutonium, as needed.

Table A.3-1
As-Built Borehole Locations, Total Depth, and Sampling Depths

Hole #	Northing	Easting	Collar Elevation (ft)	Sample Depth(s) (ft)	Bottom of Muckpile (ft)	Total Depth (ft)/Comments
Deep Boreholes						
BH-01	900,883.1	677,016.9	5,019.0	3, 18, 27.5	23	28
BH-02	900,920.7	677,072.1	5,008.7	3.5, 20.5	16	21
BH-03	900,936.0	677,120.1	5,016.8	4, 15.5	11	16
BH-04A	900,916.4	677,000.9	5,024.0	8.5, 13, 25.5	20	26 / BH-04A drilled because BH-04 was not accessible
BH-05	900,880.1	677,131.5	5,015.1	9.5, 19.5	15	20
BH-06	901,071.6	676,985.5	5,025.1	None	0	4.5 / Moved to Alternate BH-06A because no muck at location
BH-06A	900,940.4	677,100.8	5,019.7	9.5, 15,5	11	16
BH-07	900,854.6	677,277.2	5,016.0	10, 21	17.5	22.5
BH-08	900,901.0	677,149.6	5,016.9	13, 21	16.5	21.5
BH-09	901,012.0	676,965.5	5,030.0	1.5, 11.5	7.5	12
BH-10	900,997.9	676,986.0	5,025.0	1.5, 10	6	10.5
BH-11	900.946.7	677,037.2	5,022.3	0.5, 6.5, 17	12.5	17.5
BH-12	900,966.4	676,981.7	5,025.2	1, 7, 17	12.5	17.5
BH-13	900,550.4	677,230.1	5,008.3	16, 28	26	28.5
BH-14	900,596.0	677,282.0	5,012.0	7, 12, 35.5	31	35.5
BH-15	900,653.3	677,492.7	5,010.9	1, 3	2	3.5
BH-16A	900,666.0	677,489.0	5,007.3	1, 4.5	2.5	5
Shallow Boreholes						
SH-01	900,888.6	677,019.4	5,016.7	4.5	N/A	5
SH-02	900,994.1	677,034.1	5,024.3	0.5	N/A	5
SH-03	900,649.8	677,222.2	4,993.4	0.5	N/A	5
SH-04	900,598.0	677,279.0	5,010.0	0.5	N/A	5

N/A = Not applicable

A.3.5 Pond Soil Samples; CAS 15-38-01

The rotosonic drill rig was not used to sample CAS 15-38-01 because the terrain was too rough. Also, preliminary data suggested that the site might be contaminated with plutonium and it was deemed prudent not to risk contaminating the drill rig. A hand auger or shovel was used to dig the hole, and a disposable plastic scoop was used to collect the soil sample from each pond location (Figure A.3-2). The ponds are shallow, and refusal was encountered at the pond/native interface. Therefore, one sample was collected from the pond/native interface at each random and biased sampling location in the ponds. In addition, because the surface soils are extremely dry and there is no staining that might indicate the presence of volatile organics, no samples collected from the ponds were analyzed for VOCs or SVOCs.

Sample depths for the ponds ranged to a maximum of 21 inches (in.) at sample location PB-01. A total of six environmental soil samples were collected to characterize the soil in the ponds. Sample locations at the ponds were designated PB-1 through PB-3 and PR-1 through PR-3. As-built sample location coordinates and depth of sampling are shown in Table A.3-2.

A.3.6 Drainage Soil Samples

The rotosonic drill rig was not used to sample the drainage since the terrain was too rough and steep to allow safe access. Decontaminated stainless-steel trowels and disposable plastic scoops were used to collect both biased and random samples to characterize the area (Figure A.3-2). The biased samples were collected in areas where the walkover survey results recorded elevated radiological readings. The random samples were selected using a simple random number generator to select northings and eastings within the same boundaries as the walkover survey.

At each of the soil sample locations in the drainage, soil was excavated by hand in 6-inch lifts. Sampling continued until a “clean” (not exceeding background levels of radiation as measured by the Electra in the field) sample interval was encountered. The clean interval was then sampled and sent to the laboratory for analysis. All of the 6-inch intervals above the clean sample were then composited and one sample collected for shipment to the laboratory. In the event that the surface sample did not exceed the background radiation level, only one sample was collected at that location. Sample depths ranged to a maximum depth of 18 inches at sample location S11. A total of 17 environmental soil samples were collected from 14 locations to characterize the soil in the drainage. Sample locations at this CAS were designated S1 through S11, and biased samples from the drainage were designated DB1 through DB3. All of the soil samples were sent to an off-site laboratory to be analyzed for SVOCs, TPH-DRO, total RCRA metals, and radionuclides. Samples were archived pending the decision as to which samples to analyze for strontium-90 and isotopic plutonium. As-built sample location coordinates and depth of sampling are shown in Table A.3-2.

Table A.3-2
As-Built Sample Locations and Sampling Depths

Site ID	Northing	Easting	Elevation (ft)	Sample Depth(s)
Pond Sample Locations				
Pond 4 PB-1	900,098.1	677,591.5	4,948.2	15-21 in.
Pond 3 PR-1	900,249.4	677,539.4	4,969.8	14-20 in.
Pond 2 PR-2	900,346.6	677,597.3	4,979.8	0-6 in.
Pond 2 PB-2	900,353.8	677,586.1	4,977.4	0-4 in.
Pond 1 PR-3	900,448.9	677,629.3	4,988.9	0-6 in.
Pond 1 PB-3	900,429.9	677,627.6	4,989.2	0-6 in.
Drainage Sample Locations				
S1	900,251.1	677,202.0	4,949.6	0-6 in.
S2A	900,266.9	677,175.3	4,950.4	0-6 in.
S3	900,458.8	677,280.3	4,971.5	0-12 in.
S4	900,447.2	677,225.8	4,966.4	0-12 in.
S5	900,438.6	677,150.2	4,954.1	0-6 in.
S6	900,368.2	677,301.9	4,958.9	0-6 in.
S7	900,380.9	677,196.4	4,957.3	0-6 in.
S8	900,367.9	677,222.8	4,969.2	0-6 in.
S9	900,237.0	677,312.9	4,949.0	0-6 in., 7-12 in.
S10	900,228.4	677,295.7	4,934.2	0-6 in.
S11	900,141.7	677,285.1	4,928.0	0-12 in., 12-18 in.
DB1	900,073.0	677,291.2	4,929.4	0-12 in.
DB2	899,591.5	677,650.9	4,887.1	0-12 in.
DB3	899,488.1	677,654.2	4,891.4	0-12 in.
Background Sample Locations				
BA1	901,331.9	676,607.2	5,038.7	6-18 in.
BA2	901,151.5	676,533.8	5,046.1	6-18 in.
BA3	901,474.1	677,559.5	5,056.5	6-18 in.

A.3.7 Background Native Soil Samples (0.5 to 1.5 ft)

Background soil samples were collected at three locations near the U15a/e Muckpiles (Figure A.3-2). These background sample locations were designated as BA-1, BA-2, and BA-3. The first background hole was used as a dry run to critique the drilling and sampling process for the rotosonic drill. The other two samples were collected using decontaminated hand tools. The one-foot interval from 0.5 to 1.5 ft was sampled in each hole. The samples were sent to an off-site laboratory to be analyzed for total RCRA metals and radionuclides. As-built sample location coordinates and depth of sampling are shown in Table A.3-2.

A.3.8 Other Sampling

In addition to the environmental samples, 55 quality assurance (QA)/quality control (QC) samples were collected during drilling and surface soil sampling. These QA/QC samples included 4 blind duplicate samples, collected and analyzed to check on the laboratory's precision; 4 matrix spike/matrix spike duplicate samples, collected to check for matrix interference; 4 rinsate samples, collected to check on the effectiveness of the decontamination procedures; 4 field blanks, collected to check on possible environmental interferences; 3 background samples to compare with results from potentially contaminated areas; and 17 trip blanks sent with the VOC samples. Before field work commenced, decontamination water from the Area 1 Water Supply well was used to fill the drillers' water truck. The water was sampled and analyzed. The aliquots that required cooling to 4 degrees Celsius were resampled when it was discovered that the sample arrived at the laboratory warmer than the required temperature. Results indicated that there were no COPCs present in these sources. All of the QC samples were sent to the off-site laboratory to be analyzed for VOCs, SVOCs, TPH-DRO, total RCRA metals, and radionuclides.

A.4.0 Results

Tables of the analytical results are provided in Attachment C. These tables include only those analytical results where COPCs were detected, even if the detect was qualified as estimated (J qualifier). A detect merely indicates that the parameter was identified in the sample and does not have any reference to action levels or regulatory limits. The analytical results from the investigation are summarized in the following tables. Table A.4-1 is a summary of the detected analytical results in soil for VOCs, SVOCs, TPH-DRO, and total RCRA metals. Table A.4-2 is a summary of the detected analytical results in soil for the radionuclides.

The sampling showed that there was no migration through the muckpile into the native soil underneath. None of the samples from the native material had chemical or man made radionuclide concentrations. There were some naturally occurring radionuclides but they were all at background levels.

The contamination in the ponds is all contained in the ponds and no migration was found from the ponds.

There was some evidence of radionuclide migration from the U15a muckpile in storm water runoff. The drainage below the muckpile has concentrations of man made radionuclides above the PALs but they are confined in the drainage and have traveled less than 1,000 ft downgradient.

Table A.4-1
VOCs, SVOCs, and Total Metals for the U15a/e Muckpiles and Ponds Investigation
(Page 1 of 2)

	U15a Muckpile				U15e Muckpile				Ponds		Drainage		Background		QC Water	
	Muck		Native		Muck		Native									
	Range	No. of detects	Range	No. of detects	Range	No. of detects	Range	No. of detects	Range	No. of detects	Range	No. of detects	Range	No. of detects	Range	No. of detects
Total No. of Samples Collected	**23**		**14**		**2**		**2**		**6**		**17**		**3**		**25**	
Volatile Compounds	µg/kg[1]		µg/kg		µg/kg		µg/kg		µg/kg		µg/kg		µg/kg		µg/L[2]	
2-butanone	11	1	ND[3]	0	ND	0	ND	0	N/A[4]	--	N/A[4]	--	N/A[4]	--	ND	0
Acetone	8.4-48	11	10	2	ND	0	ND	0	N/A	--	N/A	--	N/A	--	9.3-24	2
Bromodichloromethane	ND	0	ND	0	ND	0	ND	0	N/A	--	N/A	--	N/A	--	1.6-2.3	5
Chloroform	ND	0	ND	0	ND	0	ND	0	N/A	--	N/A	--	N/A	--	2.4-7.4	5
Dibromochloromethane	ND	0	ND	0	ND	0	ND	0	N/A	--	N/A	--	N/A	--	0.74	1
Methylene chloride	3.6-44	6	2.3-7.7	4	2.6	1	3.5	1	N/A	--	N/A	--	N/A	--	ND	0
P-isopropyltoluene	1.4-17	2	ND	0	ND	0	ND	0	N/A	--	N/A	--	N/A	--	ND	0
Toluene	3.6	1	ND	0	ND	0	ND	0	N/A	--	N/A	--	N/A	--	ND	0
Semivolatile Compounds	µg/kg		µg/kg		µg/kg		µg/kg		µg/kg		µg/kg		µg/kg		µg/L	
Benzo(A)anthracene	ND	0	ND	0	ND	0	ND	0	ND	0	43-190	2	ND	0	ND	0
Benzo(A)pyrene	ND	0	ND	0	ND	0	ND	0	ND	0	44-210	2	ND	0	ND	0
Benzo(B)fluoranthene	ND	0	ND	0	ND	0	ND	0	ND	0	84-360	2	ND	0	ND	0
Benzo(G,H,I)perylene	ND	0	ND	0	ND	0	ND	0	ND	0	190	1	ND	0	ND	0
Benzo(K)fluoranthene	ND	0	ND	0	ND	0	ND	0	ND	0	110	1	ND	0	ND	0
Bis(2-ethylhexyl)phthalate	200-310	2	ND	0	ND	0	ND	0	ND	0	ND	0	ND	0	ND	0
Chrysene	ND	0	ND	0	ND	0	ND	0	ND	0	76-290	2	ND	0	ND	0
Di-N-butyl phthalate	ND	0	ND	0	ND	0	ND	0	ND	0	58	1	ND	0	ND	0
Fluoranthene	ND	0	ND	0	ND	0	ND	0	ND	0	160	1	ND	0	ND	0
Indeno(1,2,3-CD)pyrene	ND	0	ND	0	ND	0	ND	0	ND	0	130	1	ND	0	ND	0
Pyrene	ND	0	ND	0	ND	0	ND	0	ND	0	260	1	ND	0	ND	0
Petroleum Hydrocarbons	mg/kg[5]		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg		mg/L[6]	
Diesel-range organics	4-510	17	4.5	1	ND	0	ND	0	10	1	3.9-97	2	ND	0	ND	0

Table A.4-1
VOCs, SVOCs, and Total Metals for the U15a/e Muckpiles and Ponds Investigation
(Page 2 of 2)

	U15a Muckpile				**U15e Muckpile**				**Ponds**		**Drainage**		**Background**		**QC Water**	
	Muck		**Native**		**Muck**		**Native**									
	Range	**No. of detects**	**Range**	**No. of detects**	**Range**	**No. of detects**	**Range**	**No. of detects**	**Range**	**No. of detects**	**Range**	**No. of detects**	**Range**	**No. of detects**	**Range**	**No. of detects**
Total No. of Samples Collected		**23**		**14**		**2**		**2**		**6**		**17**		**3**		**25**
Metals (total)	**mg/kg**		**mg/kg**		**mg/kg**		**mg/kg**		**mg/kg**		**mg/kg**		**mg/kg**		**mg/L**	
Arsenic	1.7-15	20	0.81-12	11	3.5-3.7	2	1.2-3.5	2	2.6-6.7	6	1.8-4.8	17	1.7-3.1	3	ND	0
Barium	46-230	23	41-120	14	74-95	2	39-91	2	62-140	5	45-220	17	40-70	3	ND	0
Cadmium	0.11-2.9	3	ND	0	ND	0	ND	0	0.56-3.5	2	0.52-0.61	2	0.39	1	ND	0
Chromium	1.6-30	23	2.2-4.9	14	1.9-2.1	2	1.7-3	2	2.4-12	6	1.6-8.2	17	2-3.5	3	ND	0
Lead	5.9-57	23	0.67-4.5	14	2-3.5	2	0.97-4	2	7.4-39	6	4.2-34	17	4.5-7.9	3	ND	0
Mercury	0.0026-0.047	12	0.0019-0.0031	5	0.018	1	0.0066	1	0.011-0.051	6	0.0057-0.024	17	0.013-0.22	2	ND	0
Selenium	0.41-1.1	14	0.37-0.99	7	0.42	1	ND	0	ND	0	0.42-1.8	3	ND	0	ND	0
Silver	0.6-1.5	4	ND	0	ND	0	ND	0	ND	0	ND	0	ND	0	ND	0

[1] µg/kg = Micrograms per kilogram
[2] µg/L = Micrograms per liter
[3] ND = Not detected
[4] N/A = This group was not analyzed for VOCs.
[5] mg/kg = Milligrams per kilogram
[6] mg/L = Milligrams per liter

Table A.4-2
Radionuclide Detects for the U15a/e Muckpiles and Ponds Investigation

	U15a Muckpile				U15e Muckpile				Ponds		Drainage		Background		QC Water	
	Muck		Native		Muck		Native									
	Range	No. of detects	Range	No. of detects	Range	No. of detects	Range	No. of detects	Range	No. of detects	Range	No. of detects	Range	No. of detects	Range	No. of detects
Total No. of Samples Collected		**23**		**14**		**2**		**2**		**6**		**17**		**3**		**25**
Radionuclide	**pCi/g[1]**		**pCi/g**		**pCi/g**		**pCi/g**		**pCi/g**		**pCi/g**		**pCi/g**		**pCi/L[2]**	
Ac-228	0.65-1.26	13	0.68-0.92	10	0.86-1.09	2	0.86-0.92	2	0.8-1.14	5	0.7-1.27	9	0.94-1.29	2	ND[3]	0
Am-241	ND	0	ND	0	ND	0	ND	0	4.07-182	4	0.41-3.1	2	ND	0	ND	0
Bi-214	0.65-1.71	19	0.42-1.11	12	0.59-0.78	2	0.56-0.92	2	0.35-0.6	2	0.32-1.07	11	0.38-0.7	2	ND	0
Co-60	0.123	1	ND	0	ND	0	ND	0	ND	0	0.323	1	ND	0	ND	0
Cs-137	0.282-3050	21	0.202-0.246	2	0.69	1	ND	0	0.63-830	6	0.55-472	16	0.33-0.57	2	ND	0
K-40	19.9-28	23	18.4-37	14	22.4-24.3	2	21-25.6	2	17-24.3	6	10.7-25.5	17	11.1-27	3	ND	0
Pb-212	0.85-1.33	15	0.7-1.12	14	0.88-1.25	2	0.85-0.91	2	0.81-1.16	5	0.44-1.17	16	0.36-1.43	3	ND	0
Pb-214	0.95-1.49	15	0.48-1.11	14	0.79-0.86	2	0.54-0.91	2	0.53-0.56	2	0.35-1	13	0.45-0.99	3	ND	0
Pu-238	0.089-1.28	2	ND	0	ND	0	ND	0	0.327-18.3	5	0.065-3.96	5	ND	0	ND	0
Pu-239	0.038-7.7	7	ND	0	ND	0	ND	0	0.379-1000	6	0.421-23.3	5	ND	0	ND	0
Sr-90	0.38-66	11	ND	0	ND	0	ND	0	0.21-65	6	0.79-43.8	4	ND	0	4.63	1
Tl-208	0.239-0.5	10	0.19-0.46	12	0.334-0.36	2	0.3-0.33	2	0.25-0.29	2	0.278-0.46	9	0.318-0.38	2	ND	0

[1] pCi/g = Picocuries per gram
[2] pCi/L = Picocuries per liter
[3] ND = Not detected

A.5.0 Waste Management

Management of the investigation-derived waste (IDW) was guided by the CAIP (DTRA, 2002a) requirements, field observations, and the results of the laboratory analysis of the muckpile characterization samples. Administrative controls were used to minimize the amount of waste generated during the investigation.

A.5.1 Waste Segregation

The IDW was segregated into solid (personal protective equipment [PPE], plastic liners) and liquid (rinsate) waste streams to limit the amount of potentially contaminated waste. As each exclusion zone was closed, the solid IDW was bagged, the bag was sealed with tape, and marked with the associated sample numbers for that exclusion zone; no other waste was put in that bag. The bag was then placed in a lined 55-gallon drum in the hazardous waste accumulation area (HWAA). Liquid waste generated from decontamination activities was pumped or poured into drums and then moved into the HWAA. When the liquid waste was generated and pumped or poured into the drum, the soil borings associated with the decontaminated equipment were recorded in the waste management log book. Each drum is marked with a unique identification number and when the drum was filled, it was sealed with a tamper-indicating device (TID). The type of material in the drum and the date filled were recorded in the waste management log book so that a waste characterization determination could be conducted.

A.5.2 Waste Generation

Waste generated during the field work was either sanitary waste or IDW. The sanitary waste consisted mostly of paper and kitchen debris generated in the field office. This trash was removed from the site on a daily basis by BN. The IDW consisted of rinsates, PPE, used sampling equipment, soil, plastic liners, and plastic sleeves generated during the drilling and sampling efforts. This waste was dealt with as described in the rest of this section. In accordance with the CAIP, the soil cores generated by the drilling were put back in the borehole after sampling was completed so that no soils were containerized as IDW.

A.5.2.1 Rinsates

Rinsate was generated through decontamination operations at the main decontamination facility and rig-side portable decontamination tub. The main decontamination facility was a rectangular area lined with a 20 mil Herculine® liner. The pad was sloped to the north. The liner was approximately 200 ft^2 and was held in place with sandbags. Decontamination activities conducted at the main decontamination facility included decontamination of the drill rig, pipe truck, drill pipe, and hole casing at the beginning and end of the project. The equipment and tools were decontaminated by backing the pipe truck into the decontamination sump and washing everything with high pressure hot water and Alconox®. After being decontaminated, the core barrels were cased in plastic sleeves and the drill rods and hole casing were covered with plastic to prevent them from getting contaminated before being used. All rinsate from the decontamination pad was containerized.

After the initial decontamination, all core barrels, bits, and drill rods were decontaminated in the portable decontamination tub next to the drill rig. The rinsates generated at the rig-side decontamination unit were from decontamination of the core barrels, drill bits, and the non-disposable sampling equipment (primarily stainless-steel bowls, trowels, and spoons). Once the core barrels, drill bits, and sampling equipment were decontaminated, they were slid into plastic sleeves to protect them from becoming contaminated before their next use. This rinsate was placed in 55-gallon drums and logged in the waste management log book at the end of each day.

A.5.2.2 Soil

No significant quantity of soil accumulated in the bottom of the decontamination tub, nor was any soil contaminated by spills; therefore, no soil required disposal other than the drill core, which was disposed of in the borehole it came from.

A.5.2.3 PPE, Plastic Sleeves, and Sampling Equipment IDW

The PPE generated as IDW in the exclusion zone consisted of the Tyvek® anti-contamination clothing, nitrile gloves, latex surgical gloves, cotton glove liners, and tape. These items were containerized as they were removed at the hot line when personnel were exiting the exclusion zone.

Plastic sleeves were used to keep the decontaminated core barrels clean before use and to containerize slough as it was cleaned out of the boreholes. After sampling, the core and slough material were returned to the borehole. The empty sleeves were containerized in a clear plastic bag pending disposal as IDW.

The IDW generated from the sampling equipment consisted of the disposable plastic scoops, plastic wrappers, paper label backing, latex gloves, nitrile gloves, plastic, tape, paper towels, and Kimwipes®. The debris generated inside the exclusion zone was placed in a clear plastic trash bag and labeled with a waste management tracking tag. The date, waste tracking tag number, and associated sample numbers were written on the bag before it was put in a lined drum in the HWAA.

A.5.2.4 Plastic Liners

Plastic liners were used under the drill rig, the water/pipe truck, and the decontamination tub to prevent hydrocarbon leaks from getting on the ground. To minimize waste generation, each liner was used at several locations unless it was damaged, leaked on, or field screening of the core samples indicated the presence of contamination, in which case the liner was replaced at the completion of the hole.

A.5.3 Waste Accumulation

All IDW was put in U.S. Department of Transportation compliant, 55-gallon, steel drums. For the drums that would receive solid IDW, an absorbent (Stergo®) pad was placed in the bottom and a plastic liner was inserted. After receiving waste, the drums were stored on wooden or plastic pallets in the fenced HWAA. The HWAA was lined and bermed in case any of the drums of rinsate leaked. The HWAA was also designated a radiation materials area. The rings for the open-topped 55-gallon drums were provided with drilled bolts to receive a TID. Once a drum received waste, it was marked with an identification number and labeled with “Hazardous Waste Pending Analysis” and “Radioactive Material Pending Analysis” stickers and was secured with a TID. A waste management log book was used to track the drums used, the contents of each drum, along with an estimate of how much material was put in the drum. The drums were not filled completely, so the number of gallons for each type of material is an approximation based on the amount of material estimated to have been put in each drum from each waste stream.
A drum log spreadsheet was maintained to help track the waste. Table A.5-1 provides a tally of the number of drums used, what they contained, and their final disposition.

Table A.5-1
Drum Count

Number of Drums	Volume (Gallons)	Waste Stream	Disposition
6	270	Rinsate	Sanitary Waste
7	288	PPE & Plastic	Sanitary Waste
1	16	PPE & Plastic	Low-Level Waste
Total Number: 14			

A.5.3.1 Rinsates

Rinsates from decontamination activities were accumulated on a daily basis from the rig-side decontamination unit. Accumulated rinsate was pumped from the rig-side decontamination tub into unlined 55-gallon drums staged next to the decontamination trailer. When a drum was filled (leaving some ullage) it was labeled, sealed with a TID, and moved to the HWAA. If the drum was not full, it was labeled, sealed with a TID, and left inside the HWAA for the night.

A.5.3.2 Soil

No soil residue was disposed of.

A.5.3.3 PPE and Sampling Equipment IDW

The PPE was collected and deposited in a plastic bag at the hot line as personnel exited the exclusion zone. When the exclusion zone was closed, or at the end of the shift, the plastic bag was taped closed and was screened for radioactivity before being released. After the bag was released, a waste tracking tag was prepared to document the contents of the bag. The date, waste tracking tag number, and associated sample numbers were written on the bag. It was then logged into the waste management logbook and put in a lined drum in the HWAA.

The disposable sampling equipment was collected in a plastic bag inside the exclusion zone as the sampling was conducted. IDW was accumulated until the bag was filled, and then it was taped closed. Once the bag was filled it was handled in the same manner as the PPE.

A.5.3.4 Plastic Liners

When the plastic liners that were placed under the drill rig or the rig-side decontamination unit became ripped or if field screening indicated that contaminated material had been encountered, the liner was placed into a lined drum and moved to the HWAA. When the plastic liners filled a drum, one waste tracking tag was prepared for the entire drum rather than preparing a separate tag for the individual liners.

A.5.4 Waste Characterization

The IDW was considered potentially contaminated waste only by virtue of contact with potentially contaminated media. Therefore, additional sampling and analysis of the IDW, separate from the borehole soil sampling and analysis, was not required. The data generated as a result of the site characterization were used to make waste determinations of the IDW.

The IDW was characterized by identifying the borehole samples associated with each waste container and then comparing the analytical results from those samples to various standards. For the hazardous waste determination, the borehole sample results were compared to the RCRA waste characterization levels for hazardous waste. For total petroleum hydrocarbon wastes, the sample results were compared to the *Nevada Administrative Code* for TPH-DRO determination. For the low-level radioactive waste determination, the sample results were compared to concentrations in soil and water samples taken from background locations in the western and southwestern United States, and to the “rad added” screening levels of the *Nevada Test Site Performance Objective for Certification of Nonradioactive Hazardous Waste* (POC) (BN, 1995).

The hazardous waste determination did not identify any drums associated with samples that contained concentrations of hazardous constituents high enough to be considered hazardous. The preliminary radiological waste determination identified one drum, 482P01 that was associated with samples that were considered to have potential “rad added” in excess of the POC screening levels. Because there was a small total quantity of material in the drum relative to the volume of soil, this drum was classified as low-level waste.

A.5.5 Waste Disposal

All of the drums of IDW were disposed of as sanitary waste except for drum 482P01, which was disposed of as low-level waste at the Area 5 Low-Level Waste Facility.

A.6.0 Health and Safety

At the start of the project, a preliminary hazard assessment was prepared and used to guide the preparation of the SSHASP (IT, 2002), the Radiation Work Permits (IT-2002-U15a/e-01 and IT-2002-U15a/e-02), and the CAIP (DTRA, 2002a). The work was then performed in accordance with these documents.

Prefield health and safety preparation was accomplished using a project-specific health and safety checklist. The checklist was developed to ensure that all required items were verified and/or available before mobilization to the field.

A.6.1 Physical Hazards

The primary physical hazards fell into three general categories: fatigue; heat stress; and slip, trip, and fall. Sources of these hazards were the long drive to and from the work site, the general hazards of working around moving machinery, the high ambient air temperatures on the test site at that time of year, and working on uneven ground and around the slope of the muckpile.

The hazards associated with fatigue, heat stress, and slip, trip, and fall were mitigated by discussing the long drive, the hazards involved with the machinery, heat stress symptoms, and site-specific slip, trip, and fall hazards during the morning tailgate safety meetings. The length of the work day was limited and workers were observed by the SSO and SS for fatigue and heat stress and were encouraged to drink water. This ensured that workers did not become overly fatigued and could safely drive back to Mercury, Nevada, at the end of the day.

The hazard posed by the slope of the muckpile was addressed by applying a similar restriction to the U15a/e Muckpiles as was used at 16a-Tunnel. The restriction was to drill no closer than 25 ft from the edge of the muckpile. This conservative restriction ensured personnel did not work too close to the edge of the muckpile and ensured that the vibrations and weight of the rotosonic drill rig would not cause the slope to fail.

A.6.2 Chemical and Radiological Hazards

Chemical hazards believed to be contained within the muckpile debris included mostly hydrocarbon products, epoxies, and chemical grouts that may have been disposed of on the muckpile. These products were used for fuels, ground support, and various other applications during mining operations. Preliminary soil sampling indicated the potential presence of lead and arsenic at levels that could pose an inhalation hazard. Radiological hazards were thought to have come from the waste rock deposited on the muckpile during reentry mining operations following testing and from water from the mine workings that was discharged to the ponds. Before the regulation of disposal activities on the muckpile, rock contaminated with low-level radioactivity may have been deposited on the muckpile (DTRA, 2002a).

Products brought on site to assist with the characterization investigation were required to have a material safety data sheet before receiving approval for use. These items generally consisted of fuels, lubricants, cooling and cleaning agents, and grout.

Action levels for the chemical constituents and radiological hazards were posted on the tailgate safety briefing as noted in the SSHASP. All intrusive work required that real-time monitoring be conducted and the results documented in the Daily Safety Reports.

As a precaution, those personnel who would experience the highest likelihood of exposure to airborne soil were required to wear respirators (Level C) and personal air monitors during operations until the air filters from three days of continuous monitoring could be sent to the analytical laboratory for analysis. Following receipt of the results indicating that there was no inhalation hazard present from lead and arsenic, the PPE level was downgraded from Level C to Level D modified, allowing personnel to work without air-purifying respirators. Field-screening results established that action limits for occupational threat to personnel during the drilling and sampling operations were not exceeded.

A.6.3 Drilling

An equipment inspection of the Boart-Longyear drill rig was performed by IT personnel upon its arrival on site and before any drilling activity. This inspection was documented on the Drill Rig Inspection form as described in the Field Instruction. All safety devices were present and operational.

The rotosonic drill rig was operated safely and performed reliably throughout the project. The drilling team from Boart-Longyear was well skilled and worked both efficiently and safely.

A.6.4 Noise

During rotosonic drilling operations personnel exposure to noise is always a concern. Noise-level monitoring was conducted before startup and during actual drilling, with a sound level meter set on the ‘A’ scale with a slow response. Measurements indicated that average noise levels of 85 to 110 decibels were common within 35 ft of the drill rig. With this knowledge, all personnel working or observing operations within this distance were required to wear hearing protection. Personnel were also diligent in watching out for each other to make certain that hearing protection was available and in use before equipment startup.

A.6.5 Air Monitoring

A Photovac 2020 photoionization detector was used for real-time air monitoring for VOCs during all intrusive work. The 2020 measures and records the values of concentrations of photoionizable gases. It cannot distinguish between individual pollutants, it merely lets the operator know that something is present. During drilling activities at the U15a/e Muckpiles and Ponds, the 2020 was used to measure concentrations in a worker's breathing zone. All concentrations logged during field activities were well below the established action level of one part per million sustained in the breathing zone.

In addition to the VOC monitoring, radiation monitoring was conducted daily through high volume air sampling. One air sample was collected in the exclusion zone side of the sample van and another sample was collected in the clean side of the sample van. These samples were collected by continuously drawing air through the two filters during work hours. Once work ceased for the day, the filters were removed and counted on a Ludlum Model 2929 alpha/beta scaler. The results were discussed at the next morning's tailgate safety briefing. No airborne radioactive particles were detected in the high volume air sample filters during field activities.

A.6.6 Personnel Monitoring

At the beginning of the field work all personnel turned in a bioassay sample to be archived by the laboratory. In the event of a possible radiological uptake, this sample would be used as a baseline to be compared to future samples. All personnel were required to wear a thermal luminescent dosimeter while working at the muckpile.

A.6.7 Impacts/Delays/Incidents

The start of field work was delayed due to the lack of health and safety support and late delivery of respirators. In addition, afternoon lightning storms delayed the start of drilling from the afternoon of September 12 to the next day.

A.6.8 Training

Before assignment, all necessary training documentation for specific tasks was reviewed and verified as to current status. By verifying all documentation before personnel arrived on site, delays to track down missing or incomplete training documentation were minimized.

Training requirements for this project were outlined in the SSHASP and included 40-hour Hazardous Waste Operations and Emergency Response, annual 8-hour refresher, medical surveillance with respirator qualification, and Radiological Worker II. Additional training for specific personnel included 8-hour supervisory training, first aid and cardiopulmonary resuscitation, blood-borne pathogens training, classroom and field waste management training, and training and fit testing for respirator use.

A.7.0 Lessons Learned

Following the drilling dry run exercise on September 12, 2002, a meeting was held to critique the process. On September 16, 2002, a mid-work cycle lessons learned meeting was held to assess the drilling process to ensure that any improvements noted could be implemented to benefit the current field program. A second lessons learned meeting was held on September 25, 2002, at the completion of the drilling. In each case, the field crew, the client, and the safety officer attended the meeting. In addition, quality assurance staff also attended if they were on site. The purpose of the meetings was to identify those practices which were done well and should be continued and to generate improvements on those practices that need to be improved for the next DTRA muckpile characterization project. The results of the lessons learned meetings are summarized in the next two sections: a "Did Well" section, Section A.7.1; and a "Do Better" section, Section A.7.2. Several items in the "Did Well" section were issues that were corrected as a result of the dry run critique meeting.

A.7.1 Did Well

The following is a listing of the areas that everyone agreed were done well.

A.7.1.1 Health and Safety

- The field crew required to wear respirators met the challenge very well in spite of the discomfort.

- The sampler went into the zone only when needed.

- Having up-gradable Radiological Work Permits worked out very well.

- Gatorade as well as water was provided for rehydrating the field crew.

A.7.1.2 Drilling, Sampling, and Deconning

- The process was changed so that after all of the hole has been drilled, the sampler collected samples from the bottom of the hole first, and then moved up the length of cuttings or core to collect the next sample. This reduced the time between drill holes by allowing the drillers to put the cuttings back into the hole sooner. The casing could then be pulled, and the drillers could move to the next site while the sample team finished collecting samples.

- The dry run helped people understand their processes and fix anything that needed to be fixed.

- The half rounds worked out very well for staging cores for logging and sampling.

- Sampling equipment was minimized inside the van, with only essential materials present. This helped the traffic in the van, as well as minimizing the potential for materials to have to be decontaminated or discarded.

- Pallets, rocks, and other debris were used as well as cones to mark holes, and were spray painted to locate easily.

- The person conducting the decontamination was working in a full rain suit, but after evaluation of the process, Health and Safety agreed that the rain suit was unnecessary. Due to the heat and waterproof barrier, the person doing the decontamination was suffering heat stress. The decontamination set up was protective enough to allow him to work without the rain suit, which significantly extended the time he could work without needing a break. If the set up required more protection, a big rubber apron would work better than the overalls because much less of the body surface area would be covered in the rubber.

- The H-shaped cuts on core liners provided easier access to the cuttings for logging and sampling.

A.7.1.3 Facilities

- The sampling van is a great convenience.

- The new box truck stairs are an improvement over the thin blue stairs.

- The office trailer is nice.

- Preventing last year’s problem of having the hyper-pure germanium spectrometer (HPGe) vulnerable to generator unreliability would have required getting a main dewer for liquid nitrogen supplied on site. Instead, the HPGe was left at Bldg. 153 and the technician transported samples back and forth.

A.7.2 Do Better

The following is a list of the areas where things need to be changed or improved.

A.7.2.1 Mobilization

- Confirmation is needed from in-house support staff to ensure badging paperwork, medical clearances, and respirator fit tests are done for the drillers.

- Two weeks are needed to get the radiation instrumentation up and running before the project. Doing the calibrations and using it for a couple of days is necessary to get it ready.

- There was a disconnect on the timing of the mobilization. More time was needed to do it correctly.
- The punch list is needed earlier.
- Schedule aggressive (weekly) meetings at about 2 months before going into the field.
- Calibration certificates are needed for all instruments (e.g., health and safety, laboratory) ahead of field work.

A.7.2.2 Health and Safety

- The vibration of the breathing zone apparatus was very annoying. It needs to be located away from bone structure.
- Respirators need to be pulled off the face and away to doff.
- Respirators should not be put on until intrusive activities begin to minimize the stress from using them.
- The PPE was too tight for one of the drillers. A work around with duct tape and large Tyveks was implemented. If tall or large crew members will be participating, PPE needs to be ordered to fit.
- A more thorough resuspension analysis should be conducted to prevent respirator use unless it is absolutely necessary. Respirator use causes a lot of heat stress and discomfort, as well as restricting vision during inherently dangerous operations.
- Tinted respirator covers would help. Bright sun was a hazard.

A.7.2.3 Field Activities

- The sample van needs to be located upwind of the drilling to minimize exposure potential in the van.
- The person doing decontamination needs to be careful not to overspray.
- When sampling, the paper work should be consistently done on one side of the van, and the core should be managed on the other side. That allows the sampler, geologist, and radiation technician to move about in the sample van without running into each other.
- The volume of grout used to fill each hole should be measured to the nearest gallon.
- The checklists need improvement. They need to be ordered according to the process for the site. Some things cannot be checked off because they are the one thing on the list that does not get done until later.

- It would be helpful to have bigger bowls and two scoop sizes available so as to have choices ready for various sampling medium textures.

- Gamma spectrometry results are needed before shipping potentially hot samples.

- Shelves installed above the work surface in sampling van would be useful.

- Holders are needed for empty half rounds under the counter to keep them in place, or maybe there were too many in the van.

- Wire baskets could be used to contain the bowls for pressure washing and for drying. If they were welded in place, they would be more secure. Kennels would work.

- The rinse water sprayer did not have enough pressure.

- The new pressure washer was not acquired in time to use on this project.

- A saw horse needed for the decontamination tub had been borrowed by another project.

- Consider installing permanent storage racks or shelves to organize the box truck.

- The Tailgate Safety Briefing form should have a specific spot for the daily lessons learned.

A.7.2.4 Communications

- The Site Supervisor needed to carry a radio.
- Communication is a problem with hearing protection.

A.8.0 References

BN, see Bechtel Nevada.

Bechtel Nevada. 1995. *Nevada Test Site Performance Objective for Certification of Nonhazardous Waste,* Rev. 0. North Las Vegas, NV.

DTRA, see Defense Threat Reduction Agency.

Defense Threat Reduction Agency. 2002a. *Corrective Action Investigation Plan for Corrective Action Unit 482: Area 15 U15a/e Muckpiles and Ponds, Nevada Test Site,* Rev. 0. Prepared by IT Corporation. North Las Vegas, NV.

Defense Threat Reduction Agency. 2002b. *Field Instruction for Corrective Action Unit 482: Area 15 15a/e Muckpiles and Ponds Characterization,* Rev. 0. Prepared by IT Corporation. North Las Vegas, NV.

FFACO, see *Federal Facility Agreement and Consent Order.*

Federal Facility Agreement and Consent Order. 1996. Agreed to by the Nevada Division of Environmental Protection, the U.S. Department of Energy, and the U.S. Department of Defense. Las Vegas, NV.

Gilbert, Richard O. 1987. *Statistical Methods for Environmental Pollution Monitoring. Van Nostrand Reinhold.* New York, NY.

IT, see IT Corporation.

IT Corporation. 2002. *ITLV Site-Specific Health and Safety Plan, Corrective Action Unit 482: Area 15 U15a/e Muckpiles and Ponds, Nevada Test Site,* Rev. 0. IT Corporation. North Las Vegas, NV.

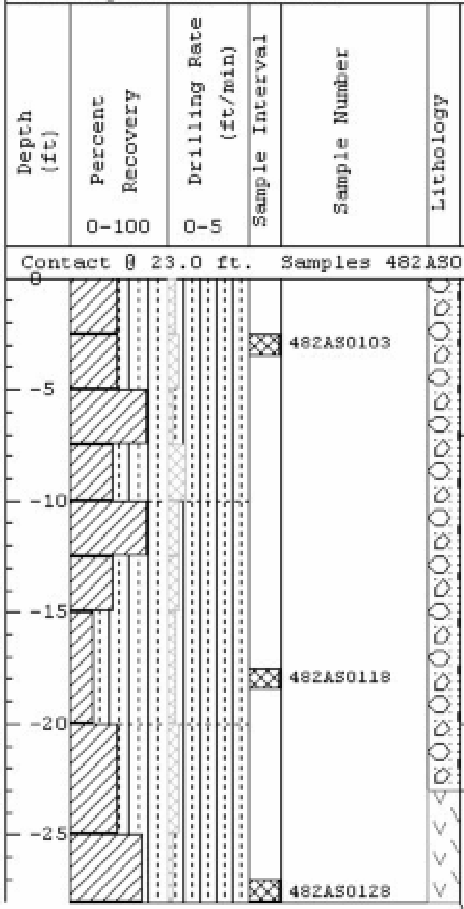
Attachment A

Soil Boring Logs
(20 Pages)

Project Name: CAU 482 15a/e Muckpiles & Ponds
Project Number: 831844.02010615
Borehole Number: BH-01
Logged By: Dawn Arnold
Drilled By: Boart-Longyear
Drilling Method: RotoSonic

Date Started: 9/13/02
Date Completed: 9/13/02
Elevation: 5019 ft
Northing: 900883.1
Easting: 677016.9
Total Depth: 28.0 ft

Contact @ 23.0 ft. Samples 482AS0103, 482AS0118, 482AS0128.



Lithologic Description Comments	Field Screening Results		
	VOCs (ppm)	Alpha (dpm)	Beta (dpm)
Muck: Silt and sand matrix with gravel to cobbles of quartz granite. White to white/gray color; slight pinkish white to whitish gray silt and sand.	2.8	0	6124
	0	277	3217
	0	60	3217
Muck: 7.0 ft: Moisture change. Increases. Coincides with slight color change.	1.1	48	4571
	1.1	24	5152
	0	36	4508
	2.5	12	5694
Muck: Gray silt and sand with gravel granite.	7.1	36	5053
Native: 23.0 ft: Yellowish-red, weathered/stained granite. Friable, medium to coarse sand and fine to medium gravel-sized grains.	18.1	BKG	BKG

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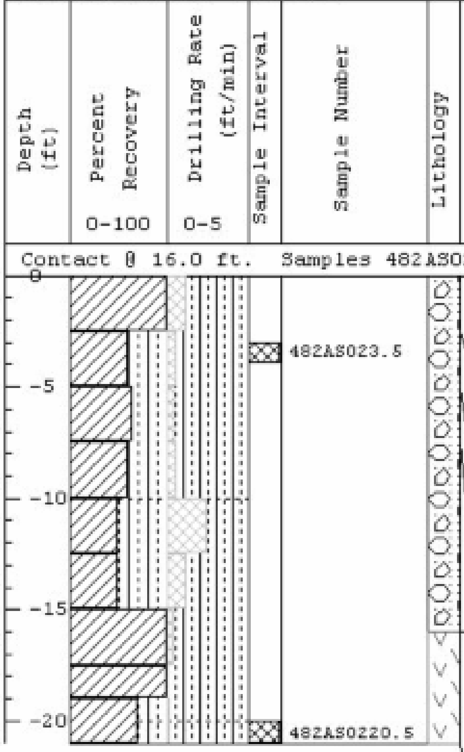
Project Name: CAU 482 15a/e Muckpiles & Ponds
Project Number: 831844.02010615
Borehole Number: BH-02
Logged By: Dawn Arnold
Drilled By: Boart-Longyear
Drilling Method: RotoSonic

Date Started: 9/16/02
Date Completed: 9/16/02
Elevation: 5008.7 ft
Northing: 900920.7
Easting: 677072.1
Total Depth: 21.0 ft

Contact @ 16.0 ft. Samples 482AS023.5, 482AS0220.5.



Lithologic Description Comments

Muck: Pinkish-orange alluvium, silty-gravelly sands, dry, loose.

Muck: Grayish/white gravel to cobble muck within sand matrix.

Muck: 2.5 to 7.5 ft dark gray sand and gravel, unusual color.

Muck: Gray cobble to gravel muck.

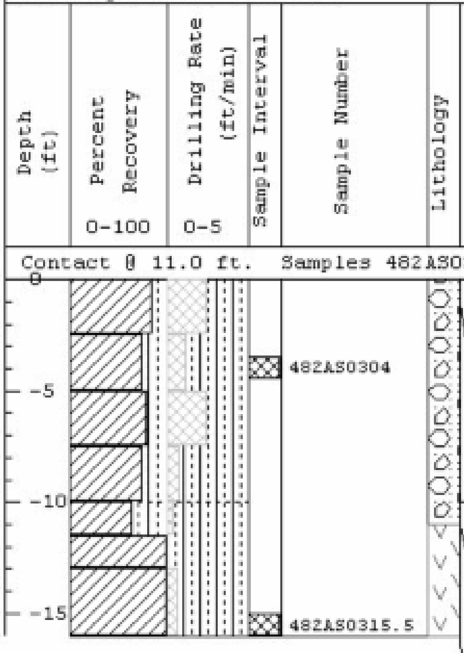
Native: 16.0 ft. Native soil/muck interface. Dark top soil (organic) slightly damp. Weathered granite. Gravelly sand with pieces of slighly cohesive bedrock.

Field Screening Results		
VOCs (ppm)	Alpha (dpm)	Beta (dpm)
5.1	22	2,500
6.5	0	2,900
12.0	22	2,200
	45	2,900
4.9	22	2,500
15.8	22	2,500
4.2	0	2,700
3.5	0	2,500
12.9	22	2,400

Project Name: CAU 482 15a/e Muckpiles & Ponds
Project Number: 831844.02010615
Borehole Number: BH-03
Logged By: Dawn Arnold
Drilled By: Boart-Longyear
Drilling Method: RotoSonic

Date Started: 9/17/02
Date Completed: 9/17/02
Elevation: 5016.8 ft
Northing: 900936.0
Easting: 677120.1
Total Depth: 16.0 ft

Contact @ 11.0 ft. Samples 482AS0304, 482AS0315.5.



Lithologic Description Comments

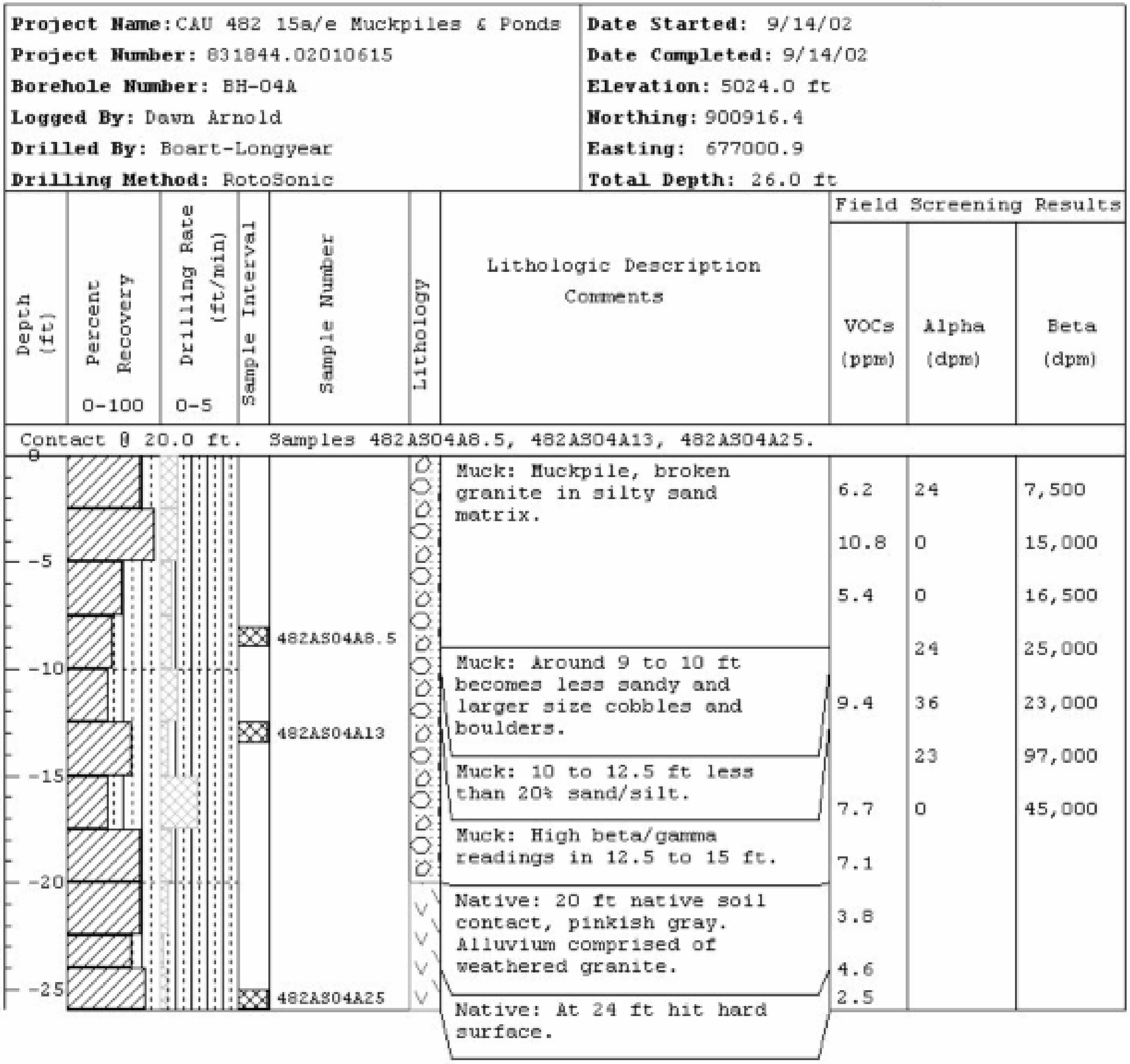
Muck: 0 to 1.0 ft pink-orange color alluvium, silty sands with gravel.

Muck: 1.0 ft gray gravelly sands with silt, muckpile waste.

Muck: Large cobble size muck pieces.

Native: Native interface with muck at 11.0 ft. Slight color change and less gravel. Friable pieces of weathered granite. Contact not as distinct as previous holes. 12 to 16 ft pink orange weathered, silty sand.

Field Screening Results		
VOCs (ppm)	Alpha (dpm)	Beta (dpm)
15.4	0	2,800
12.8	0	2,500
14.2	0	2,700
6.8	0	2,300
2.0	0	2,100
18.6	0	2,800
27.1	0	2,400



Project Name: CAU 482 15a/e Muckpiles & Ponds
Project Number: 831844.02010615
Borehole Number: BH-04A
Logged By: Dawn Arnold
Drilled By: Boart-Longyear
Drilling Method: RotoSonic

Date Started: 9/14/02
Date Completed: 9/14/02
Elevation: 5024.0 ft
Northing: 900916.4
Easting: 677000.9
Total Depth: 26.0 ft

Contact @ 20.0 ft. Samples 482AS04A8.5, 482AS04A13, 482AS04A25.

Sample Number	Lithologic Description Comments	VOCs (ppm)	Alpha (dpm)	Beta (dpm)
	Muck: Muckpile, broken granite in silty sand matrix.	6.2	24	7,500
		10.8	0	15,000
		5.4	0	16,500
482AS04A8.5			24	25,000
	Muck: Around 9 to 10 ft becomes less sandy and larger size cobbles and boulders.	9.4	36	23,000
482AS04A13				
	Muck: 10 to 12.5 ft less than 20% sand/silt.		23	97,000
		7.7	0	45,000
	Muck: High beta/gamma readings in 12.5 to 15 ft.	7.1		
	Native: 20 ft native soil contact, pinkish gray. Alluvium comprised of weathered granite.	3.8		
		4.6		
482AS04A25		2.5		
	Native: At 24 ft hit hard surface.			

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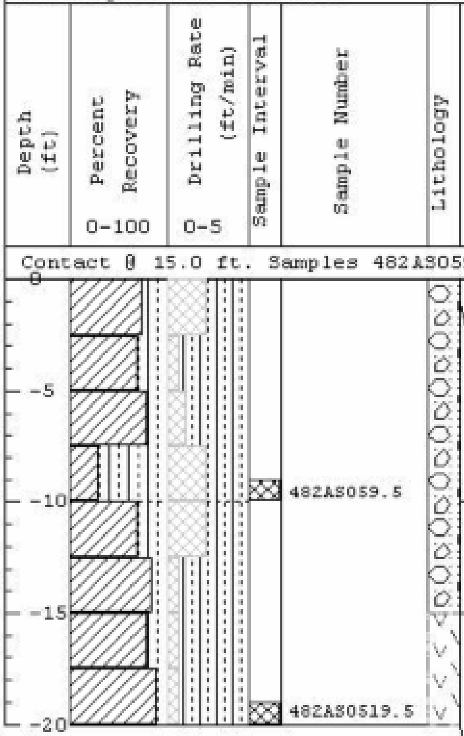
Project Name: CAU 482 15a/e Muckpiles & Ponds
Project Number: 831844.02010615
Borehole Number: BH-05
Logged By: Dawn Arnold
Drilled By: Boart-Longyear
Drilling Method: RotoSonic

Date Started: 9/17/02
Date Completed: 9/17/02
Elevation: 5015.1 ft
Northing: 900880.1
Easting: 677131.5
Total Depth: 20.0 ft

Contact @ 15.0 ft. Samples 482AS059.5, 482AS0519.5.



Sample Number	Lithologic Description Comments	Field Screening Results VOCs (ppm)	Alpha (dpm)	Beta (dpm)
	Muck: Pinkish-orange alluvium 0.0 to 1.0 ft.	4.1	0	2,700
	Muck: Gray granite (muck) mixed with sandy soil gravel to cobble size.	7.4	0	2,700
		20.8	22	2,600
482AS059.5		13.5	22	2,500
	Muck: Debris present in core/gravel - cobbles > 70% (wood, wire).	16.1	0	2,700
		0.0	22	2,700
	Muck: Native/muck interface at 15.0 ft. Distinct color and composition change to weathered granite soil, sand, well-graded, friable with iron oxide stains.	5.4	0	2,500
482AS0519.5		7.2	0	2,700

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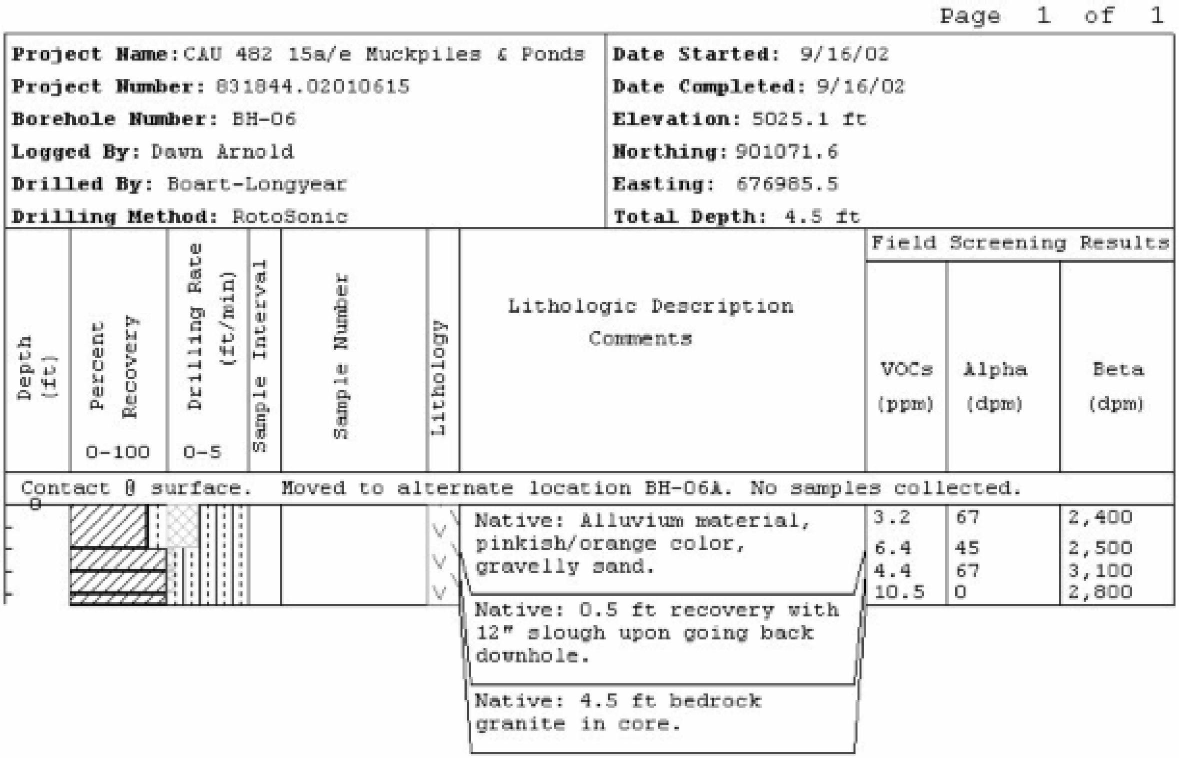

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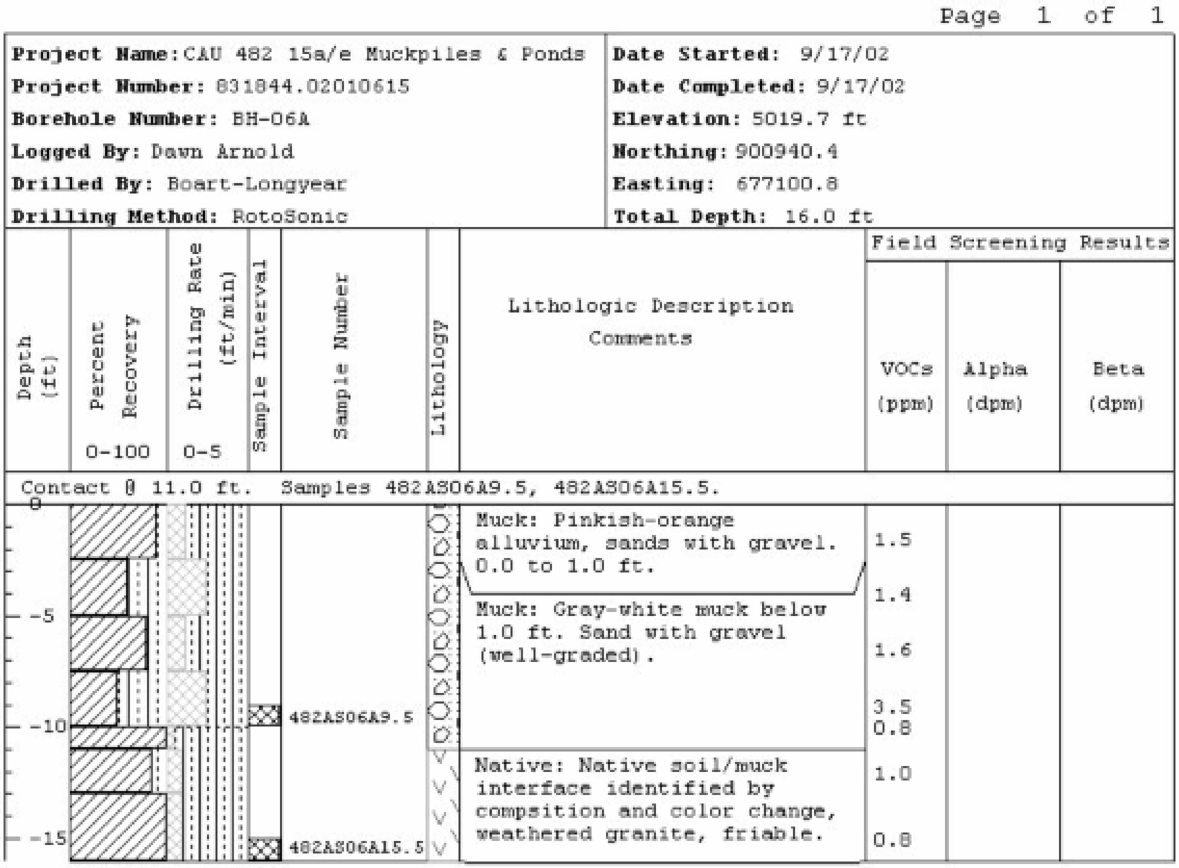
Project Name: CAU 482 15a/e Muckpiles & Ponds
Project Number: 831844.02010615
Borehole Number: BH-06
Logged By: Dawn Arnold
Drilled By: Boart-Longyear
Drilling Method: RotoSonic

Date Started: 9/16/02
Date Completed: 9/16/02
Elevation: 5025.1 ft
Northing: 901071.6
Easting: 676985.5
Total Depth: 4.5 ft

Depth (ft)	Percent Recovery 0-100	Drilling Rate (ft/min) 0-5	Sample Interval	Sample Number	Lithology	Lithologic Description Comments	Field Screening Results		
							VOCs (ppm)	Alpha (dpm)	Beta (dpm)
Contact @ surface. Moved to alternate location BH-06A. No samples collected.									
0						Native: Alluvium material, pinkish/orange color, gravelly sand.	3.2	67	2,400
							6.4	45	2,500
							4.4	67	3,100
						Native: 0.5 ft recovery with 12" slough upon going back downhole.	10.5	0	2,800
						Native: 4.5 ft bedrock granite in core.			



Project Name: CAU 482 15a/e Muckpiles & Ponds
Project Number: 831844.02010615
Borehole Number: BH-06A
Logged By: Dawn Arnold
Drilled By: Boart-Longyear
Drilling Method: RotoSonic

Date Started: 9/17/02
Date Completed: 9/17/02
Elevation: 5019.7 ft
Northing: 900940.4
Easting: 677100.8
Total Depth: 16.0 ft

Contact @ 11.0 ft. Samples 482AS06A9.5, 482AS06A15.5.

Sample Number:
482AS06A9.5
482AS06A15.5

Lithologic Description Comments:

Muck: Pinkish-orange alluvium, sands with gravel. 0.0 to 1.0 ft.

Muck: Gray-white muck below 1.0 ft. Sand with gravel (well-graded).

Native: Native soil/muck interface identified by compsition and color change, weathered granite, friable.

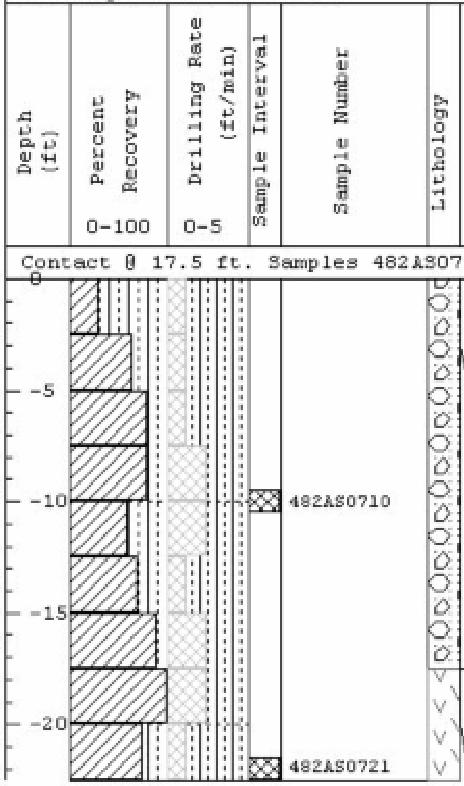
Field Screening Results

VOCs (ppm)	Alpha (dpm)	Beta (dpm)
1.5		
1.4		
1.6		
3.5		
0.8		
1.0		
0.8		

Project Name: CAU 482 15a/e Muckpiles & Ponds
Project Number: 831844.02010615
Borehole Number: BH-07
Logged By: Dawn Arnold
Drilled By: Boart-Longyear
Drilling Method: RotoSonic

Date Started: 9/18/02
Date Completed: 9/18/02
Elevation: 5016.0 ft
Northing: 900854.6
Easting: 677277.2
Total Depth: 22.5 ft

Contact @ 17.5 ft. Samples 482AS0710, 482AS0721.



Lithologic Description Comments

Muck: Little to no alluvium in first core, gray muck - gravel to cobble with little fines.

Muck: Alternates with sandy gravel to gravelly sand.

Native: Native soil/muck interface at 17.5 ft. Top soil with weathered granite and alluvium below.

Field Screening Results		
VOCs (ppm)	Alpha (dpm)	Beta (dpm)
5.2	0	2,200
2.1	22	2,500
5.3	45	2,700
1.5	22	2,700
1.7	22	2,800
4.5	22	2,500
4.5	45	2,600
4.1	0	2,500
7.6	0	2,500

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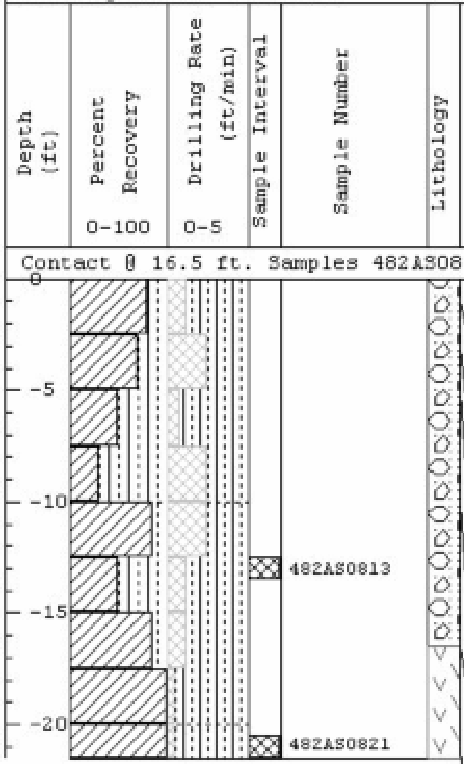
Project Name: CAU 482 15a/e Muckpiles & Ponds
Project Number: 831844.02010615
Borehole Number: BH-08
Logged By: Dawn Arnold
Drilled By: Boart-Longyear
Drilling Method: RotoSonic

Date Started: 9/17/02
Date Completed: 9/17/02
Elevation: 5016.9 ft
Northing: 900901.0
Easting: 677149.6
Total Depth: 21.5 ft

Contact @ 16.5 ft. Samples 482AS0813, 482AS0821.



Lithologic Description Comments

Muck: 0.0 to 1.0 ft alluvium.

Muck: 1.0 ft and below muck, gray/white sand with gravel and cobbles.

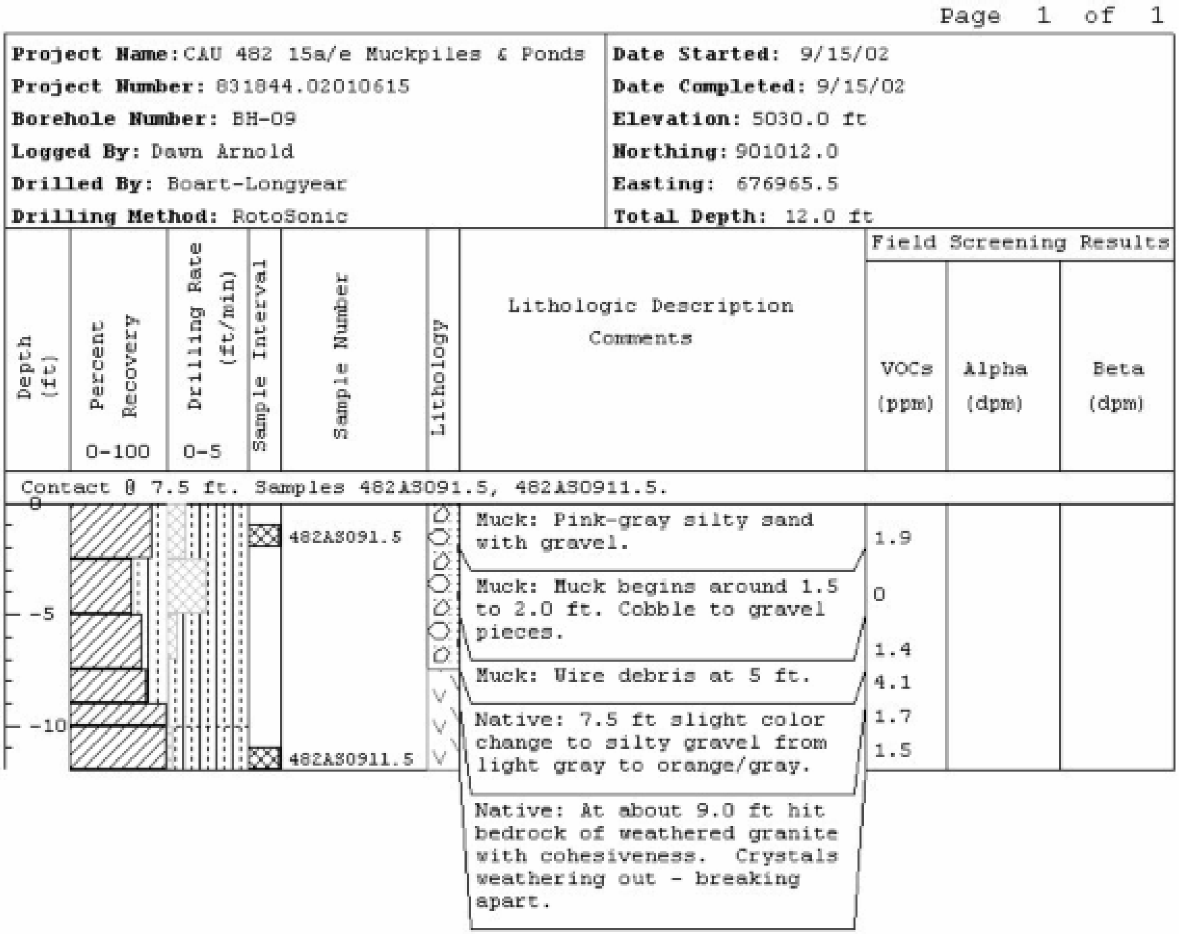
Muck: Muck covered by reddish/orange sand, sand < 40%.

Muck: Muck and sand mixture varied from previous hole. Sand/silt more pink/red than white-gray.

Muck: Gravel-cobble with sand.

Native: 16.5 ft native interface with muck. Distinct color change with weathered granite and iron oxide stain. Silty sand at contact.

Field Screening Results		
VOCs (ppm)	Alpha (dpm)	Beta (dpm)
1.2	0	2,600
0.8	22	2,500
3.2	67	2,300
2.3	45	2,900
3.8	0	2,500
4.6	0	2,300
2.5	22	2,500
12.5	0	2,300
2.0	22	2,100



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Project Name: CAU 482 15a/e Muckpiles & Ponds
Project Number: 831844.02010615
Borehole Number: BH-09
Logged By: Dawn Arnold
Drilled By: Boart-Longyear
Drilling Method: RotoSonic

Date Started: 9/15/02
Date Completed: 9/15/02
Elevation: 5030.0 ft
Northing: 901012.0
Easting: 676965.5
Total Depth: 12.0 ft

Contact @ 7.5 ft. Samples 482AS091.5, 482AS0911.5.

482AS091.5

Muck: Pink-gray silty sand with gravel.

Muck: Muck begins around 1.5 to 2.0 ft. Cobble to gravel pieces.

Muck: Wire debris at 5 ft.

Native: 7.5 ft slight color change to silty gravel from light gray to orange/gray.

Native: At about 9.0 ft hit bedrock of weathered granite with cohesiveness. Crystals weathering out - breaking apart.

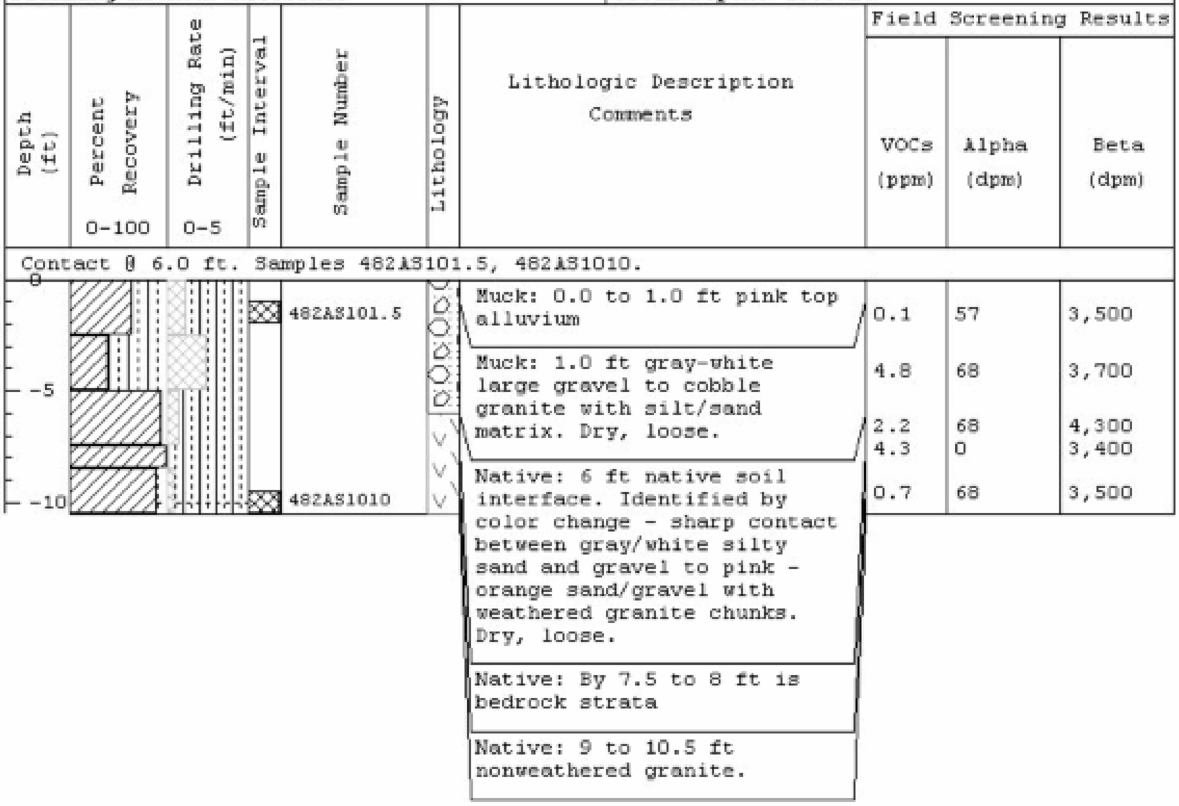
482AS0911.5

VOCs (ppm): 1.9, 0, 1.4, 4.1, 1.7, 1.5

Project Name: CAU 482 15a/e Muckpiles & Ponds
Project Number: 831844.02010615
Borehole Number: BH-10
Logged By: Dawn Arnold
Drilled By: Boart-Longyear
Drilling Method: RotoSonic

Date Started: 9/15/02
Date Completed: 9/15/02
Elevation: 5025.0 ft
Northing: 900997.9
Easting: 676986.0
Total Depth: 10.5 ft

Contact @ 6.0 ft. Samples 482AS101.5, 482AS1010.



Sample Number	Field Screening Results VOCs (ppm)	 Alpha (dpm)	 Beta (dpm)
482AS101.5	0.1	57	3,500
	4.8	68	3,700
	2.2	68	4,300
	4.3	0	3,400
482AS1010	0.7	68	3,500

Lithologic Description
Comments

Muck: 0.0 to 1.0 ft pink top alluvium

Muck: 1.0 ft gray-white large gravel to cobble granite with silt/sand matrix. Dry, loose.

Native: 6 ft native soil interface. Identified by color change - sharp contact between gray/white silty sand and gravel to pink - orange sand/gravel with weathered granite chunks. Dry, loose.

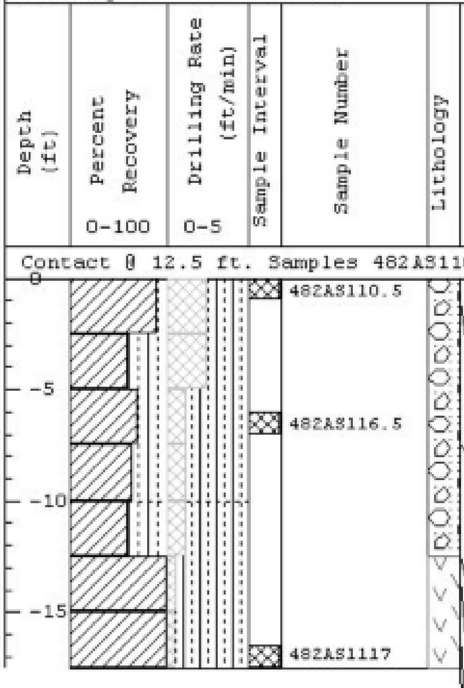
Native: By 7.5 to 8 ft is bedrock strata

Native: 9 to 10.5 ft nonweathered granite.

Project Name: CAU 482 15a/e Muckpiles & Ponds
Project Number: 831844.02010615
Borehole Number: BH-11
Logged By: Dawn Arnold
Drilled By: Boart-Longyear
Drilling Method: RotoSonic

Date Started: 9/16/02
Date Completed: 9/16/02
Elevation: 5022.3 ft
Northing: 900946.7
Easting: 677037.2
Total Depth: 17.5 ft

Contact @ 12.5 ft. Samples 482AS110.5, 482AS116.5, 482AS1117.



Lithologic Description Comments

Muck: 0.0 to 1.0 ft pinkish orange gravelly sands and silt. Alluvium.

Muck: 1.0 ft and below gray colored muck, gravel and cobbles. Dry and loose.

Muck: 7.5 ft dark gray soil - gravel, moisure. Looks like gravel rather than muck. Strong organic soil odor.

Native: Native interface with alluvium, orange weathered granite.

Native: At about 13.5 ft competent granite, weathered creates powdered matrix in core.

Native: Silty sand with gravel, granite composition. Dry, loose.

Field Screening Results		
VOCs (ppm)	Alpha (dpm)	Beta (dpm)
4.3	22	4,200
3.2	22	2,400
5.6	22	2,400
3.5	22	2,700
10.0	0	2,800
9.5	22	2,500
9.1	0	2,700

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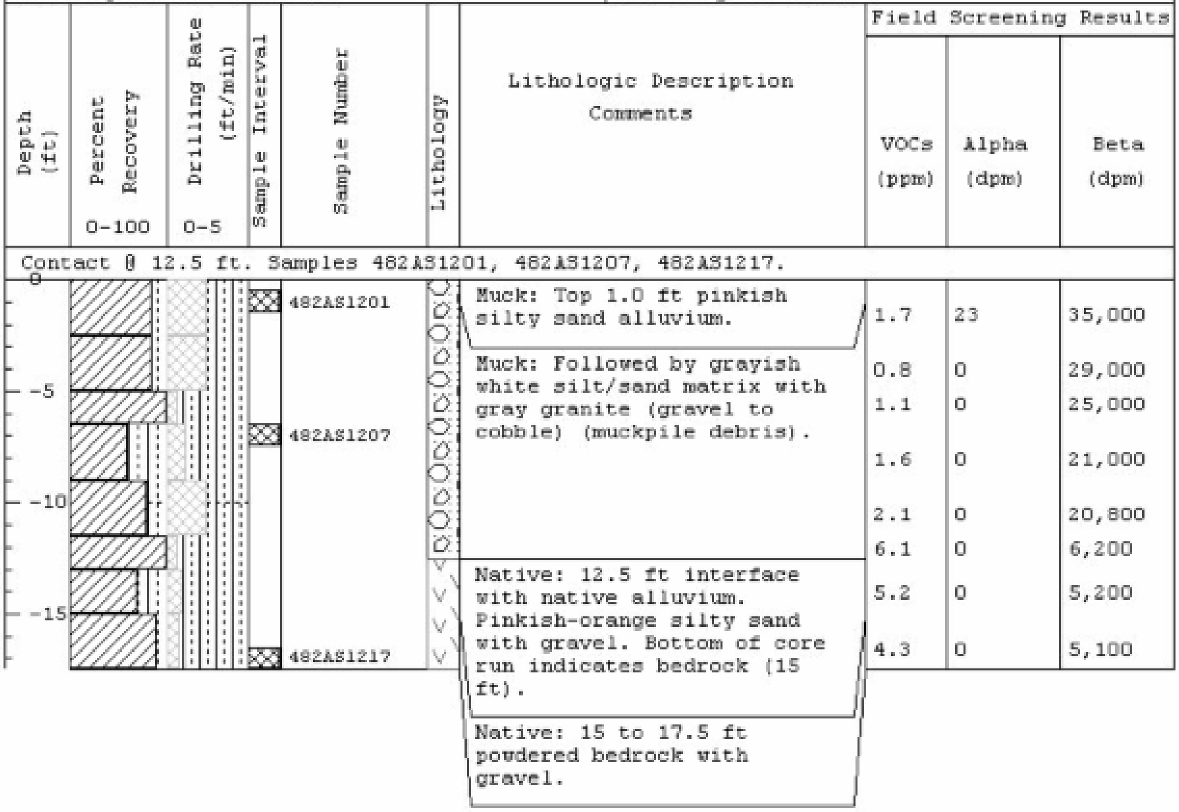
Project Name: CAU 482 15a/e Muckpiles & Ponds
Project Number: 831844.02010615
Borehole Number: BH-12
Logged By: Dawn Arnold
Drilled By: Boart-Longyear
Drilling Method: RotoSonic

Date Started: 9/15/02
Date Completed: 9/15/02
Elevation: 5025.2 ft
Northing: 900966.4
Easting: 676981.7
Total Depth: 17.5 ft



Lithologic Description Comments

Contact @ 12.5 ft. Samples 482AS1201, 482AS1207, 482AS1217.

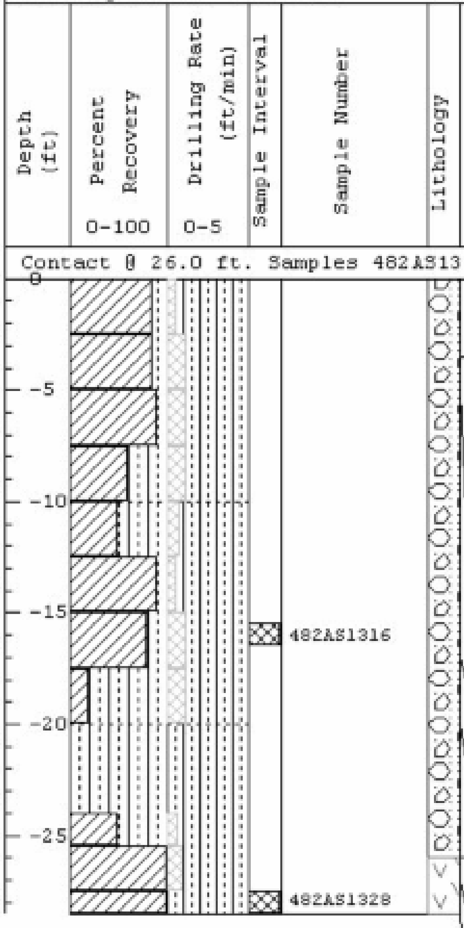
Sample Number	Lithologic Description Comments
482AS1201	Muck: Top 1.0 ft pinkish silty sand alluvium.
482AS1207	Muck: Followed by grayish white silt/sand matrix with gray granite (gravel to cobble) (muckpile debris).
482AS1217	Native: 12.5 ft interface with native alluvium. Pinkish-orange silty sand with gravel. Bottom of core run indicates bedrock (15 ft).
	Native: 15 to 17.5 ft powdered bedrock with gravel.

Field Screening Results

VOCs (ppm)	Alpha (dpm)	Beta (dpm)
1.7	23	35,000
0.8	0	29,000
1.1	0	25,000
1.6	0	21,000
2.1	0	20,800
6.1	0	6,200
5.2	0	5,200
4.3	0	5,100

Project Name: CAU 482 15a/e Muckpiles & Ponds
Project Number: 831844.02010615
Borehole Number: BH-13
Logged By: Dawn Arnold
Drilled By: Boart-Longyear
Drilling Method: RotoSonic

Date Started: 9/18/02
Date Completed: 9/18/02
Elevation: 5008.3 ft
Northing: 900550.4
Easting: 677230.1
Total Depth: 28.5 ft



Contact @ 26.0 ft. Samples 482AS1316, 482AS1328.

Lithologic Description
Comments

Muck: Gravelly sand, well-graded pinkish-orange.

Muck: Large cobbles and coarse gravel of gray muck present but in well-graded sand matrix and occasional layer of silt and sand. Color is reddish brown/medium brown, not typical gray. Appears to be fill material, not typical muck.

Muck: Debris present in core at 17.0 ft (wood and plastic).

Muck: Void space in core - no resistance in barrel advancement and no recovery.

Muck: Gravel - appears more typical muck material.

Native: Native soil/muck interface at 26.0 ft.

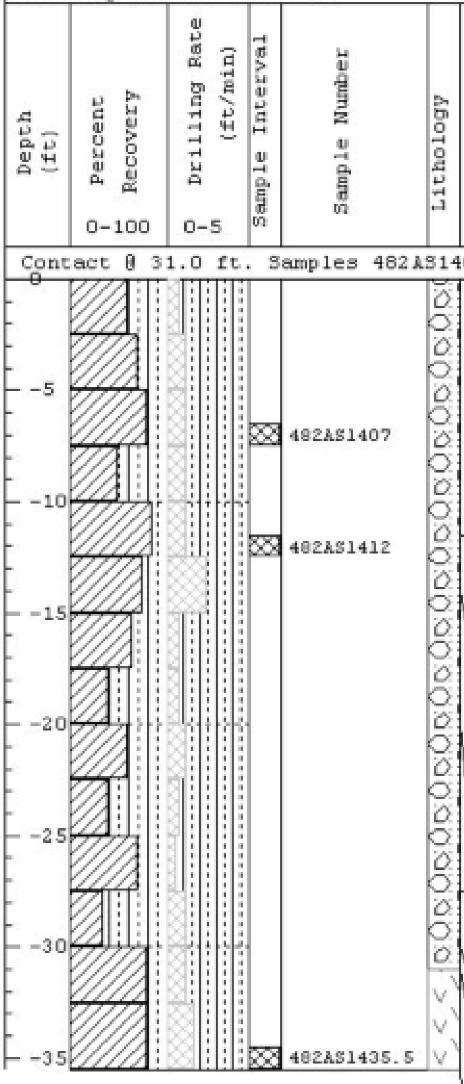
Native: Weathered granite appears in core at about 26.0 ft. Bedrock in core bit.

Field Screening Results		
VOCs (ppm)	Alpha (dpm)	Beta (dpm)
0.4	0	2,600
0.4	0	2,700
1.0	0	2,800
6.5	22	2,700
3.4	45	2,400
0	22	2,400
1.0	22	2,200
3.8	0	2,200
N/A	N/A	N/A
0.8	45	2,300
1.8	0	2,600
4.8	22	2,600

Project Name: CAU 482 15a/e Muckpiles & Ponds
Project Number: 831844.02010615
Borehole Number: BH-14
Logged By: Dawn Arnold
Drilled By: Boart-Longyear
Drilling Method: RotoSonic

Date Started: 9/19/02
Date Completed: 9/19/02
Elevation: 5012 ft
Northing: 900596
Easting: 677282
Total Depth: 35.5 ft

Contact @ 31.0 ft. Samples 482AS1407, 482AS1412, 482AS1435.5.



Lithologic Description
Comments

Muck: Well-graded sand alluvium, pink-orange color. Grades into muck gravel to cobbles.

Muck: Wire debris present at 12.0 ft, rusty orange color. For about 1.0 ft silt and fine sand.

Muck: Material is difficult to identify if muck or native. Reddish orange sand with non-weathered granite gravel to cobble size pieces. Determined to be muck.

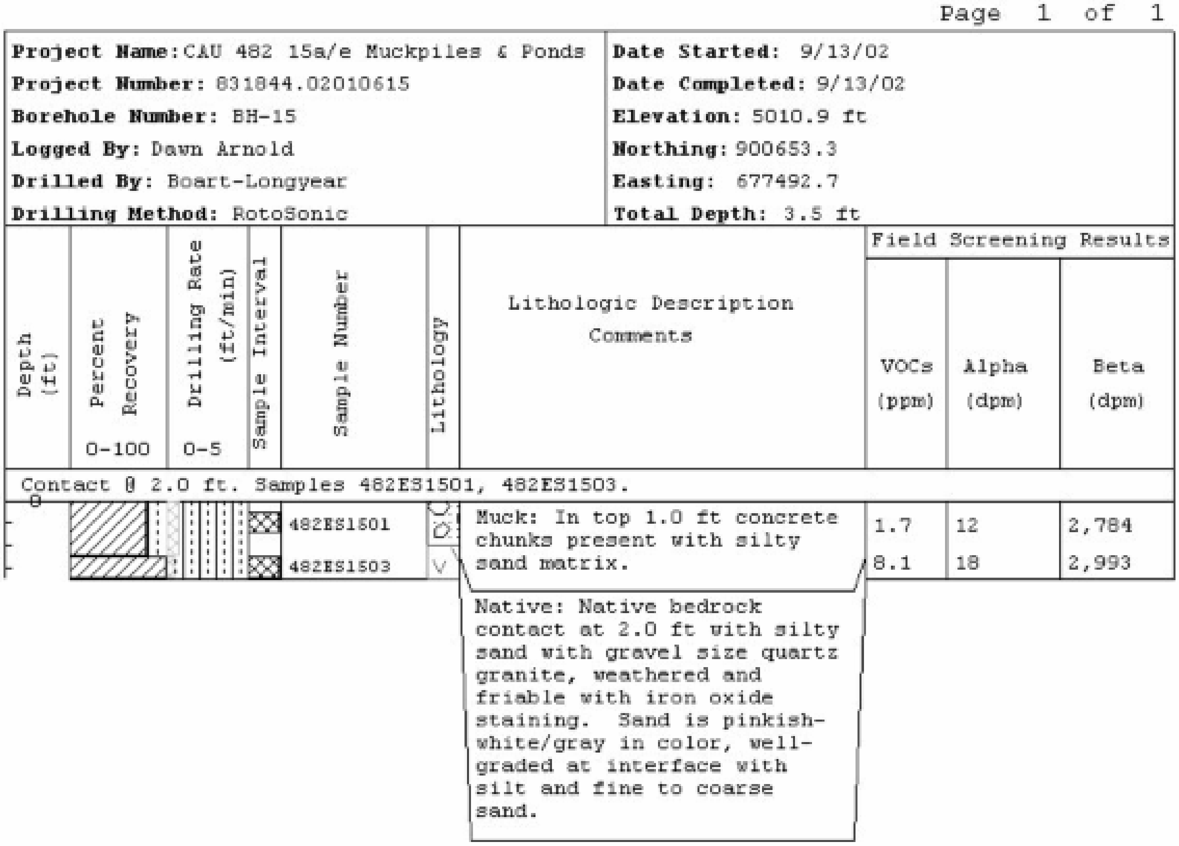
Muck: Muck - cobbles.

Muck: Cored through boulder in muck - core of grnite and cobbles >90% of recovery.

Muck: Gray - muck.

Native: Native soil/muck interface at 31.0 ft pink/orange with iron oxide stains. Weathered, friable granite. Sand with silt and gravel.

Field Screening Results		
VOCs (ppm)	Alpha (dpm)	Beta (dpm)
26.1	0	2,600
1.6	45	2,500
2.9	22	2,800
8.6	0	2,300
25.0	22	2,500
2.8	22	2,600
2.2	45	2,800
3.0	45	2,500
2.8	0	2,300
5.4	22	2,500
3.5	22	2,500
15.1	0	2,300
2.5	45	2,400
14.9	45	2,600



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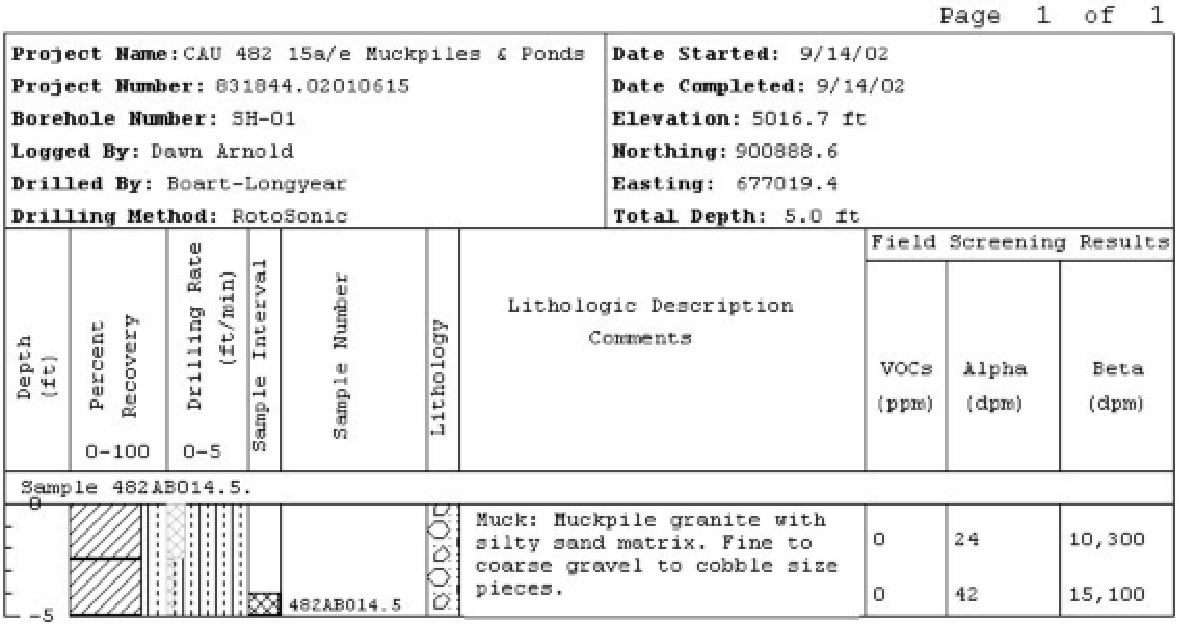
Project Name: CAU 482 15a/e Muckpiles & Ponds
Project Number: 831844.02010615
Borehole Number: BH-15
Logged By: Dawn Arnold
Drilled By: Boart-Longyear
Drilling Method: RotoSonic

Date Started: 9/13/02
Date Completed: 9/13/02
Elevation: 5010.9 ft
Northing: 900653.3
Easting: 677492.7
Total Depth: 3.5 ft

Depth (ft)	Percent Recovery 0-100	Drilling Rate (ft/min) 0-5	Sample Interval	Sample Number	Lithology	Lithologic Description Comments	Field Screening Results		
							VOCs (ppm)	Alpha (dpm)	Beta (dpm)
Contact @ 2.0 ft. Samples 482ES1501, 482ES1503.									
0				482ES1501		Muck: In top 1.0 ft concrete chunks present with silty sand matrix.	1.7	12	2,784
				482ES1503		Native: Native bedrock contact at 2.0 ft with silty sand with gravel size quartz granite, weathered and friable with iron oxide staining. Sand is pinkish-white/gray in color, well-graded at interface with silt and fine to coarse sand.	8.1	18	2,993



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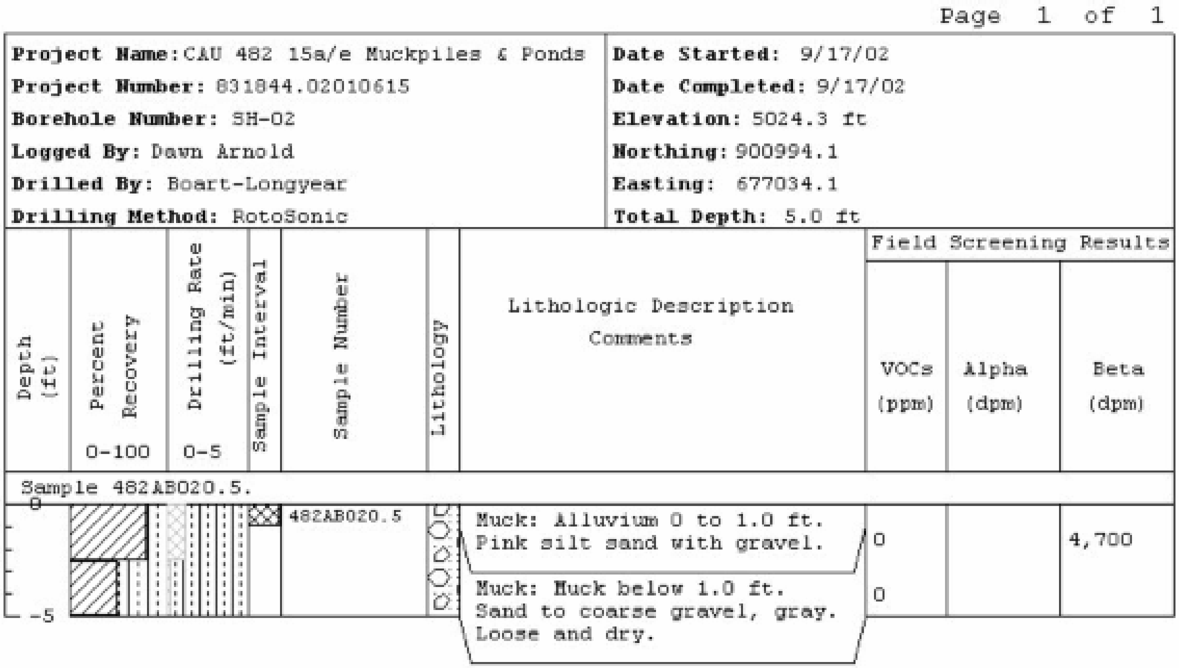
Project Name: CAU 482 15a/e Muckpiles & Ponds
Project Number: 831844.02010615
Borehole Number: SH-01
Logged By: Dawn Arnold
Drilled By: Boart-Longyear
Drilling Method: RotoSonic

Date Started: 9/14/02
Date Completed: 9/14/02
Elevation: 5016.7 ft
Northing: 900888.6
Easting: 677019.4
Total Depth: 5.0 ft

Depth (ft)	Percent Recovery 0-100	Drilling Rate (ft/min) 0-5	Sample Interval	Sample Number	Lithology	Lithologic Description Comments	Field Screening Results		
							VOCs (ppm)	Alpha (dpm)	Beta (dpm)
Sample 482AB014.5.									
0						Muck: Muckpile granite with silty sand matrix. Fine to coarse gravel to cobble size pieces.	0	24	10,300
-5				482AB014.5			0	42	15,100



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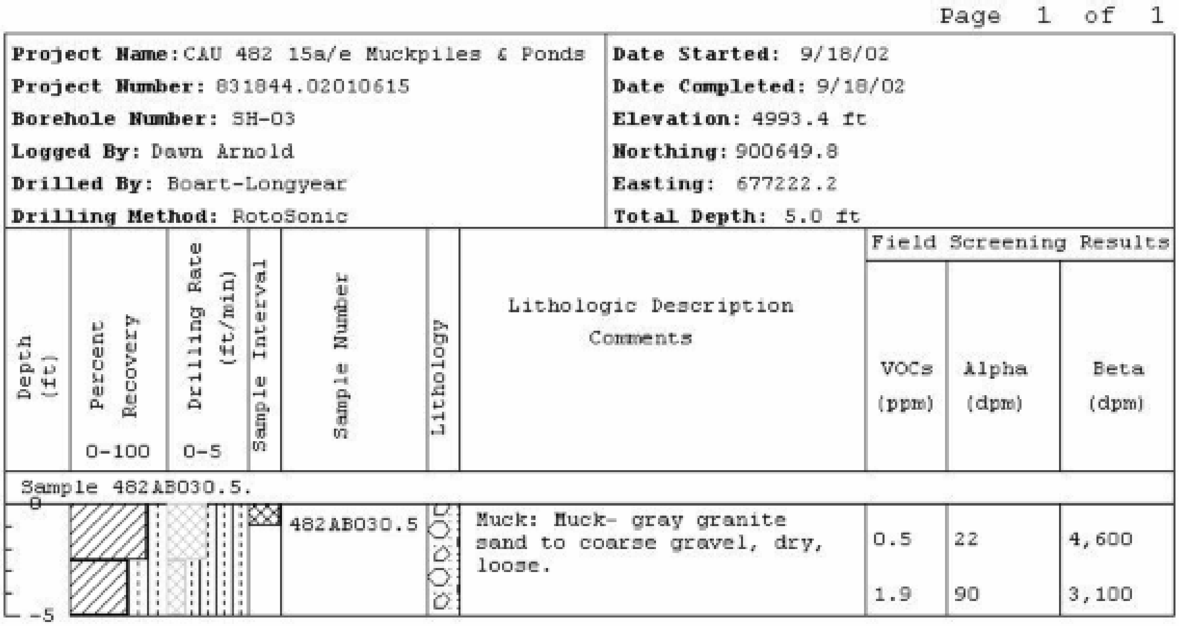
Project Name: CAU 482 15a/e Muckpiles & Ponds
Project Number: 831844.02010615
Borehole Number: SH-02
Logged By: Dawn Arnold
Drilled By: Boart-Longyear
Drilling Method: RotoSonic

Date Started: 9/17/02
Date Completed: 9/17/02
Elevation: 5024.3 ft
Northing: 900994.1
Easting: 677034.1
Total Depth: 5.0 ft

							Field Screening Results		
Depth (ft)	Percent Recovery 0-100	Drilling Rate (ft/min) 0-5	Sample Interval	Sample Number	Lithology	Lithologic Description Comments	VOCs (ppm)	Alpha (dpm)	Beta (dpm)
Sample 482AB020.5.									
0				482AB020.5		Muck: Alluvium 0 to 1.0 ft. Pink silt sand with gravel.	0		4,700
-5						Muck: Muck below 1.0 ft. Sand to coarse gravel, gray. Loose and dry.	0		



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Project Name: CAU 482 15a/e Muckpiles & Ponds
Project Number: 831844.02010615
Borehole Number: SH-03
Logged By: Dawn Arnold
Drilled By: Boart-Longyear
Drilling Method: RotoSonic

Date Started: 9/18/02
Date Completed: 9/18/02
Elevation: 4993.4 ft
Northing: 900649.8
Easting: 677222.2
Total Depth: 5.0 ft

Depth (ft)	Percent Recovery 0-100	Drilling Rate (ft/min) 0-5	Sample Interval	Sample Number	Lithology	Lithologic Description Comments	Field Screening Results		
							VOCs (ppm)	Alpha (dpm)	Beta (dpm)
Sample 482AB030.5.									
0				482AB030.5		Muck: Muck- gray granite sand to coarse gravel, dry, loose.	0.5	22	4,600
-5							1.9	90	3,100

Project Name: CAU 482 15a/e Muckpiles & Ponds
Project Number: 831844.02010615
Borehole Number: SH-04
Logged By: Rick Deshler
Drilled By: Boart-Longyear
Drilling Method: RotoSonic

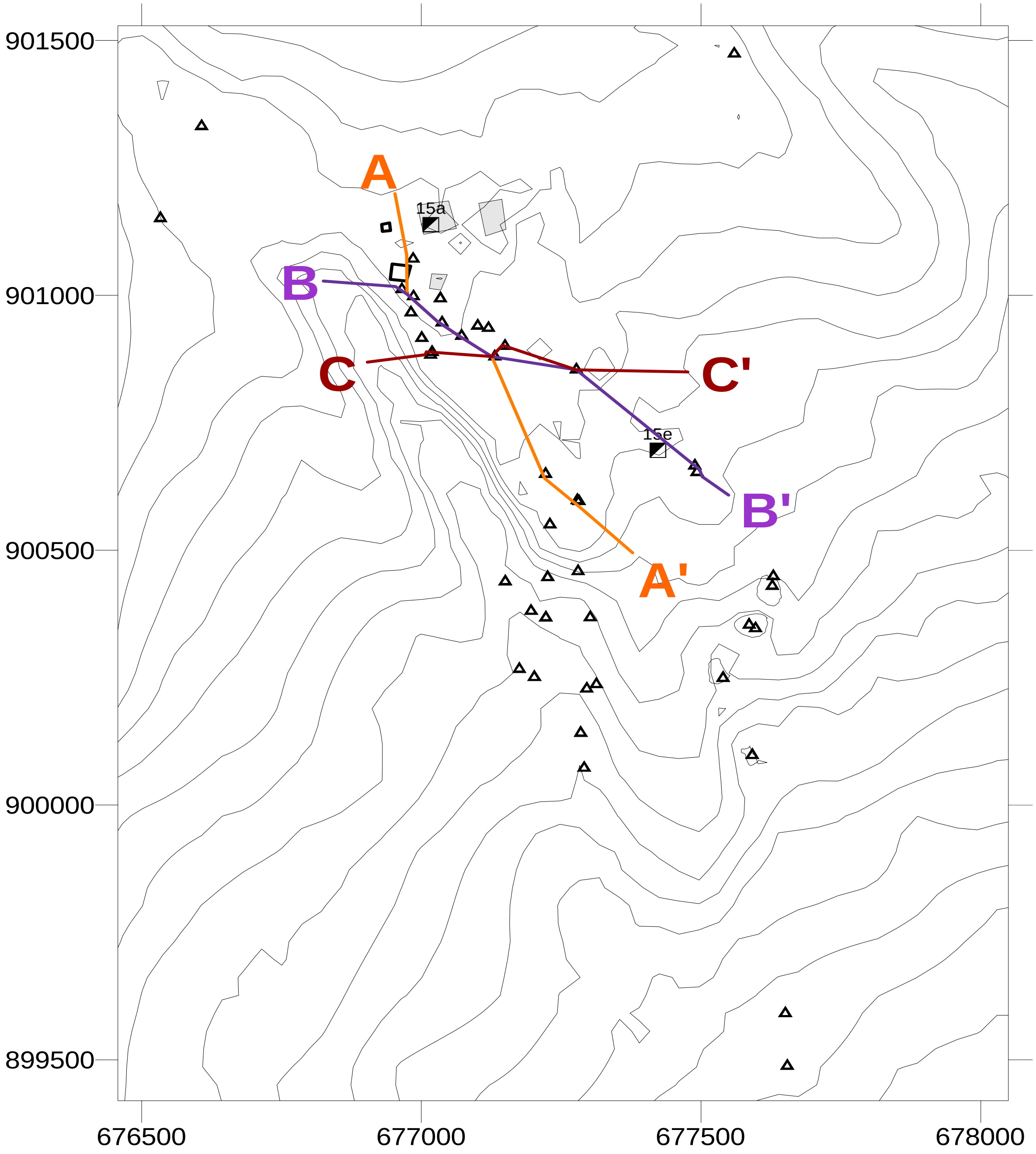
Date Started: 9/24/02
Date Completed: 9/24/02
Elevation: 5010 ft
Northing: 900598
Easting: 677279
Total Depth: 5.0 ft

Depth (ft)	Percent Recovery 0-100	Drilling Rate (ft/min) 0-5	Sample Interval	Sample Number	Lithology	Lithologic Description Comments	Field Screening Results VOCs (ppm)	Alpha (dpm)	Beta (dpm)
Sample 482AB040.5.									
0 -5				482AB040.5		Muck: Light gray coarse rock fragments with fine sand and rock powder. Large pieces of quartz monzonite.	0 0	45 45	11,800 2,800

Attachment B

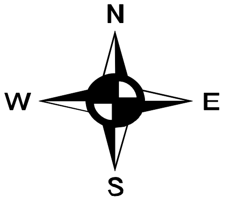
Cross Sections

(4 Pages)

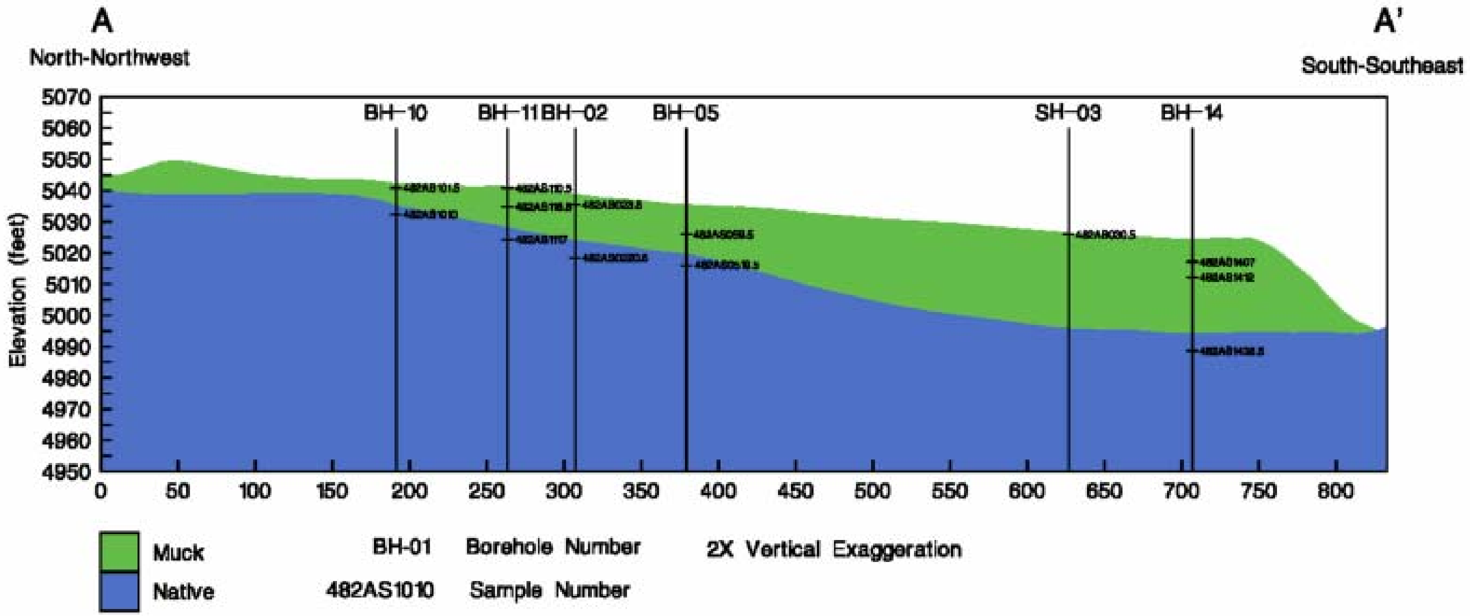


EXPLANATION

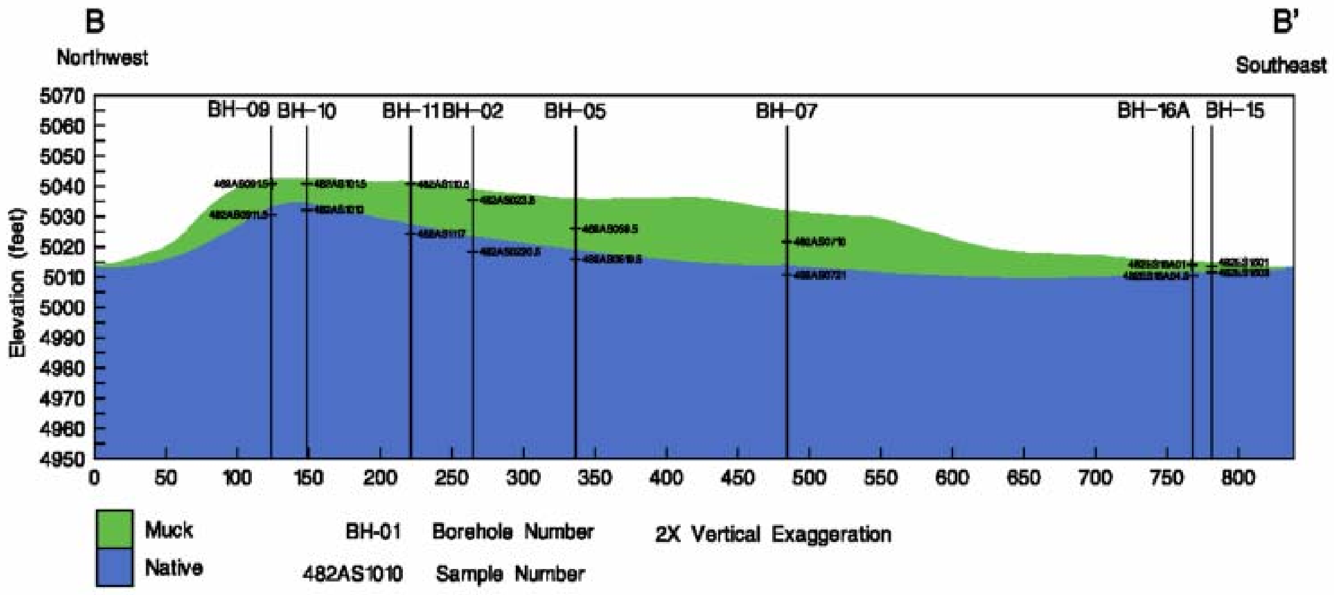
A A' Cross Section Line



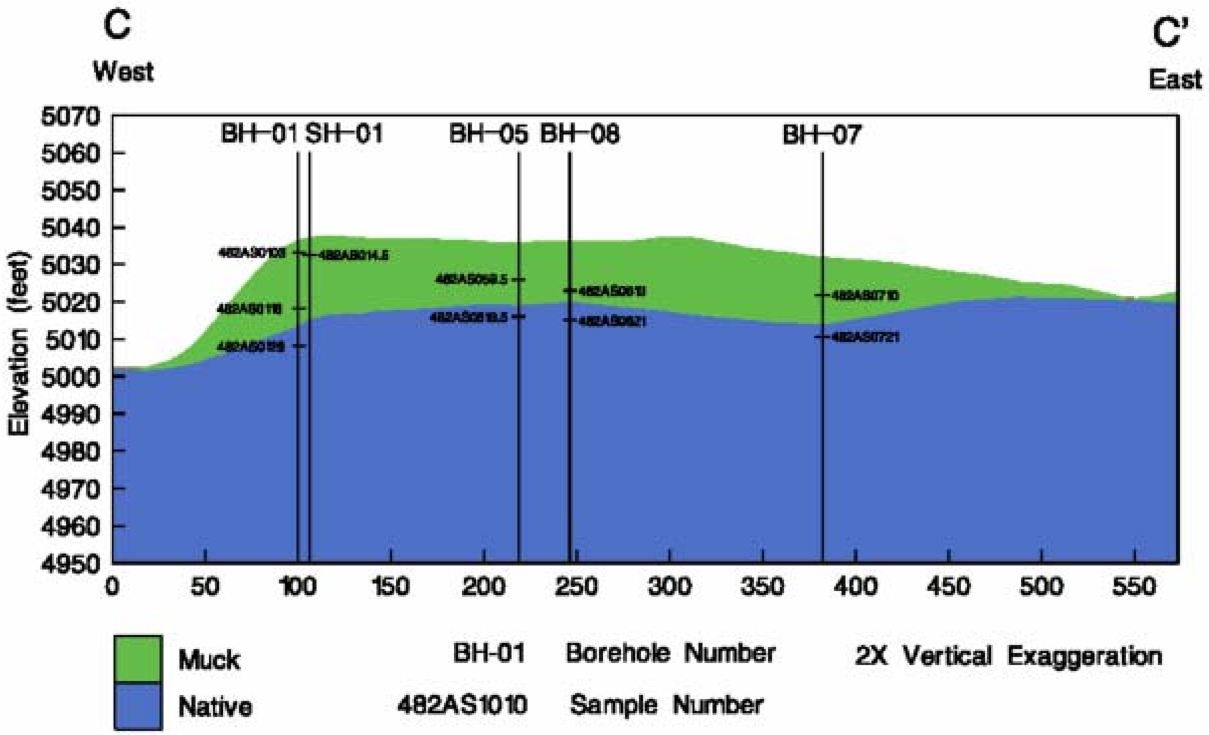
Cross Section Traverses



15a/e Muckpiles North-Northwest to South-Southeast Cross Section A-A'



15a/e Muckpiles Northwest to Southeast Cross Section B-B'



15a/e Muckpiles West to East Cross Section C-C'

Attachment C

Analytical Results Tables

(26 Pages)

SAMPLE_NO	CASNO	PARAMETER	User Test Group	Sample Matrix	UNITS	Sample Date	Result	Detect Limit	Error	Validation Qualifier
482AB014.5	10045-97-3	Cs-137	HASL300	SOIL	pCi/g	9/14/2002	470	2.4	78	
482AB014.5	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/14/2002	23	4.4	5.8	
482AB014.5	68334-30-5	Diesel-Range Organics	EPA8015	SOIL	mg/kg	9/14/2002	22	5.1		J
482AB014.5	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/14/2002	25	0.3		J
482AB014.5	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/14/2002	90	10		J
482AB014.5	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/14/2002	3.2	1		J
482AB014.5	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/14/2002	6.8	1		J
482AB014.5	7782-49-2	SELENIUM	EPA6010	SOIL	mg/kg	9/14/2002	0.59	0.51		J
482AB014.5	10098-97-2	Sr-90	SR7500	SOIL	pCi/g	9/14/2002	10.5	0.16	2.2	J
482AB014.5	15117-48-3	Pu-239	UGTAISOPU	SOIL	pCi/g	9/14/2002	0.052	0.01	0.027	
482AB014.5DUP	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/14/2002	1.44	0.85	0.53	
482AB014.5DUP	10045-97-3	Cs-137	HASL300	SOIL	pCi/g	9/14/2002	481	0.67	79	
482AB014.5DUP	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/14/2002	26.4	1.9	5.0	
482AB020.5	14913-50-9	Tl-208	HASL300	SOIL	pCi/g	9/17/2002	0.38	0.17	0.14	
482AB020.5	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/17/2002	1.04	0.38	0.29	
482AB020.5	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/17/2002	0.88	0.32	0.26	
482AB020.5	10045-97-3	Cs-137	HASL300	SOIL	pCi/g	9/17/2002	44	0.18	7.3	
482AB020.5	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/17/2002	1.21	0.34	0.31	
482AB020.5	14331-83-0	Ac-228	HASL300	SOIL	pCi/g	9/17/2002	0.96	0.33	0.30	
482AB020.5	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/17/2002	24	1.2	4.6	
482AB020.5	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/17/2002	100	10		
482AB020.5	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/17/2002	17	0.61		
482AB020.5	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/17/2002	3.3	1		
482AB020.5	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/17/2002	2.8	1		J
482AB020.5	67-64-1	ACETONE	EPA8260	SOIL	μg/kg	9/17/2002	17	20		J
482AB020.5	68334-30-5	Diesel-Range Organics	EPA8015	SOIL	mg/kg	9/17/2002	68	5.1		M
482AB020.5	7439-97-6	MERCURY	EPA7470	SOIL	mg/kg	9/17/2002	0.024	0.1		B
482AB020.5	50-32-8	BENZO(A)PYRENE	EPA8270	SOIL	μg/kg	9/17/2002	340	340		R
482AB020.5	205-99-2	BENZO(B)FLUORANTHENE	EPA8270	SOIL	μg/kg	9/17/2002	340	340		R
482AB020.5	191-24-2	BENZO(G,H,I)PERYLENE	EPA8270	SOIL	μg/kg	9/17/2002	340	340		R
482AB020.5	207-08-9	BENZO(K)FLUORANTHENE	EPA8270	SOIL	μg/kg	9/17/2002	340	340		R
482AB020.5	53-70-3	DIBENZO(A,H)ANTHRACENE	EPA8270	SOIL	μg/kg	9/17/2002	340	340		R
482AB020.5	193-39-5	INDENO(1,2,3-CD)PYRENE	EPA8270	SOIL	μg/kg	9/17/2002	340	340		R
482AB020.5	10098-97-2	Sr-90	SR7500	SOIL	pCi/g	9/17/2002	1.37	0.21	0.29	
482AB020.5	13981-16-3	Pu-238	UGTAISOPU	SOIL	pCi/g	9/17/2002	0.089	0.029	0.038	
482AB020.5	15117-48-3	Pu-239	UGTAISOPU	SOIL	pCi/g	9/17/2002	4.5	0.024	0.68	
482AB030.5	10045-97-3	Cs-137	HASL300	SOIL	pCi/g	9/18/2002	121	0.23	20	
482AB030.5	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/18/2002	1.47	0.88	0.51	
482AB030.5	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/18/2002	1.28	0.45	0.35	

SAMPLE_NO	CASNO	PARAMETER	User Test Group	Sample Matrix	UNITS	Sample Date	Result	Detect Limit	Error	Validation Qualifier
482AB030.5	14331-83-0	Ac-228	HASL300	SOIL	pCi/g	9/18/2002	0.84	0.35	0.28	
482AB030.5	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/18/2002	21.3	0.96	4.1	
482AB030.5	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/18/2002	2.6	1		
482AB030.5	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/18/2002	5.7	1		
482AB030.5	68334-30-5	Diesel-Range Organics	EPA8015	SOIL	mg/kg	9/18/2002	73	5.1		M
482AB030.5	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/18/2002	15	0.62		
482AB030.5	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/18/2002	98	10		
482AB030.5	67-64-1	ACETONE	EPA8260	SOIL	µg/kg	9/18/2002	21	21		R
482AB030.5	75-09-2	METHYLENE CHLORIDE	EPA8260	SOIL	µg/kg	9/18/2002	44	5.1		B
482AB030.5	10098-97-2	Sr-90	SR7500	SOIL	pCi/g	9/18/2002	0.69	0.17	0.17	
482AB030.5DUP	7439-97-6	MERCURY	EPA7470	SOIL	mg/kg	9/18/2002	0.01	0.103		B
482AB040.5	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/24/2002	2.8	1		
482AB040.5	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/24/2002	4.5	1		
482AB040.5	7782-49-2	SELENIUM	EPA6010	SOIL	mg/kg	9/24/2002	1	1		B
482AB040.5	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/24/2002	130	10		
482AB040.5	7439-97-6	MERCURY	EPA7470	SOIL	mg/kg	9/24/2002	0.022	0.1		B
482AB040.5	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/24/2002	10	0.61		
482AB040.5	68334-30-5	Diesel-Range Organics	EPA8015	SOIL	mg/kg	9/24/2002	8.8	5		M
482AB040.5	75-09-2	METHYLENE CHLORIDE	EPA8260	SOIL	µg/kg	9/24/2002	3.6	5.1		J
482AB040.5	67-64-1	ACETONE	EPA8260	SOIL	µg/kg	9/24/2002	20	20		R
482AB040.5	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/24/2002	1.16	0.64	0.36	
482AB040.5	10045-97-3	Cs-137	HASL300	SOIL	pCi/g	9/24/2002	498	0.47	82	
482AB040.5	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/24/2002	21.8	1	3.9	
482AB040.5	10198-40-0	Co-60	HASL300	SOIL	pCi/g	9/24/2002	0.123	0.076	0.044	
482AB040.5	14331-83-0	Ac-228	HASL300	SOIL	pCi/g	9/24/2002	1.01	0.34	0.28	
482AB040.5	10098-97-2	Sr-90	SR7500	SOIL	pCi/g	9/24/2002	66	0.23	12	
482AB040.5	13981-16-3	Pu-238	UGTAISOPU	SOIL	pCi/g	9/24/2002	1.28	0.017	0.22	
482AB040.5	15117-48-3	Pu-239	UGTAISOPU	SOIL	pCi/g	9/24/2002	7.7	0.017	1.1	
482AB040.5DUP	10045-97-3	Cs-137	HASL300	SOIL	pCi/g	9/24/2002	482	0.47	79	
482AB040.5DUP	14331-83-0	Ac-228	HASL300	SOIL	pCi/g	9/24/2002	0.77	0.41	0.28	
482AB040.5DUP	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/24/2002	21.9	1.1	4.2	
482AS0103	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/13/2002	1.22	0.18	0.24	
482AS0103	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/13/2002	0.95	0.23	0.21	
482AS0103	14913-50-9	Tl-208	HASL300	SOIL	pCi/g	9/13/2002	0.362	0.1	0.093	
482AS0103	10045-97-3	Cs-137	HASL300	SOIL	pCi/g	9/13/2002	15.8	0.092	2.6	
482AS0103	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/13/2002	22.7	0.97	4.0	
482AS0103	14331-83-0	Ac-228	HASL300	SOIL	pCi/g	9/13/2002	1.02	0.3	0.25	
482AS0103	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/13/2002	0.72	0.2	0.18	
482AS0103	78-93-3	2-BUTANONE	EPA8260	SOIL	µg/kg	9/13/2002	11	20		J

SAMPLE_NO	CASNO	PARAMETER	User Test Group	Sample Matrix	UNITS	Sample Date	Result	Detect Limit	Error	Validation Qualifier
482AS0103	68334-30-5	Diesel-Range Organics	EPA8015	SOIL	mg/kg	9/13/2002	18	5		M,Z
482AS0103	75-09-2	METHYLENE CHLORIDE	EPA8260	SOIL	µg/kg	9/13/2002	4.7	5.1		J
482AS0103	99-87-6	P-ISOPROPYLTOLUENE	EPA8260	SOIL	µg/kg	9/13/2002	17	5.1		
482AS0103	67-64-1	ACETONE	EPA8260	SOIL	µg/kg	9/13/2002	48	20		
482AS0103	108-88-3	TOLUENE	EPA8260	SOIL	µg/kg	9/13/2002	3.6	5.1		J
482AS0103	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/13/2002	4.8	1		
482AS0103	7440-43-9	CADMIUM	EPA6010	SOIL	mg/kg	9/13/2002	0.11	0.51		B
482AS0103	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/13/2002	7.3	1		
482AS0103	7782-49-2	SELENIUM	EPA6010	SOIL	mg/kg	9/13/2002	0.82	0.51		
482AS0103	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/13/2002	13	0.3		
482AS0103	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/13/2002	130	10		
482AS0118	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/13/2002	1.36	0.76	0.56	
482AS0118	10045-97-3	Cs-137	HASL300	SOIL	pCi/g	9/13/2002	70	0.61	12	
482AS0118	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/13/2002	22.7	2.4	5.3	
482AS0118	68334-30-5	Diesel-Range Organics	EPA8015	SOIL	MG/KG	9/13/2002	36	5.1		M
482AS0118	75-09-2	METHYLENE CHLORIDE	EPA8260	SOIL	µg/kg	9/13/2002	7.5	5.1		
482AS0118	67-64-1	ACETONE	EPA8260	SOIL	µg/kg	9/13/2002	19	20		J
482AS0118	7440-22-4	SILVER	EPA6010	SOIL	mg/kg	9/13/2002	0.61	1		B
482AS0118	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/13/2002	2.9	1		
482AS0118	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/13/2002	9.4	1		
482AS0118	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/13/2002	72	10		
482AS0118	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/13/2002	10	0.3		
482AS0118	117-81-7	BIS(2-ETHYLHEXYL)PHTHALATE	EPA8270	SOIL	µg/kg	9/13/2002	310	340		J
482AS0118	10098-97-2	Sr-90	SR7500	SOIL	pCi/g	9/13/2002	2.61	0.18	0.49	
482AS0118	15117-48-3	Pu-239	UGTAISOPU	SOIL	pCi/g	9/13/2002	0.231	0.023	0.069	
482AS0128	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/13/2002	1	0.28	0.30	
482AS0128	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/13/2002	1.11	0.34	0.32	
482AS0128	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/13/2002	37	2.7	8.3	
482AS0128	75-09-2	METHYLENE CHLORIDE	EPA8260	SOIL	µg/kg	9/13/2002	4.1	5.4		J
482AS0128	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/13/2002	12	1.1		
482AS0128	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/13/2002	4.9	1.1		
482AS0128	7782-49-2	SELENIUM	EPA6010	SOIL	mg/kg	9/13/2002	0.73	0.54		
482AS0128	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/13/2002	2.3	0.32		
482AS0128	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/13/2002	49	11		
482AS0220.5	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/16/2002	0.89	0.16	0.20	
482AS0220.5	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/16/2002	0.58	0.17	0.15	
482AS0220.5	14913-50-9	Tl-208	HASL300	SOIL	pCi/g	9/16/2002	0.261	0.088	0.088	
482AS0220.5	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/16/2002	0.44	0.2	0.17	
482AS0220.5	14331-83-0	Ac-228	HASL300	SOIL	pCi/g	9/16/2002	0.76	0.4	0.25	

SAMPLE_NO	CASNO	PARAMETER	User Test Group	Sample Matrix	UNITS	Sample Date	Result	Detect Limit	Error	Validation Qualifier
482AS0220.5	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/16/2002	25.1	1.1	4.8	
482AS0220.5	67-64-1	ACETONE	EPA8260	SOIL	µg/kg	9/16/2002	20	20		R
482AS0220.5	7782-49-2	SELENIUM	EPA6010	SOIL	mg/kg	9/16/2002	0.4	0.51		B
482AS0220.5	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/16/2002	3.3	1		
482AS0220.5	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/16/2002	1.4	0.3		
482AS0220.5	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/16/2002	49	10		
482AS0220.5	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/16/2002	1.7	1		
482AS023.5	14913-50-9	Tl-208	HASL300	SOIL	pCi/g	9/16/2002	0.31	0.16	0.12	
482AS023.5	10045-97-3	Cs-137	HASL300	SOIL	pCi/g	9/16/2002	19.5	0.13	3.3	
482AS023.5	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/16/2002	1.02	0.22	0.24	
482AS023.5	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/16/2002	1.06	0.36	0.27	
482AS023.5	14331-83-0	Ac-228	HASL300	SOIL	pCi/g	9/16/2002	1.14	0.47	0.33	
482AS023.5	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/16/2002	1.03	0.26	0.27	
482AS023.5	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/16/2002	23.1	1.1	4.4	
482AS023.5	67-64-1	ACETONE	EPA8260	SOIL	µg/kg	9/16/2002	21	21		R
482AS023.5	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/16/2002	13	0.31		
482AS023.5	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/16/2002	160	10		
482AS023.5	7440-22-4	SILVER	EPA6010	SOIL	mg/kg	9/16/2002	1.5	1		
482AS023.5	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/16/2002	3	1		
482AS023.5	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/16/2002	6.4	1		
482AS023.5	7782-49-2	SELENIUM	EPA6010	SOIL	mg/kg	9/16/2002	0.43	0.52		B
482AS0304	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/17/2002	0.85	0.19	0.23	
482AS0304	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/17/2002	0.99	0.34	0.28	
482AS0304	10045-97-3	Cs-137	HASL300	SOIL	pCi/g	9/17/2002	4.04	0.2	0.78	
482AS0304	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/17/2002	1.14	0.27	0.35	
482AS0304	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/17/2002	22.2	2.1	5.3	
482AS0304	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/17/2002	5.9	0.31		
482AS0304	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/17/2002	94	10		
482AS0304	68334-30-5	Diesel-Range Organics	EPA8015	SOIL	mg/kg	9/17/2002	37	5.1		H
482AS0304	7439-97-6	MERCURY	EPA7470	SOIL	mg/kg	9/17/2002	0.017	0.1		B
482AS0304	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/17/2002	2.5	1		
482AS0304	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/17/2002	4.2	1		J
482AS0315.5	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/17/2002	0.48	0.18	0.15	
482AS0315.5	14913-50-9	Tl-208	HASL300	SOIL	pCi/g	9/17/2002	0.3	0.1	0.10	
482AS0315.5	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/17/2002	0.81	0.17	0.20	
482AS0315.5	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/17/2002	0.56	0.2	0.19	
482AS0315.5	10045-97-3	Cs-137	HASL300	SOIL	pCi/g	9/17/2002	0.202	0.11	0.088	
482AS0315.5	14331-83-0	Ac-228	HASL300	SOIL	pCi/g	9/17/2002	0.88	0.45	0.31	
482AS0315.5	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/17/2002	23.8	0.97	4.6	

SAMPLE_NO	CASNO	PARAMETER	User Test Group	Sample Matrix	UNITS	Sample Date	Result	Detect Limit	Error	Validation Qualifier
482AS0315.5	7439-97-6	MERCURY	EPA7470	SOIL	mg/kg	9/17/2002	0.0019	0.1		B
482AS0315.5	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/17/2002	120	10		
482AS0315.5	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/17/2002	1.2	0.6		
482AS0315.5	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/17/2002	3.9	1		J
482AS0315.5	7782-49-2	SELENIUM	EPA6010	SOIL	mg/kg	9/17/2002	0.99	1		B
482AS04A13	10045-97-3	Cs-137	HASL300	SOIL	pCi/g	9/14/2002	3050	2.3	500	
482AS04A13	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/14/2002	20.7	2.4	5.3	
482AS04A13	68334-30-5	Diesel-Range Organics	EPA8015	SOIL	mg/kg	9/14/2002	5.3	5.1		M
482AS04A13	67-64-1	ACETONE	EPA8260	SOIL	µg/kg	9/14/2002	10	20		J
482AS04A13	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/14/2002	2.6	1		
482AS04A13	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/14/2002	12	1		J
482AS04A13	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/14/2002	10	0.61		
482AS04A13	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/14/2002	120	10		
482AS04A13	7439-97-6	MERCURY	EPA7470	SOIL	mg/kg	9/14/2002	0.022	0.1		B
482AS04A13	10098-97-2	Sr-90	SR7500	SOIL	pCi/g	9/14/2002	44.2	0.22	8.0	
482AS04A13	15117-48-3	Pu-239	UGTAISOPU	SOIL	pCi/g	9/14/2002	0.069	0.0098	0.031	
482AS04A13DUP	10045-97-3	Cs-137	HASL300	SOIL	pCi/g	9/14/2002	2170	4.8	360	
482AS04A13DUP	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/14/2002	21	3.6	5.2	
482AS04A25	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/14/2002	0.55	0.14	0.13	
482AS04A25	14913-50-9	Tl-208	HASL300	SOIL	pCi/g	9/14/2002	0.334	0.068	0.080	
482AS04A25	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/14/2002	0.87	0.12	0.18	
482AS04A25	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/14/2002	0.42	0.16	0.13	
482AS04A25	10045-97-3	Cs-137	HASL300	SOIL	pCi/g	9/14/2002	0.246	0.071	0.069	
482AS04A25	14331-83-0	Ac-228	HASL300	SOIL	pCi/g	9/14/2002	0.89	0.25	0.22	
482AS04A25	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/14/2002	21.8	0.89	3.8	
482AS04A25	75-09-2	METHYLENE CHLORIDE	EPA8260	SOIL	µg/kg	9/14/2002	2.3	5.1		J
482AS04A25	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/14/2002	2.2	1		
482AS04A25	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/14/2002	1.3	1		
482AS04A25	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/14/2002	1.3	0.3		
482AS04A25	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/14/2002	52	10		
482AS04A25DUP	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/14/2002	0.61	0.23	0.20	
482AS04A25DUP	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/14/2002	21.4	1.8	4.3	
482AS04A25DUP	14913-50-9	Tl-208	HASL300	SOIL	pCi/g	9/14/2002	0.26	0.12	0.10	
482AS04A25DUP	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/14/2002	0.85	0.18	0.21	
482AS04A25DUP	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/14/2002	0.6	0.22	0.17	
482AS04A25DUP	10045-97-3	Cs-137	HASL300	SOIL	pCi/g	9/14/2002	0.219	0.12	0.096	
482AS04A8.5	10045-97-3	Cs-137	HASL300	SOIL	pCi/g	9/14/2002	288	0.43	48	
482AS04A8.5	14331-83-0	Ac-228	HASL300	SOIL	pCi/g	9/14/2002	1.19	0.61	0.44	
482AS04A8.5	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/14/2002	1.62	0.87	0.55	

SAMPLE_NO	CASNO	PARAMETER	User Test Group	Sample Matrix	UNITS	Sample Date	Result	Detect Limit	Error	Validation Qualifier
482AS04A8.5	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/14/2002	23.5	1.5	5.0	
482AS04A8.5	68334-30-5	Diesel-Range Organics	EPA8015	SOIL	mg/kg	9/14/2002	19	5.1		J
482AS04A8.5	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/14/2002	9.7	1		J
482AS04A8.5	99-87-6	P-ISOPROPYLTOLUENE	EPA8260	SOIL	μg/kg	9/14/2002	1.4	5.1		J
482AS04A8.5	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/14/2002	2.9	1		J
482AS04A8.5	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/14/2002	110	10		J
482AS04A8.5	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/14/2002	12	0.31		J
482AS04A8.5	7782-49-2	SELENIUM	EPA6010	SOIL	mg/kg	9/14/2002	0.41	0.51		J
482AS04A8.5	10098-97-2	Sr-90	SR7500	SOIL	pCi/g	9/14/2002	5.02	0.13	0.92	Y1
482AS0519.5	14331-83-0	Ac-228	HASL300	SOIL	pCi/g	9/17/2002	0.7	0.36	0.25	
482AS0519.5	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/17/2002	0.54	0.18	0.18	
482AS0519.5	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/17/2002	0.87	0.14	0.20	
482AS0519.5	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/17/2002	0.56	0.18	0.15	
482AS0519.5	14913-50-9	Tl-208	HASL300	SOIL	pCi/g	9/17/2002	0.278	0.082	0.088	
482AS0519.5	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/17/2002	25.2	1	4.8	
482AS0519.5	7439-97-6	MERCURY	EPA7470	SOIL	mg/kg	9/17/2002	0.0024	0.1		B
482AS0519.5	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/17/2002	1.2	0.61		
482AS0519.5	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/17/2002	56	10		
482AS0519.5	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/17/2002	1.8	1		
482AS0519.5	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/17/2002	2.5	1		J
482AS0519.5DUP	14913-50-9	Tl-208	HASL300	SOIL	pCi/g	9/17/2002	0.356	0.069	0.083	
482AS0519.5DUP	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/17/2002	0.55	0.12	0.12	
482AS0519.5DUP	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/17/2002	0.55	0.15	0.14	
482AS0519.5DUP	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/17/2002	0.77	0.11	0.16	
482AS0519.5DUP	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/17/2002	25.1	0.86	4.4	
482AS0519.5DUP	14331-83-0	Ac-228	HASL300	SOIL	pCi/g	9/17/2002	0.77	0.28	0.20	
482AS0519.5DUP	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/17/2002	1.49	0.612		
482AS0519.5DUP	7439-97-6	MERCURY	EPA7470	SOIL	mg/kg	9/17/2002	0.00248	0.102		B
482AS0519.5DUP	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/17/2002	59.9	10.2		
482AS0519.5DUP	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/17/2002	1.59	1.02		
482AS0519.5DUP	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/17/2002	2.49	1.02		
482AS059.5	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/17/2002	1.71	0.29	0.42	
482AS059.5	10045-97-3	Cs-137	HASL300	SOIL	pCi/g	9/17/2002	4.72	0.19	0.87	
482AS059.5	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/17/2002	0.85	0.27	0.25	
482AS059.5	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/17/2002	25.1	1.8	5.4	
482AS059.5	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/17/2002	1.49	0.32	0.35	
482AS059.5	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/17/2002	6.8	0.31		
482AS059.5	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/17/2002	53	10		
482AS059.5	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/17/2002	9.5	1		J

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482AS06A15.5	14331-83-0	Ac-228	HASL300	SOIL	pCi/g	9/17/2002	0.87	0.36	0.25	
482AS06A15.5	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/17/2002	0.61	0.15	0.17	
482AS06A15.5	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/17/2002	29.7	0.72	5.4	
482AS06A15.5	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/17/2002	0.86	0.13	0.19	
482AS06A15.5	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/17/2002	0.72	0.14	0.17	
482AS06A15.5	14913-50-9	Tl-208	HASL300	SOIL	pCi/g	9/17/2002	0.19	0.082	0.073	
482AS06A15.5	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/17/2002	4.2	0.3		
482AS06A15.5	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/17/2002	3.4	1		
482AS06A15.5	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/17/2002	3.1	1		J
482AS06A15.5	7782-49-2	SELENIUM	EPA6010	SOIL	mg/kg	9/17/2002	0.59	0.51		
482AS06A15.5	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/17/2002	55	10		
482AS06A15.5	7439-97-6	MERCURY	EPA7470	SOIL	mg/kg	9/17/2002	0.0031	0.1		B
482AS06A9.5	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/17/2002	1.15	0.37	0.39	
482AS06A9.5	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/17/2002	1.05	0.27	0.30	
482AS06A9.5	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/17/2002	1.21	0.44	0.36	
482AS06A9.5	10045-97-3	Cs-137	HASL300	SOIL	pCi/g	9/17/2002	2.01	0.2	0.46	
482AS06A9.5	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/17/2002	26.3	3.5	6.5	
482AS06A9.5	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/17/2002	4.2	1.1		J
482AS06A9.5	7782-49-2	SELENIUM	EPA6010	SOIL	mg/kg	9/17/2002	1.1	0.53		
482AS06A9.5	68334-30-5	Diesel-Range Organics	EPA8015	SOIL	mg/kg	9/17/2002	4.6	5.3		J
482AS06A9.5	7439-97-6	MERCURY	EPA7470	SOIL	mg/kg	9/17/2002	0.047	0.11		B
482AS06A9.5	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/17/2002	8.4	0.32		
482AS06A9.5	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/17/2002	55	11		
482AS06A9.5	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/17/2002	3.9	1.1		
482AS0710	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/18/2002	1.02	0.24	0.27	
482AS0710	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/18/2002	1.38	0.33	0.34	
482AS0710	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/18/2002	1.06	0.47	0.40	
482AS0710	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/18/2002	23.3	3.5	5.7	
482AS0710	68334-30-5	Diesel-Range Organics	EPA8015	SOIL	mg/kg	9/18/2002	4	5.1		J
482AS0710	67-64-1	ACETONE	EPA8260	SOIL	µg/kg	9/18/2002	20	20		R
482AS0710	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/18/2002	82	10		
482AS0710	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/18/2002	3.6	1		
482AS0710	7782-49-2	SELENIUM	EPA6010	SOIL	mg/kg	9/18/2002	0.47	0.51		B
482AS0710	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/18/2002	10	0.31		
482AS0721	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/18/2002	1.05	0.22	0.24	
482AS0721	14913-50-9	Tl-208	HASL300	SOIL	pCi/g	9/18/2002	0.46	0.13	0.13	
482AS0721	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/18/2002	1.06	0.21	0.25	
482AS0721	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/18/2002	1.11	0.26	0.29	
482AS0721	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/18/2002	29.5	1.5	5.6	

SAMPLE_NO	CASNO	PARAMETER	User Test Group	Sample Matrix	UNITS	Sample Date	Result	Detect Limit	Error	Validation Qualifier
482AS0721	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/18/2002	2.6	1		
482AS0721	67-64-1	ACETONE	EPA8260	SOIL	µg/kg	9/18/2002	20	20		R
482AS0721	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/18/2002	2.1	1		
482AS0721	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/18/2002	2	0.31		
482AS0721	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/18/2002	45	10		
482AS0813	10045-97-3	Cs-137	HASL300	SOIL	pCi/g	9/17/2002	3.34	0.14	0.59	
482AS0813	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/17/2002	0.98	0.2	0.23	
482AS0813	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/17/2002	1.43	0.28	0.30	
482AS0813	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/17/2002	1.26	0.34	0.33	
482AS0813	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/17/2002	28	1.9	5.2	
482AS0813	14913-50-9	Tl-208	HASL300	SOIL	pCi/g	9/17/2002	0.239	0.13	0.098	
482AS0813	7439-97-6	MERCURY	EPA7470	SOIL	mg/kg	9/17/2002	0.0026	0.1		B
482AS0813	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/17/2002	11	1		J
482AS0813	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/17/2002	7.4	0.31		
482AS0813	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/17/2002	46	10		
482AS0813	67-64-1	ACETONE	EPA8260	SOIL	µg/kg	9/17/2002	8.4	20		J
482AS0821	14913-50-9	Tl-208	HASL300	SOIL	pCi/g	9/17/2002	0.256	0.097	0.090	
482AS0821	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/17/2002	0.82	0.2	0.21	
482AS0821	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/17/2002	0.67	0.23	0.18	
482AS0821	14331-83-0	Ac-228	HASL300	SOIL	pCi/g	9/17/2002	0.92	0.38	0.27	
482AS0821	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/17/2002	0.8	0.25	0.24	
482AS0821	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/17/2002	27.4	1.3	5.2	
482AS0821	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/17/2002	0.67	0.3		
482AS0821	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/17/2002	41	10		
482AS0821	7439-97-6	MERCURY	EPA7470	SOIL	mg/kg	9/17/2002	0.0028	0.1		B
482AS0821	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/17/2002	2.5	1		J
482AS0821	7782-49-2	SELENIUM	EPA6010	SOIL	mg/kg	9/17/2002	0.37	0.51		B
482AS091.5	14913-50-9	Tl-208	HASL300	SOIL	pCi/g	9/15/2002	0.291	0.1	0.095	
482AS091.5	10045-97-3	Cs-137	HASL300	SOIL	pCi/g	9/15/2002	0.282	0.085	0.090	
482AS091.5	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/15/2002	0.95	0.15	0.21	
482AS091.5	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/15/2002	1.29	0.16	0.26	
482AS091.5	14331-83-0	Ac-228	HASL300	SOIL	pCi/g	9/15/2002	0.82	0.33	0.25	
482AS091.5	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/15/2002	1.05	0.17	0.24	
482AS091.5	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/15/2002	26.5	0.93	4.9	
482AS091.5	68334-30-5	Diesel-Range Organics	EPA8015	SOIL	mg/kg	9/15/2002	4.4	5.1		J
482AS091.5	75-09-2	METHYLENE CHLORIDE	EPA8260	SOIL	µg/kg	9/15/2002	7.2	5.1		
482AS091.5	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/15/2002	2	1		
482AS091.5	7782-49-2	SELENIUM	EPA6010	SOIL	mg/kg	9/15/2002	0.43	0.51		B
482AS091.5	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/15/2002	1.7	1		

SAMPLE_NO	CASNO	PARAMETER	User Test Group	Sample Matrix	UNITS	Sample Date	Result	Detect Limit	Error	Validation Qualifier
482AS091.5	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/15/2002	6.9	0.31		
482AS091.5	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/15/2002	53	10		
482AS0911.5	14331-83-0	Ac-228	HASL300	SOIL	pCi/g	9/15/2002	0.75	0.29	0.22	
482AS0911.5	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/15/2002	0.9	0.16	0.22	
482AS0911.5	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/15/2002	24.4	0.99	4.6	
482AS0911.5	14913-50-9	Tl-208	HASL300	SOIL	pCi/g	9/15/2002	0.258	0.1	0.090	
482AS0911.5	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/15/2002	0.82	0.13	0.18	
482AS0911.5	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/15/2002	0.91	0.18	0.20	
482AS0911.5	75-09-2	METHYLENE CHLORIDE	EPA8260	SOIL	μg/kg	9/15/2002	7.7	5.1		
482AS0911.5	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/15/2002	2.2	1		
482AS0911.5	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/15/2002	3.4	0.31		
482AS0911.5	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/15/2002	48	10		
482AS0911.5	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/15/2002	2.7	1		
482AS101.5	14913-50-9	Tl-208	HASL300	SOIL	pCi/g	9/15/2002	0.41	0.17	0.14	
482AS101.5	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/15/2002	1.1	0.36	0.30	
482AS101.5	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/15/2002	1.16	0.52	0.34	
482AS101.5	10045-97-3	Cs-137	HASL300	SOIL	pCi/g	9/15/2002	55.8	0.19	9.3	
482AS101.5	14331-83-0	Ac-228	HASL300	SOIL	pCi/g	9/15/2002	0.85	0.31	0.28	
482AS101.5	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/15/2002	1.31	0.3	0.32	
482AS101.5	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/15/2002	22.8	1.1	4.4	
482AS101.5	68334-30-5	Diesel-Range Organics	EPA8015	SOIL	mg/kg	9/15/2002	510	5.1		H
482AS101.5	75-09-2	METHYLENE CHLORIDE	EPA8260	SOIL	μg/kg	9/15/2002	7.3	5.1		
482AS101.5	67-64-1	ACETONE	EPA8260	SOIL	μg/kg	9/15/2002	8.5	20		J
482AS101.5	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/15/2002	93	10		
482AS101.5	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/15/2002	3.6	1		
482AS101.5	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/15/2002	4.7	1		
482AS101.5	7782-49-2	SELENIUM	EPA6010	SOIL	mg/kg	9/15/2002	0.74	1		B
482AS101.5	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/15/2002	57	0.61		
482AS101.5	10098-97-2	Sr-90	SR7500	SOIL	pCi/g	9/15/2002	0.38	0.19	0.14	LT
482AS101.5	15117-48-3	Pu-239	UGTAISOPU	SOIL	pCi/g	9/15/2002	0.056	0.012	0.030	
482AS1010	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/15/2002	0.55	0.17	0.18	
482AS1010	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/15/2002	0.8	0.14	0.19	
482AS1010	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/15/2002	0.7	0.16	0.17	
482AS1010	14913-50-9	Tl-208	HASL300	SOIL	pCi/g	9/15/2002	0.248	0.084	0.086	
482AS1010	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/15/2002	22.6	1.1	4.5	
482AS1010	75-09-2	METHYLENE CHLORIDE	EPA8260	SOIL	μg/kg	9/15/2002	6.8	5		
482AS1010	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/15/2002	1.9	0.6		
482AS1010	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/15/2002	52	10		
482AS1010	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/15/2002	0.81	1		B

SAMPLE_NO	CASNO	PARAMETER	User Test Group	Sample Matrix	UNITS	Sample Date	Result	Detect Limit	Error	Validation Qualifier
482AS1010	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/15/2002	3.1	1		
482AS110.5	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/16/2002	1.25	0.39	0.34	
482AS110.5	14331-83-0	Ac-228	HASL300	SOIL	pCi/g	9/16/2002	0.99	0.39	0.30	
482AS110.5	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/16/2002	1.2	0.4	0.32	
482AS110.5	10045-97-3	Cs-137	HASL300	SOIL	pCi/g	9/16/2002	72	0.19	12	
482AS110.5	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/16/2002	19.9	0.9	3.9	
482AS110.5	68334-30-5	Diesel-Range Organics	EPA8015	SOIL	mg/kg	9/16/2002	26	5.2		M
482AS110.5	67-64-1	ACETONE	EPA8260	SOIL	µg/kg	9/16/2002	21	21		R
482AS110.5	7440-22-4	SILVER	EPA6010	SOIL	mg/kg	9/16/2002	0.6	1		B
482AS110.5	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/16/2002	3.5	1		
482AS110.5	7440-43-9	CADMIUM	EPA6010	SOIL	mg/kg	9/16/2002	2.9	0.52		
482AS110.5	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/16/2002	6.3	1		
482AS110.5	7782-49-2	SELENIUM	EPA6010	SOIL	mg/kg	9/16/2002	0.86	0.52		
482AS110.5	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/16/2002	110	10		
482AS110.5	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/16/2002	17	0.31		
482AS110.5	7439-97-6	MERCURY	EPA7470	SOIL	mg/kg	9/16/2002	0.02	0.1		B
482AS110.5	10098-97-2	Sr-90	SR7500	SOIL	pCi/g	9/16/2002	1.03	0.25	0.25	
482AS110.5	15117-48-3	Pu-239	UGTAISOPU	SOIL	pCi/g	9/16/2002	0.038	0.0096	0.022	LT
482AS1117	14913-50-9	Tl-208	HASL300	SOIL	pCi/g	9/16/2002	0.268	0.066	0.069	
482AS1117	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/16/2002	0.76	0.11	0.16	
482AS1117	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/16/2002	0.6	0.13	0.13	
482AS1117	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/16/2002	0.48	0.15	0.13	
482AS1117	14331-83-0	Ac-228	HASL300	SOIL	pCi/g	9/16/2002	0.74	0.24	0.18	
482AS1117	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/16/2002	22.9	0.76	4.0	
482AS1117	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/16/2002	2.7	0.3		
482AS1117	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/16/2002	44	10		
482AS1117	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/16/2002	3.5	1		
482AS1117	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/16/2002	3.1	1		
482AS1117	7782-49-2	SELENIUM	EPA6010	SOIL	mg/kg	9/16/2002	0.49	0.51		B
482AS1117	67-64-1	ACETONE	EPA8260	SOIL	µg/kg	9/16/2002	20	20		R
482AS1117DUP	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/16/2002	0.81	0.18	0.20	
482AS1117DUP	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/16/2002	1.02	0.2	0.23	
482AS1117DUP	14913-50-9	Tl-208	HASL300	SOIL	pCi/g	9/16/2002	0.238	0.11	0.091	
482AS1117DUP	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/16/2002	0.66	0.23	0.21	
482AS1117DUP	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/16/2002	25.5	1.9	4.9	
482AS1117DUP	7782-49-2	SELENIUM	EPA6010	SOIL	mg/kg	9/16/2002	0.573	0.506		
482AS1117DUP	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/16/2002	2.82	1.01		
482AS1117DUP	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/16/2002	2.6	0.303		
482AS1117DUP	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/16/2002	39.9	10.1		

SAMPLE_NO	CASNO	PARAMETER	User Test Group	Sample Matrix	UNITS	Sample Date	Result	Detect Limit	Error	Validation Qualifier
482AS1117DUP	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/16/2002	3.26	1.01		
482AS116.5	14913-50-9	Tl-208	HASL300	SOIL	pCi/g	9/16/2002	0.4	0.14	0.13	
482AS116.5	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/16/2002	1.18	0.21	0.27	
482AS116.5	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/16/2002	1.37	0.29	0.30	
482AS116.5	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/16/2002	0.96	0.36	0.30	
482AS116.5	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/16/2002	27.6	2.1	5.3	
482AS116.5	68334-30-5	Diesel-Range Organics	EPA8015	SOIL	mg/kg	9/16/2002	4.6	5.2		J
482AS116.5	67-64-1	ACETONE	EPA8260	SOIL	µg/kg	9/16/2002	8.5	21		J
482AS116.5	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/16/2002	1.6	1		
482AS116.5	7782-49-2	SELENIUM	EPA6010	SOIL	mg/kg	9/16/2002	1	0.52		
482AS116.5	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/16/2002	1.8	1		
482AS116.5	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/16/2002	12	0.31		
482AS116.5	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/16/2002	77	10		
482AS116.5	7439-97-6	MERCURY	EPA7470	SOIL	mg/kg	9/16/2002	0.02	0.1		B
482AS116.5DUP	14913-50-9	Tl-208	HASL300	SOIL	pCi/g	9/16/2002	0.38	0.18	0.15	
482AS116.5DUP	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/16/2002	1.14	0.31	0.29	
482AS116.5DUP	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/16/2002	0.9	0.32	0.32	
482AS116.5DUP	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/16/2002	1.1	0.23	0.28	
482AS116.5DUP	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/16/2002	25	2.2	5.5	
482AS1201	14331-83-0	Ac-228	HASL300	SOIL	pCi/g	9/15/2002	0.65	0.36	0.22	
482AS1201	10045-97-3	Cs-137	HASL300	SOIL	pCi/g	9/15/2002	1400	0.81	230	
482AS1201	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/15/2002	23.1	0.96	4.1	
482AS1201	67-64-1	ACETONE	EPA8260	SOIL	µg/kg	9/15/2002	8.6	20		J
482AS1201	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/15/2002	6.5	0.61		
482AS1201	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/15/2002	140	10		
482AS1201	7439-97-6	MERCURY	EPA7470	SOIL	mg/kg	9/15/2002	0.023	0.1		B
482AS1201	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/15/2002	1.8	1		
482AS1201	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/15/2002	2.4	1		J
482AS1201	7782-49-2	SELENIUM	EPA6010	SOIL	mg/kg	9/15/2002	1.1	1		
482AS1201	10098-97-2	Sr-90	SR7500	SOIL	pCi/g	9/15/2002	7.3	0.29	1.3	
482AS1207	14331-83-0	Ac-228	HASL300	SOIL	pCi/g	9/15/2002	0.9	0.52	0.35	
482AS1207	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/15/2002	21.9	1.4	4.2	
482AS1207	10045-97-3	Cs-137	HASL300	SOIL	pCi/g	9/15/2002	640	0.86	100	
482AS1207	67-64-1	ACETONE	EPA8260	SOIL	µg/kg	9/15/2002	10	20		J
482AS1207	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/15/2002	120	10		
482AS1207	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/15/2002	2.1	1		
482AS1207	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/15/2002	8	1		
482AS1207	7782-49-2	SELENIUM	EPA6010	SOIL	mg/kg	9/15/2002	0.85	1		B
482AS1207	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/15/2002	8.3	0.61		

SAMPLE_NO	CASNO	PARAMETER	User Test Group	Sample Matrix	UNITS	Sample Date	Result	Detect Limit	Error	Validation Qualifier
482AS1207	10098-97-2	Sr-90	SR7500	SOIL	pCi/g	9/15/2002	21.6	0.19	3.9	
482AS1207DUP	10098-97-2	Sr-90	SR7500	SOIL	pCi/g	9/15/2002	19.9	0.19	3.6	
482AS1217	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/15/2002	0.81	0.11	0.17	
482AS1217	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/15/2002	0.74	0.13	0.15	
482AS1217	14913-50-9	Tl-208	HASL300	SOIL	pCi/g	9/15/2002	0.263	0.071	0.069	
482AS1217	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/15/2002	0.63	0.15	0.15	
482AS1217	14331-83-0	Ac-228	HASL300	SOIL	pCi/g	9/15/2002	0.78	0.28	0.20	
482AS1217	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/15/2002	24.7	0.82	4.3	
482AS1217	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/15/2002	2	0.6		
482AS1217	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/15/2002	50	10		
482AS1217	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/15/2002	1.1	1		
482AS1217	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/15/2002	2.5	1		
482AS1217DUP	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/15/2002	22.9	0.84	4.3	
482AS1217DUP	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/15/2002	0.79	0.13	0.18	
482AS1217DUP	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/15/2002	0.71	0.14	0.16	
482AS1217DUP	14913-50-9	Tl-208	HASL300	SOIL	pCi/g	9/15/2002	0.259	0.071	0.079	
482AS1217DUP	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/15/2002	0.76	0.14	0.19	
482AS1217DUP	14331-83-0	Ac-228	HASL300	SOIL	pCi/g	9/15/2002	0.82	0.31	0.23	
482AS1217DUP	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/15/2002	1.29	0.604		
482AS1217DUP	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/15/2002	37.7	10.1		
482AS1217DUP	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/15/2002	0.724	1.01		B
482AS1217DUP	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/15/2002	2.13	1.01		
482AS1316	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/18/2002	1.3	0.13	0.25	
482AS1316	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/18/2002	1	0.16	0.20	
482AS1316	14913-50-9	Tl-208	HASL300	SOIL	pCi/g	9/18/2002	0.382	0.085	0.091	
482AS1316	14331-83-0	Ac-228	HASL300	SOIL	pCi/g	9/18/2002	1.26	0.26	0.27	
482AS1316	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/18/2002	0.83	0.16	0.19	
482AS1316	10045-97-3	Cs-137	HASL300	SOIL	pCi/g	9/18/2002	0.6	0.076	0.12	
482AS1316	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/18/2002	20.5	1	3.7	
482AS1316	117-81-7	BIS(2-ETHYLHEXYL)PHTHALATE	EPA8270	SOIL	µg/kg	9/18/2002	200	350		J
482AS1316	68334-30-5	Diesel-Range Organics	EPA8015	SOIL	mg/kg	9/18/2002	16	5.3		M
482AS1316	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/18/2002	230	11		
482AS1316	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/18/2002	5.7	1.1		
482AS1316	7440-43-9	CADMIUM	EPA6010	SOIL	mg/kg	9/18/2002	0.26	0.53		B
482AS1316	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/18/2002	18	1.1		
482AS1316	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/18/2002	45	0.32		
482AS1316	67-64-1	ACETONE	EPA8260	SOIL	µg/kg	9/18/2002	15	21		J
482AS1316	7439-97-6	MERCURY	EPA7470	SOIL	mg/kg	9/18/2002	0.022	0.11		B
482AS1328	14913-50-9	Tl-208	HASL300	SOIL	pCi/g	9/18/2002	0.33	0.11	0.11	

SAMPLE_NO	CASNO	PARAMETER	User Test Group	Sample Matrix	UNITS	Sample Date	Result	Detect Limit	Error	Validation Qualifier
482AS1328	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/18/2002	1.12	0.13	0.24	
482AS1328	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/18/2002	0.66	0.19	0.18	
482AS1328	14331-83-0	Ac-228	HASL300	SOIL	pCi/g	9/18/2002	0.68	0.4	0.25	
482AS1328	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/18/2002	0.59	0.18	0.19	
482AS1328	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/18/2002	18.4	1.3	3.9	
482AS1328	68334-30-5	Diesel-Range Organics	EPA8015	SOIL	mg/kg	9/18/2002	4.5	5.1		J
482AS1328	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/18/2002	2.7	0.3		
482AS1328	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/18/2002	94	10		
482AS1328	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/18/2002	4.8	1		
482AS1328	67-64-1	ACETONE	EPA8260	SOIL	µg/kg	9/18/2002	10	20		J
482AS1407	14913-50-9	Tl-208	HASL300	SOIL	pCi/g	9/19/2002	0.5	0.1	0.13	
482AS1407	10045-97-3	Cs-137	HASL300	SOIL	pCi/g	9/19/2002	2.8	0.096	0.50	
482AS1407	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/19/2002	1.33	0.17	0.27	
482AS1407	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/19/2002	1.12	0.21	0.24	
482AS1407	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/19/2002	23	0.81	4.4	
482AS1407	14331-83-0	Ac-228	HASL300	SOIL	pCi/g	9/19/2002	1.23	0.3	0.30	
482AS1407	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/19/2002	0.95	0.18	0.23	
482AS1407	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/19/2002	15	0.31		
482AS1407	7782-49-2	SELENIUM	EPA6010	SOIL	mg/kg	9/19/2002	0.74	0.51		
482AS1407	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/19/2002	160	10		
482AS1407	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/19/2002	4.4	1		
482AS1407	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/19/2002	6.8	1		J
482AS1407	67-64-1	ACETONE	EPA8260	SOIL	µg/kg	9/19/2002	21	20		
482AS1407	7439-97-6	MERCURY	EPA7470	SOIL	mg/kg	9/19/2002	0.031	0.1		B
482AS1412	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/19/2002	0.65	0.33	0.24	
482AS1412	10045-97-3	Cs-137	HASL300	SOIL	pCi/g	9/19/2002	1.67	0.14	0.32	
482AS1412	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/19/2002	0.97	0.2	0.23	
482AS1412	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/19/2002	1.22	0.24	0.27	
482AS1412	14913-50-9	Tl-208	HASL300	SOIL	pCi/g	9/19/2002	0.26	0.13	0.10	
482AS1412	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/19/2002	23.2	2.1	4.5	
482AS1412	68334-30-5	Diesel-Range Organics	EPA8015	SOIL	mg/kg	9/19/2002	15	5.2		M
482AS1412	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/19/2002	5.9	0.93		
482AS1412	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/19/2002	76	10		
482AS1412	7440-22-4	SILVER	EPA6010	SOIL	mg/kg	9/19/2002	0.66	1		B
482AS1412	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/19/2002	15	1		
482AS1412	7439-97-6	MERCURY	EPA7470	SOIL	mg/kg	9/19/2002	0.0037	0.1		B
482AS1412	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/19/2002	30	1		J
482AS1435.5	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/19/2002	22.2	1.9	5.0	
482AS1435.5	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/19/2002	0.7	0.23	0.22	

SAMPLE_NO	CASNO	PARAMETER	User Test Group	Sample Matrix	UNITS	Sample Date	Result	Detect Limit	Error	Validation Qualifier
482AS1435.5	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/19/2002	0.7	0.24	0.21	
482AS1435.5	67-64-1	ACETONE	EPA8260	SOIL	µg/kg	9/19/2002	10	21		J
482AS1435.5	7439-97-6	MERCURY	EPA7470	SOIL	mg/kg	9/19/2002	0.0021	0.1		B
482AS1435.5	7782-49-2	SELENIUM	EPA6010	SOIL	mg/kg	9/19/2002	0.65	0.52		
482AS1435.5	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/19/2002	56	10		
482AS1435.5	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/19/2002	3.3	1		
482AS1435.5	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/19/2002	3.4	1		J
482AS1435.5	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/19/2002	4.5	0.31		
482ASQ0315.5	14331-83-0	Ac-228	HASL300	SOIL	pCi/g	9/17/2002	0.9	0.35	0.27	
482ASQ0315.5	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/17/2002	24.1	1.2	4.8	
482ASQ0315.5	14913-50-9	Tl-208	HASL300	SOIL	pCi/g	9/17/2002	0.31	0.088	0.10	
482ASQ0315.5	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/17/2002	0.77	0.16	0.19	
482ASQ0315.5	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/17/2002	0.55	0.18	0.16	
482ASQ0315.5	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/17/2002	0.41	0.19	0.17	
482ASQ0315.5	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/17/2002	3.7	1		J
482ASQ0315.5	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/17/2002	1	0.61		
482ASQ0315.5	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/17/2002	100	10		
482ASQ0315.5	7782-49-2	SELENIUM	EPA6010	SOIL	mg/kg	9/17/2002	0.94	1		B
482ASQ04A25	14913-50-9	Tl-208	HASL300	SOIL	pCi/g	9/14/2002	0.272	0.085	0.086	
482ASQ04A25	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/14/2002	0.98	0.1	0.20	
482ASQ04A25	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/14/2002	0.56	0.15	0.14	
482ASQ04A25	14331-83-0	Ac-228	HASL300	SOIL	pCi/g	9/14/2002	0.92	0.38	0.25	
482ASQ04A25	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/14/2002	0.52	0.14	0.15	
482ASQ04A25	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/14/2002	22.5	0.68	4.2	
482ASQ04A25	75-09-2	METHYLENE CHLORIDE	EPA8260	SOIL	µg/kg	9/14/2002	2.3	5.1		J
482ASQ04A25	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/14/2002	2.8	1		
482ASQ04A25	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/14/2002	1.8	0.61		
482ASQ04A25	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/14/2002	67	10		
482ASQ04A25	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/14/2002	1.6	1		
482BSB101	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/12/2002	0.36	0.19	0.14	
482BSB101	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/12/2002	0.45	0.27	0.16	
482BSB101	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/12/2002	11.1	2	2.6	
482BSB101	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/12/2002	7.9	1.6		J
482BSB101	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/12/2002	40	10		J
482BSB101	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/12/2002	1.7	1		J
482BSB101	7440-43-9	CADMIUM	EPA6010	SOIL	mg/kg	9/12/2002	0.39	0.52		J
482BSB101	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/12/2002	2	1		J
482BSB101DUP	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/12/2002	8.9	1.7	2.6	
482BSB101DUP	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/12/2002	1.95	1.04		

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482BSB101DUP	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/12/2002	7.17	1.56		
482BSB101DUP	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/12/2002	37.8	10.4		
482BSB101DUP	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/12/2002	1.44	1.04		
482BSB101DUP	7440-43-9	CADMIUM	EPA6010	SOIL	mg/kg	9/12/2002	0.667	0.519		
482BSB201	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/30/2002	2.1	1		
482BSB201	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/30/2002	3.5	1		
482BSB201	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/30/2002	64	10		
482BSB201	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/30/2002	6.2	0.3		J
482BSB201	7439-97-6	MERCURY	EPA7470	SOIL	mg/kg	9/30/2002	0.013	0.1		B
482BSB201	14913-50-9	Tl-208	HASL300	SOIL	pCi/g	9/30/2002	0.318	0.074	0.079	
482BSB201	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/30/2002	0.7	0.16	0.17	
482BSB201	10045-97-3	Cs-137	HASL300	SOIL	pCi/g	9/30/2002	0.57	0.076	0.12	
482BSB201	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/30/2002	1.09	0.14	0.22	
482BSB201	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/30/2002	0.99	0.15	0.20	
482BSB201	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/30/2002	27	0.99	4.7	
482BSB201	14331-83-0	Ac-228	HASL300	SOIL	pCi/g	9/30/2002	0.94	0.3	0.23	
482BSB301	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/30/2002	2.3	1		
482BSB301	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/30/2002	3.1	1		
482BSB301	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/30/2002	4.5	0.6		J
482BSB301	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/30/2002	70	10		
482BSB301	7439-97-6	MERCURY	EPA7470	SOIL	mg/kg	9/30/2002	0.022	0.1		B
482BSB301	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/30/2002	1.43	0.14	0.29	
482BSB301	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/30/2002	0.57	0.17	0.15	
482BSB301	14913-50-9	Tl-208	HASL300	SOIL	pCi/g	9/30/2002	0.38	0.09	0.11	
482BSB301	14331-83-0	Ac-228	HASL300	SOIL	pCi/g	9/30/2002	1.29	0.41	0.35	
482BSB301	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/30/2002	0.38	0.2	0.16	
482BSB301	10045-97-3	Cs-137	HASL300	SOIL	pCi/g	9/30/2002	0.33	0.12	0.11	
482BSB301	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/30/2002	24	1.1	4.6	
482DB10.5	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/30/2002	6.9	0.3		J
482DB10.5	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/30/2002	90	10		
482DB10.5	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/30/2002	2.4	1		
482DB10.5	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/30/2002	2.7	1		
482DB10.5	7439-97-6	MERCURY	EPA7470	SOIL	mg/kg	9/30/2002	0.0087	0.1		B
482DB10.5	10045-97-3	Cs-137	HASL300	SOIL	pCi/g	9/30/2002	39.4	0.34	6.6	
482DB10.5	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/30/2002	0.92	0.44	0.33	
482DB10.5	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/30/2002	18.8	1.9	4.0	
482DB10.5	10098-97-2	Sr-90	SR7500	SOIL	pCi/g	9/30/2002	5.05	0.17	0.93	J
482DB10.5	15117-48-3	Pu-239	UGTAISOPU	SOIL	pCi/g	9/30/2002	0.421	0.005	0.075	
482DB10.5	13981-16-3	Pu-238	UGTAISOPU	SOIL	pCi/g	9/30/2002	0.065	0.005	0.022	

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482DB10.5DUP	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/30/2002	2.42	1.01		
482DB10.5DUP	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/30/2002	45.8	0.302		
482DB10.5DUP	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/30/2002	105	10.1		
482DB10.5DUP	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/30/2002	2.26	1.01		
482DB10.5DUP	7439-97-6	MERCURY	EPA7470	SOIL	mg/kg	9/30/2002	0.0106	0.101		B
482DB10.5DUP	14913-50-9	Tl-208	HASL300	SOIL	pCi/g	9/30/2002	0.28	0.15	0.11	
482DB10.5DUP	10045-97-3	Cs-137	HASL300	SOIL	pCi/g	9/30/2002	37.8	0.16	6.3	
482DB10.5DUP	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/30/2002	0.73	0.26	0.22	
482DB10.5DUP	14331-83-0	Ac-228	HASL300	SOIL	pCi/g	9/30/2002	0.88	0.31	0.28	
482DB10.5DUP	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/30/2002	20.3	1	4.0	
482DB10.5DUP	10098-97-2	Sr-90	SR7500	SOIL	pCi/g	9/30/2002	4.62	0.19	0.85	J
482DB20.5	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/30/2002	3.8	1		
482DB20.5	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/30/2002	3.7	1		
482DB20.5	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/30/2002	12	0.62		J
482DB20.5	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/30/2002	180	10		
482DB20.5	7439-97-6	MERCURY	EPA7470	SOIL	mg/kg	9/30/2002	0.016	0.1		B
482DB20.5	10045-97-3	Cs-137	HASL300	SOIL	pCi/g	9/30/2002	35.8	0.28	6.0	
482DB20.5	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/30/2002	1.04	0.37	0.31	
482DB20.5	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/30/2002	1	0.53	0.37	
482DB20.5	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/30/2002	0.86	0.44	0.34	
482DB20.5	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/30/2002	21.2	2.2	4.5	
482DB20.5	10098-97-2	Sr-90	SR7500	SOIL	pCi/g	9/30/2002	5.5	0.23	1.0	J
482DB20.5	13981-16-3	Pu-238	UGTAISOPU	SOIL	pCi/g	9/30/2002	0.175	0.011	0.040	
482DB20.5	15117-48-3	Pu-239	UGTAISOPU	SOIL	pCi/g	9/30/2002	1.08	0.005	0.16	
482DB30.5	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/30/2002	3.4	1		
482DB30.5	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/30/2002	12	0.61		J
482DB30.5	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/30/2002	140	10		
482DB30.5	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/30/2002	2.8	1		
482DB30.5	68334-30-5	Diesel-Range Organics	EPA8015	SOIL	mg/kg	9/30/2002	3.9	5.1		J
482DB30.5	7439-97-6	MERCURY	EPA7470	SOIL	mg/kg	9/30/2002	0.012	0.1		B
482DB30.5	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/30/2002	1.14	0.36	0.32	
482DB30.5	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/30/2002	1.07	0.4	0.35	
482DB30.5	10045-97-3	Cs-137	HASL300	SOIL	pCi/g	9/30/2002	22	0.32	3.7	
482DB30.5	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/30/2002	17.7	2	4.0	
482DBQ10.5	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/30/2002	89	10		
482DBQ10.5	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/30/2002	2.9	1		
482DBQ10.5	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/30/2002	2.8	1		
482DBQ10.5	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/30/2002	7.4	0.3		J
482DBQ10.5	7439-97-6	MERCURY	EPA7470	SOIL	mg/kg	9/30/2002	0.0085	0.1		B

SAMPLE_NO	CASNO	PARAMETER	User Test Group	Sample Matrix	UNITS	Sample Date	Result	Detect Limit	Error	Validation Qualifier
482DBQ10.5	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/30/2002	0.84	0.38	0.29	
482DBQ10.5	10045-97-3	Cs-137	HASL300	SOIL	pCi/g	9/30/2002	39.9	0.24	6.6	
482DBQ10.5	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/30/2002	22.3	2.1	4.5	
482DR0106	10045-97-3	Cs-137	HASL300	SOIL	pCi/g	9/26/2002	0.55	0.087	0.14	
482DR0106	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/26/2002	0.44	0.13	0.13	
482DR0106	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/26/2002	0.35	0.17	0.13	
482DR0106	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/26/2002	14.4	0.53	2.9	
482DR0106	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/26/2002	2.2	1		
482DR0106	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/26/2002	9.2	0.9		J
482DR0106	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/26/2002	220	10		
482DR0106	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/26/2002	2.1	1		
482DR0106	7440-43-9	CADMIUM	EPA6010	SOIL	mg/kg	9/26/2002	0.52	0.5		
482DR0106	7439-97-6	MERCURY	EPA7470	SOIL	mg/kg	9/26/2002	0.0086	0.1		B
482DR0106DUP	14913-50-9	Tl-208	HASL300	SOIL	pCi/g	9/26/2002	0.199	0.085	0.075	
482DR0106DUP	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/26/2002	0.44	0.14	0.13	
482DR0106DUP	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/26/2002	0.45	0.17	0.13	
482DR0106DUP	10045-97-3	Cs-137	HASL300	SOIL	pCi/g	9/26/2002	0.54	0.078	0.13	
482DR0106DUP	14331-83-0	Ac-228	HASL300	SOIL	pCi/g	9/26/2002	0.6	0.27	0.20	
482DR0106DUP	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/26/2002	0.3	0.13	0.12	
482DR0106DUP	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/26/2002	13.8	0.87	2.9	
482DR02A06	14913-50-9	Tl-208	HASL300	SOIL	pCi/g	9/26/2002	0.278	0.1	0.096	
482DR02A06	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/26/2002	0.99	0.19	0.22	
482DR02A06	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/26/2002	0.72	0.21	0.21	
482DR02A06	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/26/2002	0.79	0.13	0.19	
482DR02A06	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/26/2002	22.9	1	4.5	
482DR02A06	14331-83-0	Ac-228	HASL300	SOIL	pCi/g	9/26/2002	0.7	0.38	0.28	
482DR02A06	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/26/2002	160	10		
482DR02A06	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/26/2002	4.2	1		
482DR02A06	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/26/2002	2.8	1		
482DR02A06	7782-49-2	SELENIUM	EPA6010	SOIL	mg/kg	9/26/2002	1.8	1		
482DR02A06	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/26/2002	5	0.61		J
482DR02A06	7439-97-6	MERCURY	EPA7470	SOIL	mg/kg	9/26/2002	0.0057	0.1		B
482DR02A06	68334-30-5	Diesel-Range Organics	EPA8015	SOIL	mg/kg	9/26/2002	97	5		M
482DR03C	14596-10-2	Am-241	HASL300	SOIL	pCi/g	9/26/2002	3.1	1.6	1.1	
482DR03C	10045-97-3	Cs-137	HASL300	SOIL	pCi/g	9/26/2002	472	0.53	78	
482DR03C	10198-40-0	Co-60	HASL300	SOIL	pCi/g	9/26/2002	0.323	0.11	0.081	
482DR03C	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/26/2002	19.6	1.3	3.6	
482DR03C	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/26/2002	4.8	1		
482DR03C	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/26/2002	8.2	1		

SAMPLE_NO	CASNO	PARAMETER	User Test Group	Sample Matrix	UNITS	Sample Date	Result	Detect Limit	Error	Validation Qualifier
482DR03C	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/26/2002	34	0.61		J
482DR03C	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/26/2002	210	10		
482DR03C	7439-97-6	MERCURY	EPA7470	SOIL	mg/kg	9/26/2002	0.013	0.1		B
482DR03C	10098-97-2	Sr-90	SR7500	SOIL	pCi/g	9/26/2002	43.8	0.3	7.9	
482DR03C	13981-16-3	Pu-238	UGTAISOPU	SOIL	pCi/g	9/26/2002	3.96	0.017	0.59	
482DR03C	15117-48-3	Pu-239	UGTAISOPU	SOIL	pCi/g	9/26/2002	23.3	0.0094	3.3	
482DR0406	14913-50-9	Tl-208	HASL300	SOIL	pCi/g	9/26/2002	0.38	0.16	0.13	
482DR0406	10045-97-3	Cs-137	HASL300	SOIL	pCi/g	9/26/2002	15.3	0.15	2.6	
482DR0406	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/26/2002	0.98	0.27	0.26	
482DR0406	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/26/2002	0.93	0.33	0.27	
482DR0406	14331-83-0	Ac-228	HASL300	SOIL	pCi/g	9/26/2002	0.99	0.41	0.34	
482DR0406	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/26/2002	0.74	0.3	0.26	
482DR0406	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/26/2002	21.2	1.1	4.2	
482DR0406	7439-97-6	MERCURY	EPA7470	SOIL	mg/kg	9/26/2002	0.017	0.11		B
482DR0406	193-39-5	INDENO(1,2,3-CD)PYRENE	EPA8270	SOIL	µg/kg	9/26/2002	130	350		J
482DR0406	191-24-2	BENZO(G,H,I)PERYLENE	EPA8270	SOIL	µg/kg	9/26/2002	190	350		J
482DR0406	207-08-9	BENZO(K)FLUORANTHENE	EPA8270	SOIL	µg/kg	9/26/2002	110	350		J
482DR0406	205-99-2	BENZO(B)FLUORANTHENE	EPA8270	SOIL	µg/kg	9/26/2002	360	350		
482DR0406	56-55-3	BENZO(A)ANTHRACENE	EPA8270	SOIL	µg/kg	9/26/2002	190	350		J
482DR0406	50-32-8	BENZO(A)PYRENE	EPA8270	SOIL	µg/kg	9/26/2002	210	350		J
482DR0406	206-44-0	FLUORANTHENE	EPA8270	SOIL	µg/kg	9/26/2002	160	350		J
482DR0406	218-01-9	CHRYSENE	EPA8270	SOIL	µg/kg	9/26/2002	290	350		J
482DR0406	129-00-0	PYRENE	EPA8270	SOIL	µg/kg	9/26/2002	260	350		J
482DR0406	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/26/2002	14	0.63		J
482DR0406	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/26/2002	180	11		
482DR0406	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/26/2002	2.6	1.1		
482DR0406	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/26/2002	3.8	1.1		
482DR0412	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/26/2002	0.94	0.13	0.19	
482DR0412	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/26/2002	0.66	0.17	0.15	
482DR0412	14913-50-9	Tl-208	HASL300	SOIL	pCi/g	9/26/2002	0.295	0.08	0.078	
482DR0412	14331-83-0	Ac-228	HASL300	SOIL	pCi/g	9/26/2002	1.02	0.32	0.24	
482DR0412	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/26/2002	0.54	0.18	0.15	
482DR0412	10045-97-3	Cs-137	HASL300	SOIL	pCi/g	9/26/2002	2.66	0.079	0.46	
482DR0412	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/26/2002	25.4	0.85	4.4	
482DR0412	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/26/2002	1.8	1		
482DR0412	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/26/2002	2.3	1		
482DR0412	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/26/2002	98	10		
482DR0412	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/26/2002	4.2	0.6		J
482DR0412	7439-97-6	MERCURY	EPA7470	SOIL	mg/kg	9/26/2002	0.012	0.1		B

SAMPLE_NO	CASNO	PARAMETER	User Test Group	Sample Matrix	UNITS	Sample Date	Result	Detect Limit	Error	Validation Qualifier
482DR0412	205-99-2	BENZO(B)FLUORANTHENE	EPA8270	SOIL	µg/kg	9/26/2002	84	340		J
482DR0412	56-55-3	BENZO(A)ANTHRACENE	EPA8270	SOIL	µg/kg	9/26/2002	43	340		J
482DR0412	50-32-8	BENZO(A)PYRENE	EPA8270	SOIL	µg/kg	9/26/2002	44	340		J
482DR0412	218-01-9	CHRYSENE	EPA8270	SOIL	µg/kg	9/26/2002	76	340		J
482DR0506	10045-97-3	Cs-137	HASL300	SOIL	pCi/g	9/26/2002	0.6	0.088	0.14	
482DR0506	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/26/2002	0.52	0.12	0.14	
482DR0506	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/26/2002	0.35	0.15	0.12	
482DR0506	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/26/2002	0.32	0.13	0.12	
482DR0506	14596-10-2	Am-241	HASL300	SOIL	pCi/g	9/26/2002	0.41	0.15	0.13	
482DR0506	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/26/2002	10.7	0.87	2.4	
482DR0506	7782-49-2	SELENIUM	EPA6010	SOIL	mg/kg	9/26/2002	0.57	0.5		
482DR0506	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/26/2002	1.6	1		
482DR0506	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/26/2002	6	0.6		J
482DR0506	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/26/2002	60	10		
482DR0506	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/26/2002	2	1		
482DR0506	7440-43-9	CADMIUM	EPA6010	SOIL	mg/kg	9/26/2002	0.61	0.5		
482DR0506	7439-97-6	MERCURY	EPA7470	SOIL	mg/kg	9/26/2002	0.0071	0.1		B
482DR0506	13981-16-3	Pu-238	UGTAISOPU	SOIL	pCi/g	9/26/2002	0.342	0.04	0.087	
482DR0506	15117-48-3	Pu-239	UGTAISOPU	SOIL	pCi/g	9/26/2002	2.42	0.021	0.39	
482DR0606	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/26/2002	0.88	0.18	0.21	
482DR0606	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/26/2002	0.67	0.18	0.18	
482DR0606	14913-50-9	Tl-208	HASL300	SOIL	pCi/g	9/26/2002	0.4	0.1	0.12	
482DR0606	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/26/2002	0.6	0.23	0.20	
482DR0606	10045-97-3	Cs-137	HASL300	SOIL	pCi/g	9/26/2002	0.89	0.12	0.20	
482DR0606	14331-83-0	Ac-228	HASL300	SOIL	pCi/g	9/26/2002	1.27	0.44	0.35	
482DR0606	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/26/2002	23.2	1	4.5	
482DR0606	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/26/2002	3.4	1		
482DR0606	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/26/2002	5.2	0.6		J
482DR0606	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/26/2002	89	10		
482DR0606	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/26/2002	2.7	1		
482DR0606	7439-97-6	MERCURY	EPA7470	SOIL	mg/kg	9/26/2002	0.0076	0.1		B
482DR0706	14913-50-9	Tl-208	HASL300	SOIL	pCi/g	9/26/2002	0.3	0.12	0.11	
482DR0706	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/26/2002	0.54	0.28	0.22	
482DR0706	10045-97-3	Cs-137	HASL300	SOIL	pCi/g	9/26/2002	3.05	0.16	0.56	
482DR0706	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/26/2002	0.81	0.23	0.22	
482DR0706	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/26/2002	0.6	0.27	0.19	
482DR0706	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/26/2002	19.4	1.7	4.0	
482DR0706	14331-83-0	Ac-228	HASL300	SOIL	pCi/g	9/26/2002	1.2	0.47	0.36	
482DR0706	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/26/2002	3.1	1		

SAMPLE_NO	CASNO	PARAMETER	User Test Group	Sample Matrix	UNITS	Sample Date	Result	Detect Limit	Error	Validation Qualifier
482DR0706	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/26/2002	13	0.6		J
482DR0706	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/26/2002	120	10		
482DR0706	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/26/2002	2.2	1		
482DR0706	7439-97-6	MERCURY	EPA7470	SOIL	mg/kg	9/26/2002	0.013	0.1		B
482DR0806	14913-50-9	Tl-208	HASL300	SOIL	pCi/g	9/26/2002	0.46	0.1	0.12	
482DR0806	10045-97-3	Cs-137	HASL300	SOIL	pCi/g	9/26/2002	5.22	0.13	0.91	
482DR0806	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/26/2002	1.17	0.16	0.25	
482DR0806	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/26/2002	0.89	0.23	0.21	
482DR0806	14331-83-0	Ac-228	HASL300	SOIL	pCi/g	9/26/2002	1.11	0.34	0.30	
482DR0806	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/26/2002	0.87	0.22	0.23	
482DR0806	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/26/2002	21.8	0.81	4.2	
482DR0806	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/26/2002	5.3	1		
482DR0806	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/26/2002	3.4	1		
482DR0806	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/26/2002	13	0.61		J
482DR0806	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/26/2002	140	10		
482DR0806	7439-97-6	MERCURY	EPA7470	SOIL	mg/kg	9/26/2002	0.024	0.1		B
482DR0806	84-74-2	DI-N-BUTYL PHTHALATE	EPA8270	SOIL	µg/kg	9/26/2002	58	340		J
482DR0806	10098-97-2	Sr-90	SR7500	SOIL	pCi/g	9/26/2002	0.79	0.32	0.26	J
482DR0806	13981-16-3	Pu-238	UGTAISOPU	SOIL	pCi/g	9/26/2002	1.16	0.048	0.22	
482DR0806	15117-48-3	Pu-239	UGTAISOPU	SOIL	pCi/g	9/26/2002	9.7	0.035	1.5	
482DR0906	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/26/2002	0.9	0.25	0.24	
482DR0906	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/26/2002	0.61	0.24	0.19	
482DR0906	14913-50-9	Tl-208	HASL300	SOIL	pCi/g	9/26/2002	0.3	0.14	0.11	
482DR0906	14331-83-0	Ac-228	HASL300	SOIL	pCi/g	9/26/2002	0.89	0.43	0.32	
482DR0906	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/26/2002	0.61	0.29	0.24	
482DR0906	10045-97-3	Cs-137	HASL300	SOIL	pCi/g	9/26/2002	6	0.23	1.1	
482DR0906	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/26/2002	21.6	1.9	4.4	
482DR0906	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/26/2002	12	0.61		J
482DR0906	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/26/2002	120	10		
482DR0906	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/26/2002	3.2	1		
482DR0906	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/26/2002	5	1		
482DR0906	7439-97-6	MERCURY	EPA7470	SOIL	mg/kg	9/26/2002	0.019	0.1		B
482DR0912	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/26/2002	1.1	0.2	0.25	
482DR0912	14331-83-0	Ac-228	HASL300	SOIL	pCi/g	9/26/2002	1.21	0.67	0.42	
482DR0912	10045-97-3	Cs-137	HASL300	SOIL	pCi/g	9/26/2002	2.99	0.18	0.55	
482DR0912	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/26/2002	25.5	2.1	5.0	
482DR0912	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/26/2002	0.72	0.31	0.22	
482DR0912	14913-50-9	Tl-208	HASL300	SOIL	pCi/g	9/26/2002	0.38	0.15	0.13	
482DR0912	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/26/2002	6.4	1		

SAMPLE_NO	CASNO	PARAMETER	User Test Group	Sample Matrix	UNITS	Sample Date	Result	Detect Limit	Error	Validation Qualifier
482DR0912	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/26/2002	3.7	1		
482DR0912	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/26/2002	16	0.6		J
482DR0912	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/26/2002	130	10		
482DR0912	7439-97-6	MERCURY	EPA7470	SOIL	mg/kg	9/26/2002	0.019	0.1		B
482DR0912DUP	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/26/2002	0.93	0.18	0.22	
482DR0912DUP	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/26/2002	0.68	0.23	0.19	
482DR0912DUP	14913-50-9	Tl-208	HASL300	SOIL	pCi/g	9/26/2002	0.35	0.12	0.12	
482DR0912DUP	14331-83-0	Ac-228	HASL300	SOIL	pCi/g	9/26/2002	0.77	0.38	0.26	
482DR0912DUP	14596-10-2	Am-241	HASL300	SOIL	pCi/g	9/26/2002	0.45	0.17	0.15	
482DR0912DUP	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/26/2002	0.59	0.2	0.20	
482DR0912DUP	10045-97-3	Cs-137	HASL300	SOIL	pCi/g	9/26/2002	2.1	0.12	0.41	
482DR0912DUP	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/26/2002	22.2	1.1	4.5	
482DR0912DUP	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/26/2002	2.96	1.01		
482DR0912DUP	7440-43-9	CADMIUM	EPA6010	SOIL	mg/kg	9/26/2002	0.248	1.01		B
482DR0912DUP	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/26/2002	5.48	1.01		
482DR0912DUP	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/26/2002	112	10.1		
482DR0912DUP	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/26/2002	10.1	0.605		
482DR0912DUP	7439-97-6	MERCURY	EPA7470	SOIL	mg/kg	9/26/2002	0.0185	0.101		B
482DR1006	14913-50-9	Tl-208	HASL300	SOIL	pCi/g	9/26/2002	0.36	0.11	0.11	
482DR1006	10045-97-3	Cs-137	HASL300	SOIL	pCi/g	9/26/2002	0.95	0.089	0.20	
482DR1006	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/26/2002	0.89	0.14	0.20	
482DR1006	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/26/2002	0.63	0.15	0.16	
482DR1006	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/26/2002	0.69	0.2	0.21	
482DR1006	14331-83-0	Ac-228	HASL300	SOIL	pCi/g	9/26/2002	0.99	0.37	0.27	
482DR1006	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/26/2002	19.8	0.99	3.9	
482DR1006	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/26/2002	7.1	0.6		J
482DR1006	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/26/2002	87	10		
482DR1006	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/26/2002	3	1		
482DR1006	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/26/2002	3.6	1		
482DR1006	7439-97-6	MERCURY	EPA7470	SOIL	mg/kg	9/26/2002	0.011	0.1		B
482DR1118	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/26/2002	0.66	0.19	0.18	
482DR1118	10045-97-3	Cs-137	HASL300	SOIL	pCi/g	9/26/2002	2.76	0.15	0.51	
482DR1118	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/26/2002	16.6	1.5	3.5	
482DR1118	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/26/2002	5.2	0.61		J
482DR1118	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/26/2002	45	10		
482DR1118	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/26/2002	2.1	1		
482DR1118	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/26/2002	2	1		
482DR1118	7439-97-6	MERCURY	EPA7470	SOIL	mg/kg	9/26/2002	0.0061	0.1		B
482DR11C	10045-97-3	Cs-137	HASL300	SOIL	pCi/g	9/26/2002	19.1	0.14	3.2	

SAMPLE_NO	CASNO	PARAMETER	User Test Group	Sample Matrix	UNITS	Sample Date	Result	Detect Limit	Error	Validation Qualifier
482DR11C	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/26/2002	0.77	0.26	0.23	
482DR11C	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/26/2002	0.58	0.31	0.21	
482DR11C	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/26/2002	22.8	1.2	4.5	
482DR11C	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/26/2002	5.5	0.3		J
482DR11C	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/26/2002	89	10		
482DR11C	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/26/2002	1.9	1		
482DR11C	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/26/2002	2.7	1		
482DR11C	7782-49-2	SELENIUM	EPA6010	SOIL	mg/kg	9/26/2002	0.42	0.5		B
482DR11C	7439-97-6	MERCURY	EPA7470	SOIL	mg/kg	9/26/2002	0.0058	0.1		B
482DRQ0706	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/26/2002	0.91	0.19	0.22	
482DRQ0706	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/26/2002	0.67	0.2	0.18	
482DRQ0706	14913-50-9	Tl-208	HASL300	SOIL	pCi/g	9/26/2002	0.37	0.085	0.11	
482DRQ0706	14331-83-0	Ac-228	HASL300	SOIL	pCi/g	9/26/2002	1.06	0.41	0.30	
482DRQ0706	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/26/2002	0.65	0.2	0.20	
482DRQ0706	10045-97-3	Cs-137	HASL300	SOIL	pCi/g	9/26/2002	2.34	0.095	0.43	
482DRQ0706	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/26/2002	21.9	1	4.3	
482DRQ0706	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/26/2002	11	0.6		J
482DRQ0706	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/26/2002	130	10		
482DRQ0706	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/26/2002	2.4	1		
482DRQ0706	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/26/2002	5.4	1		
482DRQ0706	7439-97-6	MERCURY	EPA7470	SOIL	mg/kg	9/26/2002	0.013	0.1		B
482ES1501	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/13/2002	0.88	0.16	0.20	
482ES1501	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/13/2002	0.79	0.18	0.19	
482ES1501	14913-50-9	Tl-208	HASL300	SOIL	pCi/g	9/13/2002	0.36	0.088	0.10	
482ES1501	14331-83-0	Ac-228	HASL300	SOIL	pCi/g	9/13/2002	0.86	0.32	0.25	
482ES1501	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/13/2002	0.59	0.17	0.17	
482ES1501	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/13/2002	22.4	0.89	4.3	
482ES1501	75-09-2	METHYLENE CHLORIDE	EPA8260	SOIL	UG/KG	9/13/2002	2.6	5.1		J
482ES1501	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/13/2002	2	0.61		J
482ES1501	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/13/2002	95	10		J
482ES1501	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/13/2002	3.5	1		J
482ES1501	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/13/2002	1.9	1		J
482ES1503	14913-50-9	Tl-208	HASL300	SOIL	pCi/g	9/13/2002	0.3	0.084	0.092	
482ES1503	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/13/2002	0.91	0.15	0.20	
482ES1503	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/13/2002	0.91	0.18	0.21	
482ES1503	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/13/2002	0.92	0.18	0.23	
482ES1503	14331-83-0	Ac-228	HASL300	SOIL	pCi/g	9/13/2002	0.92	0.44	0.31	
482ES1503	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/13/2002	25.6	0.94	4.9	
482ES1503	75-09-2	METHYLENE CHLORIDE	EPA8260	SOIL	µg/kg	9/13/2002	3.5	5.1		J

SAMPLE_NO	CASNO	PARAMETER	User Test Group	Sample Matrix	UNITS	Sample Date	Result	Detect Limit	Error	Validation Qualifier
482ES1503	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/13/2002	39	10		
482ES1503	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/13/2002	3.5	1		
482ES1503	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/13/2002	3	1		
482ES1503	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/13/2002	4	0.3		
482ES16A01	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/24/2002	2.1	1		
482ES16A01	7782-49-2	SELENIUM	EPA6010	SOIL	mg/kg	9/24/2002	0.42	0.51		B
482ES16A01	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/24/2002	3.7	1		
482ES16A01	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/24/2002	3.5	0.31		
482ES16A01	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/24/2002	74	10		
482ES16A01	7439-97-6	MERCURY	EPA7470	SOIL	mg/kg	9/24/2002	0.018	0.1		B
482ES16A01	67-64-1	ACETONE	EPA8260	SOIL	µg/kg	9/24/2002	20	20		R
482ES16A01	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/24/2002	1.25	0.15	0.26	
482ES16A01	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/24/2002	0.86	0.17	0.19	
482ES16A01	14331-83-0	Ac-228	HASL300	SOIL	pCi/g	9/24/2002	1.09	0.42	0.30	
482ES16A01	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/24/2002	0.78	0.2	0.22	
482ES16A01	10045-97-3	Cs-137	HASL300	SOIL	pCi/g	9/24/2002	0.69	0.12	0.16	
482ES16A01	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/24/2002	24.3	0.98	4.6	
482ES16A01	14913-50-9	Tl-208	HASL300	SOIL	pCi/g	9/24/2002	0.334	0.094	0.099	
482ES16A4.5	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/24/2002	1.7	1		
482ES16A4.5	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/24/2002	0.97	0.3		
482ES16A4.5	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/24/2002	91	10		
482ES16A4.5	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/24/2002	1.2	1		
482ES16A4.5	7439-97-6	MERCURY	EPA7470	SOIL	mg/kg	9/24/2002	0.0066	0.1		B
482ES16A4.5	67-64-1	ACETONE	EPA8260	SOIL	µg/kg	9/24/2002	20	20		R
482ES16A4.5	14913-50-9	Tl-208	HASL300	SOIL	pCi/g	9/24/2002	0.33	0.13	0.11	
482ES16A4.5	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/24/2002	0.85	0.18	0.21	
482ES16A4.5	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/24/2002	0.54	0.22	0.17	
482ES16A4.5	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/24/2002	0.56	0.27	0.22	
482ES16A4.5	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/24/2002	21	1.9	4.3	
482ES16A4.5	14331-83-0	Ac-228	HASL300	SOIL	pCi/g	9/24/2002	0.86	0.41	0.30	
482PSS121	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/25/2002	0.53	0.15	0.13	
482PSS121	14913-50-9	Tl-208	HASL300	SOIL	pCi/g	9/25/2002	0.25	0.072	0.070	
482PSS121	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/25/2002	0.85	0.13	0.18	
482PSS121	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/25/2002	0.35	0.18	0.13	
482PSS121	10045-97-3	Cs-137	HASL300	SOIL	pCi/g	9/25/2002	2.12	0.075	0.37	
482PSS121	14331-83-0	Ac-228	HASL300	SOIL	pCi/g	9/25/2002	0.8	0.27	0.20	
482PSS121	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/25/2002	24.3	0.91	4.3	
482PSS121	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/25/2002	2.6	1		
482PSS121	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/25/2002	2.4	1		

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482PSS121	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/25/2002	62	10		
482PSS121	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/25/2002	9.4	0.61		
482PSS121	7439-97-6	MERCURY	EPA7470	SOIL	mg/kg	9/25/2002	0.013	0.1		B
482PSS121	10098-97-2	Sr-90	SR7500	SOIL	pCi/g	9/25/2002	1.88	0.18	0.37	
482PSS121	13981-16-3	Pu-238	UGTAISOPU	SOIL	pCi/g	9/25/2002	0.327	0.0092	0.077	
482PSS121	15117-48-3	Pu-239	UGTAISOPU	SOIL	pCi/g	9/25/2002	2.76	0.0092	0.42	
482PSS121DUP	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/25/2002	0.77	0.18	0.19	
482PSS121DUP	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/25/2002	0.47	0.21	0.16	
482PSS121DUP	14913-50-9	Tl-208	HASL300	SOIL	pCi/g	9/25/2002	0.23	0.082	0.081	
482PSS121DUP	14596-10-2	Am-241	HASL300	SOIL	pCi/g	9/25/2002	0.51	0.17	0.15	
482PSS121DUP	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/25/2002	0.64	0.22	0.21	
482PSS121DUP	10045-97-3	Cs-137	HASL300	SOIL	pCi/g	9/25/2002	1.96	0.11	0.37	
482PSS121DUP	14331-83-0	Ac-228	HASL300	SOIL	pCi/g	9/25/2002	0.87	0.33	0.27	
482PSS121DUP	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/25/2002	26	1	5.0	
482PSS121DUP	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/25/2002	9.46	0.607		
482PSS121DUP	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/25/2002	64.2	10.1		
482PSS121DUP	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/25/2002	2.48	1.01		
482PSS121DUP	7440-43-9	CADMIUM	EPA6010	SOIL	mg/kg	9/25/2002	0.166	0.506		B
482PSS121DUP	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/25/2002	2.22	1.01		
482PSS121DUPDUP	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/25/2002	2.48	1.01		
482PSS121DUPDUP	7440-43-9	CADMIUM	EPA6010	SOIL	mg/kg	9/25/2002	0.166	0.506		B
482PSS121DUPDUP	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/25/2002	2.22	1.01		
482PSS121DUPDUP	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/25/2002	64.2	10.1		
482PSS121DUPDUP	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/25/2002	9.46	0.607		
482PSS220	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/25/2002	1.16	0.48	0.37	
482PSS220	10045-97-3	Cs-137	HASL300	SOIL	pCi/g	9/25/2002	66	0.25	11	
482PSS220	14331-83-0	Ac-228	HASL300	SOIL	pCi/g	9/25/2002	1.04	0.53	0.35	
482PSS220	14596-10-2	Am-241	HASL300	SOIL	pCi/g	9/25/2002	30.8	1.9	5.4	
482PSS220	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/25/2002	17	1.6	3.7	
482PSS220	7440-43-9	CADMIUM	EPA6010	SOIL	mg/kg	9/25/2002	0.56	1.1		B
482PSS220	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/25/2002	6	1.1		
482PSS220	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/25/2002	6.7	1.1		
482PSS220	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/25/2002	22	0.64		
482PSS220	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/25/2002	140	11		
482PSS220	7439-97-6	MERCURY	EPA7470	SOIL	mg/kg	9/25/2002	0.051	0.11		B
482PSS220	68334-30-5	Diesel-Range Organics	EPA8015	SOIL	mg/kg	9/25/2002	10	5.3		M
482PSS220	10098-97-2	Sr-90	SR7500	SOIL	pCi/g	9/25/2002	50	1.9	10	J
482PSS220	13981-16-3	Pu-238	UGTAISOPU	SOIL	pCi/g	9/25/2002	2.44	0.53	0.95	
482PSS220	15117-48-3	Pu-239	UGTAISOPU	SOIL	pCi/g	9/25/2002	132	0.53	20	

SAMPLE_NO	CASNO	PARAMETER	User Test Group	Sample Matrix	UNITS	Sample Date	Result	Detect Limit	Error	Validation Qualifier
482PSS306	14913-50-9	Tl-208	HASL300	SOIL	pCi/g	9/25/2002	0.29	0.15	0.12	
482PSS306	14733-03-0	Bi-214	HASL300	SOIL	pCi/g	9/25/2002	0.6	0.31	0.25	
482PSS306	10045-97-3	Cs-137	HASL300	SOIL	pCi/g	9/25/2002	20.9	0.18	3.5	
482PSS306	14596-10-2	Am-241	HASL300	SOIL	pCi/g	9/25/2002	4.07	0.3	0.74	
482PSS306	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/25/2002	0.81	0.27	0.24	
482PSS306	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/25/2002	23.2	1.4	4.8	
482PSS306	14331-83-0	Ac-228	HASL300	SOIL	pCi/g	9/25/2002	0.82	0.39	0.29	
482PSS306	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/25/2002	2.7	1		
482PSS306	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/25/2002	9.4	0.62		
482PSS306	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/25/2002	65	10		
482PSS306	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/25/2002	5	1		
482PSS306	7439-97-6	MERCURY	EPA7470	SOIL	mg/kg	9/25/2002	0.017	0.1		B
482PSS306	10098-97-2	Sr-90	SR7500	SOIL	pCi/g	9/25/2002	38.5	1.7	8.0	J
482PSS306	13981-16-3	Pu-238	UGTAISOPU	SOIL	pCi/g	9/25/2002	0.384	0.011	0.090	
482PSS306	15117-48-3	Pu-239	UGTAISOPU	SOIL	pCi/g	9/25/2002	21	0.026	3.0	
482PSS404	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/25/2002	1.09	0.4	0.32	
482PSS404	14331-83-0	Ac-228	HASL300	SOIL	pCi/g	9/25/2002	1.14	0.33	0.34	
482PSS404	14596-10-2	Am-241	HASL300	SOIL	pCi/g	9/25/2002	11.6	0.4	2.0	
482PSS404	10045-97-3	Cs-137	HASL300	SOIL	pCi/g	9/25/2002	61	0.2	10	
482PSS404	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/25/2002	23	1.2	4.6	
482PSS404	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/25/2002	17	0.61		
482PSS404	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/25/2002	88	10		
482PSS404	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/25/2002	6.5	1		
482PSS404	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/25/2002	4.7	1		
482PSS404	7439-97-6	MERCURY	EPA7470	SOIL	mg/kg	9/25/2002	0.027	0.1		B
482PSS404	10098-97-2	Sr-90	SR7500	SOIL	pCi/g	9/25/2002	65	1.5	13	J
482PSS404	15117-48-3	Pu-239	UGTAISOPU	SOIL	pCi/g	9/25/2002	43.8	0.022	6.0	
482PSS404	13981-16-3	Pu-238	UGTAISOPU	SOIL	pCi/g	9/25/2002	0.75	0.019	0.14	
482PSS404DUP	10098-97-2	Sr-90	SR7500	SOIL	pCi/g	9/25/2002	63	1.5	13	J
482PSS404DUP	13981-16-3	Pu-238	UGTAISOPU	SOIL	pCi/g	9/25/2002	0.79	0.02	0.15	
482PSS404DUP	15117-48-3	Pu-239	UGTAISOPU	SOIL	pCi/g	9/25/2002	45.8	0.02	6.5	
482PSS506	10045-97-3	Cs-137	HASL300	SOIL	pCi/g	9/25/2002	0.63	0.17	0.18	
482PSS506	15092-94-1	Pb-212	HASL300	SOIL	pCi/g	9/25/2002	0.96	0.2	0.23	
482PSS506	15067-28-4	Pb-214	HASL300	SOIL	pCi/g	9/25/2002	0.56	0.23	0.18	
482PSS506	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/25/2002	22	1.9	4.5	
482PSS506	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/25/2002	76	10		
482PSS506	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/25/2002	4.5	1		
482PSS506	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/25/2002	2.9	1		
482PSS506	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/25/2002	7.4	0.61		

SAMPLE_NO	CASNO	PARAMETER	User Test Group	Sample Matrix	UNITS	Sample Date	Result	Detect Limit	Error	Validation Qualifier
482PSS506	7439-97-6	MERCURY	EPA7470	SOIL	mg/kg	9/25/2002	0.016	0.1		B
482PSS506	15117-48-3	Pu-239	UGTAISOPU	SOIL	pCi/g	9/25/2002	0.379	0.011	0.089	
482PSS606	14331-83-0	Ac-228	HASL300	SOIL	pCi/g	9/25/2002	1.12	0.32	0.28	
482PSS606	14596-10-2	Am-241	HASL300	SOIL	pCi/g	9/25/2002	182	2.7	30	
482PSS606	10045-97-3	Cs-137	HASL300	SOIL	pCi/g	9/25/2002	830	0.59	140	
482PSS606	13966-00-2	K-40	HASL300	SOIL	pCi/g	9/25/2002	18.7	0.88	3.3	
482PSS606	7440-38-2	ARSENIC	EPA6010	SOIL	mg/kg	9/25/2002	5.3	1		
482PSS606	7440-43-9	CADMIUM	EPA6010	SOIL	mg/kg	9/25/2002	3.5	0.51		
482PSS606	7440-47-3	CHROMIUM	EPA6010	SOIL	mg/kg	9/25/2002	12	1		
482PSS606	7440-39-3	BARIUM	EPA6010	SOIL	mg/kg	9/25/2002	98	10		
482PSS606	7439-92-1	LEAD	EPA6010	SOIL	mg/kg	9/25/2002	39	0.61		
482PSS606	7439-97-6	MERCURY	EPA7470	SOIL	mg/kg	9/25/2002	0.011	0.1		B
482PSS606	10098-97-2	Sr-90	SR7500	SOIL	pCi/g	9/25/2002	44.2	1.4	9.1	
482PSS606	15117-48-3	Pu-239	UGTAISOPU	SOIL	pCi/g	9/25/2002	1000	0.28	130	Y1
482PSS606	13981-16-3	Pu-238	UGTAISOPU	SOIL	pCi/g	9/25/2002	18.3	0.34	3.1	Y1
482PSS606DUP	10098-97-2	Sr-90	SR7500	SOIL	pCi/g	9/25/2002	45.9	1.3	9.5	**

Appendix B

Data Quality Objective Process for CAU 482, Area 15 U15a/e Muckpiles and Ponds

B.1.0 Seven-Step DQO Process Characterization of CAU 482 (U15a/e Muckpiles)

The Data Quality Objective (DQO) process is a planning approach based on the scientific method that is used to ensure that data collected during site characterization will provide sufficient and reliable information to identify, evaluate, and technically defend potentially viable corrective actions (i.e., no further action, closure in place, or clean closure). The existing information about the nature and extent of contamination at the three Corrective Action Sites (CASs) in Corrective Action Unit (CAU) 482 is insufficient to evaluate and select preferred corrective actions. The CAU 482 investigation will be based on DQOs agreed to by representatives of the Nevada Division of Environmental Protection (NDEP) and the Defense Threat Reduction Agency (DTRA).

Three CASs comprise CAU 482:

- CAS 15-06-02, U15a Muckpile
- CAS 15-06-01, U15e Muckpile
- CAS 15-38-01, Area 15 U15a/e Settling Ponds

This section presents the seven-step DQO process for the Area 15 U15a/e Muckpiles and Ponds characterization.

B.1.1 Step 1 - State the Problem

This step identifies the DQO planning team members, states the problem that has initiated the CAU 482 investigation, and develops the conceptual site model (CSM).

B.1.1.1 Planning Team Members

The DQO planning team consists of representatives from NDEP, DTRA, and ITLV. The primary decision-makers include NDEP and DTRA representatives. Table B-1 lists representatives from each organization who attended the April 16, 2002, DQO kickoff meeting.

Table B-1
DQO Meeting Participants

Participant	Affiliation
Wayne Griffin	BN/DTRA
Don Elle	NDEP
Ted Zafaratos	NDEP
Syl Hersh	IT/QA
Dan Jensen	SAIC/H&S
Steve Mergenmeier	IT/QA
Steve Adams	IT/HP
Tiffany Lantow	BN/DTRA
Rick Deshler	IT/PM

B.1.1.2 State the Problem

It is unknown whether contaminants of potential concern (COPCs) that exceed regulatory limits are present in or below the U15a/e Muckpiles and/or the Settling Ponds. If there are contaminants present that exceed the regulatory limits, they may present a risk to human health and/or the environment and have the potential for migrating off site. If contaminants are present, their nature and extent need to be determined and their risk to human health and/or the environment evaluated.

B.1.1.3 Conceptual Site Model

A CSM has been developed to describe potential exposure pathways from possible contaminant sources in the U15a/e Muckpiles and Settling Ponds. If the conceptual model is proven incorrect by the results of the environmental sampling, NDEP will be notified and the corrective action investigation rescoped. The following statements are assumptions and/or facts that were considered in developing the model:

- The U15a/e Muckpiles and Ponds were placed on a thin veneer of alluvium overlying the quartz monzonite of the Climax Stock.
- The U15a/e Muckpiles consist primarily of mining debris (rock) generated during the excavation phase of shaft construction; therefore, the bulk of the Muckpiles is assumed to be uncontaminated material. The post-test portion, which includes disturbed geologic materials and construction/reentry debris, comprises a small fraction of the Muckpiles.

- The thickness of the muckpile ranges from less than 5 feet (ft) at the northwest end of the muckpile to approximately 30 ft at the southeast end of the muckpile. The muckpile is approximately 370 ft wide and 780 ft long in a northwest-southeast direction. The muckpile is estimated to contain 160,333 cubic yards of material.

- The driveover radiological surveys identified areas of low-level radiological contamination on the muckpile. The muckpile may also contain very small volumes of *Resource Conservation and Recovery Act* (RCRA)-regulated hazardous constituents (primarily lead). The possible distribution of these COPCs is not known.

- Naturally occurring lead in the form of galena (lead sulfide) (NBMG, 1998) occurs in the Climax Stock and is expected to be found in the muckpile. Arsenic is found in the native soils (NBMG, 1998) and is also expected to be found in the muckpile.

- The muckpile does not have a liner at its base; however, it probably received very little free liquid waste. Although specific permeability data are lacking, low precipitation and high evaporation rates in this region would tend to limit downward leaching of contaminants within the muckpile.

- Past surface activities of concern include equipment maintenance and storage of equipment and petroleum products. Releases to the muckpile from surface activities may be locally significant, but vertical infiltration of contaminants is probably limited to less than 5 ft.

- There are four Settling Ponds, 50 ft wide and extending a distance of approximately 250 ft downgradient in a southwesterly direction.

- The material in the Ponds consists of fine-grained sediments that settled out of wash water from the Tiny Tot test cavity washdown and drainage water pumped from the U15a Shaft workings.

- The thickness of the material in the Ponds is unknown.

- The walkover radiological survey identified radiological contamination in the two Ponds that are the furthest upgradient.

- Based on the results of the walkover radiological survey, radiological contamination extends approximately 1,045 ft down the drainage from the muckpile.

- The contamination is discontinuous in the drainage below the muckpile.

- The most likely pathway for migration of contaminants away from the muckpile is in storm water runoff. Migration might also result when precipitation infiltrates into the thin, peripheral portions of the muckpile and enters the native material and/or drains downgradient along the contact between the fill and the underlying native alluvium or bedrock.

- Possible future uses of the muckpile may include surface activities which might intrude into the muckpile to a depth of no more than 7 ft.

Using these assumptions the CSM was developed. It was postulated that the majority of the muckpile does not contain COPCs, and if any COPCs are present they are probably isolated. Because there are no records concerning the precise subsurface distribution of fill materials, the location of buried COPCs cannot be predicted. Operational knowledge and surface radiological surveys can be used to increase the probability of finding impacted areas of the muckpile. The areas most likely to be affected are the areas where petroleum compounds were used for tunnel equipment maintenance activities, possibly resulting in releases to the surface and shallow subsurface (0-5 ft) soils. These releases, if present, are anticipated to have limited lateral and vertical extent. It is also possible, but unlikely, that the native soil beneath the Muckpiles and Ponds has been impacted by downward migration of COPCs. Figure B.1-1 is a generalized drawing of the CSM.

B.1.2 Step 2 - Identify the Decision

This step develops the decision statement.

B.1.2.1 Develop the Decision Statement

Are there concentrations of COPCs present in the muckpile which exceed the action levels and, if so, do they pose a threat to human health and/or the environment?

B.1.3 Step 3 - Identify Inputs to the Decision

This step identifies the information needed, determines sources for information, determines the basis for establishing the action level, and identifies sampling and analysis methods that can meet the data requirements.

B.1.3.1 Information Needs and Information Sources

Inputs to the decision are centered on the sampling approach, which depends foremost on a reasonable conceptual model. The model provides a basis for development of the approach and ultimately the course of action that will be taken for the site. In turn, the conceptual model is tested and confirmed by the results of the sampling. The sampling will consist of collecting

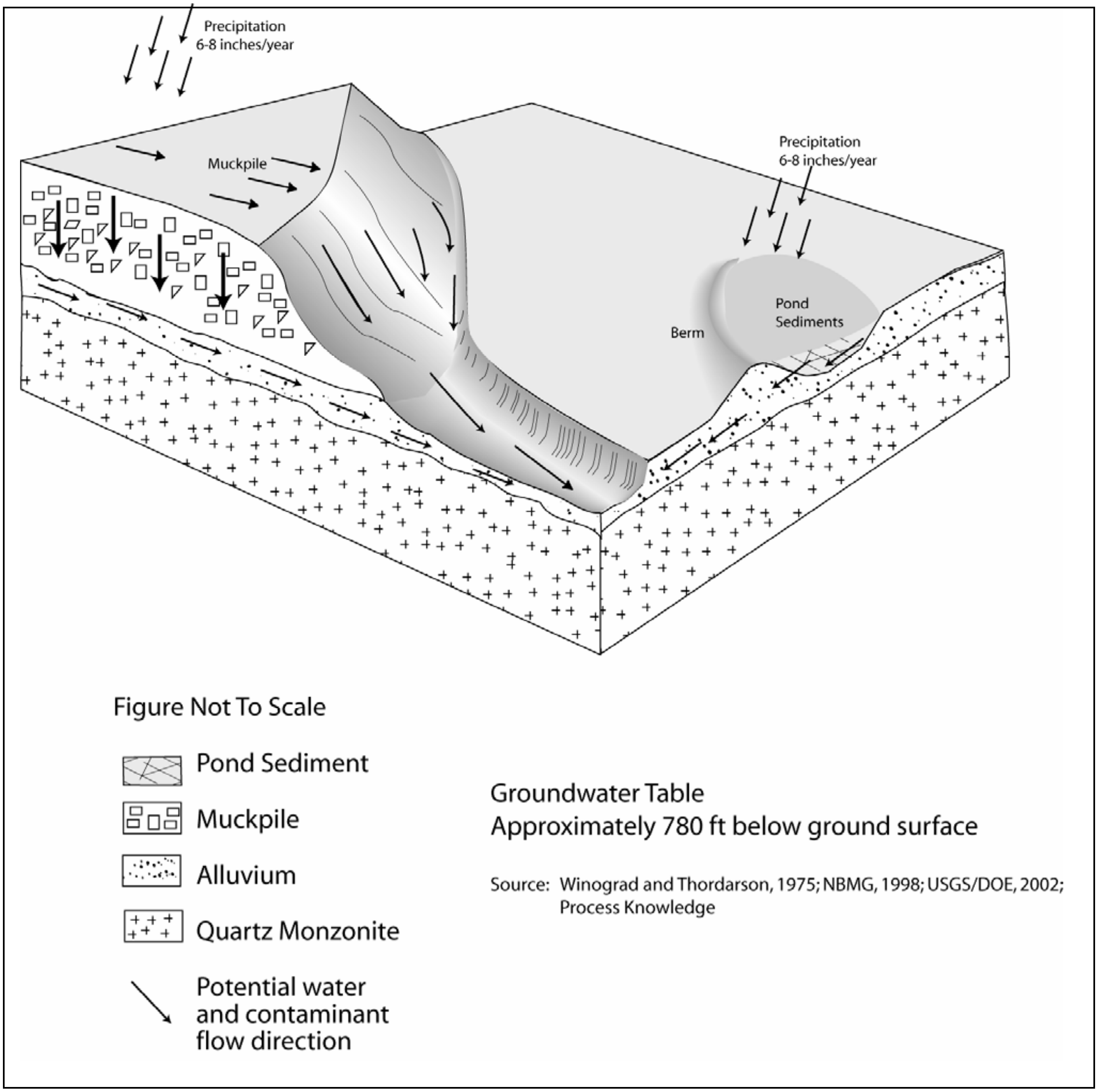


Figure Not To Scale

Groundwater Table
Approximately 780 ft below ground surface

Source: Winograd and Thordarson, 1975; NBMG, 1998; USGS/DOE, 2002; Process Knowledge

Figure B.1-1

Generalized Conceptual Site Model CAU 482

random and biased environmental samples from the Muckpiles, the Ponds, the native materials below the Muckpiles and Ponds, and the drainages below the Muckpiles and Ponds.

Table B-2 lists the information needs, the source of information for each need, the proposed methods to collect the data, and the quality assurance (QA)/quality control (QC) data type. The data type is determined by the intended use of the resulting data in decision making. Data types are discussed in the following text.

B.1.3.1.1 Quantitative Data

Quantitative data directly measure the quantity or amount of a characteristic or component within the population of interest. These data require the highest level of QA/QC in collection and measurement systems because the intended use of the data is to resolve primary decisions (i.e., rejecting or accepting the null hypothesis) and/or verifying that closure standards have been met. Laboratory analytical data are generally considered quantitative.

B.1.3.1.2 Semiquantitative Data

Semiquantitative data indirectly measure the quantity or amount of a characteristic or component. Inferences are drawn about the quantity or amount of a characteristic or component because a correlation has been shown to exist between the indirect measurement and the results from a quantitative measurement. The QA/QC requirements on semiquantitative collection and measurement systems are high, but may not be as rigorous as a quantitative measurement system. Semiquantitative data contribute to decision making but are not used alone to resolve primary decisions. Field-screening data are generally considered semiquantitative. The data are often used to guide investigations toward quantitative data collection.

B.1.3.1.3 Qualitative Data

Qualitative data identify or describe the characteristics or components of the population of interest. The QA/QC requirements are the least rigorous on data collection methods and measurement systems. The intended use of the data is for information purposes, to refine conceptual models, and to guide investigations rather than resolve primary decisions. This measurement of quality is typically assigned to historical information and data where QA/QC may be highly variable or not known. Professional judgment is often used to generate qualitative data.

Table B-2
Information Needs to Resolve the Decision
(Page 1 of 2)

Information Need	Information Source	Collection Method	Data Type
Identify the COPCs.	– Results of historical data review – Results of the walkover and driveover radiological surveys	– Review the source terms for all tests that could have contributed contaminants to the Muckpile. – Review historical data for chemicals that may have been used on site. – Review historical data for potential release information.	Qualitative
Are any COPCs present in the Muckpiles and/or Ponds?	Analytical results of soil samples collected using the drill rig and/or hand tools	– Collect soil samples at random locations and at random depths in the Muckpile utilizing a rotosonic drill rig. – Collect near-surface biased soil samples using the rotosonic drill rig or hand tools. – Send all samples to an off-site laboratory to be analyzed for chemical and radiological constituents.	Quantitative
Are any COPCs present in the native material below the Muckpiles and/or Ponds?	Analytical results of soil samples collected with the drill rig	– Collect soil samples of native material at various locations immediately under the Muckpile utilizing a rotosonic drill rig. – Send all samples to an off-site laboratory to be analyzed for chemical and radiological constituents.	Quantitative

Table B-2
Information Needs to Resolve the Decision
(Page 2 of 2)

Information Need	Information Source	Collection Method	Data Type
If COPCs are present in or below the Muckpile, are the concentrations high enough to exceed regulatory limits?	– Analytical results of soil samples collected with the drill rig – EPA Region 9 Preliminary Remediation Goals – *Nevada Administrative Code* (NAC) 445.2272 (NAC, 2000) – Individual isotope and metals concentrations in background soil samples – Individual isotope and metals concentrations from published sources	Compare the analytical results from the off-site laboratory for the chemical and radiological data to the regulatory requirements taking into account that the site is an industrial facility in a nuclear and high explosives test zone.	Quantitative
If COPCs are present in concentrations that exceed regulatory limits, what is their extent?	– Analytical results of soil samples collected with the drill rig – Results of the walkover and driveover radiological surveys – Field-screening results collected with the Electra – Analytical results soil samples run on the on-site hyperpure Germanium (HPGe) (gamma counter)	– The walkover and driveover surveys will be used to determine lateral extent of any contamination. – Boreholes will be continued until two consecutive drilling intervals are below the field-screening levels as determined from Electra and HPGe results to define the vertical extent.	Quantitative
If COPCs are present in concentrations that exceed regulatory limits, is there a potential for migration?	– Analytical results of soil samples collected with the drill rig – Results of the walkover and driveover radiological surveys – Stability and drainage surveys	– Assess existing data for usability and collect additional geotechnical samples if needed. – Evaluate the results of the surveys to determine the stability of the Muckpile.	Semiquantitative

B.1.3.1.4 Determine the Basis for the Preliminary Action Levels

Laboratory analytical results for soils will be compared to the following PALs to evaluate if COPCs are present at levels that may pose an unacceptable risk to human health and/or the environment:

- Environmental Protection Agency (EPA) *Region 9 Risk-Based Preliminary Remediation Goals (PRGs) for Industrial Soils* (EPA, 2000).
- Background concentrations for metals when natural background exceeds the PRG, as is often the case with arsenic. Background is considered the mean plus two times the standard deviation for sediment samples collected by the Nevada Bureau of Mines and Geology throughout the Nellis Air Force Range (NBMG, 1998; Moore, 1999).
- Total petroleum hydrocarbons (TPH) action level of 100 milligrams per kilogram (mg/kg) per the *Nevada Administrative Code* (NAC) 445A.2272 (NAC, 2000).
- The PALs for radionuclides are isotope-specific and defined as the maximum concentration for that isotope found in samples from undisturbed background locations in the vicinity of the Nevada Test Site (McArthur and Miller, 1989; US Ecology and Atlan-Tech, 1992; Black and Townsend, 1996).

B.1.3.1.5 Potential Sampling Techniques and Appropriate Analytical Methods

B.1.3.1.5.1 Radiological Surveys

Radiological surveys will be used to help determine the presence and lateral extent of radiological contamination. Radiological surveys will follow standard procedures. Further information is provided in Section A.1.7.1.

B.1.3.1.5.2 Soil Sampling

Rotosonic drilling and hand tools will be used to collect the soil samples. Soil sample collection and handling activities will follow standard procedures. Section 6.0 of the CAIP lists analytical methods and laboratory requirements (e.g., detection limits, precision, and accuracy) for the investigation. Sample volumes are laboratory- and method-specific, and will be determined in accordance with laboratory requirements. Specific analyses required for the disposal of IDW are identified in Section 5.0 of this CAIP.

To assure that laboratory analyses are sufficient to detect contamination in soil samples at concentrations exceeding the minimum reporting limit, chemical and/or radiological parameters of interest have been selected for the CAU. The chemical and radiological parameters are listed in Table B-3.

The volatile organic compounds (VOCs) and semivolatile organic compounds (SVOCs) expected to be analyzed for in the investigation are listed in Tables B-4 and B-5, respectively.

Table B-3
Phase I Analyses per CAS

Analyses	**Sample Type**						
	Environmental	**Duplicate**	**Background**	**MS/MSD**	**Field Blanks**	**Rinsates**	**Trip Blanks**
Organics							
VOC	X	X		X	X	X	X
SVOC	X	X		X	X	X	
TPH-DRO	X	X		X	X	X	
Metals							
Total RCRA Metals	X	X	X	X	X	X	
Radionuclides							
Gamma Spectrometry	X	X	X		X	X	
Isotopic Plutonium (at least 25% of samples for waste management)	X	X		X			
Total Strontium (at least 25% of samples for waste management) [a]	X	X		X			

[a] Total strontium uses a stable strontium carrier as opposed to a matrix spike.

Table B-4
Proposed VOCs for Analyses

1,1,1-Trichloroethane	2-Hexanone	Chloromethane
1,1,2,2-Tetrachloroethane	4-Methyl-2-pentanone	Dibromochloromethane
1,1,2-Trichloroethane	Acetone	Ethylbenzene
1,1-Dichloroethane	Benzene	Methyl tertiary butyl ether
1,1-Dichloroethene	Bromochloromethane	Methylene chloride
cis-1,2-Dichloroethene	Bromodichloromethane	Styrene
trans-1,2-Dichloroethene	Bromoform	Tetrachloroethene
1,2-Dichloroethane	Bromomethane	Toluene
1,2-Dichloropropane	Carbon disulfide	Trichloroethene
cis-1,3-Dichloropropene	Carbon tetrachloride	Vinyl acetate
trans-1,3-Dichloropropene	Chlorobenzene	Vinyl chloride
2-Butanone	Chloroethane	Xylene
	Chloroform	

Table B-5
Proposed SVOCs for Analyses

1,2,4-Trichlorobenzene*	Acenaphthene	Di-n-octyl-Phthalate
1,2-Dichlorobenzene*	Acenaphthylene	Fluoranthene
1,3-Dichlorobenzene*	Anthracene	Fluorene
1,4-Dichlorobenzene	Benzo(a)anthracene	Hexachlorobenzene
2,4,5-Trichlorophenol	Benzo(a)pyrene	Hexachlorobutadiene*
2,4,6-Trichlorophenol	Benzo(b)fluoranthene	Hexachlorocyclopentadiene
2,4-Dichlorophenol	Benzo(g,h,i)perylene	Hexachloroethane
2,4-Dimethylphenol	Benzo(k)fluoranthene	Indeno(1,2,3-cd)pyrene
2,4-Dinitrophenol	Bis(2-chloroethoxy) methane	Isophorone
2,4-Dinitrotoluene	Bis(2-chloroethyl)ether	Naphthalene*
2,6-Dinitrotoluene	Bis(2-chloroisopropyl)ether	Nitrobenzene
2-Chloronaphtalene	Bis(2-ethylhexyl) phthalate	N-Nitroso-di-n-propylamine
2-Chlorophenol	Butyl benzyl phthalate	N-Nitrosodimethylamine
2-Methylphenol	Chrysene	N-Nitrosodiphenylamine
2-Nitroaniline	Dibenzo(a,h)anthracene	Pentachlorophenol
3,3'-Dichlorobenzidine	Dibenzofuran	Phenanthrene
4-Bromophenyl phenyl ether	Diethyl Phthalate	Phenol
4-Chloroaniline	Dimethyl Phthalate	Pyrene
4-Methylphenal	Di-n-butyl Phthalate	Pyridine
4-Nitrophenol		

* May be reported with VOCs

B.1.4 Step 4 - Define the Boundaries of the Study

The purpose of this step is to define the target population of interest, specify the spatial and temporal features of the population that are pertinent for decision making, determine practical constraints on data collection, and define the scale of decision making relevant to target populations.

B.1.4.1 Define the Target Population

The target populations for the characterization are:

a. The material in the Muckpiles and Ponds
b. The native material underlying the Muckpiles and Ponds to a depth of no more than 5 ft
c. The material in the drainage below the Muckpiles and Ponds

B.1.4.2 Identify the Spatial and Temporal Boundaries

The horizontal boundaries of the study area are the edges of the Muckpiles and Settling Ponds and the drainage downgradient from the Muckpiles and Ponds to the extent that elevated radiological readings were identified by the walkover survey. The vertical boundary is 2 to 5 ft below the bottom of the muckpile or until drill refusal (defined as requiring more than 15 minutes to drill 1 ft). The study area also includes undisturbed background sample locations outside of, but adjacent to, the muckpile boundaries. There are no temporal constraints on the characterization.

B.1.4.3 Identify Practical Constraints on the Characterization

The practical constraints on the investigation are the capability of the drill to penetrate the muckpile and native material, the ability to get the drill on to the sample locations, and the weather, all of which can impact the field work.

B.1.4.4 Define the Scale of the Decision Making

The scale of decision making is defined as the Muckpile, consisting of two CASs as one unit, the Ponds consisting of one CAS as a separate unit, and the drainage below the Muckpiles and Ponds as a third unit. Dividing the units in this manner allows the corrective actions to be tailored to the different media that may be contaminated.

B.1.5 Step 5 - Develop a Decision Rule

This step integrates outputs from the previous steps into a decision rule (*"If..., then..."*) statement. This rule describes the conditions under which possible alternative actions would be chosen.

B.1.5.1 Specify the Population Parameter

The population parameter is the maximum observed concentration of each COPC within the target population. For radiological surveys, the maximum observed concentration of each COPC will be the population parameter. If sampling is performed to support the radiological survey results, the maximum observed concentration of each COC identified in the sample will be the population parameter. Radiological sampling results will supersede radiological survey results.

B.1.5.2 Choose an Action Level

Action levels are defined in Section B.1.3.1.4.

B.1.5.3 Measurement and Analysis Methods

Radiological surveys and soil sampling and analysis, identified in Section B.1.7.1, will be used to identify the presence and location of COCs.

The measurement and analysis methods referenced in the *Industrial Sites Quality Assurance Project Plan* (NNSA/NV, 2002) are capable of achieving the expected range of values to resolve the Primary Decision. The detection limit of the measurement method to be used is less than the action level for each COPC unless otherwise specified in the CAIP.

B.1.5.4 Decision Rule

The following decision rules are applicable to the CAU 482 investigation and will be used to guide the investigation and data evaluation:

- If laboratory results for the soil samples indicate the presence of COPCs above the PALs, then a CADD will be prepared.
- If the laboratory results for the soil samples do not indicate the presence of COPCs above the PALs, then a CADD/CR will be prepared.

The PALs are defined in Section B.1.3.1.4.

B.1.6 Step 6 - Specify the Tolerable Limits on the Decision Errors

Only validated analytical results (quantitative data) will be used to determine whether COPCs are present, unless otherwise stated. The baseline condition, or null hypothesis, assumed for this site is that COPCs above the action levels are present in the muckpile. The alternate hypothesis is that COPCs above the action levels are not present in the muckpile. Based on these hypotheses, two types of decision errors are possible, false positive and false negative. This CAIP has been designed to minimize both types of errors.

B.1.6.1 False Positive Decision Error

The consequences of a false positive are: (1) the corrective action could be needlessly expanded to encompass a greater quantity of media than is necessary, and (2) media incorrectly judged to be contaminated could be treated as regulated waste rather than unregulated waste. Both of these consequences could lead to increased corrective action and waste disposal costs. In addition, expanding the corrective action would decrease worker safety because work would be conducted that was not needed, exposing the workers to an increased risk of an industrial accident.

B.1.6.2 False Negative Decision Error

The consequences of a false negative are: (1) regulated contaminants might not be appropriately addressed by corrective action or treatment activities, (2) contamination could remain in place, and (3) contaminated media might be disposed of improperly. These consequences could result in unacceptable risks to human health and the environment and potential fines from regulatory agencies.

B.1.6.3 Statistical Model

Chapter 9 of EPA SW-846 defines the methodology suggested to determine the answer to two questions regarding a solid waste being characterized for remediation. The first question is, were sufficient samples taken to ensure a 90 percent confidence level in the mean COPC concentration? The second question is, does the mean concentration exceed the regulatory threshold? In order to answer these questions, SW-846 makes the following assumptions:

- A regulatory threshold for the contaminant of concern has been defined.
- The COPC is uniformly distributed throughout the waste form.
- The concentration of the COPC is normally distributed.
- There is a positive analytical result for the contaminant of concern in each sample.
- The regulatory threshold exceeds the mean concentration of the contaminant.

Based on the results of prior muckpile characterizations, the first four assumptions are not true for the radiological contaminants likely to be found in the U15a/e Muckpiles and Ponds. However, the EPA SW-846 method can still be used to predict the number of samples that will be required to reach the 90 percent confidence level. The following sections will discuss the assumptions and demonstrate that the EPA SW-846 method can still be used to determine the number of samples needed to achieve the 90 percent confidence level for the U15a/e Muckpiles and Ponds.

Regulatory Threshold

The SW-846 Chapter 9 Method is used to determine whether the upper limit of the confidence interval in the concentration of a chemical contaminant exceeds the regulatory threshold (RT). The RTs are defined by the EPA in mass units such as milligrams of contaminant per kilograms of soil. If the 90 percent confidence level of the mean concentration of the contaminant exceeds the RT, the solid waste is assumed to contain the contaminant of concern at a hazardous level. The EPA has defined RTs for many chemicals and metals in soil. However, the RTs for radionuclides in soil have only been defined for radium-226, radium-228, thorium-230, and thorium-232 (EPA, 1983). None of these radionuclides are contaminants that have been found at any of the muckpiles characterized by DTRA. The radiological COPCs that will be used to determine the number of samples required to characterize the U15a/e Muckpiles and Ponds and the drainage below the Muckpiles and Ponds are cesium-137 and strontium-90. Both of these radionuclides were found in the 16a-Tunnel Muckpile and the ravine east of the muckpile.

Radionuclide RTs have not been defined for the radiological COPCs. The radionuclide RTs used for this analysis are the established radionuclide specific background concentration or the “rad added” screening levels of the *Nevada Test Site Performance Objective for Certification of Nonradioactive Hazardous Waste*, Revision 0, 1995 (POC), whichever is greater.

Uniform Distribution

The EPA SW-846 Chapter 9 Method assumes that the COPC is uniformly distributed throughout the solid waste. That is, it assumes that the contaminants are not clumped or stratified within the solid waste form being sampled. If it is known that the contaminants are clumped or stratified, the SW-846 Chapter 9 Method requires that the volume being sampled be divided into sub-volumes of uniform distribution and that samples are collected from random locations within each stratified volume.

Radioactive contamination in soil rarely has a uniform distribution. Even samples collected at undisturbed background locations are composited, mixed, pulverized, sieved, and ground several times to ensure that the mean concentration measured in the samples is representative of the true average concentration of the radionuclides in the soil (McArthur and Miller, 1989). The distribution of radioactive contaminants in soil is usually clumped or stratified. Characterization of radiological contaminated soil sites at the Nevada Test Site, Tonopah Test Range, and Nellis Air Force Range demonstrate that the concentration of a radionuclide in samples taken just a few feet apart may differ by up to five orders of magnitude (DOE, 1996 and 1997). Assuming a uniform distribution for the radionuclides will result in the calculated mean and standard deviation of the radionuclide concentrations being skewed to higher values. Using a higher calculated mean and variance in the EPA SW-846 Method will also result in a larger number of samples being required to meet the 90 percent confidence level.

Based on the results of the walkover and driveover radiological surveys the radionuclides are not uniformly distributed which is why the stratified random sampling method has been selected to characterize the U15a/e Muckpiles and Ponds.

Normal Distribution

The EPA SW-846 Method assumes that the concentration of the COPC is normally distributed. Typically the concentrations of radioactive contaminants in soil are best described as a skewed normal or log-normal distribution. For example, the cesium-137 concentration in surface soil samples collected at 324 undisturbed background locations in Nevada does not fit either a normal or log normal distribution (McArthur and Miller, 1989). However, if the samples with the four highest cesium-137 concentrations are deleted from the data set, the cesium-137 concentration fits a lognormal distribution. If the mean and standard deviation of the cesium-137 concentration in the Nevada soil samples is assumed to be a normal distribution, the calculated 90th percentile concentration will exceed the true 90th percentile. The details on the cesium-137 concentration calculation are found in McArthur and Miller (1989). A statistical analysis of the cesium-137 concentrations in the 324 surface soil samples demonstrated the following:

- Mean concentration of cesium-137 in 324 soil samples is 0.43 picocuries per gram (pCi/g).
- The true 90th percentile concentration for cesium-137 is 0.94 pCi/g.
- The standard deviation of the cesium-137 concentration is 0.63 pCi/g.

- Assuming a normal distribution, the 90th percentile is defined as 1.64 standard deviations plus the mean, which is equal to a cesium-137 concentration of 1.46 pCi/g.
- The calculated 90th percentile of the cesium-137 concentration, 1.46 pCi/g, is 61 percent greater than the true 90th percentile cesium-137 concentration of 0.94 pCi/g.

The W test developed by Shapiro and Wilk (1965) is used to test whether a COPC's concentration in a sample is normally distributed, for COPC that are detected in less than 50 samples. Furthermore, by conducting the test on the logarithms of the data, it is an effective way of evaluating the hypothesis of a lognormal distribution. Inferences about the mean of the radionuclide concentration are still possible if the number of samples collected exceeds 30, because in that case, the sample mean is approximately normally distributed (Gilbert, 1987). Furthermore, the arithmetic mean and standard deviation are statistically unbiased estimators of the true population mean, no matter what the underlying distribution may be (e.g., lognormal, normal, Weibull) (Gilbert, 1987). When a COPC is detected in 50 or more samples, the D'Agostino's Test is used to test the null hypothesis of normality or lognormality (Gilbert, 1987).

Positive Analytical Results

The EPA SW-846 Method assumes that each sample collected will result in a measured concentration that is positive, each contaminant will be present at a concentration that exceeds the contaminant's minimum detectable concentration. This is not true for the man-made radionuclide COPC concentrations in soil samples. In applying the EPA SW-846 Chapter 9 Method, the number of samples required to ensure a 90 percent confidence level is calculated using only the data for samples with radionuclide concentrations exceeding the minimum detectable concentration. The number of samples required to meet the 90 percent confidence level increases as the number of samples decreases. Using data from the positive samples instead of the data for all samples collected will result in calculating a maximum value for the number of samples required to ensure a 90 percent confidence level.

Mean Concentration Exceeds the RT

The EPA SW-846 Method assumes that the concentration of the COPC is positive in all samples, but the mean concentration is less than the RT. The method was designed to ensure that the 90 percent confidence interval of the mean does not exceed the RT. No RT is defined for the man-made radionuclide COPCs so the POC or background concentration, which ever is greater, will be used as the RT for calculating the number of required samples.

If chemical COPCs are found at the site, the RT values used in the application of the EPA SW-846 Method for the chemical COPC are the preliminary action levels (PALs) listed in this CAIP:

- 1.7100 mg/kg TPH in soil
- 1.8EPA Region 9 Preliminary Remediation Goals for industrial soils

Testing for the Number of Required Samples

The radionuclide analytical data from the 16a-Tunnel Muckpile characterization will be used to make an estimation of the number of samples needed to characterize the U15a/e Muckpiles and Ponds because there is no analytical data available from the Muckpiles or Ponds on which to make a determination. After the characterization is completed the procedure described in Chapter 9 of the U.S. Environmental Protection Agency publication SW-846, *Test Methods for Evaluating Solid Waste,* will again be used to confirm that sufficient samples were collected to characterize the site at the 90 percent confidence level (EPA, 1986). The number of samples to collect is defined in equation (8) of Table 9-1 in SW-846.

$$n = t_{.20}^2 \times s^2 /(RT - \overline{X})^2 \qquad \text{where} \qquad \text{(Equation 1)}$$

n = minimum number of samples to ensure a 90 percent confidence level

$t_{.20}^2$ = the square of the “t” value in Table 9-2, SW-846 for a one-tailed 90 percent confidence interval

s^2 = variance in the concentration measured in the samples collected during characterization

RT = regulatory threshold and is set to the limiting PRG established by the U.S. Environmental Protection Agency (EPA) for the COPC for the industrial land use. For total petroleum hydrocarbons the RT is 100 mg/kg. For radionuclides it is the NRC and NCRP screening levels

$\overline{X}$) = the mean concentration of the COPC in the collected samples

The minimum number of samples required to ensure a 90 percent confidence level is directly proportional to the $t_{.20}^2$ value. As shown in Table 9-2 of EPA SW-846 Method, the value of $t_{.20}$ increases as the number of samples decreases. Therefore, $t_{.20}^2$ is inversely proportional to the number of samples collected. The value of $t._{20}^2$ for 13 samples is 1.839 while the value of $t._{20}^2$ for 41 samples is 1.698. As the number of samples collected increases from 13 to 41, an increase of >315 percent, the value of $t._{20}{}^2$ decreases by only 8.5 percent. Therefore, the number of samples taken during characterization has very little effect on the number of samples required to demonstrate a 90 percent confidence level. It should be noted that EPA SW-846 Method does not list any $t._{20}$ value except for the 90 percent value. It is not possible to quantify the precise confidence level in the number of samples using the EPA SW-846 Method. This method can only be used to confirm whether or not the confidence level is less than or greater than 90 percent.

The minimum number of samples required to ensure a 90 percent confidence level is also directly proportional to the variance, s^2, in the concentration of the COPC. The s^2 is a quantification of the amount of internal fluctuation in the concentration from sample to sample. It is an absolute measure of the amount of internal scatter in the concentration data and does not, to a first approximation, depend on the number of samples collected (Gilbert, 1987). It may seem intuitive that as the amount of fluctuation in the concentration increases, the number of samples required to define the mean concentration with high precision increases. However, as demonstrated previously for the value of $t._{20}{}^2$, after a relatively large number of samples are collected, collecting additional samples will not result in a substantially different value in the s^2.

The minimum number of samples required to ensure a 90 percent confidence level is inversely proportional to the square of the difference between the RT and the mean concentration, $\overline{X}$). As the $\overline{X}$) concentration of the contaminant of concern in the samples increases and approaches the value of the RT, the number of required samples increases. If the $\overline{X}$) concentration of the contaminant of concern is insignificant in comparison to the RT, very few samples are required to demonstrate compliance. In this analysis the W and the D’Agostino test are used to determine whether the arithmetic or geometric mean and variance of the positive samples should be used to calculate “n.” Because these values may be skewed by the high concentration outliers, the calculated number of samples required to be collected, n, will be a maximum.

Because there is no soil sampling data available for the U15a/e Muckpiles and Ponds the cesium-137 and strontium-90 results from characterization of the 16a-Tunnel Muckpile will be used to calculate the number of samples required to characterize the U15a/e Muckpiles and Ponds. The cesium-137 and strontium-90 results from characterization of the drainage east of the 16a-Tunnel Muckpile will be used to calculate the number of samples required to characterize the drainage below the U15a/e Muckpiles and Ponds.

Calculation of the Number of Samples

Determine the number of samples required to obtain a 90 percent confidence interval for the U15a/e Muckpiles and Ponds using the cesium-137 and strontium-90 data from the 16a-Tunnel Muckpile characterization.

$$n \;=\; t_{.20}^{2} \times s^{2} /(RT - \overline{X}))^{2} \qquad \text{where}$$

Required number of samples for the muckpile using cesium-137 data:

$n =$ minimum number of samples to ensure a 90 percent confidence level in the calculated mean concentration in the COPC

$t_{.20}^{2} =$ 1.787, the square of 1.337, the $t_{.20}$ value for 16 degrees of freedom, 90 percent confidence level, Table 9-2, SW-846

$s^{2} =$ variance of the cesium-137 concentration in the positive 16a muckpile samples, 306,477 pCi/g

RT = 7 pCi/g

$\overline{X}) =$ mean cesium-137 concentration in the positive 16a muckpile soil samples, 320.6 pCi/g

$n =$ $t_{.20}^{2} \times s^{2} /(RT - \overline{X}))^{2} = (1.787 \text{ x } 306{,}477)/(7 - 320.6)^{2} = 5.57$ samples

Required number of samples for the muckpile using strontium-90 data:

$n =$ minimum number of samples to ensure a 90 percent confidence level in the calculated mean concentration in the COPC

$t_{.20}^{2} =$ 1.940, the square of 1.393, the $t_{.20}$ value for 9 degrees of freedom, 90 percent confidence level, Table 9-2, SW-846

$s^{2} =$ v ariance of the strontium-90 concentration in the positive 16a muckpile samples, 524.44 pCi/g

RT = 3 pCi/g

$\overline{X}$) = mean strontium-90 concentration in the positive 16a muckpile soil samples, 18.45 pCi/g

n = $t_{.20}^2 \times s^2 /(RT - \overline{X}))^2 = (1.940 \text{ x } 524.44)/(3 - 18.45)^2 = 4.26$ samples

Required number of samples for the ravine using cesium-137 data:

n = minimum number of samples to ensure a 90 percent confidence level in the calculated mean concentration in the COPC

$t_{.20}^2$ = 1.798, the square of 1.341, the $t_{.20}$ value for 15 degrees of freedom, 90 percent confidence level, Table 9-2, SW-846

s^2 = variance of the cesium-137 concentration in the positive 16a ravine samples, 1,292.35 pCi/g

RT = 7 pCi/g

$\overline{X}$) = mean cesium-137 concentration in the positive 16a ravine soil samples, 24.98 pCi/g

n = $t_{.20}^2 \times s^2 /(RT - \overline{X}))^2 = (1.798 \text{ x } 1292.35)/(7 - 24.98)^2 = 7.19$ samples

Required number of samples for the muckpile using strontium-90 data:

n = minimum number of samples to ensure a 90 percent confidence level in the calculated mean concentration in the COPC

$t_{.20}^2$ = 2.002, the square of 1.415, the t.20 value for 7 degrees of freedom, 90 percent confidence level, Table 9-2, SW-846

s^2 = variance of the strontium-90 concentration in the positive 16a ravine samples, 3.72 pCi/g

RT = 3 pCi/g

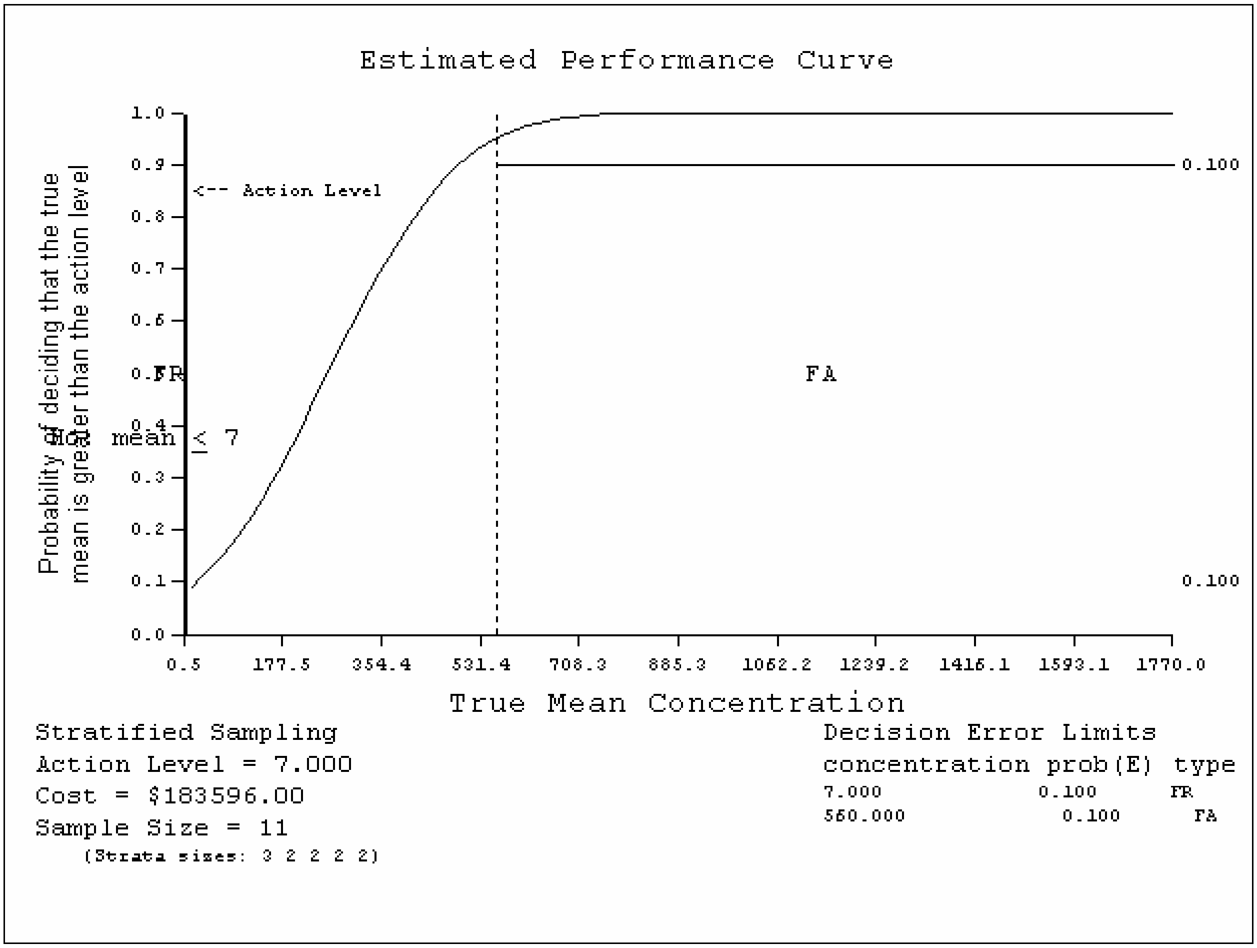
$\overline{X}$) = mean strontium-90 concentration in the positive 16a ravine soil samples, 2.24 pCi/g

n = $t_{.20}^2 \times s^2 /(RT - \overline{X}))^2 = (2.002 \text{ x } 3.72)/(3 - 2.24)^2 = 12.89$ samples

In addition to the calculated number of required samples, decision performance curve graphs were prepared using the same data from the 16a-Tunnel Muckpile characterization. The number of samples was calculated using a simple stratified random sampling strategy. The action level (the lower limit on the graph) was set at the POC or background whichever was greater. The upper bound of the gray area was set at the action level plus one standard deviation of the data of the data from 16a-Tunnel. The graphs are presented in Figures B.1-2, B.1-3, B.1-4, and B.1-5.

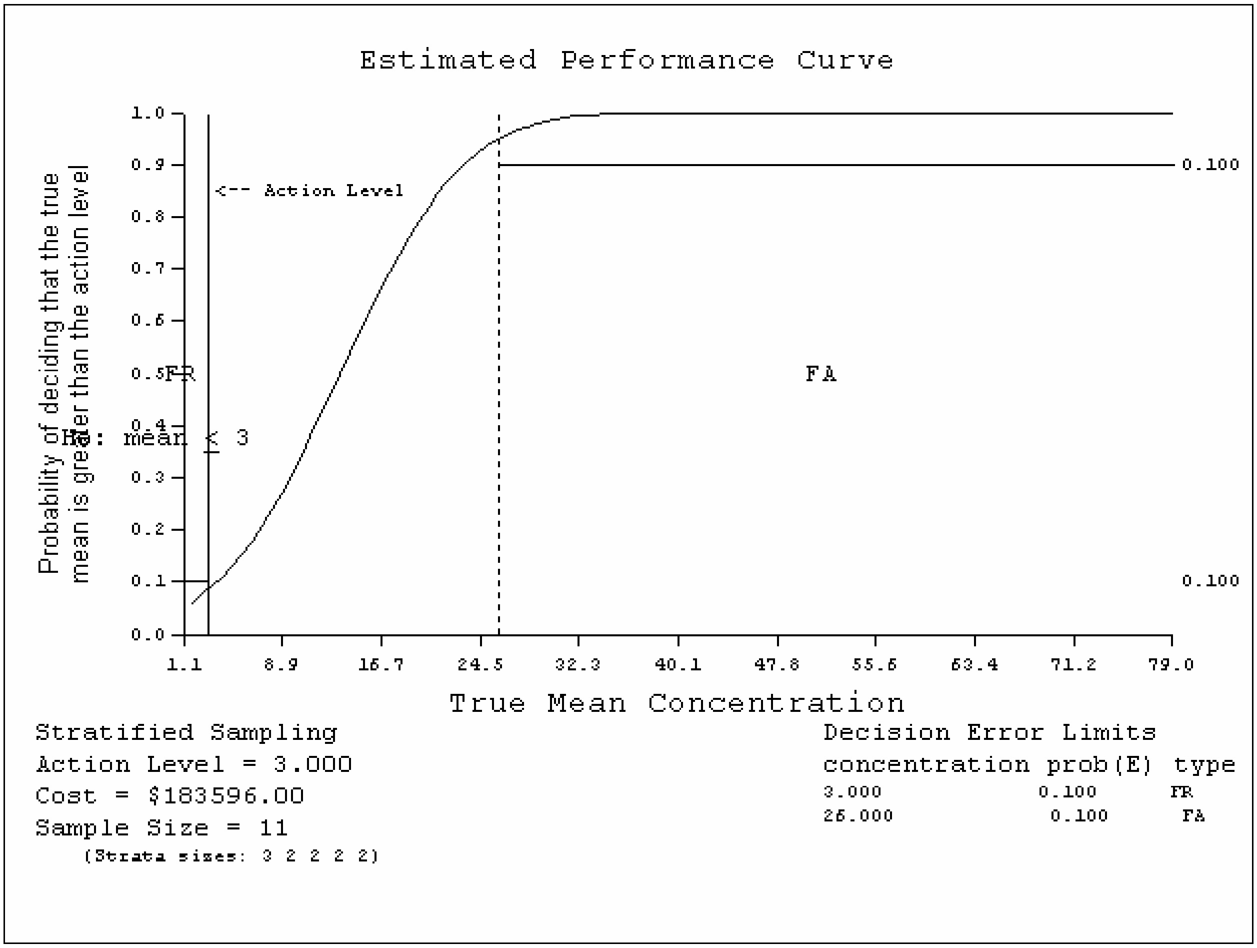
Based on the results of the two different analyses the proposed sampling plan exceeds the number of required samples. According to the calculated numbers, only six samples need to be collected from the U15a/e Muckpiles and Ponds and 13 samples need to be collected from the ravine. From the decision performance curves, 11 samples need to be collected from the Muckpiles and Ponds, and 10 samples need to be collected from the ravine. The number of samples for the proposed stratified random sampling of the U15a/e Muckpiles and Ponds (see Appendix C) exceeds these numbers.

The sampling program for U15a/e Muckpiles was designed to provide sufficient data to allow a statistical determination of whether enough samples were collected to adequately characterize the site. This determination will be made using the procedures described in Chapter 9 of the EPA publication SW-846, *Test Methods for Evaluating Solid Waste* (EPA, 1996). The mean concentration (or activity) and standard deviation of each targeted analyte in the muckpile soils will be used to calculate the number of samples necessary to make the determination with a 90 percent confidence level.



```
Stratified Sampling                         Decision Error Limits
Action Level = 7.000                        concentration prob(E) type
Cost = $183596.00                           7.000          0.100    FR
Sample Size = 11                            560.000          0.100    FA
   (Strata sizes: 3 2 2 2 2)
```

Figure B.1-2
Decision Performance Curve for Cesium-137 from the 16a-Tunnel Muckpile



Stratified Sampling
Action Level = 3.000
Cost = $183596.00
Sample Size = 11
(Strata sizes: 3 2 2 2 2)

Decision Error Limits

concentration	prob(E)	type
3.000	0.100	FR
26.000	0.100	FA

Figure B.1-3
Decision Performance Curve for Strontium-90 from the 16a-Tunnel Muckpile

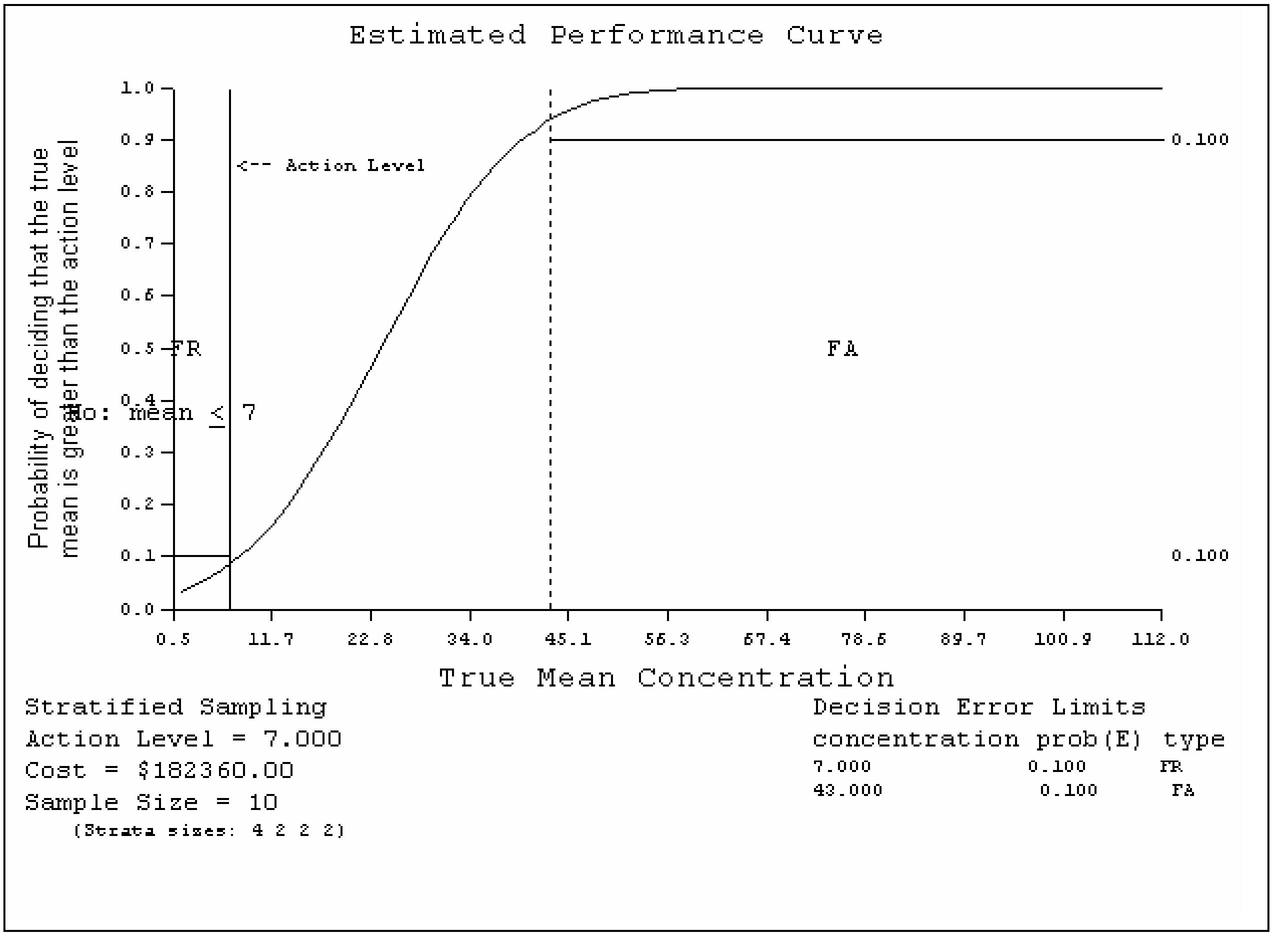


Figure B.1-4

Decision Performance Curve for Cesium-137 from the 16a-Tunnel Ravine

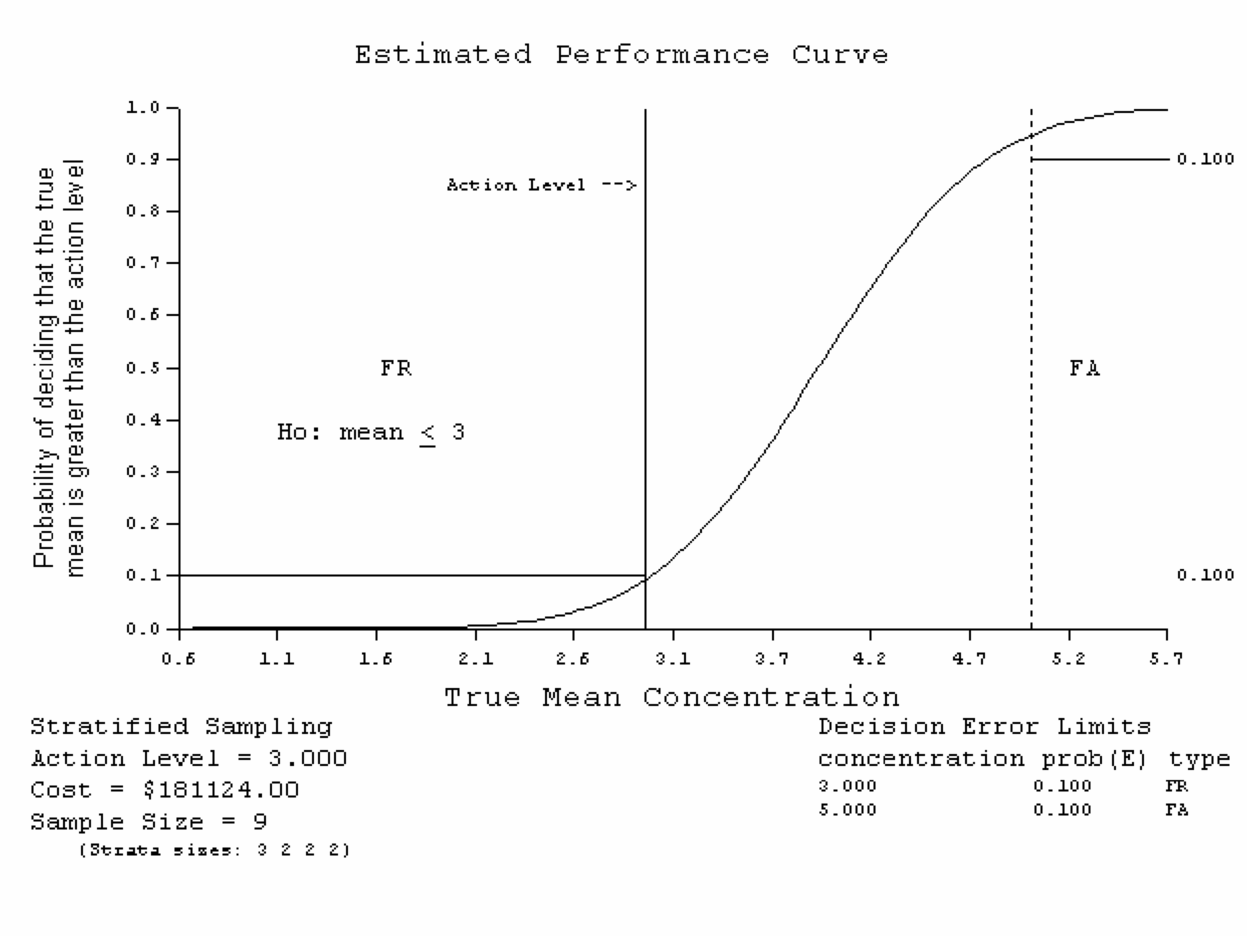


Figure B.1-5
Decision Performance Curve for Strontium-90 from the 16a-Tunnel Ravine

B.1.6.4 Quality Assurance/Quality Control

Radiological survey instruments will be calibrated in accordance with the manufacturer's instructions, and periodic calibrations will be performed in accordance with approved procedures.

Quality control samples will be collected as required by established procedures. The required QC samples include:

- Trip blanks (one per sample cooler containing VOC environmental samples)
- Equipment blanks (one per sampling event for each type of decontamination procedure)
- Source blanks (one per source lot per sampling event)
- Field duplicates (minimum of one per matrix per 20 environmental samples)
- Field blanks (minimum of one per 20 environmental samples or one per sampling day, whichever best exemplifies field conditions)
- Matrix spike/matrix spike duplicate (minimum of one per matrix per 20 environmental samples), not needed for some radioanalytical measurements (e.g., gamma spectrometry)

Additional QC samples may be submitted based on site conditions.

The DQIs of precision, accuracy, comparability, completeness, and representativeness are defined in the Industrial Sites QAPP (NNSA/NV, 2002). Site-specific DQIs are discussed in more detail in Section 6.0 of the CAIP.

B.1.7 Step 7 - Optimize the Design

The site characterization will consist of collecting both random and biased soil samples from the Muckpiles, Ponds, and the drainage downgradient from the Muckpiles and Ponds. The sampling program has been optimized by conducting preliminary drive- and walkover radiological surveys to help guide the biased sampling, by determining the location and number of samples to collect, and by determining which parameters to analyze for. The COPCs for CAU 482 listed in Section B.1.3.1.5.2 are TPH-DRO, VOCs, SVOCs, total RCRA metals, and radionuclides. All environmental samples will be analyzed for these parameters with the exception of the background samples, which will be analyzed for radionuclides and RCRA metals only. Sample locations identified on the surface of the Muckpiles are biased to reflect areas where preliminary radiological surveys identified elevated radiological readings, there is visible staining, or work processes may have impacted the muckpile surface soils.

B.1.7.1 Radiological Survey Methodologies and Instruments

Radiological surveys were conducted at CAU 482 to define the presence and lateral extent of radiological contaminants.

A combination of walkover surveys using hand-held instruments and driveover surveys using a vehicle-mounted detector were performed at CAU 485 resulting in nearly 100 percent coverage. In areas where elevated surface readings were encountered, an effort will be made to identify the source term as being either a surface, near-surface, or subsurface source term using soil sampling. Hand-held radiological survey instruments such as the NE Technology Electra, Eberline E-600, TSA-PRM-470B, and Bicron mRem, or equivalent, will be used and the Dual Large-Area Plastic Scintillator with a TSA-VMR-3 controller will be used as the vehicle-mounted instrument.

Additional equipment and software used in the radiological data collection and processing include a global positioning system receiver, such as Trimble or Motorola, and associated laptop computers used to log and process the walkover and driveover radiological data. Mapping programs such as Surfer and EarthVision are used to plot data on site maps or aerial photographs.

B.1.7.2 Intrusive Investigation

Intrusive investigations will be conducted at CAU 482 to determine if COPCs are present. Samples will be collected from predetermined random and biased locations. Selection of biased locations will be based on the results of the radiological surveys, a review of the operational history, and visual inspection of the CAU.

Rotosonic drilling will be the primary tool used to collect the soil samples for laboratory analysis to determine whether COPCs are present in the Muckpile and Ponds. Boreholes will be drilled 5 ft into the native material if it is alluvium and 2 ft or until refusal if it is bedrock. If the bottom interval of the hole exceeds the field-screening levels, the hole will be continued at 2-ft intervals until there are two consecutive clean intervals or until drill refusal. In the event that the drill cannot be used on the Ponds, and in those areas that cannot be accessed by the drill rig (drainage below the Muckpiles and edges of the Muckpiles), hand augers or similar hand tools will be used to collect the soil samples.

B.2.0 References

Black, S.C. and Y.E. Townsend. 1996. *U.S. Department of Energy, Nevada Operations Office Environmental Data Report for the Nevada Test Site - 1994.* Las Vegas, NV.

EPA, see U.S. Environmental Protection Agency.

McArthur, R.D., and F.L. Miller, Jr. 1989. *Offsite Radiation Exposure Review Project (ORERP), Phase II Soils Programs*, DOE/NV/10384-23. Las Vegas, NV: Desert Research Institute.

Moore, J., Science Applications International Corporation. 1999. Memorandum to M. Todd (SAIC) entitled, "Background Concentrations for NTS and TTR Soil Samples." Las Vegas, NV.

NAC, see *Nevada Administrative Code*.

NBMG, see Nevada Bureau of Mines and Geology.

NNSA/NV, see U.S. Department of Energy, National Nuclear Security Administration Nevada Operations Office.

Nevada Administrative Code. 2000. NAC 445A.2272, "Water Controls." Carson City, NV.

Nevada Bureau of Mines and Geology. 1998. *Mineral and Energy Resource Assessment of the Nellis Air Force Range*, Open File Report 98-1. Las Vegas, NV.

U.S. Department of Energy, National Nuclear Security Administration Nevada Operations Office. 2002a. *Industrial Sites Quality Assurance Project Plan, Nevada Test Site, Nevada*, NNSA/NV--372, Rev. 3. Las Vegas, NV.

U.S. Department of Energy, Nevada Operations Office. 1996. *Double Tracks Test Site Characterization Report*. DOE/NV-484. Las Vegas, NV.

U.S. Department of Energy, Nevada Operations Office. 1997. *Clean Slate 1 Corrective Action Decision Document Corrective Action Unit No. 412*. DOE/NV-472. Las Vegas, NV.

US Ecology and Atlan-Tech, Inc. 1991. *Environmental Monitoring Report for the Proposed Ward Valley, California, Low-Level Radioactive Waste (LLRW) Facility*, Vols. 1 and 2, Version 2. Rosewell, GA: California Department of Health, Environmental Management Branch.

U.S. Environmental Protection Agency. 2000a. *Guidance for the Data Quality Objectives Process*, EPA QA/G-4. Washington, DC.

Appendix C

Data Assessment

C.1.0 Data Assessment

The DQA process is the scientific evaluation of the investigation results to determine whether the DQO criteria established in the CAU 482 CAIP were met and whether the DQO decisions can be answered at the desired level of confidence. The DQO process ensures that the right type, quality, and quantity of data will be available to support the resolution of the decisions at an appropriate level of confidence. Using both the DQO and DQA processes helps to ensure that the DQO decisions are sound and defensible.

The DQA involves five steps that begin with a review of the DQOs and end with an answer to the DQO decisions. The five steps are briefly summarized below.

Step 1: Review the DQOs and Sampling Design – Review the DQO process to provide context for analyzing the data. State the primary statistical hypotheses; confirm the limits on the decision errors for committing false rejection (Type I) or false acceptance (Type II) decision errors; and review any special features, potential problems, or deviations to the sampling design.

Step 2: Conduct a Preliminary Data Review – The preliminary data review involves reviewing QA reports and inspecting the data both numerically and graphically, validating and verifying the data to ensure that the measurement systems performed in accordance with the criteria specified, and using the validated data to determine whether the quality of the data is satisfactory.

Step 3: Select the Test – Select the test based on the population of interest, population parameter, and the hypotheses. Identify the key underlying assumptions that could cause a change in one of the DQO questions.

Step 4: Verify the Assumptions – Perform tests of assumptions. If data are missing or are censored, determine the impact on the DQO decision error.

Step 5: Draw Conclusions from the Data – Perform the calculations required for the test.

C.1.1 Review the DQOs and Sampling Design

This section contains a review of the DQO process presented in Appendix A of the CAU 482 CAIP (DTRA, 2002) and Appendix B of this document. The DQO decisions are presented with the DQO provisions for limiting false negative or false positive decision errors. Special features, potential problems, or any deviations from the sampling design are also presented.

C.1.1.1 Review DQOs

The decision statement as presented in the CAU 482 CAIP: "Are there concentrations of COPCs present in the muckpile which exceed the action levels and, if so, do they pose a threat to human health and/or the environment?"

Decision Rules:

- If laboratory results for the soil samples indicate the presence of COPCs above the PALs, then a CADD will be prepared.
- If laboratory results for the soil samples do not indicate the presence of COPCs above the PALs, then a CADD/CR will be prepared.

Population Parameter: The mean plus one standard deviation of each analyte with observed results.

DQO Provisions To Limit False Negative Decision Error

A false negative decision error (where consequences are more severe) was controlled by meeting the following criteria:

1. Having a high degree of confidence that the combination of random and biased sampling strategies will identify COCs if present in the CASs.
2. Having a high degree of confidence that analyses conducted will be sufficient to detect any COCs present in the samples.
3. Having a high degree of confidence that the data are of sufficient quality and completeness.

Criterion 1:

The following methods (stipulated in the CAU 482 DQOs [DTRA, 2002]) were used in selecting the sample locations:

- Stratified random locations based on methods described in Chapter 5 of *Statistical Methods for Environmental Pollution Monitoring* (Gilbert, 1987).
- Selection of biased sampling locations associated with professional judgment, site knowledge, and preliminary radiological walkover and driveover surveys.

This provides a high degree of confidence that sampling will detect any COCs that may be present.

Criteria 2:

All samples were analyzed using the analytical methods listed in Table 3-1 of the CAIP and for the chemical and radiological parameters listed in Table A-3 of the CAIP. Table C.1-1 provides a reconciliation of samples analyzed to the planned analytical program. Samples were analyzed for all of the analytical methods specified in the CAIP (DTRA, 2002).

Table C.1-1
CAU 482 Number of Samples Submitted per Analyte

CAS	ANALYTES						
	VOCs	SVOCs	TPH-DRO	Metals	Gamma Spectroscopy	Isotopic Plutonium	Strontium-90
15-06-02	39	39	39	39	39	11	11
15-06-01	4	4	4	4	4	0	0
15-38-01	6	6	6	6	6	6	6
Drainage	19	19	19	19	19	5	5
Background	0	0	0	3	3	0	0

DRO = Diesel-range organics
SVOC = Semivolatile organic compounds
TPH = Total petroleum hydrocarbons
VOC = Volatile organic compounds

Sample results were assessed against the DQI of sensitivity as defined in the Industrial Sites QAPP (NNSA/NV, 2002). The sensitivity acceptance criteria defined in the CAIP is that analytical detection limits will be less than the corresponding action level. This goal was not achieved for the chemical analyses listed in Table C.1-2. All radiological analytes met the sensitivity goal. Results not meeting the sensitivity goal were not used in making DQO decisions and will therefore be considered as rejected data.

Table C.1-2
Chemical Analytes Failing Sensitivity Criteria for CAU 482
(Page 1 of 2)

Sample Number	Parameter	Result (µg/kg)	Detection Limit (µg/kg)	2002 Industrial PRG (µg/kg)
482AB014.5	N-Nitrosodimethylamine	340	340	34
482AB020.5	N-Nitrosodimethylamine	340	340	34
482AB030.5	N-Nitrosodimethylamine	340	340	34
482AB040.5	N-Nitrosodimethylamine	340	340	34
482AS0103	N-Nitrosodimethylamine	340	340	34
482AS0118	N-Nitrosodimethylamine	340	340	34
482AS0128	N-Nitrosodimethylamine	360	360	34
482AS0220.5	N-Nitrosodimethylamine	340	340	34
482AS023.5	N-Nitrosodimethylamine	350	350	34
482AS0304	N-Nitrosodimethylamine	340	340	34
482AS0315.5	N-Nitrosodimethylamine	340	340	34
482AS04A13	N-Nitrosodimethylamine	340	340	34
482AS04A25	N-Nitrosodimethylamine	340	340	34
482AS04A8.5	N-Nitrosodimethylamine	340	340	34
482AS0519.5	N-Nitrosodimethylamine	340	340	34
482AS059.5	N-Nitrosodimethylamine	340	340	34
482AS06A15.5	N-Nitrosodimethylamine	340	340	34
482AS06A9.5	N-Nitrosodimethylamine	350	350	34
482AS0710	N-Nitrosodimethylamine	340	340	34
482AS0721	N-Nitrosodimethylamine	340	340	34
482AS0813	N-Nitrosodimethylamine	340	340	34
482AS0821	N-Nitrosodimethylamine	340	340	34
482AS091.5	N-Nitrosodimethylamine	340	340	34
482AS0911.5	N-Nitrosodimethylamine	340	340	34
482AS101.5	N-Nitrosodimethylamine	340	340	34
482AS1010	N-Nitrosodimethylamine	340	340	34
482AS110.5	N-Nitrosodimethylamine	340	340	34
482AS1117	N-Nitrosodimethylamine	340	340	34
482AS116.5	N-Nitrosodimethylamine	350	350	34
482AS1201	N-Nitrosodimethylamine	340	340	34
482AS1207	N-Nitrosodimethylamine	340	340	34
482AS1217	N-Nitrosodimethylamine	340	340	34
482AS1316	N-Nitrosodimethylamine	350	350	34
482AS1328	N-Nitrosodimethylamine	340	340	34
482AS1407	N-Nitrosodimethylamine	340	340	34
482AS1412	N-Nitrosodimethylamine	340	340	34
482AS1435.5	N-Nitrosodimethylamine	350	350	34
482ASQ0315.5	N-Nitrosodimethylamine	340	340	34
482ASQ04A25	N-Nitrosodimethylamine	340	340	34
482BSB301	N-Nitrosodimethylamine	340	340	34

Table C.1-2
Chemical Analytes Failing Sensitivity Criteria for CAU 482
(Page 2 of 2)

Sample Number	Parameter	Result (µg/kg)	Detection Limit (µg/kg)	2002 Industrial PRG (µg/kg)
482DB10.5	N-Nitrosodimethylamine	340	340	34
482DB20.5	N-Nitrosodimethylamine	340	340	34
482DB30.5	N-Nitrosodimethylamine	340	340	34
482DBQ10.5	N-Nitrosodimethylamine	340	340	34
482DR0106	N-Nitrosodimethylamine	330	330	34
482DR02A06	N-Nitrosodimethylamine	340	340	34
482DR03C	N-Nitrosodimethylamine	340	340	34
482DR0406	N-Nitrosodimethylamine	350	350	34
482DR0412	N-Nitrosodimethylamine	340	340	34
482DR0506	N-Nitrosodimethylamine	340	340	34
482DR0606	N-Nitrosodimethylamine	330	330	34
482DR0706	N-Nitrosodimethylamine	340	340	34
482DR0806	N-Nitrosodimethylamine	340	340	34
482DR0906	N-Nitrosodimethylamine	340	340	34
482DR0912	N-Nitrosodimethylamine	340	340	34
482DR1006	N-Nitrosodimethylamine	340	340	34
482DR1118	N-Nitrosodimethylamine	340	340	34
482DR11C	N-Nitrosodimethylamine	340	340	34
482DRQ0706	N-Nitrosodimethylamine	340	340	34
482ES1501	N-Nitrosodimethylamine	340	340	34
482ES1503	N-Nitrosodimethylamine	340	340	34
482ES16A01	N-Nitrosodimethylamine	340	340	34
482ES16A4.5	N-Nitrosodimethylamine	340	340	34
482PSS121	N-Nitrosodimethylamine	340	340	34
482PSS220	N-Nitrosodimethylamine	350	350	34
482PSS306	N-Nitrosodimethylamine	340	340	34
482PSS404	N-Nitrosodimethylamine	340	340	34
482PSS506	N-Nitrosodimethylamine	340	340	34
482PSS606	N-Nitrosodimethylamine	340	340	34

PRG = Preliminary remediation goal
µg/kg = Micrograms per kilogram

Criterion 3:

To satisfy the third criterion, the entire dataset, as well as individual sample results, were assessed against the acceptance criteria for the DQIs of precision, accuracy, comparability, completeness, and representativeness, as defined in the Industrial Sites QAPP (NNSA/NV, 2002). The DQI acceptance criteria are presented in Table 6-1 of the CAIP. As presented in the following sections, these goals were met for each DQI except as noted.

Precision

The duplicate precision is evaluated using the relative percent difference (RPD) or normalized difference. For the purpose of determining the data precision of chemical analyses, the RPD between duplicate analyses was calculated. For radionuclides, the RPD was not calculated unless both the sample and its duplicate had concentrations of the target radionuclide exceeding five times their MDC. Otherwise radionuclide duplicate results were evaluated using the normalized difference. Table C.1-3 provides the chemical and radiological precision analysis results for all constituents that were qualified for precision. The chemical analyte qualified for precision was lead. No radionuclides were qualified for precision.

Table C.1-3
Precision Measurements

Parameter	CAS Number	User Test Panel	Number of Analyses Qualified	Number of Measurements Performed	Percent within Criteria
Lead	7439-92-1	EPA 6010B	19	67	71.6

CAS = Chemical Abstract Number
EPA = U.S. Environmental Protection Agency, SW 846 methods (EPA, 1999 and 2002)

As shown in Table C.1-3, the precision rate for lead was below the acceptance criterion. The precision rate for all of the other constituents is 100 percent. The precision rate for lead was 71.6 percent; however, there is negligible potential for a false negative DQO decision error because the highest reported value is still small in comparison to the FAL. The highest lead concentration (57 mg/kg) is 13 times smaller than the FAL (750 mg/kg). Therefore, the lead results that were qualified for reasons of precision can be confidently used to support DQO decisions. Because all of the other constituents exceed the acceptance criteria for precision, the dataset is determined to be acceptable for the DQI of precision.

Accuracy

For the purpose of determining data accuracy of sample analyses, environmental soil samples were evaluated and incorporated into the accuracy calculation. The results qualified for accuracy were associated with laboratory control samples (LCSs) exceeding control limits and could potentially be reported at concentrations lower or higher than actual concentration. Table C.1-4 provides the accuracy analysis results for the constituent qualified for accuracy.

Table C.1-4
Accuracy Measurements

Parameter	CAS Number	User Test Panel	Number of Analyses Qualified	Number of Measurements Performed	Percent within Criteria
Strontium-90	10098-97-2	Strontium	8	22	63.6

Strontium-90 was only analyzed for waste characterization for disposal purposes, so the fact that it did not meet the accuracy criteria will not have an effect on the DQO decisions.

As the accuracy rate for all other constituents exceeds the acceptance criteria for accuracy, the dataset is determined to be acceptable for the DQI of accuracy.

Representativeness

The DQO process as identified in Appendix A of the CAU 482 CAIP (DTRA, 2002) was used to address sampling and analytical requirements for CAU 482. During this process, appropriate locations were selected that enabled the samples collected to be representative of the population parameters identified in the DQO (random locations and biased locations that were most likely to encounter contamination). The sampling locations identified in the Criterion 1 discussion meet these criteria. Therefore, the analytical data acquired during the CAU 482 CAI are considered to be representative of the population parameters.

Comparability

Field sampling, as described in the CAU 482 CAIP (DTRA, 2002), was performed and documented in accordance with approved procedures that are comparable to standard industry practices. Approved analytical methods and procedures were used to analyze, report, and validate the data. These are comparable to other methods used not only in industry and government practices, but most importantly are comparable to other investigations conducted at the NTS. Therefore, project datasets are considered comparable to other datasets generated using these same standardized U.S. Department of Energy (DOE) procedures, thereby meeting the DQO requirements. Also, standard, approved field and analytical methods ensure that data were appropriate for comparison to the investigation action levels specified in the CAIP (DTRA, 2002).

Completeness

The CAU 482 CAIP (DTRA, 2002) defines acceptable criteria for completeness to be 80 percent of CAS-specific non-critical analytes identified in the CAIP having valid results and 100 percent of critical analytes having valid results. Also, the dataset must be sufficiently complete to be able to make the DQO decisions. Critical analytes for CAU 482 are the COCs identified from previously investigated NTS muckpiles (arsenic, lead, TPH-DRO, Pu-239, Cs-137, and Co-60).

Rejected data (either qualified as rejected or data that failed the criterion of sensitivity) were not used in the resolution of DQO decisions and are not counted toward meeting the completeness acceptance criterion. Table C.1-5 shows the data rejected because of completeness. None of the rejected data are critical analytes, and all of the qualified data except acetone exceed the 80 percent criteria for completeness. The acetone samples were rejected because calibration verification was not done or did not meet criteria. This results in a determination that the acetone may or may not be present. However, because the maximum acetone concentration found (48 micrograms per kilogram [µg/kg]) is 125,000 times smaller than the FAL (6,000,000 µg/kg), this will not have an effect on the DQO decisions. Because all other chemical and radiological data exceed the criteria, the dataset is considered complete for purposes of making the DQO decisions.

Table C.1-5
Rejected Measurements for Completeness

Parameter	CAS Number	User Test Panel	Number of Analyses Qualified	Number of Measurements Performed	Percent within Criteria
Acetone	67-64-1	EPA8260	10	41	75.6
Benzo(B)Fluoranthene	205-99-2	EPA8270	1	66	98.5
Benzo(K)Fluoranthene	207-08-9	EPA8270	1	66	98.5
Benzo(A)Pyrene	50-32-8	EPA8270	1	66	98.5
Benzo(G,H,I)Perylene	191-24-2	EPA8270	1	66	98.5
Ideno(1,2,3-CD)Pyrene	193-39-5	EPA8270	1	66	98.5
Dibenzo(A,H)Anthracene	53-70-3	EPA8270	1	66	98.5

DQO Provisions To Limit False Positive Decision Error

The false positive decision error was controlled by assessing the potential for false positive analytical results. Quality assurance/QC samples such as field blanks, trip blanks, LCSs, and method blanks were used to determine whether a false positive analytical result may have occurred. Of the 55 QA/QC samples submitted, no false positive analytical results were detected.

Proper decontamination of sampling equipment and the use of certified clean sampling equipment and containers minimized the potential for cross contamination that could lead to a false positive analytical result.

C.1.1.2 Sampling Design

The CAIP (DTRA, 2002) made the following commitments for sampling:

1. Stratified random sampling will be conducted at CAS 15-06-01 (U15e Muckpile), CAS 15-06-02 (U15a Muckpile), CAS 15-38-01 (Area 15 U15a/e Ponds), and in the drainage below the Muckpiles.

   Result: All of the random locations identified by the stratified random sampling method defined in chapter 5 of *Statistical Methods for Environmental Pollution Monitoring* (Gilbert, 1987) were collected and analyzed. This included four samples from CAS 15-06-01, 28 samples from CAS 15-06-02, three samples from CAS 15-38-01, and 23 samples from the drainage.

2. Biased locations will be selected at CAS 15-06-02, CAS 15-38-01, and in the drainage at locations that are most likely to contain contaminated soil.

   Result: Eight biased soil samples were collected at CAS 15-06-02, three were collected at CAS 15-38-01, and three were collected in the drainage. The locations were identified through walkover radiological surveys, visual inspection of the surface, or process knowledge.

C.1.2 Conduct a Preliminary Data Review

A preliminary data review was conducted by reviewing QA reports and inspecting the data. The contract analytical laboratories generate a QA non-conformance report when data quality does not meet contractual requirements. All data received from the analytical laboratories met contractual requirements, and no QA non-conformance reports were generated. Data were validated and verified to ensure that the measurement systems performed in accordance with the criteria specified. The validated dataset quality was found to be satisfactory.

C.1.3 Select the Test

The CAIP (DTRA, 2002) committed to using the procedure described in Chapter 9 of the EPA SW-846 Method (EPA, 1999) to answer two questions: 1) Were enough samples collected to ensure a 90-percent confidence level in the mean COPC concentration and 2) Does the mean concentration exceed the regulatory threshold?

Because of the change in closure strategy agreed to by NDEP, DTRA, and DOE, National Nuclear Security Administration Nevada Site Office (NNSA/NSO), the regulatory threshold is now the risk-based FAL instead of the PALs discussed in the CAIP. Comparing the average concentration of the most prevalent contaminants to their PAL and, if they exceed the PAL, comparing them to their respective FALs will also be used to help answer the questions.

C.1.4 SW-846 Evaluation

To answer the first question, equation (8) of Table 9-1 in SW 846 was used. To answer the second question, equation (6) of Table 9-1 in SW-846 was used (EPA, 1996). Only random samples were used for this evaluation. Cesium-137 was chosen for conducting the calculations because it was the most prevalent contaminant found during the characterization. Both of these equations are presented and explained in Appendix B of this document. The PAL screening level for Cs-137 is 7.3 pCi/g. The values used for the calculations and the results are presented in Table C.1-6.

Table C.1-6
SW-846 Evaluation of the Number of Samples and Comparison of 90% Confidence Level with the PAL

Variable	U15a Muck	U15e Muck	U15a Native	U15e Native	Ponds	Drainage
$T_{.20}$	1.35	3.078	1.35	3.078	1.886	1.372
$T_{.20}^2$	1.823	9.474	1.823	9.474	3.557	1.882
S^2	32,269	0.18	0.0045	0.0005	1,120	20,085
RT for Cs137 (pCi/g)	7.3	7.3	7.3	7.3	7.3	7.3
Avg $\overline{X}$	74.1	0.39	0.14	0.1	29.2	44.7
n collected	14	2	14	2	3	11
n needed	13.2	0.036	0.001	0.0005	8.3	27
Confidence Interval (pCi/g)	64.8	1	1	1	36.4	58.6
90% Confidence (pCi/g)	138.9	1.31	1	1	65.6	103.3
90% Confidence>7.3 pCi/g	Yes	No	No	No	Yes	Yes

Note: Only random samples were used in this evaluation.

Based on the results of the calculations, an adequate number of samples were collected to meet the 90 percent confidence level that enough samples had been collected to characterize the sites except in the Ponds. In comparing the 90 percent confidence level to the PAL, the confidence level exceeds the PAL in the Muckpile, the Ponds, and the drainage. Because the PAL is exceeded in the Ponds by almost 13 times, the fact that not enough samples were collected at that site has less importance. It would be more significant if the 90 percent confidence level were close to the PAL.

C.1.5 Verify the Assumptions

The results of the investigation support the assumptions identified in the CAU 482 DQOs and in Table C.1-7.

Table C.1-7
Key Assumptions

Exposure Scenario	Exposure to contaminants is limited to industrial site workers, construction/remediation workers, and military personnel conducting training. Exposure could occur through ingestion, inhalation, external exposure, or dermal contact.
	The investigation did not reveal any potential exposures that were not identified in the conceptual site model (CSM).
Affected Media	Surface and subsurface soils in and below the Muckpiles. Contamination of perched, deep, and regional groundwater is not a concern.
	The investigation results did not identify any affected media that was not identified in the CSM.
Location of Contamination Release Points	The Muckpiles, Ponds, and drainage may contain small volumes of RCRA-regulated constituents in addition to radiological constituents.
	The investigation results confirmed this and did not reveal any potential releases off the Muckpiles.
Transport Mechanisms	Surface transport may occur as a result of storm water runoff. Contamination may migrate through the Muckpiles into the native material as a result of rainwater infiltration.
	The investigation results confirmed there was some surface transport down the drainage but there was no transport through the Muckpiles into the native material.
Preferential Pathways	Percolation of precipitation through the soils of the Muckpiles.
	The investigation did not identify any contaminant migration through the Muckpiles.
Lateral and Vertical Extent of Contamination	Contamination could be locally significant, but vertical infiltration of contaminants is probably limited to less than 5 feet.
	The investigation results confirmed this. Vertical extent was confirmed to the Muckpiles and Ponds sediments; no migration into the native material below the Muckpiles and Ponds sediments was found. Lateral extend was also confined to the Muckpiles and Ponds sediment, except for the surface transport in the drainage.
Groundwater Impacts	There are no groundwater impacts.
Future Land Use	Nonresidential, zoned for nuclear and high explosives tests.
	The investigation results did not reveal any future land uses other than those identified in the CSM.

C.1.6 Results

This section resolves the DQO decision for CAU 482.

C.1.6.1 Decision Rules for CAU 482

Decision Rule: If laboratory results for the soil samples indicate the presence of COPCs above the PALs, then a CADD will be prepared.

Result: Because the site was characterized and a CADD was prepared, the DOE and NDEP came to an agreement that a risk-based approach could be used for characterizing the Muckpiles. Because of this decision, NDEP agreed to allow existing muckpile CADDs that had been approved by NDEP to be re-evaluated using the risk-based approach. Using the risk-based approach, FALs were exceeded in CAS 15-06-02 for Co-60, Cs-137, Pu-238, Pu-239, and Sr-90; in CAS 15-38-01 for Am-241, Cs-137, Pu-238, Pu-239, and Sr-90; and in the drainage for Am-241, Co-60, Cs-137, Pu-238, Pu-239, and Sr-90.

Decision Rule: If laboratory results for the soil samples do not indicate the presence of COPCs above the PALs, then a CADD/CR will be prepared.

Result: The COPCs are above the PALs, so the first decision rule applies.

C.2.0 References

DTRA, see Defense Threat Reduction Agency.

Defense Threat Reduction Agency. 2002. *Corrective Action Investigation Plan for Corrective Action Unit 482: Area 15 U15a/e Muckpiles and Ponds, Nevada Test Site*. Rev. 0. July 2002.

EPA, see U. S. Environmental Protection Agency.

Gilbert, R.O. 1987. *Statistical Methods for Environmental Pollution Monitoring,* Chapter 4. New York, NY: Van Nostrand Reinhold.

NNSA/NV, see U. S. Department of Energy, National Nuclear Security Administration Nevada Operations Office.

U.S. Department of Energy, National Nuclear Security Administration Nevada Operations Office. 2002. *Industrial Sites Quality Assurance Project Plan, Nevada Test Site, Nevada,* DOE/NV--372, Rev. 3. Las Vegas, NV.

U.S. Environmental Protection Agency. 1996. *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846* CD ROM PB97-501928GEI, which contains updates for 1986, 1992, 1994, and 1996. Washington, DC.

U.S. Environmental Protection Agency. 1999. *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods,* SW-846. 3rd Edition. Washington, DC.

U.S. Environmental Protection Agency. 2002. *Region 9 Preliminary Remediation Goals (PRGs)*. San Francisco, CA.

Appendix D

Risk Assessment for CAU 482

D.1.0 Risk-Based Corrective Action Process

This section contains documentation of the ASTM Method E 1739-95 (ASTM, 1995) risk-based corrective action process as applied to CAU 482. The ASTM Method E 1739-95 defines three tiers or levels in evaluating DQO decisions involving increasingly more sophisticated analyses.

- Tier 1 – Sample results from source areas (highest concentrations) compared to the PALs based on generic (non-site-specific) conditions.
- Tier 2 – Sample results from exposure points compared to SSTLs calculated using site-specific inputs and Tier I formulas (from the ASTM procedure).
- Tier 3 – Sample results from exposure points compared to SSTLs and points of compliance calculated using chemical fate/transport and probabilistic modeling.

The risk based corrective action decision process stipulated in ASTM method E 1739-95 is summarized in Figure D.1-1.

D.1.1 Scenario

Corrective Action Unit 482 consists of the three CASs and one associated area.

- CAS 15-06-01, U15e Muckpile
- CAS 15-06-02, U15a Muckpile
- CAS 15-38-01, Area 15 U15a/e Ponds
- The drainage below the Muckpile

Corrective Action Sites 15-06-01 and 15-06-02 consist of the U15e and U15a Muckpiles, respectively. The Muckpiles are associated with the U15e and U15a Shafts, which were mined vertically into the quartz monzonite of the Climax Stock and then horizontally from the bottom of the shafts. The shafts were used for three weapons effects tests between 1962 and 1966. The Muckpiles consist of approximately 160,333 yd^3 of material mined from the shafts and tunnels. The surface elevation at the top of the U15a Muckpile is about 5,030 ft above mean sea level. The U15a Muckpile was deposited in a southeasterly direction from the collar of the 15a-Shaft. The U15e Muckpile is adjacent to the U15a Muckpile and forms a small lobe on the southeast side of the U15a Muckpile. The combined Muckpiles are approximately 370 ft across and 780 ft long in a northwest-southeast direction. The thickness of the U15a Muckpile ranges from less than 5 ft at the northwest end to approximately 30 ft at the southeast end.

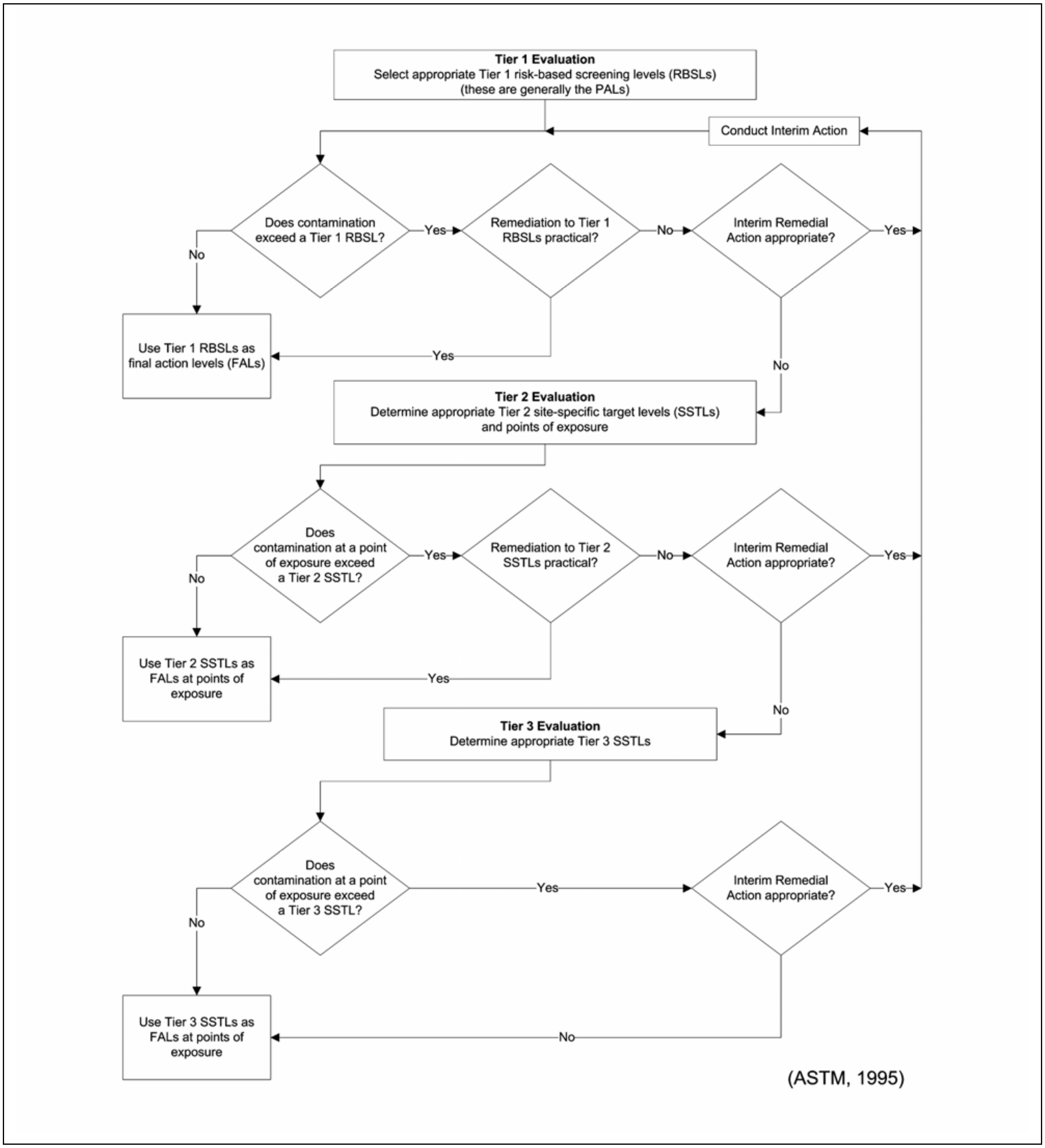


Figure D.1-1
ASTM Method E 1739-95 Risk-Based Corrective Action Decision Process

Corrective Action Site 15-38-01 (Area 15 U15a/e Ponds) is located approximately 90 ft east of the U15a/e Muckpiles. The CAS consists of four ponds ranging in diameter from 20 to 50 ft. The upper three ponds are located in a southwesterly trend 30 to 70 ft apart and separated by earthen berms. The fourth pond is located approximately 135 ft southeast of the third pond. The thickness of the material in the Area 15 U15a/e Ponds reached a maximum of 2 ft.

The drainage that was included in this investigation trends southerly down slope from the base of the U15a Muckpile for approximately 1,000 ft.

D.1.2 Site Assessment

The CAI at CAU 482 involved walkover and driveover radiological surveys, soil sampling with a rotosonic drill rig, and soil sampling with hand tools. The investigation results identified TPH-DRO in one sample and radiological COCs that exceeded the PALs as defined in the CAIP (DTRA, 2002). The maximum concentration of the COCs identified at each site and their corresponding PALs (Tier 1 comparison) are presented in Tables D.1-1 (chemical results) and D.1-2 (radiological results).

Table D.1-1
Maximum Reported Chemical Values for Tier 1 Comparison
(Page 1 of 3)

Contaminant of Concern	CAS Number	Sample Number	Results (mg/kg)	PAL (mg/kg)
U15a (Muck CAS 15-06-02)				
2-Butanone	78-93-3	482AS0103	0.011	110,000
Acetone	67-64-1	482AS0103	0.048	54,000
Arsenic	7440-38-2	482AS1412	15	23
Barium	7440-39-3	482AS1316	230	67,000
Benzo(A)Pyrene	50-32-8	482AB020.5	0.34	0.21[1]
Benzo(B)Fluoranthene	205-99-2	482AB020.5	0.34	2.1
Benzo(K)Fluoranthene	207-08-9	482AB020.5	0.34	21
Bis(2-ethylhexyl)Phthalate	117-81-7	482AS0118	0.31	120
Cadmium	7440-43-9	482AS110.5	2.9	450
Chromium	7440-47-3	482AS1412	30	450
Dibenzo(A,H,)Anthracene	53-70-3	482AB020.5	0.34	0.21[1]
Diesel-Range Organics	68334-30-5	482AS101.5	**510**	**100**
Ideno(1,2,3-CD)Pyrene	193-39-5	482AB020.5	0.34	2.1

Table D.1-1
Maximum Reported Chemical Values for Tier 1 Comparison
(Page 2 of 3)

Contaminant of Concern	CAS Number	Sample Number	Results (mg/kg)	PAL (mg/kg)
Lead	7439-92-1	482AS101.5	57	800
Mercury	7439-97-6	482AS06A9.5	0.047	310
Methylene Chloride	75-09-2	482AB030.5	0.044	21
Selenium	7782-49-2	482AS1201	1.1	5,100
Silver	7440-22-4	482AS023.5	1.5	5,100
Toluene	108-88-3	482AS0103	0.0036	520
U15a Native (CAS 15-06-02)				
Acetone	67-64-1	482AS1117	0.02	54,000
Arsenic	7440-38-2	482AS0128	12	23
Barium	7440-39-3	482AS0315.5	120	67,000
Chromium	7440-47-3	482AS0128	4.9	450
Diesel-Range Organics	68334-30-5	482AS1328	4.5	100
Lead	7439-92-1	482AS1435.5	4.5	800
Mercury	7439-97-6	482AS06A15.5	0.0031	310
Methylene Chloride	75-09-2	482AS0911.5	0.0077	21
Selenium	7782-49-2	482AS0315.5	0.99	5,100
U15e Muck (CAS 15-06-01				
Acetone	67-64-1	482ES16A01	0.02	54,000
Arsenic	7440-38-2	482ES16A01	3.7	23
Barium	7440-39-3	482ES1501	95	67,000
Chromium	7440-47-3	482ES16A01	2.1	450
Lead	7439-92-1	482ES16A01	3.5	800
Mercury	7439-97-6	482ES16A01	0.018	310
Methylene Chloride	75-09-2	482ES1501	0.0026	21
Selenium	7782-49-2	482ES16A01	0.42	5,100
U15e Native (CAS 15-06-01)				
Acetone	67-64-1	482ES16A4.5	0.02	54,000
Arsenic	7440-38-2	482ES1503	3.5	23
Barium	7440-39-3	482ES16A4.5	91	67,000
Chromium	7440-47-3	482ES1503	3	450

Table D.1-1
Maximum Reported Chemical Values for Tier 1 Comparison
(Page 3 of 3)

Contaminant of Concern	CAS Number	Sample Number	Results (mg/kg)	PAL (mg/kg)
Lead	7439-92-1	482ES1503	4	800
Mercury	7439-97-6	482ES16A4.5	0.0066	310
Methylene Chloride	75-09-2	482ES1503	0.0035	21
Area 15 U15a/e Ponds (CAS 15-38-01)				
Arsenic	7440-38-2	482PSS220	6.7	23
Barium	7440-39-3	482PSS220	140	67,000
Cadmium	7440-43-9	482PSS606	3.5	450
Chromium	7440-47-3	482PSS606	12	450
Diesel-Range Organics	68334-30-5	482PSS220	10	100
Lead	7439-92-1	482PSS602	39	800
Mercury	7439-97-6	482PSS220	0.051	310
Drainage				
Arsenic	7440-38-2	482DR03C	4.8	23
Barium	7440-39-3	482DR0106	220	67,000
Cadmium	7440-43-9	482DR0506	0.61	450
Chromium	7440-47-3	482DR03C	8.2	450
Diesel-Range Organics	68334-30-5	482DR02A06	97	100
Lead	7439-92-1	482DR03C	34	800
Mercury	7439-97-6	482DR0806	0.024	310
Selenium	7782-49-2	482DR02A06	1.8	5,100
Background				
Arsenic	7440-38-2	482BSB301	3.1	23
Barium	7440-39-3	482BSB301	70	67,000
Cadmium	7440-43-9	482BSB101	0.39	450
Chromium	7440-47-3	482BSB201	3.5	450
Lead	7439-92-1	482BSB101	7.9	800
Mercury	7439-97-6	482BSB301	0.022	310

[1] The detection level is 0.34 mg/kg.

Table D.1-2
Maximum Reported Radiological Values for Tier 1 Comparison
(Page 1 of 2)

Contaminant of Concern	CAS Number	Sample Number	Results (pCi/g)	PAL[1] (pCi/g)
U15a Muck (CAS 15-06-02)				
Actinium-228	14331-83-0	482AS1316	1.26	15
Bismuth-214	14733-03-0	482AS059.5	1.71	15
Cesium-137	10045-97-3	482AS04A13	**3,050** [2]	**7.3**
Cobalt-60	10198-40-0	482AB040.5	0.123	1.61
Lead-212	15092-94-1	482AS1407	1.33	15
Lead-214	15067-28-4	482AS059.5	1.49	15
Plutonium-238	13981-16-3	482AB040.5	1.28	7.78
Plutonium-239	15117-48-3	482AB040.5	**7.7** [2]	**7.62**
Strontium-90	10098-97-2	482AB040.5	66	503
Thallium-208	14913-50-9	482AS1407	0.5	15
U15a Native (CAS 15-06-02)				
Actinium-228	14331-83-0	482AS04A25	0.92	15
Bismuth-214	14733-03-0	482AS0721	1.11	15
Cesium-137	10045-97-3	482AS04A25	0.246	7.3
Lead-212	15092-94-1	482AS1328	1.12	15
Lead-214	15067-28-4	482AS0128	1.11	15
Thallium-208	14913-50-9	482AS0721	0.46	15
U15e Muck (CAS 15-06-01)				
Actinium-228	14331-83-0	482ES16A01	1.09	15
Bismuth-214	14733-03-0	482ES16A01	0.78	15
Cesium-137	10045-97-3	482ES16A01	0.69	7.3
Lead-212	15092-94-1	482ES16A01	1.25	15
Lead-214	15067-28-4	482ES16A01	0.86	15
Thallium-208	14913-50-9	482ES1501	0.36	15
U15e Native (CAS 15-06-01)				
Actinium-228	14331-83-0	482ES1503	0.92	15
Bismuth-214	14733-03-0	482ES1503	0.92	15
Lead-212	15092-94-1	482ES1503	0.91	15
Lead-214	15067-28-4	482ES1503	0.91	15
Thallium-208	14913-50-9	482ES16A4.5	0.33	15

Table D.1-2
Maximum Reported Radiological Values for Tier 1 Comparison
(Page 2 of 2)

Contaminant of Concern	CAS Number	Sample Number	Results (pCi/g)	PAL[1] (pCi/g)
Area 15 U15a/e Ponds (CAS 15-38-01)				
Actinium-228	14331-83-0	482PSS404	1.14	5
Americium-241	14596-10-2	482PSS606	**182** [2]	**7.62**
Bismuth-214	14733-03-0	482PSS606	0.6	5
Cesium-137	10045-97-3	482PSS606	**830** [2]	**7.3**
Lead-212	15092-94-1	482PSS220	1.16	5
Lead-214	15067-28-4	482PSS506	0.56	5
Plutonium-238	13981-16-3	482PSS606	**18.3** [2]	**7.78**
Plutonium-239	15117-48-3	482PSS606	**1,000** [2]	**7.62**
Strontium-90	10098-97-2	482PSS404	65	503
Thallium-208	14913-50-9	482PSS306	0.29	5
Drainage				
Actinium-228	14331-83-0	482DR0606	1.27	5
Americium-241	14596-10-2	482DR03C	3.1	7.62
Bismuth-214	14733-03-0	482DB30.5	1.07	5
Cesium-137	10045-97-3	482DR03C	**472** [2]	**7.3**
Cobalt-60	10198-40-0	482DR03C	0.323	1.61
Lead-212	15092-94-1	482DR0806	1.17	5
Lead-214	15067-28-4	482DB20.5	1	5
Plutonium-238	13981-16-3	482DR03C	3.96	7.78
Plutonium-239	15117-48-3	482DR03C	**23.3** [2]	**7.62**
Strontium-90	10098-97-2	482DR03C	43.8	503
Thallium-208	14913-50-9	482DR0806	0.46	5
Background				
Actinium-228	14331-83-0	482BSB301	1.29	5
Bismuth-214	14733-03-0	482BSB201	0.7	5
Cesium-137	10045-97-3	482BSB201	0.57	7.3
Lead-212	15092-94-1	482BSB301	1.43	5
Lead-214	15067-28-4	482BSB201	0.99	5
Thallium-208	14913-50-9	482BSB301	0.38	5

[1] PALs used as action levels. The PALs for radiological contaminants are based on background or the National Council of Radiation Protection and Measurement Report No. 129 recommended screening limits for construction, commercial, and industrial land use scenario (NCRP, 1999) scaled from 25- to 15-millirem-per-year dose and the generic guidelines for residual concentration of radionuclides in DOE Order 5400.5 (DOE, 1993).

[2] Exceeds the PALs

pCi/g = Picocuries per gram

D.1.3 Site Classification and Initial Response Action

The four major site classifications listed in Table 3 of the ASTM standard are: (1) immediate threat to human health, safety, and/or the environment; (2) short-term (0 to 2 years) threat to human health, safety, and/or the environment; (3) long-term (greater than 2 years) threat to human health, safety, and/or the environment; (4) no demonstrated long-term threats.

Based on the CAI, none of the CASs or associated areas present an immediate threat to human health, safety, and/or the environment; therefore, no interim response actions are necessary at these sites. The CAI demonstrated that the contamination present at CAU 482 is limited to the points of release; the U15a Muckpile, the Ponds, and the drainage. The results further showed that there has been no migration into the subsurface. Analytical results from the native material show no chemical or radiological contamination in the underlying native material. A discussion of the nature and extent of contamination is presented in Appendix A. Based on this information, CAS 15-06-02 (U15a Muckpile), CAS 15-38-01 (Area 15 U15a/e Ponds), and the drainage below the U15a Muckpile are determined to be Classification 3 as defined by ASTM Method E 1739-95 (ASTM, 1999). At these sites COCs were identified that may pose long-term threats to human health or the environment. No contaminants were found at CAS 15-06-01 (U15e Muckpile), so it is determined to be Classification 4.

D.1.4 Development of Tier 1 Look-Up Table of Risk-Based Screening Level Selection

Tier 1 action levels have been defined as the PALs established during the DQO process. The PALs are a tabulation of chemical-specific (but not site-specific) screening levels based on the type of media (soil) and potential exposure scenarios (industrial). These are very conservative estimates of risk, are preliminary in nature, and are used as action levels for site screening purposes. Although the PALs are not intended to be used as FALs, a FAL may be defined as the Tier 1 action level (i.e., PAL) if individual constituent analytical results are below the corresponding Tier 1 action level. The FAL may also be established as the Tier I action level if individual constituent analytical results exceed the corresponding Tier 1 action level value and implementation of a corrective action based on the final action level is practical. The PALs are defined as:

- The EPA Region 9 Risk-Based PRGs for Industrial Soils (2002).
- Background concentrations for RCRA metals will be evaluated when natural background exceeds the PAL, as is often the case with arsenic. Background is considered to be the

mean plus two times the standard deviation of the mean based on data published in Mineral and Energy Resource Assessment of the Nellis Air Force Range (NBMG, 1998; Moore, 1999).

- Concentrations for TPH-DRO above 100 mg/kg per NAC 445A.2272 (NAC, 2003b).
- For COPCs without established PRGs, a protocol similar to EPA Region 9 will be used to establish an action level; otherwise, an established PRG from another EPA region may be chosen.
- When the CAIP was written the PALs for radionuclides were isotope-specific and defined as the higher of the maximum concentration for that isotope found in samples from undisturbed background locations in the vicinity of the NTS (McArthur and Miller, 1989; US Ecology and Atlan-Tech, 1991; Black and Townsend, 1996), from any of the three background samples collected during the investigation, or the POC as specified in the *Nevada Test Site Performance Objective for Certification of Nonradioactive Hazardous Waste* (BN, 1995).

Since the corrective action was completed, the radiological PALs have been changed through agreement with NDEP as follows: The PALs for radioactive contaminants are based on the NCRP Report No. 129 recommended screening limits for construction, commercial, and industrial land-use scenarios (NCRP, 1999) scaled to 25-millirem-per-year dose constraint (Appenzeller-Wing, 2004) and the generic guidelines for residual concentration of radionuclides in DOE Order 5400.5 (DOE, 1993).

The PALs were developed based on an industrial scenario. Because CAU 482 in Area 15 is not assigned any work stations and is considered to be in remote or occasional use areas, the use of industrial land use based PALs is conservative. The Tier 1 look-up table is defined as the PAL concentrations or activities defined in the CAIP.

D.1.5 Exposure Pathway Evaluation

The DQOs stated that site workers would only be exposed to COCs through oral ingestion, inhalation, or dermal contact (absorption) due to exposure to potentially contaminated media (i.e., soil) at the CASs. The results of the CAI showed that all COCs identified in CAU 482 are localized near the release points and have not significantly migrated laterally or vertically in the subsurface. Because the contaminants were only identified in the soil of the Muckpile, the pad, and the drainage and the sediments in the Ponds, the only potential exposure pathway would be through worker contact with the contaminated soil. The lack of migration demonstrated by the analytical results, elapsed time since the suspected release, and the depth to groundwater supports the selection and evaluation of only the surface and shallow subsurface contact as the complete exposure pathway. Groundwater is not considered to be an exposure pathway.

D.1.6 Comparison of Site Conditions with Tier 1 Risk-Based Screening Levels

All analytical results for CAU 482 were less than corresponding Tier 1 action levels (i.e., PALs) except for those listed in Table D.1-3.

Table D.1-3
COPCs Detected Above Preliminary Action Levels

	TPH-DRO	Am-241	Cs-137	Pu-238	Pu-239
CAS 15-06-01 15e Muckpile Muck					
CAS 15-06-01 15e Muckpile Native					
CAS 15-06-02 U15a Muckpile Muck	X		X		X
CAS 15-06-02 U15a Muckpile Native					
CAS 15-38-01 Area 15 U15a/e Ponds		X	X	X	X
Drainage			X		X

D.1.7 Evaluation of Tier 1 Results

For all constituents at CAU 482 not listed in Section D.1.6, the FALs were established as the Tier 1 risk-based screening levels. It was determined that no further action is required for these constituents at CAU 482.

It was determined by DTRA and NNSA/NSO that remediation of the remaining constituents listed in Table D.1-3 is not practical. Therefore, Tier 2 SSTLs will be calculated for those constituents at each CAS.

D.1.8 Tier 1 Remedial Action Evaluation

TPH-DRO Evaluation

Remediation to Tier 1 action levels would be difficult and expensive while potentially not providing a significant risk reduction. Therefore, it was determined to assess the risk to human health posed by the hazardous constituents of TPH-DRO at CAU 482 under a Tier 2 evaluation before establishing FALs for TPH-DRO constituents or implementing a corrective action.

Chemical Evaluation

None of the chemicals exceeded the PALs; therefore, no further action is required with respect to the chemical parameters.

Radionuclide Evaluation

Actions to remediate Am-241, Cs-137, Pu-238, and Pu-239 to Tier 1 action levels would be difficult and expensive while potentially not providing a significant risk reduction. Therefore, these radionuclides were moved to a Tier 2 evaluation before establishing FALs or implementing a corrective action.

D.1.9 Tier 2 Evaluation

No additional data were needed to complete a Tier 2 evaluation.

D.1.10 Development of Tier 2 Table of SSTLs

Evaluation of TPH-DRO SSTLs

The ASTM Method E 1739-95 (ASTM, 1999) stipulates that risk evaluations for TPH-DRO contamination be calculated and evaluated based on the risk posed by the potentially hazardous constituents of TPH-DRO. Section 6.4.3, “Use of Total Petroleum Hydrocarbon Measurements” of ASTM Method E 1739-95 states: “TPH should not be used for risk assessment because the general measure of TPH provides insufficient information about the amounts of individual chemical(s) of concern present” (see also Sections X1.5.4 and X1.42 of Method E 1739-95). Therefore, the individual potentially hazardous constituents in TPH-DRO were compared to corresponding Tier 2 SSTLs to evaluate the need for corrective action at CAU 482. Although Tier 2 SSTLs are generally calculated using site-specific inputs and general risk formulas, the Tier 2 SSTLs selected for the hazardous constituents of TPH-DRO are the EPA Region 9 PRGs (EPA, 2002). These SSTLs and the maximum reported level for each diesel constituent per CAS are presented in Table D.1-4.

Table D.1-4
Tier 2 SSTLs and CAU 482 Results for Hazardous Constituents of Diesel

CAS No.	Common Name	SSTL (mg/kg)	Maximum Reported Value (mg/kg)
108-67-8	1,3,5-Trimethylbenzene	70	ND
91-57-6	2-Methylnaphthalene[a]	175,000	ND
120-12-7	Anthracene	100,000	ND
71-43-2	Benzene	2.1	ND
56-55-3	Benzo(a)anthracene	1.4	ND
50-32-8	Benzo(a)pyrene	0.21	ND
205-99-2	Benzo(b)Fluoranthene	2.1	0.36
191-24-2	Benzo(g,h,i)Perylene	29,000	ND
207-08-9	Benzo(k)Fluoranthene	21	ND
218-01-9	Chrysene	210	ND
100-41-4	Ethylbenzene	400	ND
206-44-0	Fluoranthene	22,000	ND
86-73-7	Fluorene	26,000	ND
91-20-3	Naphthalene	190	ND
104-51-8	N-Butylbenzene	240	ND
103-65-1	N-Propylbenzene	240	ND
85-01-8	Phenanthrene	100,000	ND
129-00-0	Pyrene	29,000	ND
108-88-3	Toluene	520	ND
1330-20-7	Total Xylene[b]	420	ND

[a] Uses PRG for naphthalene as surrogate
[b] Total of m-, o-, and p-xylenes

CAS = Chemical Abstracts Service
mg/kg = Milligrams per kilograms
ND = Nondetect
SSTL = Site-specific target level

Evaluation of Chemical SSTLs

No chemical SSTLs were calculated because all the reported concentrations were below the PALs.

Evaluation of Radiological Constituent SSTLs

The Tier 2 evaluation consisted of evaluating the mixture of all radionuclides detected at each CAS to develop Tier 2 action levels for the radionuclides that exceeded Tier 1 levels. The CAS specific Tier 2 action levels were calculated using the RESRAD code (version 6.22) and site-specific parameters. The RESRAD calculations were based on continued use of the site under the Occasional Use Area scenario, assuming that a site worker will be on site for 10 days per year, 8 hours a day for 5 years. A more detailed discussion of the RESRAD code, site-specific parameters used, and the printed RESRAD outputs is provided in Attachment A of this Appendix. These SSTLs, the maximum reported level, and the average level for each radiological constituent per CAS are presented in Table D.1-5.

Table D.1-5
Tier 2 SSTLs and CAU 482 Results for Radiological Constituents

Common Name	15-06-02 (pCi/g)			15-38-01 (pCi/g)			Drainage below 15-06-01 (pCi/g)		
	SSTL	Maximum Result	Average	SSTL	Maximum Result	Average	SSTL	Maximum Result	Average
Americium-241	N/A	N/A	N/A	51.88	182	38.21	N/A	N/A	N/A
Cesium-137	273.99	3050	270.58	236.58	830	163.44	272.27	472	35.35
Plutonium-238	N/A	N/A	N/A	5.22	18.3	3.70	N/A	N/A	N/A
Plutonium-239	4.24	7.7	1.15	285.03	1000	199.99	13.44	23.3	7.38

N/A = Not applicable

Although all detected radionuclides at a CAS are used in the sum-of-fractions calculation and a unique Tier 2 action level is developed for all radionuclides, only the five radionuclides which initially exceeded Tier 1 levels have a Tier 2 based FAL. The CAS specific FALs established for these radionuclides are the SSTLs listed in Table D.1-5.

D.1.11 Comparison of Site Conditions with Tier 2 FALs

The Tier 2 action levels are typically compared to individual sample results from reasonable points of exposure (as opposed to the source areas as is done in Tier 1) on a point-by-point basis. Points of exposure are defined as those locations or areas at which an individual or population may come in contact with a COC originating from a CAS. For CAU 482, the Tier 2 action levels were compared to maximum constituent concentrations from each sample location and to the average concentration for the site.

A comparison of the maximum concentration of the hazardous constituents of TPH-DRO was conducted against the CAS-specific Tier 2 FALs as shown in Table D.1-4. All analytical results for potentially hazardous constituents in TPH-DRO were below the FALs for the U15a Muckpile (CAS 15-06-02).

A comparison between the maximum concentration of the radionuclides identified above Tier 1 action levels (Am-241, Cs-137, Pu-238, and Pu-239) was conducted against the CAS-specific Tier 2-based FALs listed in Table D.1-5. For the U15a-Muckpile (CAS 15-06-02) and the drainage below the Muckpile, the maximum concentration of both Cs-137 and Pu-239 are above the CAS-specific FALs, but the average is less than the FALs. For the Area 15 U15a/e-Ponds (CAS 15-25-02), the maximum concentration for all four of the radionuclides is above the CAS-specific FALs, but the average is less than the FALs.

D.1.12 Tier 2 Remedial Action Evaluation

Based on the Tier 2 evaluation of the TPH-DRO hazardous constituents, the chemical constituents, and the radiological constituents, CAS 15-06-02, the drainage, and CAS 15-38-01 are contaminated with radiological constituents. These CASs pose an unacceptable risk so a remedial action needs to be implemented. Close in place with institutional controls is the most reasonable corrective action for these two CASs and the drainage within CAU 482.

As all contaminant FALs were established as Tier 1 or Tier 2 action levels, a Tier 3 evaluation was considered unnecessary.

D.2.0 Regulatory Basis

The FFACO Part III, Section III.3 (FFACO, 1996) stipulates conformance with Chapter 445 of the NAC (NAC, 2003a). Section NAC 445A.227 lists the factors to be considered in determining whether a corrective action is required.

Section NAC 445A.227 states:

1. Except as otherwise provided in NAC 445A.22715, the Director may require an owner or operator to take corrective action if the release of a hazardous substance, hazardous waste, or a regulated substance contaminates soil and the level of contamination exceeds the action level established for the soil pursuant to NAC 445A.2272.

2. In determining whether corrective action is required, the Director shall consider:

   (a) The depth of any groundwater.

   (b) The distance to irrigation wells or wells for drinking water.

   (c) The type of soil that is contaminated.

   (d) The annual precipitation.

   (e) The type of waste or substance that was released.

   (f) The extent of the contamination.

   (g) The present and potential use for the land.

   (h) The preferred routes of migration.

   (i) The location of structures or impediments.

   (j) The potential for a hazard related to fire, vapor, or explosion.

   (k) Any other information specifically related to the site that the director determines is appropriate.

For a site where it is determined that corrective action is required (the corrective action process applies to all FFACO sites), Section NAC 445A.22705 (NAC, 2003c) stipulates a process to determine the necessary remediation standards (or FALs) based on an evaluation of the risk the site poses to public health and the environment.

Section NAC 445A.22705 states:

1. Except as otherwise provided in NAC 445A.22715, if an owner or operator is required to take corrective action pursuant to NAC 445A.227, the owner or operator may conduct an evaluation of the site, based on the risk it poses to public health and the environment, to determine the necessary remediation standards or to establish that corrective action is not necessary. Such an evaluation must be conducted using Method E 1739-95, adopted by the ASTM, as it exists on October 3, 1996, or an equivalent method approved by the Division.

2. The Division shall determine whether an evaluation complies with the requirements of Method E 1739-95, or an equivalent method of testing approved by the Division. The Division may reject, require revisions be made to, or withdraw its concurrence with the evaluation at any time after the completion of the evaluation for the following reasons:

   (a) The evaluation does not comply with the applicable requirements for conducting the evaluation.

   (b) Conditions at the site have changed.

   (c) New information or previously unidentified information that would alter the results of the evaluation becomes available and demonstrates that the release may have a detrimental impact on public health or the environment.

Therefore, in compliance with Section NAC 445A.22705, NNSA/NSO will "conduct an evaluation of the site, based on the risk it poses to public health and the environment, to determine the necessary remediation standards or to establish that corrective action is not necessary" using ASTM Method E 1739-95.

D.3.0 Recommendations

Organic, inorganic, and radiological constituents detected in environmental samples during the CAI were evaluated against FALs to determine the nature and extent of COCs for CAU 482. Assessment of the data generated from the investigation activities indicates that FALs were exceeded for radionuclides in the Muckpile, the drainage below the Muckpile, and the ponds.

As COCs were identified above corresponding FALs in CAS 15-06-02, CAS 15-38-01, and the drainage below CAS 15-06-02, it was determined that closure in place with use restrictions is the best option for closing CAU 482. This is based on the fact that even though the FALs were exceeded in a few samples, this remote, controlled access site poses only limited risk overall to public heath and the environment. Given the relatively low levels of contamination present, it would create a great hazard to worker safety, public health, and the environment to remove the contamination, transport it, and bury it at another location.

No further corrective action is necessary.

D.4.0 References

ASTM, see American Society for Testing and Materials.

American Society for Testing and Materials. 1995. *Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites/American Society for Testing and Materials*, ASTM E 1739-95 (Reapproved 2002). Philadelphia, PA.

Appenzeller-Wing, J., U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office. 2004. Letter to T. A. Maize (NDEP) entitled "Submittal of Proposed Radiological Preliminary Action Levels (PALs) for the Industrial Sites Project," 15 January. Las Vegas, NV.

BN, see Bechtel Nevada.

Bechtel Nevada. 1995. *Nevada Test Site Performance Objective for Certification of Nonradioactive Hazardous Waste*. Las Vegas, NV.

Black, S.C., and Y.E. Townsend. 1996. *U.S. Department of Energy, Nevada Operations Office Environmental Data Report for the Nevada Test Site - 1994*. Las Vegas, NV.

DOE, see U.S. Department of Energy.

DTRA, see Defense Threat Reduction Agency.

Defense Threat Reduction Agency. 2002. *Corrective Action Investigation Plan for Corrective Action Unit 482: Area 15 U15a/e Muckpiles and Ponds, Nevada Test Site*, Rev. 0. Prepared by ITLV. Las Vegas, NV.

EPA, see U.S. Environmental Protection Agency.

FFACO, see *Federal Facility Agreement and Consent Order*.

Federal Facility Agreement and Consent Order. 1996 (as amended). Agreed to by the State of Nevada, the U.S. Department of Energy, and the U.S. Department of Defense. Las Vega, NV.

McArthur, R.D., and F.L. Miller, Jr. 1989. *Offsite Radiation Exposure Review Project, Phase II Soils Programs*, DOE/NV/10384-23. Las Vegas, NV: Desert Research Institute.

Moore, J., Science Applications International Corporation. 1999. Memorandum to M. Todd (SAIC) entitled, "Background Concentrations for NTS and TTR Soil Samples." Las Vegas, NV.

NAC, see *Nevada Administrative Code*.

NBMG, see Nevada Bureau of Mines and Geology.

NCRP, see National Council on Radiation Protection and Measurements.

National Council on Radiation Protection and Measurements. 1999. *Recommended Screening Limits for Contaminated Surface Soil and Review of Factors Relevant to Site-Specific Studies,* Report No. 129. Bethesda, MD.

Nevada Administrative Code. 2003a. NAC 445A, “Water Controls.” Carson City, NV.

Nevada Administrative Code. 2003b. NAC 445A.2272, “Contamination of Soil: Establishment of Action Levels.” Carson City, NV.

Nevada Administrative Code. 2003b. NAC 445A.22705, “Contamination of Soil: Evaluation of Site by Owner or Operator; Review of Evaluation by Division,” Carson City, NV.

Nevada Bureau of Mines and Geology. 1998. *Mineral and Energy Resource Assessment of the Nellis Air Force Range, Clark, Lincoln, and Nye Counties,* Nevada, Open File Report 98-1. Reno, NV.

U.S. Department of Energy. 1993. DOE Order 5400.5 Change 2, “Radiation Protection of the Public and Environment.” Washington, DC.

US Ecology and Atlan-Tech, Inc. 1991. *Environmental Monitoring Report for the Proposed Ward Valley, California, Low-Level Radioactive Waste (LLRW) Facility,* Vols. 1 and 2, Version 2. Rosewell, GA: California Department of Health, Environmental Management Branch.

U.S. Environmental Protection Agency. 2002. *Region 9 Preliminary Remediation Goals* (PRGs). San Francisco, CA.

Derivation of Residual Radioactive Material Guidelines for Radionuclides in Soil at Corrective Action Unit (CAU) 482, U15a/e Muckpiles and Ponds, Nevada Test Site, Nevada

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Derivation of Residual Radioactive Material Guidelines for Radionuclides in Soil at Corrective Action Unit (CAU) 482, U15a/e Muckpiles and Ponds, Nevada Test Site, Nevada

1.0 Introduction

The U.S. Department of Energy (DOE), the U.S. Department of Defense (DoD) (through the Defense Threat Reduction Agency [DTRA]), and the National Nuclear Security Administration Nevada Site Office (NNSA/NSO) Environmental Restoration Division have numerous sites impacted from the development, testing, and production of nuclear weapons. These impacts can take the form of chemical and/or radiological contaminants. Similar to its approach for chemical contamination, DoD and NNSA/NSO are committed to properly evaluating, radiologically characterizing, and where appropriate, remediating these sites to ensure the doses to radiation workers and members of the public are maintained as-low-as-reasonably achievable (ALARA), at a minimum, below the primary dose limits as stated in DOE Order 5400.5 (DOE, 1993).

To accomplish this, the potential for residual radioactive contamination in soils must be evaluated to determine the status of compliance with the requirements of DOE Order 5400.5 (DOE, 1993). The DOE Order 5400.5 requires that: “The Authorized Limits shall be established to (1) provide that, at a minimum, the basic dose limits … will not be exceeded, or (2) be consistent with applicable generic guidelines.” Because generic guidelines have not been established for volumetric residual radioactivity for the radionuclides of concern at CAU 482 land areas, Authorized Limits or final action levels (FALs) were derived using the Residual Radioactivity (RESRAD) model and computer code (Yu et al., 2001). The goal of this effort was to produce Authorized Limits, in units of picocuries per gram (pCi/g) in soil above background, for CAU 482 that would result in radiation doses less than 25 mrem per year (mrem/yr) to an industrial worker at the site.

To develop the FALs, a “realistic” yet conservative radiation dose analysis was conducted using approved exposure scenarios and site-specific data to determine the translation between surface soil concentrations and individual radiation doses. For this analysis, site-specific data included soil sampling results obtained during site investigation activities at CAU 482, and meteorological data obtained from the Air Resources Laboratory (ARL)/Special Operations and Research Division (SORD). This report provides the radiation dose modeling analysis supporting the technical derivation of the Authorized Limits for CAU 482, U15a/e Muckpiles and Ponds, Nevada Test Site (NTS), Nevada. This report also defines the radionuclides considered and approved exposure scenarios for the NTS, identifies the applicable exposure pathways and key input data or assumptions, presents the radiation doses for unit concentrations of radionuclides in soil, and establishes the FALs for selected land parcels at CAU 482.

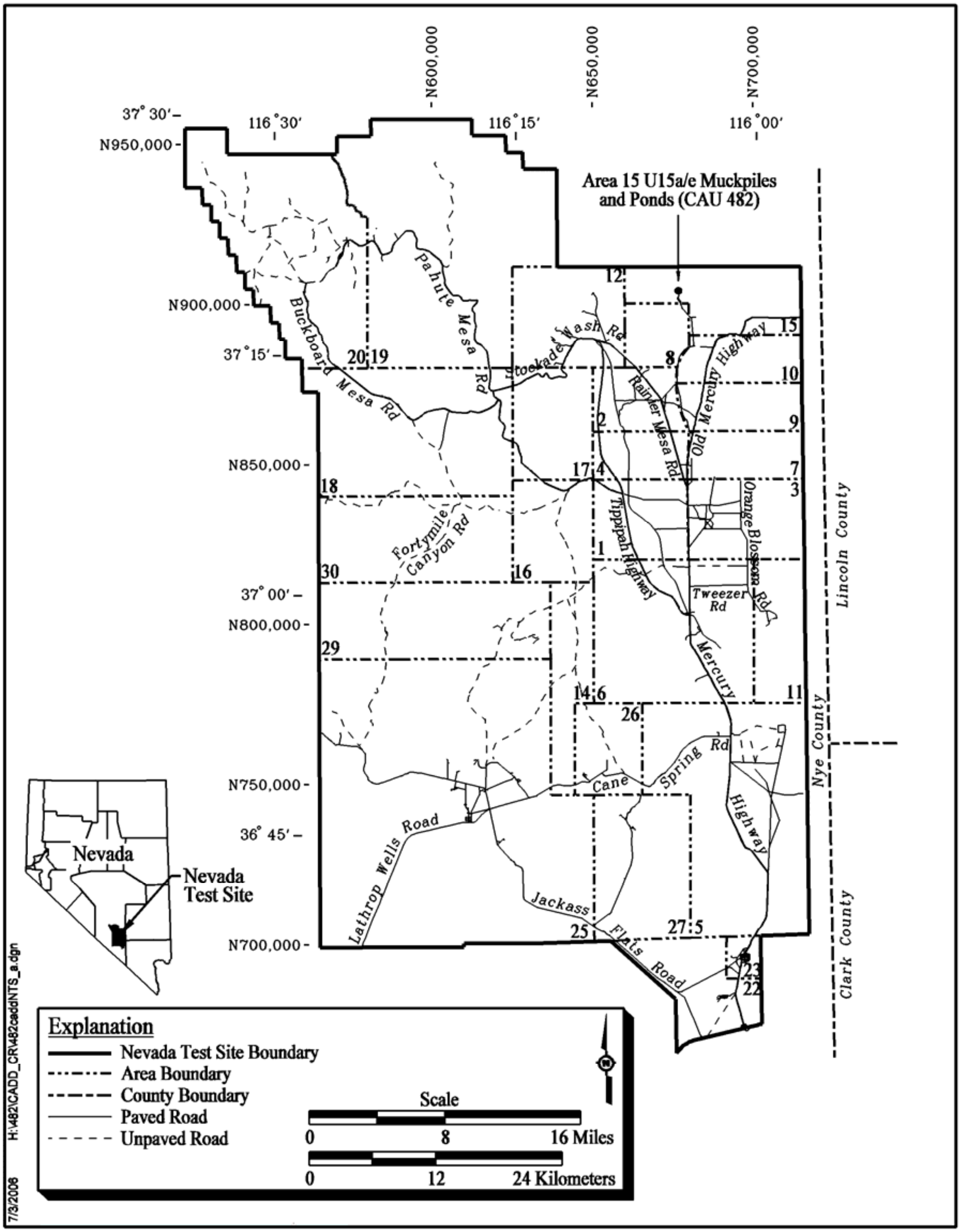

Figure 2-1

15a/e Muckpiles and Ponds Location Map, Area 15, Nevada Test Site

2.0 Facility Description

Corrective Action Unit 482, U15a/e Muckpiles and Ponds, is located approximately 42 miles north of Mercury in Area 15 of the Nevada Test Site (Figure 2-1). CAU 482 consists of three Corrective Action Sites (CASs): 15-06-01, 15-06-02, and 15-38-01. The CASs and impacted areas investigated during the CAU 482 Corrective Action Investigation (CAI) are:

- CAS 15-06-01, U15e Muckpile
- CAS 15-06-02, U15a Muckpile
- CAS 15-38-01, Area 15 U15a/e Ponds

Each CAS is fully described in the Corrective Action Investigation Plan (CAIP) for CAU 482 (DTRA, 2002).

2.1 Operational History

The 15a Shaft was used for nuclear weapons effects tests between 1962 and 1966, and the 15e Shaft was used for testing in 1965. Following each test, reentry mining generated potentially contaminated rock debris and construction wastes, such as cabling, scrap metal, and cementitious mixtures which became part of the muckpiles. The materials excavated during sinking of the shafts and the reentry mining following each test were generally hauled outside the shafts to the edge of the muckpiles, dumped over the edge, and then leveled. A total of three nuclear tests were conducted in the 15a/e Shafts. The 15a/e Ponds were used as settling ponds for water pumped during the reentry and the groundwater encountered during excavation for test. The muckpiles are estimated to contain 160,333 cubic yards of mining and reentry debris. Only a small fraction of this material is thought to be reentry debris.

2.2 Release Information

Release of radionuclides to the environment occurred during each of the tests and during at least one of the drillbacks. Release mechanisms, migration pathways, exposure pathways, and exposure points are described in the CAU 482 CAIP.

3.0 Site Investigation Activities

3.1 Site Investigation Plans

Corrective action investigation activities were performed as set forth in the CAU 482 CAIP (DTRA, 2002) from September 10 to 30, 2002. The objectives of the CAU 482 CAIP were to address the decision statements in the project-specific Data Quality Objectives (DQOs) by:

- Characterizing the near-surface materials (from 0 to 5 ft) for each of the CASs.
- Characterizing the subsurface from greater than 5 ft to the native material interface for each of the CASs (the Ponds may not be more than 2 or 3 ft deep).
- Characterizing the soils in the drainage between the muckpile and the first pond.
- Characterizing the native materials underlying each of the CASs (from 2 to 5 ft below the muckpile or pond/native interface or until drill refusal) for impacts from COPCs.
- Characterizing the soils in the drainage below the muckpiles.
- Establishing background levels of radioactivity and metals in the native soils surrounding the muckpiles and ponds.

The DQO process is a seven-step strategic planning approach based upon the scientific method used to plan data collection activities for CAU 482, U15a/e Muckpiles and Ponds, Nevada Test Site. The DQOs are designed to ensure that data collected will provide sufficient and reliable information to identify, evaluate and technically defend the recommended corrective actions (i.e., no further action, closure in place, or clean closure).

The primary objective of the investigation was to provide sufficient information and data to develop appropriate corrective action alternatives for each CAS in CAU 482. This objective was achieved by identifying the nature and extent, both horizontal and vertical of COCs (i.e., COPCs at concentrations above action levels).

The investigation strategy was developed by representatives of NDEP and DTRA, in accordance with U.S. Environmental Protection Agency (EPA) *Guidance for Quality Assurance Project Plans,* EPA QA/G-5 (EPA, 2002a) and *Guidance for the Data Quality Objectives Process,* EPA QA/G-4 (EPA, 2000b). The investigation strategy also identifies and references the associated EPA Quality System Documents entitled *Data Quality Objectives for Hazardous Waste Site Investigation,* EPA QA/G-4HW (EPA, 2000a), and *Guidance on Choosing a Sampling Design for Environmental Data Collection,* EPA QA/G-5S (EPA, 2002b), upon which the DQO process is based. The CAU 482 CAIP contains a detailed description of the investigation strategy and the DQO process.

3.2 Summary of Specific Site Investigation Activities

This section provides a brief description of work activities conducted to support the investigation of radioactive contamination at CAU 482.

Radiological Surveys
Prior to commencing drilling and sampling, walk-over and drive-over radiological surveys were conducted to identify surface and near-surface areas with elevated readings. The drive-over survey was conducted on the muckpiles and the walk-over surveys were conducted in the ponds and in the drainage channel.

Sampling of the Muckpile Contents and Underlying Native Soils (CAS 15-06-02 and CAS 15-06-01)

Seventeen randomly located boreholes were drilled to characterize the subsurface of the muckpile (from ground surface into native soil). Thirty-eight environmental samples were collected and submitted to an off-site analytical laboratory to be analyzed. Seventeen of these samples were from the native materials beneath the muckpile and the other 21 were collected from the muckpile materials.

Surface/shallow Subsurface Sampling (CAS 15-06-02 and CAS 15-06-01)
Four locations were drilled to a depth of 5 ft to characterize the surface of the muckpile. Sample locations were selected based on anomalous radiation readings found during the drive over radiological survey. One sample was collected from each location for a total of 35 environmental samples.

Pond Sampling (CAS 15-38-02)
Six soil samples were collected from the ponds area. Three were randomly located and three were selected based on elevated radiological readings. All samples were sent to an off-site analytical laboratory for analysis.

Surface Soil Sampling Using Hand Tools (the drainage channel south of CAS 15-06-02)
Seventeen environmental samples were collected from 14 locations to characterize these areas. Eleven of the locations were randomly selected, and three were biased. All samples were sent to an off-site analytical laboratory for analysis.

Background Sampling
Three locations were identified; one was drilled to five ft, and two were hand-excavated to collect background native soil samples. All samples were sent to an off-site analytical laboratory for analysis.

3.3 Sampling Locations

To achieve the objective of identifying the nature and extent of the COCs, a combined random and judgmental (non-probabilistic) sampling scheme was used for selecting sample locations and evaluating analytical results. Judgmental sampling allows the selection of sample locations that target the populations of interest (defined in the DQOs). Sampling points for each CAS were selected based on the approach described in the CAIP, which included interpretation of existing engineering drawings, aerial and land photographs, interviews with former site employees, information obtained during site visits, and site-specific biasing factors. The planned sample locations are discussed in the CAIP. Some planned locations were modified slightly from planned positions due to field conditions and observations. Sample locations were staked, labeled appropriately, and surveyed with a global positioning system (GPS) instrument. Appendix A of the CAU 482 CADD/CR contains a detailed description of the actual sample locations.

4.0 Site Investigation Sample Results

The RESRAD calculations are based on validated analytical soil sample results obtained during site investigation activities and other applicable information specified in the CAIP. The RESRAD calculations are based upon the value of the maximum radionuclide concentration, as specified in the CAU 482 CAIP. The RESRAD calculations were performed for the contaminants of concern (COC) present in the CAU 482 CASs using the maximum radionuclide concentrations obtained during site investigation. Appendix A of the CAU 482 CADD/CR contains a detailed description of the sample results, analytical parameters, and laboratory methods used to analyze the soil samples. Results from CAS 15-06-01, U15e Muckpile did not differ from the background therefore will not be analyzed in this report. The following section provides a summary of the radiological concentrations from samples taken at CAU 482.

The maximum principal radionuclide concentrations (including background) detected at the CASs included:

U15a Muckpile, CAS 15-06-02

- Muck

– Cesium (Cs) -137	3050	pCi/g
– Cobalt (Co)-60	0.123	pCi/g
– Plutonium (Pu) -238	1.28	pCi/g
– Pu-239	7.7	pCi/g
– Strontium (Sr) -90	66	pCi/g

- Drainage

– Americium (Am)-241	3.1	pCi/g
– Co-60	0.323	pCi/g
– Cs-137	472	pCi/g
– Pu-238	3.96	pCi/g
– Pu-239	23.3	pCi/g
– Sr-90	43.8	pCi/g

Ponds, CAS 15-38-01

• Am-241	182	pCi/g
• Cs-137	830	pCi/g
• Pu-238	18.3	pCi/g
• Pu-239	1000	pCi/g
• Sr-90	65	pCi/g

5.0 Initial Concentrations for Principal Radionuclides

Principal radionuclides are defined as radionuclides with a half-life greater than six months. The decay products of any principal radionuclide down to, but not including, the next principal radionuclide in its decay chain are defined as associated radionuclides. RESRAD assumes that a principal radionuclide is in secular equilibrium with its associated radionuclides at the point of exposure. Therefore, associated radionuclides and radionuclides with half-lives less than six months are not input into the RESRAD calculations.

5.1 Authorized Values for Initial Concentrations of Principal Radionuclides

The authorized exposure scenarios specify that value of the arithmetic mean plus the 95 percent UCL obtained from site-specific sampling results be entered as the principal radionuclide concentrations for RESRAD calculations. The sample results for all samples with radionuclide concentrations above the MDC within the land parcels are entered into the EPA software application ProUCL version 3.0. The ProUCL software is used to calculate the 95 percent UCL for principal radionuclide concentrations based on the distribution of the unknown mean.

For instances where the ProUCL software determined that there was not enough data to calculate the 95 percent UCL for a specific radionuclide, the maximum concentration from the sample dataset was used as the initial concentration for that radionuclide.

5.2 Authorized Values Initial Concentrations of Principal Radionuclides for Area Averaging/Hot-Spot Scenarios

The DOE Order 5400.5 (DOE, 1993) states: “Residual concentrations of radioactive material in soil are defined as those in excess of background concentrations averaged over an area of 100 m^2” (5400.5, IV, 4.a.). DOE Order 5400.5 also states: “If the average concentration of any surface or below-surface area less than or equal to 25 m^2, exceeds the limit or guideline by a factor of $(100/A)^{0.5}$, [where A is the area (in square meters) of the region in which concentrations are elevated], limits for “hot-spots” shall also be developed and applied” (5400.5, IV, 4.a.(1)). DOE G 441.1-XX (DOE 2002) discusses the rationale for the hotspot criterion in Section 5.2.2.

The purpose of the hot-spot criterion is to ensure that applying the homogeneous criteria, in which the concentrations of residual radioactive material are averaged over a 100 m^2 area, does not result in the release of small areas that, because of averaging, contain unacceptably high concentrations of residual radioactive material. The hot-spot criterion is used to supplement Authorized Limits for larger areas and is intended to prevent excessive exposures from a small, contaminated area that is within a larger area that meets the basic Authorized Limits. Thus, it is intended for use in areas where the residual radioactive material concentrations are not uniform. Also, the above hotspot criterion was derived conservatively, assuming the Authorized Limits were based on a dose constraint of 25 mrem/yr and selected to ensure unlikely exposure conditions would not cause the primary dose limit (100 mrem/yr) to be exceeded. The authorized exposure scenarios specify that the value of the maximum concentration of principal radionuclides obtained from site-specific sampling results be entered as the principal radionuclide concentrations for RESRAD hot-spot calculations. The authorized area parameters for RESRAD hot-spot calculations are 1 m^2, 10 m^2, and 100 m^2 contamination areas.

5.3 Initial Concentrations of Principal Radionuclide for CAU 482

The maximum radionuclide concentration values were used to perform the RESRAD calculations. A single result of Cs-137 with the concentration of 3050 pCi/g was noted at 15a Muckpile but not included in the analysis because the sample was taken at a depth of 13.5 - 14.5 ft.

The initial radionuclide concentrations used for the RESRAD calculations are those listed in Table 7-2 for each CAS and location.

5.4 Inhomogeneous Contamination and Initial Radionuclide Concentrations

A contaminated zone is inhomogeneous if it contains a contaminated region within which the concentration of a radionuclide exceeds three times the average for the contaminated zone. RESRAD uses a mathematical construct that assumes uniform distribution of radionuclides within a volume. However, RESRAD recognizes that radiological contamination is inhomogeneous in nature and provides detailed guidance for applying inhomogeneous criteria (hot spot criteria, sum of fractions rule, etc.). The RESRAD User Manual states that the inhomogeneous release criteria are generally more realistic and hence less restrictive than the homogeneous release criteria. This shows that the approved initial radionuclide concentration values (i.e., arithmetic mean plus 95 percent UCL or the maximum radionuclide concentration from the sample dataset) will result in more restrictive release criteria. The arithmetic mean plus the 95 percent UCL are used for the initial concentrations of principal radionuclides when the sample results are obtained using a random sampling method. The maximum radionuclide concentration values are used for the initial concentrations of principal radionuclides when the sample results are obtained using a non-random (e.g., bias or judgmental sampling) sampling method.

RESRAD states that a statistical approach should always be considered as a first priority regarding the estimation of soil concentrations, as cited in the *Data Collection Handbook to Support Modeling Impacts of Radioactive Material in Soil* (Yu et al., 1993). The 95 percent UCL represents a value that has a 5 percent chance that the actual mean of the dataset would exceed it. The 95 percent UCL is computed using the EPA code ProUCL. The code calculates the 95 percent UCL based on the distribution of the dataset (e.g., normal, log-normal, gamma, non-parametric, etc.).

The ProUCL software has been developed to compute an appropriate 95 percent UCL of the unknown population mean to support exposure assessment and cleanup decisions for EPA projects. A 95 percent UCL of the unknown population arithmetic mean is often used to:

- Estimate the EPC term,
- Determine the attainment of cleanup standards,
- Estimate background level mean contaminant concentrations, or
- Compare the soil concentrations with site-specific soil screening levels.

It is important to compute a reliable, conservative, and stable 95 percent UCL of the population mean using the available data. The 95 percent UCL should approximately provide the 95 percent coverage for the unknown population mean.

The EPA has recommended that the maximum value of the dataset be used for the initial EPC term when the 95 percent UCL exceeds the maximum (EPA RAGS Document, 1992). However, if the maximum value of the dataset is used, then most of the statistical data associated with the distribution of the dataset is ignored (except for the maximum). Therefore, by using the mean plus the 95 percent UCL the statistical data associated with the dataset is retained and the value approaches or exceeds the maximum value of the dataset as recommended by EPA.

6.0 Authorized RESRAD Exposure Pathways and Scenarios

This section describes the input parameters, exposures scenarios, and guidance for calculating site-specific radiological remediation levels for projects using the RESRAD computer code, as agreed to by NNSA/NSO, Stoller-Navarro Joint Venture (SNJV), Bechtel Nevada (BN), and NDEP.

6.1 Guidance for RESRAD Calculations

The guidance in this section was developed by NNSA/NSO, SNJV, BN, and NDEP and is only applicable to soils containing residual radioactive material. This guidance does not apply to structures, facilities, equipment, and building materials containing contaminated surfaces or volume contamination. The primary dose limit for any member of the public is 100-mrem total effective dose equivalent (TEDE) in a year. This limit applies to the sum of internal and external doses resulting from all modes of exposure to all radiation sources other than background radiation and doses received as a patient from medical sources as required by DOE 5400.5, II.1.a.(3)(a) (DOE, 1993). The dose constraint is defined as one quarter of the dose limit (i.e., 25-mrem) and will be applied to ensure that in a 1,000-year period the maximally exposed individual does not exceed the dose constraint in any single year. The requirements of Chapter IV of DOE 5400.5 Chapter IV will not specifically apply if NNSA/NSO chooses to continue to own and actively control access or use of the site. However, the radiation protection requirements in the other sections of DOE 5400.5 will apply to NNSA/NSO owned and maintained sites.

Due to the large spatial variability in background amongst sites, the “above background criterion” will be defined as the concentration of a specific radionuclide in soil that equals or exceeds its corresponding PAL. The source data for these radionuclide specific PALs are taken directly from NCRP Report No. 129 Table 2.1, Construction, Commercial, Industrial land-use scenario column for a 25-mrem dose constraint (NCRP, 1999). The generic guidelines for residual concentrations of Radium (Ra)-226, Ra-228, Thorium (Th)-230, and Th-232 are found in Chapter IV of DOE Order 5400.5, Change 2 “*Radiation Protection of the Public and Environment*.”

Background radiation refers to the local area and includes:

- Concentration of naturally occurring radionuclides.
- Cosmic radiation.
- Radionuclides of anthropogenic origin that have been globally dispersed and are present at low concentrations such as fallout from nuclear weapons. (Note: This is not the case at the NTS because the historical aspects of the NTS, e.g., above- and below-ground testing, and other operations resulted in dispersion of radionuclides locally.)

Due to the impracticality of determining “true” background, a dose constraint with no background subtraction will be used (i.e., a dose constraint not in excess of background). The use of the dose constraint with no background subtraction is a far more conservative and sensitive approach because it does not deal with the uncertainty of natural background.

6.2 Description of Approved Scenarios

Based on the future land use as identified in the *Nevada Test Site Resource Management Plan* (DOE/NV, 1998), the following two exposure scenarios have been identified as “actual” and “likely” use scenarios. Stoller-Navarro Joint Venture has approval to use two scenarios (Scenario A and Scenari B) for use with the RESRAD code (NDEP, 2004). Both scenarios consider radiation exposures to the critical population group via the following pathways:

- Direct exposure to external radiation from the contaminated soil.
- Internal dose from inhalation of airborne radionuclides.
- Internal dose from ingestion of contaminated soil.

The two scenarios vary the parameters associated with the future land use of the site but use the same dose constraint of 25 mrem/yr. Scenario A is approved for sites in Mercury or within 500 ft of an active building. Scenario B is approved for all other sites. Scenarios A and B are briefly described below.

For Scenario A, the future land use assumes continued industrial use of the site. This scenario addresses long-term exposure received by industrial workers exposed daily to residual levels of radionuclides in soil during an average workday outdoors on site (EPA, 1991). Scenario A parameters are based on the following:

- A worker will be outdoors at the site for a total of 2,000 hr per year (hr/yr) (250 days per year, 8 hours per day) for a period of 25 years.

- Indoor fraction time is zero, which means that the worker is outside being exposed for the entire workday.

- The outdoor time fraction is 0.228 and is calculated by dividing the total work hours at the site per year (2,000 hr/yr) by the total number of hours in a year (8,760 hr/yr).

- Worker exposures are limited to working hours and do not include contributions from ingestion of drinking water, plant foods, meat, or fish taken from the immediate area.

For Scenario B, the future land use assumes land use restrictions with a low occupancy factor and lighter work activities at the site. The assumptions for Scenario B include the following:

- A worker will be at the site and outdoors for a total of 335 hr/yr for a period of 25 years.

- The indoor fraction time is zero.

- The outdoor time fraction is 0.038, which is calculated by dividing the total work hours at the site per year (335 hr/yr) by the total number of hours in a year (8,760 hr/yr).

- The worker exposures are limited to working hours and do not include contributions from ingestion of drinking water, plant foods, meat or fish taken from the immediate area.

When Scenario B is selected, a Use Restriction will be included at closure that will state the use scenario and the requirement for an occupant agency or entity to re-evaluate the closure if site use changes to fit the parameters of Scenario A.

Table 6-1 lists the pathways considered for Scenarios A and B.

Table 6-1. Summary of Pathways Considered for Scenarios A and B

Pathway	Scenario A	Scenario B
External exposure	Yes	Yes
Particulate inhalation	Yes	Yes
Radon inhalation	No	No
Ingestion of soil	Yes	Yes
Ingestion of produce from on-site garden	No	No
Ingestion of meat from on-site livestock	No	No
Ingestion of milk from on-site livestock	No	No
Ingestion of fish from on-site pond	No	No
Ingestion of water from on-site well	No	No

6.3 RESRAD Parameters

The RESRAD User's Manual states that: "The RESRAD default parameter values were carefully selected and are realistic, although conservative, parameter values. (In most cases, use of these values will not result in underestimation of the dose or risk.) Site-specific parameters should be used whenever possible. Therefore, use of default values that significantly overestimate the dose or risk for a particular site is discouraged" (Yu et al., 2001).

Table 6-2 lists all of the RESRAD default values along with the site-specific RESRAD parameters approved for use with Scenarios A and B. A reference or reason is provided for parameters that require site-specific input.

Table 6-2. Approved RESRAD Parameters

Parameter	Units	Scenario A	Scenario B	Defaults	Reference/Rationale
Dose Conversion Factors					Use FGR 13 Morbidity
R02 Exposure Pathways					
Pathway 1- External Gamma		Active	Active		
Pathway 2- Inhalation		Active	Active		
Pathway 3- Plant Ingestion		Suppressed	Suppressed		
Pathway 4- Meat Ingestion		Suppressed	Suppressed		
Pathway 5- Milk Ingestion		Suppressed	Suppressed		
Pathway 6- Aquatic Foods		Suppressed	Suppressed		
Pathway 7- Drinking Water		Suppressed	Suppressed		
Pathway 8- Soil Ingestion		Active	Active		
Pathway 9- Radon		Suppressed	Suppressed		
R011 Contaminated Zone					
Area of CZ	m^2	Site Specific	Site Specific	1.000E+04	Maximum area of contamination out to two successive sample intervals below PALs. (~ 15 ft intervals laterally)
Thickness of CZ	m	Site Specific	Site Specific	2.000E+00	Maximum identified depth plus two successive intervals below PALs as identified during the site characterization. (~ 5 ft. intervals vertically)
Length Parallel to Aquifer Flow	m	not used	not used	1.000E+02	Not used with the above pathway selection
Radiation Dose Limit	mrem/yr	25	25	2.5E+001	RESRAD Default (DOE, 1993)
Elapsed Time Since Placement of Material	yr	0.0	0.0	0.0	RESRAD Default
R012 Initial Principal Radionuclide					
Site Specific Parent Radionuclide with half-life greater than 180 days, does not include naturally occurring and primordial radionuclides	pCi/g	Site Specific	Site Specific	0.0	The arithmetic mean plus the 95% UCL for the site.
R013 Cover and Contaminated Zone Hydrological Data					
Cover Depth	m	Site Specific	Site Specific	0.0	The minimum depth as identified during the site characterization
Density of Cover Material	g/cm^3	1.5	1.5	1.5	RESRAD Default unless site data significantly different
Cover Depth Erosion Rate	m/yr	1.000E-03	1.000E-03	1.000E-03	RESRAD Default unless site data significantly different

Table 6-2. Approved RESRAD Parameters

Parameter	Units	Scenario A	Scenario B	Defaults	Reference/Rationale
Density of Contaminated Zone	g/cm^3	1.5	1.5	1.5	RESRAD Default unless site data significantly different
Contamination Zone Erosion Rate	m/yr	1.000E-03	1.000E-03	1.000E-03	RESRAD Default unless site data significantly different
Contaminated Zone Total Porosity	-	4.000E-01	4.000E-01	4.000E-01	RESRAD Default unless site data significantly different
Contaminated Zone Field Capacity	-	2.000E-01	2.000E-01	2.000E-01	RESRAD Default unless site data significantly different
Contaminated Zone Hydraulic Conductivity	m/yr	1.000E+01	1.000E+01	1.000E+01	RESRAD Default unless site data significantly different
Contaminated Zone b Parameter	-	5.300E+00	5.300E+00	5.300E+00	RESRAD Default unless site data significantly different
Average Annual Wind Speed	m/sec	Site Specific	Site Specific	2.000E+00	Data from Air Resources Laboratory http://www.sord.nv.doe.gov/arlsord-1.htm
Humidity in Air	g/m^3	not used	not used	8.000E+00	Not used with the above pathway selection
Evapotranspiration Coefficient	-	5.000E-01	5.000E-01	5.000E-01	RESRAD Default not significant due to lack of groundwater pathway
Precipitation	m/yr	Site Specific	Site Specific	1.000E+00	Data from Air Resources Laboratory http://www.sord.nv.doe.gov/arlsord-1.htm
Irrigation	m/yr	0	0	2.000E-01	Assumes no artificial supply of water to soil
Irrigation Mode	-	overhead	overhead	overhead	RESRAD Default
Runoff Coefficient	-	4.000E-01	4.000E-01	2.000E-01	Open Sandy Loam 30% impervious Table 10.1 (Yu, et. al., 1993)
Watershed Area for Nearby Stream or Pond	m^2	not used	not used	1.000E+06	Not used with the above pathway selection
Accuracy for Water/Soil Computations	-	not used	not used	1.000E-03	Not used with the above pathway selection
R014 Saturated Zone Hydrological Data					
Density of Saturated Zone	g/cm^3	not used	not used	1.500E+00	Not used with the above pathway selection
Saturated Zone Total Porosity	-	not used	not used	4.000E-01	Not used with the above pathway selection
Saturated Zone Effective Porosity	-	not used	not used	2.000E-01	Not used with the above pathway selection
Saturated Zone Field Capacity	-	not used	not used	2.000E-01	Not used with the above pathway selection

Table 6-2. Approved RESRAD Parameters

Parameter	Units	Scenario A	Scenario B	Defaults	Reference/Rationale
Saturated Zone Hydraulic Conductivity	m/yr	not used	not used	1.000E+02	Not used with the above pathway selection
Saturated Zone Hydraulic Gradient	-	not used	not used	2.000E-02	Not used with the above pathway selection
Saturated Zone b Parameter	-	not used	not used	5.300E+00	Not used with the above pathway selection
Water Table Drop Rate	m/yr	not used	not used	1.000E-03	Not used with the above pathway selection
Well Pump Intake Depth	m	not used	not used	1.000E+01	Not used with the above pathway selection
Model: Nondispersion or Mass-Balance	-	ND	ND	ND	RESRAD Default
Well Pumping Rate	m^3/yr	not used	not used	2.500E+02	Not used with the above pathway selection
R015 Uncontaminated and Unsaturated Strata Hydrological Data					
Number of Unsaturated Zone Strata	-	not used	not used	1	Not used with the above pathway selection
Thickness	m	not used	not used	4.000E+00	Not used with the above pathway selection
Soil Density	g/cm^3	not used	not used	1.500E+00	Not used with the above pathway selection
Total Porosity	-	not used	not used	4.000E-01	Not used with the above pathway selection
Effective Porosity	-	not used	not used	2.000E-01	Not used with the above pathway selection
Field Capacity	-	not used	not used	2.000E-01	Not used with the above pathway selection
Soil-specific b Parameter	-	not used	not used	5.300E+00	Not used with the above pathway selection
Hydraulic Conductivity	m/yr	not used	not used	1.000E+01	Not used with the above pathway selection
R016 Distribution Coefficients and Leach Rates					
Contaminated Zone K_d (all Zones)	cm^3/g				RESRAD Defaults
Saturated Leach Rate	/yr	0.0	0.0	0.0	Not used
Solubility Constant	-	0.0	0.0	0.0	Not used
R017 Inhalation and External Gamma					
Inhalation Rate	m^3/yr	8.400E+03	1.230E+04	8.400E+03	RESRAD Default and for an individual performing outdoor activities, a typical activity mix can consist of 37% at a moderate activity level, 28% at both resting and light activity levels, and 7% at a heavy activity level, which results in a 1.4 m3/h (12,300 m3/yr) inhalation rate. (Yu, et. al., 1993)
Mass Loading for Inhalation	g/m^3	6.00E-04	6.00E-04	1E-04	The estimated mass loading for construction activities. (Yu, et. al., 1993)

Table 6-2. Approved RESRAD Parameters

Parameter	Units	Scenario A	Scenario B	Defaults	Reference/Rationale
Exposure Duration	yr	25	25	30	Standard for Industrial/Commercial Scenario
Shielding Factor Inhalation	-	1	1	0.4	Assumes no indoor time fraction.
Shielding Factor External Gamma	-	1	1	0.7	Assumes no indoor time fraction.
Fraction of Time Spent Indoors	-	0.0	0.0	0.5	Assumes no indoor time fraction.
Fraction of Time Spent Outdoors	-	0.228	0.038	0.25	Based on Industrial/Commercial use scenarios for standard occupancy and low occupancy.
Shape Factor	-	1.0	1.0	1.0	RESRAD Default
R018 Ingestion Pathway Data, Dietary Parameters					
Fruits, Vegetables, and Grain Consumption	kg/yr	not used	not used	1.600E+02	Not used with the above pathway selection
Leafy Vegetable Consumption	kg/yr	not used	not used	1.400E+01	Not used with the above pathway selection
Milk Consumption	L/yr	not used	not used	9.200E+01	Not used with the above pathway selection
Meat and Poultry Consumption	kg/yr	not used	not used	6.300E+01	Not used with the above pathway selection
Fish Consumption	kg/yr	not used	not used	5.400E+00	Not used with the above pathway selection
Other Seafood Consumption	kg/yr	not used	not used	9.000E-01	Not used with the above pathway selection
Soil Ingestion Rate	g/yr	1.752E+02	1.752E+02	36.5	480 mg/day (EPA, 1991)
Drinking Water Intake	L/yr	not used	not used	5.100E+02	Not used with the above pathway selection
Drinking Water Contaminated Fraction	-	not used	not used	1.000E+00	Not used with the above pathway selection
Household Water Contaminated Fraction	-	not used	not used	1.000E+00	Not used with the above pathway selection
Livestock Water Contaminated Fraction	-	not used	not used	1.000E+00	Not used with the above pathway selection
Irrigation Water Contaminated Fraction	-	not used	not used	1.000E+00	Not used with the above pathway selection
Aquatic Food Contamination Fraction	-	not used	not used	5.000E-01	Not used with the above pathway selection
Plant Food Contamination Fraction	-	not used	not used	-1	Not used with the above pathway selection
Meat Contamination Fraction	-	not used	not used	-1	Not used with the above pathway selection
Milk Contamination Fraction	-	not used	not used	-1	Not used with the above pathway selection
R019 Ingestion Pathway Data, Nondietary					
Livestock Fodder Intake for Meat	kg/day	not used	not used	6.800E+01	Not used with the above pathway selection
Livestock Water Intake for Milk	L/day	not used	not used	1.600E+02	Not used with the above pathway selection

Table 6-2. Approved RESRAD Parameters

Parameter	Units	Scenario A	Scenario B	Defaults	Reference/Rationale
Livestock Soil Intake	kg/day	not used	not used	5.000E-01	Not used with the above pathway selection
Mass Loading for Foliar Deposition	g/m^3	not used	not used	1.000E-04	Not used with the above pathway selection
Depth of Soil Mixing layer	m	not used	not used	1.500E-01	Not used with the above pathway selection
Depth of Roots	m	not used	not used	9.000E-01	Not used with the above pathway selection
Drinking Water Fraction from Groundwater	-	not used	not used	1.000E+00	Not used with the above pathway selection
Household Water Fraction from Groundwater	-	not used	not used	1.000E+00	Not used with the above pathway selection
Livestock Water Fraction from Groundwater	-	not used	not used	1.000E+00	Not used with the above pathway selection
Irrigation Fraction from Groundwater	-	not used	not used	1.000E+00	Not used with the above pathway selection
R021 Radon					
Radon Parameters Not Used					Not used with the above pathway selection

6.4 Residual Radioactive Material Guidelines

The residual radioactive material guideline represents the concentration of residual radioactive material that can remain in place and still allow use of that area without radiological restrictions. Using site-specific parameters and sample analysis results, the radioactive material guideline, G, can be calculated for a given dose limit of H_{EL} for an individual as follows;

$$G = H_{EL} / DSR$$

Where: DSR = the total dose/source concentration ratio.

. H_{EL}, = the dose limit; 25 mrem/yr for this report

Single radionuclide guidelines are calculated for individual radionuclides such that the annual dose to industrial/construction workers at the site should not exceed an annual dose limitation of 25 mrem/yr. Sites contaminated with two or more radionuclides (i.e., a mixture of radionuclides) require further evaluation to ensure that collective exposures from individual radionuclides do not exceed the 25 mrem/yr annual dose constraint. This evaluation is performed using a sum of the fractions method. The initial soil concentration of each radionuclide is divided by the single radionuclide guideline for that radionuclide to produce a ratio. These ratios are then summed. If the sum is less than or equal to unity, then the collective annual dose from all radionuclides at the site should not exceed the 25 mrem/yr annual dose constraint. If the sum does exceed unity, the annual dose to industrial/construction workers could exceed the 25 mrem/yr dose constraint, even if the concentrations of residual radionuclides at the site are below the single radionuclide guideline values. For sites where the sum of the ratios exceeds unity, residual radioactive material guidelines for mixtures of radionuclides are calculated such that the following equation is satisfied;

$$\overline{M} = \sum_{i} \overline{S}_i(0) / G_i(t_m) \leq 1$$

Where: $\overline{M}$ = average mixture sum (dimensionless)

$\overline{S}_i(0)$ = initial concentration of the ith principal radionuclide averaged over an area determined by scenario activities

$G_i(t_m)$ = single radionuclide soil concentration guideline for the ith principal radionuclide at time t maximum

For a site where the sum of the ratios does not exceed unity, the residual radioactive guidelines for single radionuclides are the radionuclide concentrations to be used as the FAL. For sites where the sum of the ratios exceeds unity, the residual radioactive guidelines for mixtures of radionuclides are mathematically adjusted so that the above equation is satisfied. Those adjusted values are then used as the FAL.

7.0 RESRAD Calculations for CAS 15-06-02, U15a Muckpile

This section discusses the RESRAD calculations and results for CAS 15-06-02, U15a Muckpile.

7.1 Selection of RESRAD Exposure Scenario

Scenario B was selected as the exposure scenario for the CAS 15-06-02 because of the remote location of the site. Because Scenario B parameters will be used for these calculations, a Use Restriction will be implemented at closure that will state the use scenario and the requirement for an occupant agency or entity to re-evaluate the closure if site use changes to fit the parameters of Scenario A.

7.2 User Input Parameters

The RESRAD default parameters that were modified for the calculations performed for CAU 482 in this report and the site-specific values entered are presented in Table 7-1, RESRAD Parameter Input Values for CAU 482. A complete list of the RESRAD default parameters and the parameters used for CAU 482 is provided in Table A.1 of Attachment A.

7.3 Radionuclide Concentrations and Dose Estimates

The maximum dose results from RESRAD calculations for the Muckpile is 45.43 mrem/yr and exceeds the 25 mrem/yr dose constraint. The detailed RESRAD results for this CAS are provided in Exhibit 1, RESRAD Summary Report: CAU 482 CAS 15-06-02, U15a Muckpile.

Uncertainty in the derivation of dose estimates and dose/source contribution ratios comes from the distribution of possible input parameter values, as well as uncertainty in the conceptual model used to represent the site. The pathway contributions to the total annual dose at time zero are almost all (99.75 percent) for external exposure, 0.15 percent for inhalation, and 0.10 percent for soil ingestion pathways. Therefore, uncertainties in the following parameters: erosion rates, thickness of contaminated zone, occupancy factors, and wind speed have the greatest significance on the model predictions.

The maximum dose contributions and total dose/source concentration ratios for the muckpile under Scenario B parameters have been predicted to occur at time zero. The calculated maximum dose contributions for all considered pathways are presented in Table 7-3, Maximum Dose Contributions for CAS 15-06-02 Using Scenario B. Figure 7-1. CAU 482 CAS 15-06-02 Scenario B: Dose Rate Per Year All Radionuclides Summed, All Pathways Summed, shows that at time zero, the TEDE to industrial/construction workers for the considered pathways is 45.443 mrem/yr which is above the 25 mrem/yr dose constraint.

Figure 7-2. CAU 482 CAS 15-06-02 Scenario B: Annual Dose All Radionuclides Summed, Component Pathways, shows the breakdown of the total dose into the component pathways. Together, Table 7-2 and Figures 1 and 2 show that the dose from Cs-137 at time zero is 45.24 mrem/year and drops to zero after the 300-year time interval. The result also shows that the annual dose (almost all from external radiation contributed from Cs-137) is decreased to below 25 mrem within 25 years.

Because Cs-137 has a half-life of 30 years, the concentration of Cs-137 at this site will not decay to a level below the 25 mrem/yr constraint in the first 25 years. Site remediation and/or controls that reduce workers exposures and minimize the spread of radioactive contamination into uncontaminated areas are recommended for this site.

7.4 Residual Radioactive Material Guidelines for CAS 15-06-02

The sum of the ratios for CAS 15-06-02 exceeded unity. Residual radioactive guidelines for mixtures of radionuclides were calculated for this CAS. Table 7-4 presents the calculation results for deriving guidelines for mixtures radionuclides for this CAS. The residual radioactive material guidelines for single radionuclides and mixture radionuclides are listed in Table 7-4, Residual Radioactive Material Guidelines for Single Radionuclides and Radionuclide Mixtures. The FALs for the CAS 15-06-02 scenario are the residual radioactive material guideline values for mixture radionuclides (Table 7-5).

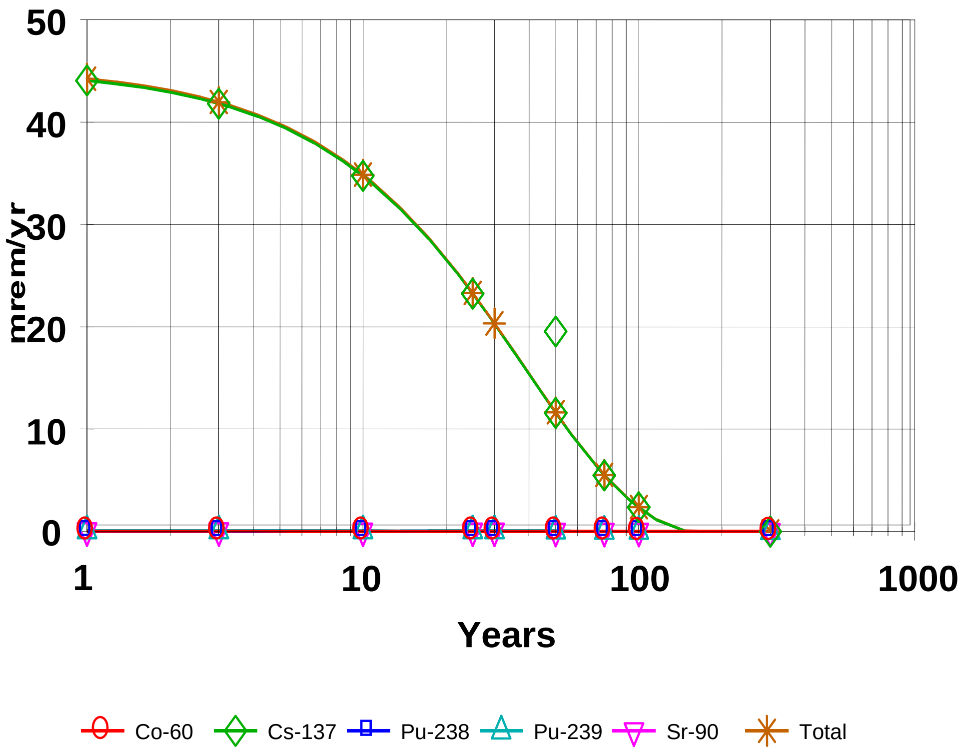

Figure 7-1.
CAU 482 CAS 15-06-02 15a Muckpile, Scenario B: Dose Rate Per Year, All Radionuclides Summed, All Pathways Summed

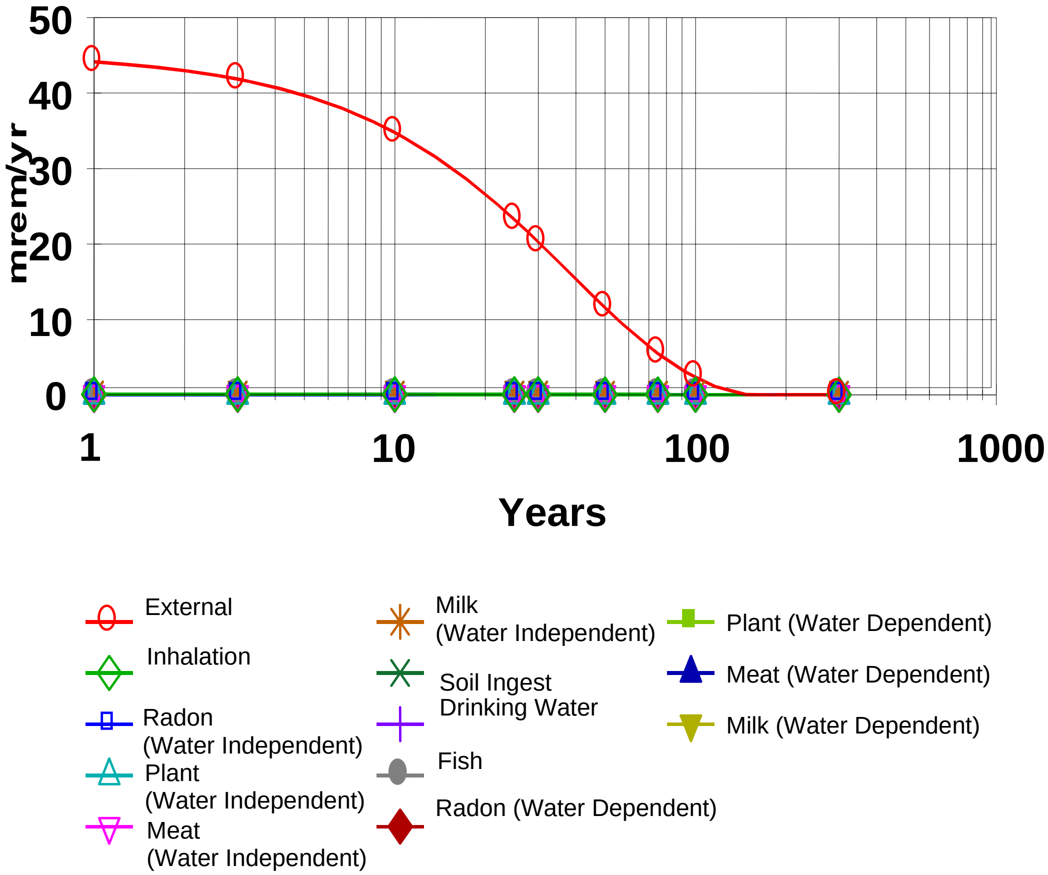

Figure 7-2.
CAU 482 CAS 15-06-02, 15a Muckpile, Scenario B: Annual Dose, All Radionuclides Summed, Component Pathways

Table 7-1.
RESRAD Parameters Input Values for CAU 482
(Page 1 of 2)

Parameter	Units	CAS 15-06-02	CAS 15-38-01	Drainage	Defaults	Reference/Rationale
R011 Contaminated Zone						
Area of CZ	m^2	1.000E+02	1.000E+02	1.000E+02	1.000E+04	Estimated using the site boundary
Thickness of CZ	m	1.500E-01	1.500E-01	1.500E-01	2.000E+00	Top layer of the contamination soil
R012 Initial Principal Radionuclide						
Principal radionuclides	pCi/g	See Table 7.2	See Table 7.2	See Table 7.2	0.0	Initial concentrations are the maximum concentrations from sample results: maximum for biased sample or average for random sample.
R013 Cover and Contaminated Zone Hydrological Data						
Average Annual Wind Speed	m/sec	3.77	3.77	3.77	2.000E+00	Data from Air Resource Laboratory (2005)
Precipitation	m/yr	2.20E-01	2.20E-01	2.20E-01	1.000E+00	Data from Air Resources Laboratory
Runoff Coefficient	-	4.000E-01	4.000E-01	4.000E-01	2.000E-01	Open Sandy Loam 30% impervious Table 10.1 (Yu, et al., 1993)
R017 Inhalation and External Gamma						
Inhalation Rate	m^3/yr	1.230E+04	1.230E+04	1.230E+04	8.400E+03	RESRAD Default and for an individual performing outdoor activities, a typical activity mix can consist of 37% at a moderate activity level, 28% at both resting and light activity levels, and 7% at a heavy activity level, which results in a 1.4 m^3/h (12,300 m^3/yr) inhalation rate. (Yu, et al., 1993)

Table 7-1.
RESRAD Parameters Input Values for CAU 482
(Page 2 of 2)

Parameter	Units	CAS 15-06-02	CAS 15-38-01	Drainage	Defaults	Reference/Rationale
Mass Loading for Inhalation	g/m^3	6.00E-04	6.00E-04	6.00E-04	1E-04	The estimated mass loading for construction activities. (Yu, et al., 1993)
Exposure Duration	yr	25	25	25	30	Standard for Industrial/Commercial Scenario
Shielding Factor Inhalation	-	1.0	1.0	1.0	0.4	Assumes no indoor time fraction
Shielding Factor External Gamma	-	1.0	1.0	1.0	0.7	Assumes no indoor time fraction
Fraction of Time Spent Indoors	-	0.0	0.0	0.0	0.5	Assumes no indoor time fraction
Fraction of Time Spent Outdoors	-	0.038	0.038	0.038	0.25	Scenario specific based on Industrial/ Commercial Use Scenarios for standard occupancy and low occupancy.
Soil Ingestion Rate	g/yr	1.752E+02	1.752E+02	1.752E+02	36.5	EPA, 1991; 480 mg/day

cm^3/g = Cubic centimeters per gram
g/cm^3 = Grams per cubic centimeter
g/m^3 = Grams per cubic meter
g/yr = Grams per year
kg/day = Kilograms per day
kg/yr = Kilograms per year
L/day = Liters per day
L/yr = Liters per year
m = Meter
m^2 = Square meter
m^2 = Square meter

m/sec = Meters per second
m/yr = Meters per year
m^3/h = Cubic meters per hour
m^3/yr = Cubic meters per year
mrem/yr = Millirem per year
N/A = Not applicable
pCi/g = Picocuries per gram
yr = Year
/yr = Per year
UCL = Upper confidence level

Table 7-2.
Principal Radionuclide Concentrations Used for CAU 482 REARAD Calculations (pCi/g) and Sampling Depth (ft)

	CAS 15-06-02	Drainage	CAS 15-38-01
Americium-241	NA	3.1 (0 – 1 ft)	182 (0 – 0.5 ft)
Cesium-137	498 (0 – 1 ft)	472 (0 – 1 ft)	830 (0 – 0.5 ft)
Cobalt-60	0.123 (0 – 1 ft)	0.323 (0 – 1 ft)	NA
Strontium-90	66 (0 – 1 ft)	43.8 (0 – 1 ft)	65 (0 – 0.3 ft)
Plutonium-238	1.28 (0 – 1 ft)	3.96 (0 – 1 ft)	18.3 (0 – 0.5 ft)
Plutonium-239	7.7 (0 – 1 ft)	23.3 (0 – 1 ft)	1000 (0 – 0.5 ft)

Table 7-3.
Maximum Dose Contributions for CAS 15-06-02 Using Scenario B (occurs at year zero) (mrem/yr)

Radionuclide	Ground		Inhalation		Soil		Total	
	Annual Dose	Fraction	Annual Dose	Fraction	Annual Dose	Fraction	Annual Dose	Fraction
Cesium-137	45.22	1.00	0.00	0.00	0.02	0.00	45.24	1.00
Cobalt-60	0.05	0.00	0.00	0.00	0.00	0.00	0.05	0.00
Plutonium-238	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00
Plutonium-239	0.00	0.00	0.07	0.00	0.02	0.00	0.09	0.00
Strontium-90	0.05	0.00	0.00	0.00	0.00	0.00	0.05	0.00
Total	45.32	1.00	0.01	0.00		0.00		1.00

Table 7-4.
CAU 482 CAS 15-06-02 Sum of Fractions and Proportional Scaling

Radionuclide	Initial Radionuclide Concentration (pCi/g)	Contribution %	Single Radionuclide Guidelines (pCi/g)	Ratio for Single Radionuclide Guideline	Mixture Radionuclides Guidelines	Ratio for Mixture Radionuclide Guidelines
Cesium-137	498	86.90	275.20	1.81	273.99	1.00
Cobalt-60	0.123	0.02	65.36	0.00	0.07	0.00
Plutonium-238	1.28	0.22	2370	0.00	0.70	0.00
Plutonium-239	7.7	1.34	2152	0.00	4.24	0.00
Strontium-90	66	11.52	30760	0.00	36.31	0.00
Total	573.10			1.82		1.00

Table 7-5.
Residual Radioactive Material Guidelines for Radionuclide Mixtures*

Radionuclides	CAS 15-06-02 15a Muckpile	CAS 15-38-01 Area 15 U15a/e Ponds	Drainage Below 15a Muckpile
Amercium-241	NA	51.88	1.79
Cesium-137	273.99	236.58	272.27
Cobalt-60	0.07	NA	0.19
Plutonium-238	0.70	5.22	2.28
Plutonium-239	4.24	285.03	13.44
Strontium-90	36.31	18.53	25.27

* The mixture radionuclide guidelines apply to areas uniformly contaminated with a mixture of radionuclides. The FALs for the areas of concern are the radionuclide guidelines for mixture radionuclide.

8.0 RESRAD Calculations for CAS 15-38-01, Area 15 U15a/e Ponds

This section discusses the RESRAD calculations and results for CAS 15-38-01, Area 15 U15a/e Ponds.

8.1 Selection of RESRAD Exposure Scenario

Scenario B was selected as the exposure scenario for the CAS 15-38-01 because of its remote location. Because Scenario B parameters will be used for these calculations, a Use Restriction will be implemented at closure that will state the use scenario and the requirement for an occupant agency or entity to re-evaluate the closure if site use changes to fit the parameters of Scenario A.

8.2 User Input Parameters

The RESRAD default parameters that were altered for the calculations in this report and the site-specific values entered are presented in Table 7-1, RESRAD Parameters Input Values for CAU 482. A complete list of the RESRAD default parameters and the parameters used for CAU 482 is provided in Table A.1 of Attachment A.

8.3 Radionuclide Concentrations and Dose Estimates for CAS 15-38-01

The maximum dose results from RESRAD calculations for CAS 15-38-01 occur at year zero at the level of 87.71 mrem/yr which exceeds the 25 mrem/yr dose constraint. The detailed RESRAD results are provided in Exhibit 2, RESRAD Summary Report: CAU 482 CAS 15-38-01, Area 15 U15a/e Ponds.

Uncertainty in the derivation of dose estimates and dose/source contribution ratios comes from the distribution of possible input parameter values, as well as uncertainty in the conceptual model used to represent the site. The pathway contributions to the total annual dose at time zero are 86.28 percent for external exposure, 10.46 percent for inhalation, and 3.26 percent for soil ingestion pathways. Therefore, uncertainties in the following parameters: erosion rates, thickness of contaminated zone, occupancy factors, and wind speed have the greatest significance on the model predictions. The RESRAD results for this CAS do not include the effects of soil migration (contaminated or clean) into the site from the adjacent land areas.

The maximum dose contributions and total dose/source concentration ratios for CAS 15-38-01 under Scenario B parameters have been predicted to occur at time zero. The calculated maximum dose contributions for all considered pathways are presented in Table 8-1, Maximum Dose Contributions for CAS 15-38-01 Using Scenario B. and Figure 8-1. CAU 482 CAS 15-38-01 Scenario B: Dose Rate Per Year All Radionuclides Summed, All Pathways Summed, shows that at time zero, the TEDE to industrial/construction workers for the considered pathways is 87.71 mrem/yr, which is higher than the 25 mrem/yr dose constraint.

Figure 8-2. CAU 482 CAS 15-38-01 Scenario B: Annual Dose All Radionuclides Summed, Component Pathways, shows the breakdown of the total dose into the component pathways.

Together, Table 8-1 and Figures 8-1 and 8-2 show that at time zero, the annual dose from Pu-239 is 9.98 mrem/yr (11.38 percent of the total dose), and Cs-137 is 75.40 mrem/yr (86.97 percent of the total dose).

This result also shows that the annual dose at time zero for external radiation is 75.68 mrem/year, for inhalation 9.17 mrem/yr, and for ingestion of soil 2.86 mrem/yr. The calculated annual dose to industrial/construction workers for CAS 15-38-01 will fall below 25 mrem by year 60 and to zero within 300 years.

Because Cs-137 has a half-life of 30 years and Pu-239 2.4E+4 years, the dose at this location will not decrease to a level below 25 mrem/yr in the first 60 years. Site remediation and/or control that reduce worker's exposures and minimize the spread of radioactive contamination into uncontaminated areas are recommended for this location.

8.4 Residual Radioactive Material Guidelines for CAS 15-38-01

The sum of the ratios for CAS 15-38-01 exceeded unity. Table 8-2 presents the calculation results for deriving guidelines for radionuclides for this CAS. The residual radioactive material guidelines for single radionuclides are listed in Table 7-5, Residual Radioactive Material Guidelines for Single Radionuclides and Radionuclide Mixtures. The FALs for the CAS 15-38-01 scenario are the residual radioactive material guideline values for mixture radionuclides.

Table 8-1.
Maximum Dose Contributions for CAS 15-38-01 Using Scenario B (occurs at year zero) (mrem/yr)

Radionuclide	Ground		Inhalation		Soil		Total	
	Annual Dose	Fraction	Annual Dose	Fraction	Annual Dose	Fraction	Annual Dose	Fraction
Americium-241	0.25	0.00	1.42	0.02	0.44	0.01	2.11	0.02
Cesium-137	75.38	0.86	0.00	0.00	0.03	0.00	75.40	0.86
Plutonium-238	0.00	0.00	0.13	0.00	0.04	0.00	0.17	0.00
Plutonium-239	0.00	0.00	7.62	0.09	2.35	0.03	9.98	0.11
Strontium-90	0.04	0.00	0.11	0.00	0.00	0.00	0.01	0.00
Total	75.68	0.86	9.17	0.10	2.86	0.03	87.87	1.00

Table 8-2.
CAU 482 CAS 15-38-01 Sum of Fractions and Proportional Scaling

Radionuclide	Initial Radionuclide Concentration (pCi/g)	Contribution %	Single Radionuclide Guidelines (pCi/g)	Ratio for Single Radionuclide Guideline	Mixture Radionuclides Guidelines	Ratio for Mixture Radionuclide Guidelines
Americium-241	182	8.69	2157	0.08	51.88	0.02
Cesium-137	830	39.61	375.20	2.21	236.58	0.63
Plutonium-238	18.3	0.87	2761	0.01	5.22	0.00
Plutonium-239	1000	47.73	2506	0.40	285.03	0.11
Strontium-90	65	3.10	30870	0.00	18.53	0.00
Total	2095.3		33027	2.70	303.56	0.11

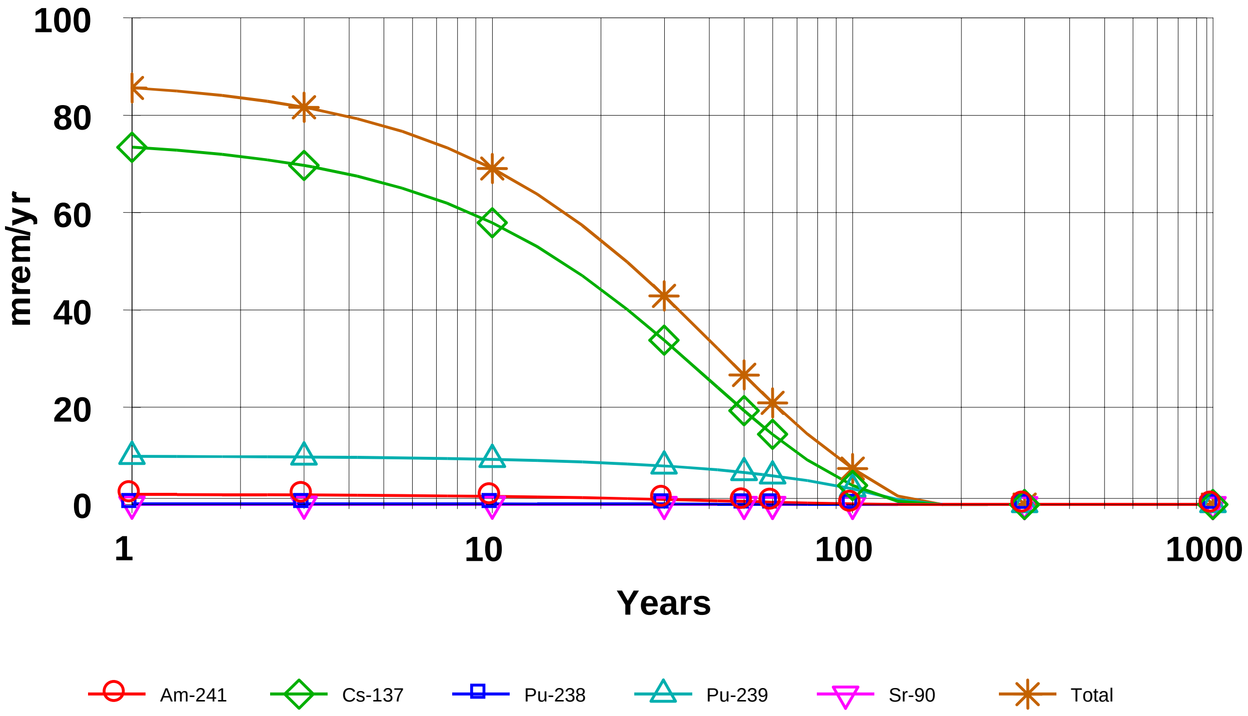

Figure 8-1.
CAU 482 CAS 15-38-01 Area 15 U15a/e Ponds, Scenario B: Dose Rate Per Year, All Radionuclides Summed, All Pathways Summed

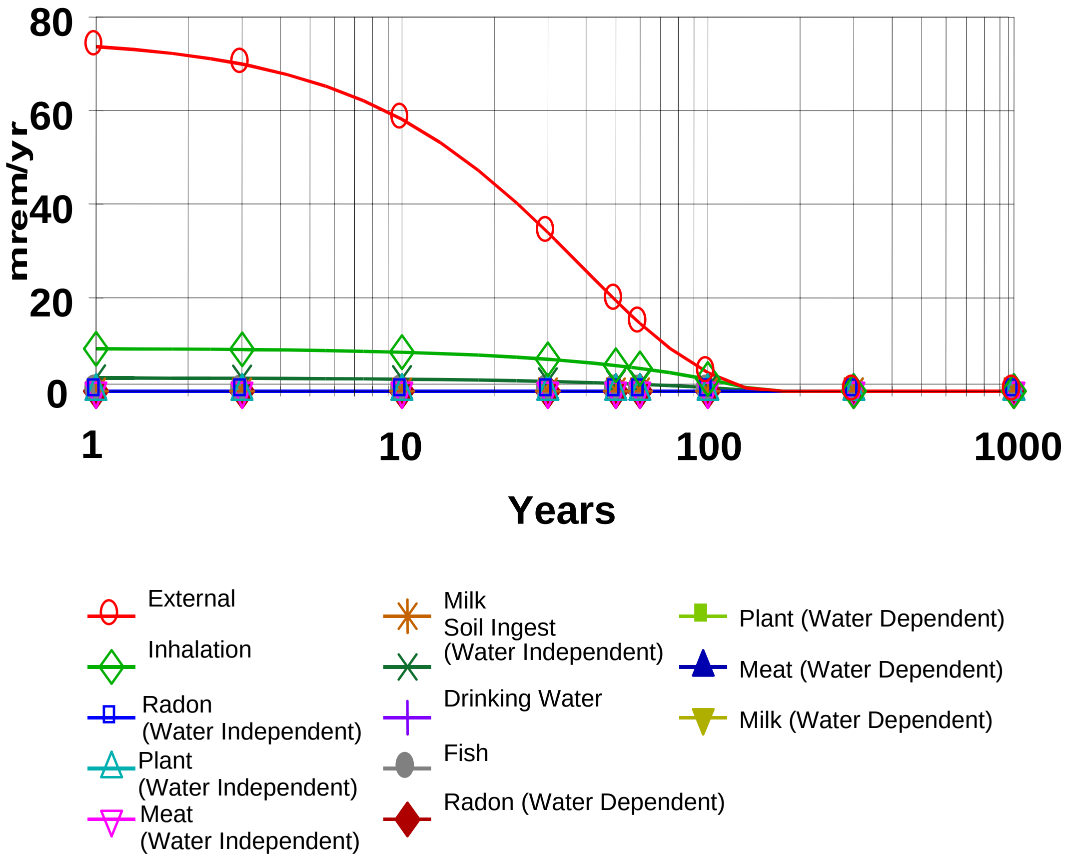

Figure 8-2.
CAU 482 CAS 15-38-01 Area 15 U15a/e Ponds, Scenario B: Annual Dose, All Radionuclides Summed, Component Pathways

9.0 RESRAD Calculations for CAU 482 Drainage Channel

This section discuses the RESRAD calculations and results for the CAU 482 drainage channel.

9.1 Selection of RESRAD Exposure Scenario

Scenario B was selected as the exposure scenario for the CAU 482 drainage channel because of the remote location of the site. Because Scenario B parameters will be used for these calculations, a Use Restriction will be implemented at closure that will state the use scenario and the requirement for an occupant agency or entity to re-evaluate the closure if site use changes to fit the parameters of Scenario A.

9.2 User Input Parameters

The RESRAD default parameters that were altered for the calculations in this report and the site-specific values entered are presented in Table 7-1 RESRAD Parameters Input Values for CAU 482. A complete list of the RESRAD default parameters and the parameters used for CAU 482 is provided in Table A.1 of Attachment A.

9.3 Radionuclide Concentrations and Dose Estimates for CAU 482 Drainage Channel

The RESRAD results for this location are only slightly different from the results for CAU 482 CAS 15-06-02. The calculated maximum dose of 43.34 mrem/yr occurs at year zero.

Uncertainty in the derivation of dose estimates and dose/source contribution ratios comes from the distribution of possible input parameter values, as well as uncertainty in the conceptual model used to represent the site. The pathway contributions to the total annual dose at time zero are 99.26 percent for external exposure, 0.53 percent for inhalation, and 0.21 percent for soil ingestion pathways. Therefore, uncertainties in the following parameters: erosion rates, thickness of contaminated zone, occupancy factors, and wind speed have the greatest significance on the model predictions. This site is located down slope from the CAS 15-06-02 Muckpile area. However, the migration of radionuclides from muckpile material into this CAS is not considered in the calculations. The detailed results for this RESRAD exposure scenario are provided in Exhibit 3, RESRAD Summary Report: CAU 482 Drainage Channel.

The maximum dose contributions and total dose/source concentration ratios for the Drainage Channel using Scenario B parameters have been predicted to occur at time zero. The calculated maximum dose contributions for all considered pathways are presented in Table 9-1, Maximum Dose Contributions for CAU 482 Drainage Channel Using Scenario B and Figure 9-1. The CAU 482 Drainage Channel Scenario B: Dose Rate Per Year All Radionuclides Summed, All Pathways Summed, shows that at time zero, the TEDE to industrial/construction workers for the considered pathways is 43.34 mrem/yr and that the annual dose rate drops to zero at the 300-year interval.

Figure 9-2. CAU 482 Drainage Channel Scenario B: Annual Dose All Radionuclides Nuclides Summed, Component Pathways shows the breakdown of the total does into the component pathways. Together, Table 9-1 and Figures 9-1 and 9-2 show that the dose from Cs-137 at time zero is 42.88 mrem/year and only drops to zero after the 300-year time interval. This result also shows that the annual dose from external radiation (almost all from Cs-137) at time zero is 42.86 mrem/year and is reduced to zero mrem/yr within 300 years.

The calculated dose for this location will decrease to a level below 25 mrem/yr by year 25. As a best management practice, site remediation or controls that reduce worker exposures and minimize the spread of radioactive contamination into uncontaminated areas is recommended for this site.

9.4 Residual Radioactive Material Guidelines for CAU 482 Drainage Channel

The sum of the ratios for Drainage Channel exceeded unity. Table 9-2 presents the calculation results for deriving guidelines for radionuclides for this CAS. The residual radioactive material guidelines for single radionuclides are listed in Table 7-5, Residual Radioactive Material Guidelines for Single Radionuclides and Radionuclide Mixtures. The FALs for the Drainage Channel scenario are the residual radioactive material guideline values for mixture radionuclides.

Table 9-1.
Maximum Dose Contributions for CAU 482 Drainage Channel Using Scenario B (occurs at year zero) (mrem/yr)

Radionuclide	Ground		Inhalation		Soil		Total	
	Annual Dose	Fraction	Annual Dose	Fraction	Annual Dose	Fraction	Annual Dose	Fraction
Americium-241	0.00	0.00	0.02	0.00	0.01	0.00	0.04	0.00
Cobalt-60	0.12	0.00	0.00	0.00	0.00	0.00	0.12	0.00
Cesium-137	42.86	0.99	0.00	0.00	0.02	0.00	42.88	0.99
Plutonium-238	0.00	0.00	0.03	0.00	0.01	0.00	0.04	0.00
Plutonium-239	0.00	0.00	0.18	0.00	0.05	0.00	0.23	0.01
Strontium-90	0.03	0.00	0.00	0.00	0.00	0.00	0.04	0.00
Total	43.02	0.99	0.23	0.00	0.09	0.00	43.34	1.00

Table 9-2.
CAU 482 Drainage Sum of Fractions and Proportional Scaling

Radionuclide	Initial Radionuclide Concentration (pCi/g)	Contribution %	Single Radionuclide Guidelines (pCi/g)	Ratio for Single Radionuclide Guideline	Mixture Radionuclides Guidelines	Ratio for Mixture Radionuclide Guidelines
Americium-241	3.1	0.57	2157	0.00	1.79	0.00
Cesium-137	472	86.37	275.20	1.72	272.27	0.99
Cobalt-60	0.323	0.06	65.36	0.00	0.19	0.00
Plutonium-238	3.96	0.72	2761	0.00	2.28	0.00
Plutonium-239	23.3	4.26	2506	0.01	13.44	0.01
Strontium-90	43.8	8.01	30870	0.00	25.27	0.00
Total	546.48			1.73		1.00

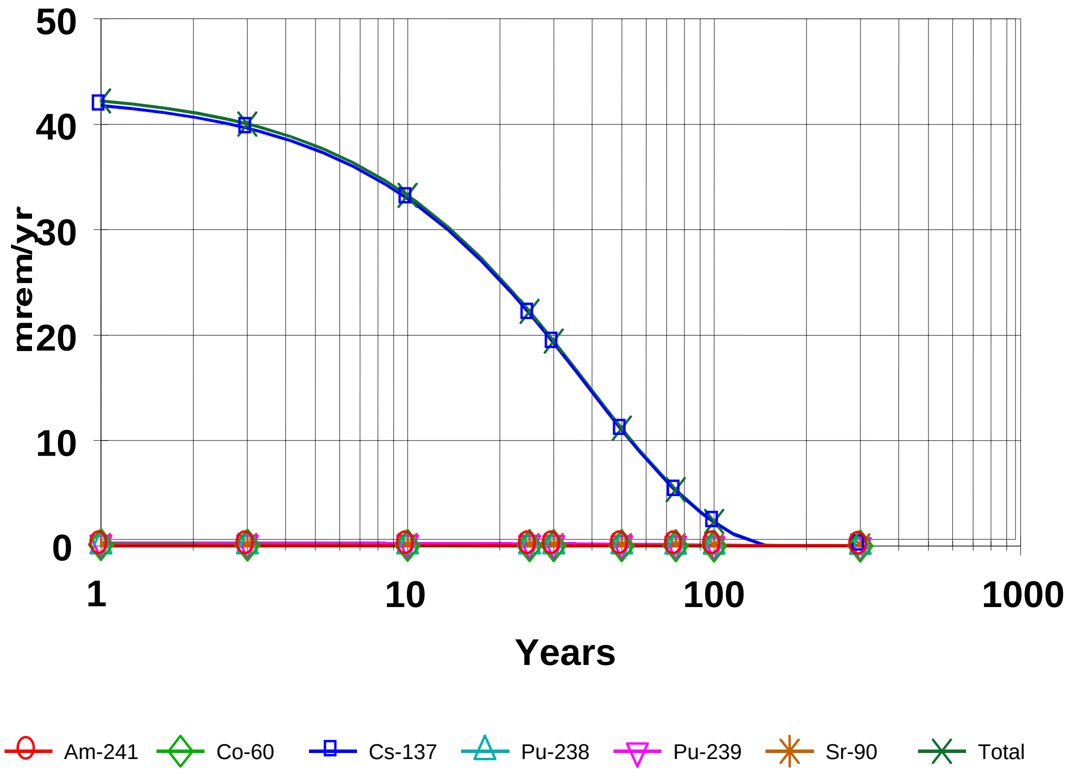

Figure 9-1.
CAU 482 Drainage Channel Scenario B: Dose Rate Per Year
All Radionuclides Summed, All Pathways Summed

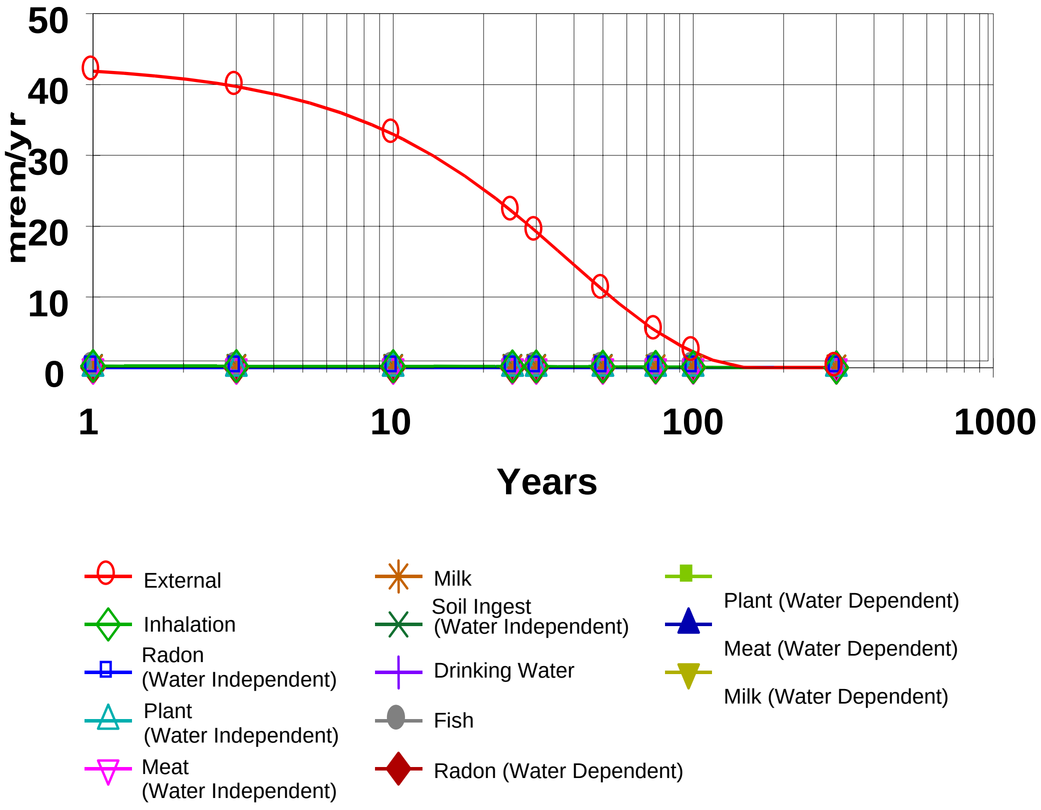

Figure 9-2.
CAU 482 Drainage Channel Scenario B: Annual Dose
All Radionuclides Nuclides Summed

References:

AEC, see Atomic Energy Commission.

ARL, see Air Resources Laboratory.

Air Resources Laboratory. 2005. "Climatological Information and Data." As accessed at http://www.sord.nv.doe.gov.

Atomic Energy Commission. 1958. "Press Release, Subject: 2,000 Pounds of Conventional High Explosives will be Detonated Within the Next Few Days in a Chamber Leading Off the Tunnel in Which the Rainier Deep Underground Event," NTA Accession Number NV0323213. Las Vegas, NV: Nuclear Testing Archive.

CFR, see *Code of Federal Regulations*.

Code of Federal Regulations. 2003a. Title 40 CFR Parts 260 - 282, "Hazardous Waste Management." Washington, DC: U.S. Government Printing Office.

Code of Federal Regulations. 2003b. Title 40 CFR 761, "Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce and Prohibitions." Washington, DC: U.S. Government Printing Office.

Defense Threat Reduction Agency. 2002. *Corrective Action Investigation Plan for Corrective Action Unit 482: U15a/e Muckpiles and Ponds, Nevada Test Site, Nevada*, Rev. 1, DOE/NV--939. Las Vegas, NV.

DOE, see U.S. Department of Energy.

DOE/NV, see U.S. Department of Energy, Nevada Operations Office.

EPA, see U.S. Environmental Protection Agency.

Holmes & Narver. 1959a. *Operation Hardtack, Phase II Completion Report*, July. Prepared for the U.S. Atomic Energy Commission. Las Vegas, NV.

Holmes & Narver. 1959b. Engineering drawing entitled, "Generator Station Plot Plan." Los Angeles, CA.

Holmes & Narver, Inc. 1966. Aerial photograph N-53_009 showing Area 12 U12b-Tunnel, 24 September. Mercury, NV: Archives and Records Center.

Lawrence, A., Office of Environmental Policy & Guidance. 2002. Memorandum to Distribution entitled, "Radiation Risk Estimation from Total Effective Dose Equivalents (TEDEs)," (EH-412-2002-1), 9 August.

NCRP, see National Council on Radiation Protection and Measurements.

NDEP, see Nevada Division of Environmental Protection.

NNSA/NV, see U.S. Department of Energy, National Nuclear Security Administration Nevada Operations Office.

National Council on Radiation Protection and Measurements. 1999. *Recommended Screening Limits for Contaminated Surface Soil and Review of Factors Relevant to Site-Specific Studies/National Council on Radiation Protection and Measurements,* NCRP Report No. 129. Bethesda, MD.

Nevada Division of Environmental Protection. 2004. *Review of Industrial Sites Project Document "Guidance for Calculating Industrial Sites Project Remediation Goals for Radionuclides in Soil Using the Residual Radiation (RESRAD) Computer Code."*

U.S. Department of Energy. 1993. *Radiation Protection of the Public and the Environment,* DOE 5400.5. Washington, DC.

U.S. Department of Energy. 2002. *Draft Implementation Guide, Control and Release of Property with Residual Radioactive Material, for use with DOE 5400.5, Radiation Protection of the Public and the Environment, DOE G 441.1-XX.* Washington, DC.

U.S. Department of Energy, Nevada Operation Office. 1996. *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada,* DOE/EIS 0243. Las Vegas, NV.

U.S. Department of Energy, Nevada Operations Office. 1998. *Nevada Test Site Resource Management Plan.* DOE/NV--518, Las Vegas, NV.

U.S. Environmental Protection Agency. 1991. *Human Health Evaluation Manual Supplemental Guidance: "Standard Default Exposure Factors."* OSWER Directive 9285.6-03.

U.S. Environmental Protection Agency. 1992. *Guidance on Risk Managers and Risk Assessors.* Memorandum from F.H. Habicht, Deputy Administrator, Washington, DC.

U.S. Environmental Protection Agency. 2000a. *Data Quality Objectives Process for Hazardous Waste Site Investigations,* EPA QA/G-4HW. Washington, DC.

U.S. Environmental Protection Agency. 2000b. *Guidance for the Data Quality Objectives Process,* EPA QA/G-4. Washington, DC.

U.S. Environmental Protection Agency. 2002a. *Guidance for Quality Assurance Project Plans, EPA QA/G-5,* EPA/240/R-02/009. Washington, DC.

U.S. Environmental Protection Agency. 2002b. *Guidance on Choosing a Sampling Design for Environmental Data Collection,* EPA QA/G-5S. Washington, DC.

Yu C., Loureiro C., Cheng C. C., Jones L. G., Wang Y. Y., Chia Y. P., and Faillace E. 1993. *Data Collection Handbook To Support Modeling the Impacts of Radioactive Material in Soil*, ANL/EAIS-8. Chicago, IL: Environmental Assessment Division, Argonne National Laboratory.

Yu C., A.J. Zielen, J.J Cheng, D.J. LePoire., E. Gnanapragasam, S. Kamboj, J. Arnish, A. Wallo III, W.A. Williams, and H. Peterson. 2001. *User's Manual for RESRAD Version 6,* ANL/EAD-4, Argonne National Laboratory, Environmental Assessment Division, Argonne, IL.

Attachment A

RESRAD Parameters Used for Analysis of CAU 482 Sites

The parametric values used in the RESRAD code for the analysis of the CAU 482 site are listed in Table A.1. Some parameters are site specific, while other values are default RESRAD values. The dose conversion factors used for inhalation and ingestion were the default FGR 13 morbidity values and correspond to the guidance and recommendations per the August 9, 2002, memorandum from A. Lawrence, Office of Environmental Policy & Guidance, to Distribution, titled "Radiation Risk Estimation from Total Effective Dose Equivalents (TEDEs)" (EH-412-2002-1) (Lawrence, 2002).

Table A.1
RESRAD Parameters
(Page 1 of 6)

Parameter	Units	CAU 482	Defaults	Reference/Rationale
R011 Contaminated Zone				
Area of CZ	m^2	1.00E+02	1.000E+04	10x10 m hot spot
Thickness of CZ	m	0.300E+00	2.000E+00	Maximum depth from contaminated samples
Length Parallel to Aquifer Flow	m	not used	1.000E+02	Not Used
Radiation Dose Limit	mrem/yr	2.5E+001	2.5E+001	RESRAD Default (Yu, et al., 1993)
Elapsed Time Since Placement of Material	yr	0.0	0.0	RESRAD Default
R012 Initial Principal Radionuclide				
Principal radionuclides	pCi/g	See Table 7.2	0.0	Site-specific
R013 Cover and Contaminated Zone Hydrological Data				
Cover Depth	m	0.0	0.0	No Cover Assumed
Density of Cover Material	g/cm^3	not used	1.5	No Cover Assumed
Cover Depth Erosion Rate	m/yr	not used	1.000E-03	No Cover Assumed
Density of Contaminated Zone	g/cm^3	1.5	1.5	RESRAD Default
Contamination Zone Erosion Rate	m/yr	1.000E-03	1.000E-03	RESRAD Default
Contaminated Zone Total Porosity	-	4.000E-01	4.000E-01	RESRAD Default
Contaminated Zone Field Capacity	-	2.000E-01	2.000E-01	RESRAD Default
Contaminated Zone Hydraulic Conductivity	m/yr	1.000E+01	1.000E+01	RESRAD Default

Table A.1
RESRAD Parameters
(Page 2 of 6)

Parameter	Units	CAU 482	Defaults	Reference/Rationale
Average Annual Wind Speed	m/sec	3.77	2.000E+00	Data from Air Resource Laboratory (2005)
Humidity in Air	g/m^3	not used	8.000E+00	Not used
Evapotranspiration Coefficient	-	5.000E-01	5.000E-01	RESRAD Default
Precipitation	m/yr	2.200E-01	1.000E+00	Data from Air Resources Laboratory
Irrigation	m/yr	2.000E-01	2.000E-01	RESRAD Default
Irrigation Mode	-	overhead	overhead	RESRAD Default
Runoff Coefficient	-	4.000E-01	2.000E-01	Open Sandy Loam 30% impervious Table 10.1 (Yu, et al., 1993)
Watershed Area for Nearby Stream or Pond	m^2	not used	1.000E+06	Not used
Accuracy for Water/Soil Computations	-	not used	1.000E-03	Not used
R014 Saturated Zone Hydrological Data				
Density of Saturated Zone	g/cm^3	not used	1.500E+00	Not used
Saturated Zone Total Porosity	-	not used	4.000E-01	Not used
Saturated Zone Effective Porosity	-	not used	2.000E-01	Not used
Saturated Zone Field Capacity	-	not used	2.000E-01	Not used
Saturated Zone Hydraulic Conductivity	m/yr	not used	1.000E+02	Not used
Saturated Zone Hydraulic Gradient	-	not used	2.000E-02	Not used
Saturated Zone b Parameter	-	not used	5.300E+00	Not used

Table A.1
RESRAD Parameters
(Page 3 of 6)

Parameter	Units	CAU 482	Defaults	Reference/Rationale
Well Pump Intake Depth	m	not used	1.000E+01	Not used
Model: Nondispersion or Mass-Balance	-	not used	ND	Not used
Well Pumping Rate	m^3/yr	not used	2.500E+02	Not used
R015 Uncontaminated and Unsaturated Strata Hydrological Data				
Number of Unsaturated Zone Strata	-	not used	1	Not used
Thickness	m	not used	4.000E+00	Not used
Soil Density	g/cm^3	not used	1.500E+00	Not used
Effective Porosity	-	not used	2.000E-01	Not used
Field Capacity	-	not used	2.000E-01	Not used
Soil-specific b Parameter	-	not used	5.300E+00	Not used
Hydraulic Conductivity	m/yr	not used	1.000E+01	Not used
R016 Distribution Coefficients and Leach Rates				
Contaminated Zone K_d (all Zones)	cm^3/g			RESRAD Default
Saturated Leach Rate	/yr	0.0	0.0	Not used
Solubility Constant	-	0.0	0.0	Not used

Table A.1
RESRAD Parameters
(Page 4 of 6)

Parameter	Units	CAU 482	Defaults	Reference/Rationale
R017 Inhalation and External Gamma				
Inhalation Rate	m^3/yr	1.230E+04	8.400E+03	RESRAD Default and for an individual performing outdoor activities, a typical activity mix can consist of 37% at a moderate activity level, 28% at both resting and light activity levels, and 7% at a heavy activity level, which results in a 1.4 m^3/h (12,300 m^3/yr) inhalation rate. (Yu, et al., 1993)
Mass Loading for Inhalation	g/m^3	6.00E-04	1E-04	The estimated mass loading for construction activities. (Yu, et al., 1993)
Exposure Duration	yr	25	30	Standard for Industrial/Commercial Scenario
Shielding Factor Inhalation	-	1.0	0.4	Assumes no indoor time fraction
Shielding Factor External Gamma	-	1.0	0.7	Assumes no indoor time fraction
Fraction of Time Spent Indoors	-	0.0	0.5	Assumes no indoor time fraction
Fraction of Time Spent Outdoors	-	0.038	0.25	Scenario specific based on Industrial/ Commercial Use Scenarios for standard occupancy and low occupancy.
Shape Factor	-	1.0	1.0	RESRAD Default
R018 Ingestion Pathway Data, Dietary Parameters				
Fruits, Vegetables, and Grain Consumption	kg/yr	not used	1.600E+02	Not used
Leafy Vegetable Consumption	kg/yr	not used	1.400E+01	Not used
Milk Consumption	L/yr	not used	9.200E+01	Not used
Meat and Poultry Consumption	kg/yr	not used	6.300E+01	Not used

Table A.1
RESRAD Parameters
(Page 5 of 6)

Parameter	Units	CAU 482	Defaults	Reference/Rationale
Fish Consumption	kg/yr	not used	5.400E+00	Not used
Other Seafood Consumption	kg/yr	not used	9.000E-01	Not used
Soil Ingestion Rate	g/yr	1.752E+02	36.5	EPA, 1991; 480 mg/day
Drinking Water Intake	L/yr	not used	5.100E+02	Not used
Drinking Water Contaminated Fraction	-	not used	1.000E+00	Not used
Household Water Contaminated Fraction	-	not used	1.000E+00	Not used
Livestock Water Contaminated Fraction	-	not used	1.000E+00	Not used
Irrigation Water Contaminated Fraction	-	not used	1.000E+00	Not used
Aquatic Food Contamination Fraction	-	not used	5.000E-01	Not used
Plant Food Contamination Fraction	-	not used	-1	Not used
Meat Contamination Fraction	-	not used	-1	Not used
Milk Contamination Fraction	-	not used	-1	Not used
R019 Ingestion Pathway Data, Nondietary				
Livestock Fodder Intake for Meat	kg/day	not used	6.800E+01	Not used
Livestock Fodder Intake for Milk	kg/day	not used	5.500E+01	Not used

Table A.1
RESRAD Parameters
(Page 6 of 6)

Parameter	Units	CAU 482	Defaults	Reference/Rationale
Livestock Water Intake for Meat	L/day	not used	5.000E+01	Not used
Livestock Water Intake for Milk	L/day	not used	1.600E+02	Not used
Livestock Soil Intake	kg/day	not used	5.000E-01	Not used
Mass Loading for Foliar Deposition	g/m^3	not used	1.000E-04	Not used
Depth of Soil Mixing Layer	m	1.500E-01	1.500E-01	RESRAD Default
Depth of Roots	m	not used	9.000E-01	Not used
Drinking Water Fraction from Groundwater	-	not used	1.000E+00	Not used
Household Water Fraction from Groundwater	-	not used	1.000E+00	Not used
Livestock Water Fraction from Groundwater	-	not used	1.000E+00	Not used
Irrigation Fraction from Groundwater	-	not used	1.000E+00	Not used
R021 Radon				
Radon Parameters Not Used				Not used

cm^3/g = Cubic centimeters per gram
g/cm^3 = Grams per cubic centimeter
g/m^3 = Grams per cubic meter
g/yr = Grams per year
kg/day = Kilograms per day
kg/yr = Kilograms per year
L/day = Liters per day
L/yr = Liters per year
m = Meter
m^2 = Square meter
m/sec = Meters per second
m/yr = Meters per year
m^3/h = Cubic meters per hour
m^3/yr = Cubic meters per year
mg.day = Milligrams per day
mrem/yr = Millirem per year
N/A = Not applicable
pCi/g = Picocuries per gram
yr = Year
/yr = Per year
UCL = Upper confidence level

Exhibit 1

RESRAD Summary Report:
CAU 482 CAS 15-06-02
U15a Muckpile

(25 Pages)

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                        Table of Contents
                        ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
    Part I: Mixture Sums and Single Radionuclide Guidelines
    ÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ
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 B-1  ³ Dose conversion factors for inhalation, mrem/pCi:          ³           ³           ³
 B-1  ³ Ac-227+D                                                    ³ 6.724E+00 ³ 6.700E+00 ³ DCF2(  1)
 B-1  ³ Co-60                                                       ³ 2.190E-04 ³ 2.190E-04 ³ DCF2(  2)
 B-1  ³ Cs-137+D                                                    ³ 3.190E-05 ³ 3.190E-05 ³ DCF2(  3)
 B-1  ³ Pa-231                                                      ³ 1.280E+00 ³ 1.280E+00 ³ DCF2(  4)
 B-1  ³ Pb-210+D                                                    ³ 2.320E-02 ³ 1.360E-02 ³ DCF2(  5)
 B-1  ³ Pu-238                                                      ³ 3.920E-01 ³ 3.920E-01 ³ DCF2(  6)
 B-1  ³ Pu-239                                                      ³ 4.290E-01 ³ 4.290E-01 ³ DCF2(  8)
 B-1  ³ Ra-226+D                                                    ³ 8.594E-03 ³ 8.580E-03 ³ DCF2(  9)
 B-1  ³ Sr-90+D                                                     ³ 1.308E-03 ³ 1.300E-03 ³ DCF2( 10)
 B-1  ³ Th-230                                                      ³ 3.260E-01 ³ 3.260E-01 ³ DCF2( 11)
 B-1  ³ U-234                                                       ³ 1.320E-01 ³ 1.320E-01 ³ DCF2( 12)
 B-1  ³ U-235+D                                                     ³ 1.230E-01 ³ 1.230E-01 ³ DCF2( 13)
      ³                                                             ³           ³           ³
 D-1  ³ Dose conversion factors for ingestion, mrem/pCi:            ³           ³           ³
 D-1  ³ Ac-227+D                                                    ³ 1.480E-02 ³ 1.410E-02 ³ DCF3(  1)
 D-1  ³ Co-60                                                       ³ 2.690E-05 ³ 2.690E-05 ³ DCF3(  2)
 D-1  ³ Cs-137+D                                                    ³ 5.000E-05 ³ 5.000E-05 ³ DCF3(  3)
 D-1  ³ Pa-231                                                      ³ 1.060E-02 ³ 1.060E-02 ³ DCF3(  4)
 D-1  ³ Pb-210+D                                                    ³ 7.276E-03 ³ 5.370E-03 ³ DCF3(  5)
 D-1  ³ Pu-238                                                      ³ 3.200E-03 ³ 3.200E-03 ³ DCF3(  6)
 D-1  ³ Pu-239                                                      ³ 3.540E-03 ³ 3.540E-03 ³ DCF3(  8)
 D-1  ³ Ra-226+D                                                    ³ 1.321E-03 ³ 1.320E-03 ³ DCF3(  9)
 D-1  ³ Sr-90+D                                                     ³ 1.528E-04 ³ 1.420E-04 ³ DCF3( 10)
 D-1  ³ Th-230                                                      ³ 5.480E-04 ³ 5.480E-04 ³ DCF3( 11)
 D-1  ³ U-234                                                       ³ 2.830E-04 ³ 2.830E-04 ³ DCF3( 12)
 D-1  ³ U-235+D                                                     ³ 2.673E-04 ³ 2.660E-04 ³ DCF3( 13)
      ³                                                             ³           ³           ³
 D-34 ³ Food transfer factors:                                      ³           ³           ³
 D-34 ³ Ac-227+D  , plant/soil concentration ratio, dimensionless   ³ 2.500E-03 ³ 2.500E-03 ³ RTF(  1,1)
 D-34 ³ Ac-227+D  , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)   ³ 2.000E-05 ³ 2.000E-05 ³ RTF(  1,2)
 D-34 ³ Ac-227+D  , milk/livestock-intake ratio, (pCi/L)/(pCi/d)    ³ 2.000E-05 ³ 2.000E-05 ³ RTF(  1,3)
 D-34 ³                                                             ³           ³           ³
 D-34 ³ Co-60     , plant/soil concentration ratio, dimensionless   ³ 8.000E-02 ³ 8.000E-02 ³ RTF(  2,1)
 D-34 ³ Co-60     , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)   ³ 2.000E-02 ³ 2.000E-02 ³ RTF(  2,2)
 D-34 ³ Co-60     , milk/livestock-intake ratio, (pCi/L)/(pCi/d)    ³ 2.000E-03 ³ 2.000E-03 ³ RTF(  2,3)
 D-34 ³                                                             ³           ³           ³
 D-34 ³ Cs-137+D  , plant/soil concentration ratio, dimensionless   ³ 4.000E-02 ³ 4.000E-02 ³ RTF(  3,1)
 D-34 ³ Cs-137+D  , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)   ³ 3.000E-02 ³ 3.000E-02 ³ RTF(  3,2)
 D-34 ³ Cs-137+D  , milk/livestock-intake ratio, (pCi/L)/(pCi/d)    ³ 8.000E-03 ³ 8.000E-03 ³ RTF(  3,3)
 D-34 ³                                                             ³           ³           ³
 D-34 ³ Pa-231    , plant/soil concentration ratio, dimensionless   ³ 1.000E-02 ³ 1.000E-02 ³ RTF(  4,1)
 D-34 ³ Pa-231    , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)   ³ 5.000E-03 ³ 5.000E-03 ³ RTF(  4,2)
 D-34 ³ Pa-231    , milk/livestock-intake ratio, (pCi/L)/(pCi/d)    ³ 5.000E-06 ³ 5.000E-06 ³ RTF(  4,3)
 D-34 ³                                                             ³           ³           ³
 D-34 ³ Pb-210+D  , plant/soil concentration ratio, dimensionless   ³ 1.000E-02 ³ 1.000E-02 ³ RTF(  5,1)
 D-34 ³ Pb-210+D  , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)   ³ 8.000E-04 ³ 8.000E-04 ³ RTF(  5,2)
 D-34 ³ Pb-210+D  , milk/livestock-intake ratio, (pCi/L)/(pCi/d)    ³ 3.000E-04 ³ 3.000E-04 ³ RTF(  5,3)
 D-34 ³                                                             ³           ³           ³
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 D-34 ³ Pu-238    , plant/soil concentration ratio, dimensionless   ³ 1.000E-03 ³ 1.000E-03 ³ RTF(  6,1)
 D-34 ³ Pu-238    , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)   ³ 1.000E-04 ³ 1.000E-04 ³ RTF(  6,2)
 D-34 ³ Pu-238    , milk/livestock-intake ratio, (pCi/L)/(pCi/d)    ³ 1.000E-06 ³ 1.000E-06 ³ RTF(  6,3)
 D-34 ³                                                             ³           ³           ³
 D-34 ³ Pu-239    , plant/soil concentration ratio, dimensionless   ³ 1.000E-03 ³ 1.000E-03 ³ RTF(  8,1)
 D-34 ³ Pu-239    , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)   ³ 1.000E-04 ³ 1.000E-04 ³ RTF(  8,2)
 D-34 ³ Pu-239    , milk/livestock-intake ratio, (pCi/L)/(pCi/d)    ³ 1.000E-06 ³ 1.000E-06 ³ RTF(  8,3)
 D-34 ³                                                             ³           ³           ³
 D-34 ³ Ra-226+D  , plant/soil concentration ratio, dimensionless   ³ 4.000E-02 ³ 4.000E-02 ³ RTF(  9,1)
 D-34 ³ Ra-226+D  , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)   ³ 1.000E-03 ³ 1.000E-03 ³ RTF(  9,2)
 D-34 ³ Ra-226+D  , milk/livestock-intake ratio, (pCi/L)/(pCi/d)    ³ 1.000E-03 ³ 1.000E-03 ³ RTF(  9,3)
 D-34 ³                                                             ³           ³           ³
 D-34 ³ Sr-90+D   , plant/soil concentration ratio, dimensionless   ³ 3.000E-01 ³ 3.000E-01 ³ RTF( 10,1)
 D-34 ³ Sr-90+D   , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)   ³ 8.000E-03 ³ 8.000E-03 ³ RTF( 10,2)
 D-34 ³ Sr-90+D   , milk/livestock-intake ratio, (pCi/L)/(pCi/d)    ³ 2.000E-03 ³ 2.000E-03 ³ RTF( 10,3)
 D-34 ³                                                             ³           ³           ³
 D-34 ³ Th-230    , plant/soil concentration ratio, dimensionless   ³ 1.000E-03 ³ 1.000E-03 ³ RTF( 11,1)
 D-34 ³ Th-230    , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)   ³ 1.000E-04 ³ 1.000E-04 ³ RTF( 11,2)
 D-34 ³ Th-230    , milk/livestock-intake ratio, (pCi/L)/(pCi/d)    ³ 5.000E-06 ³ 5.000E-06 ³ RTF( 11,3)
 D-34 ³                                                             ³           ³           ³
 D-34 ³ U-234     , plant/soil concentration ratio, dimensionless   ³ 2.500E-03 ³ 2.500E-03 ³ RTF( 12,1)
 D-34 ³ U-234     , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)   ³ 3.400E-04 ³ 3.400E-04 ³ RTF( 12,2)
 D-34 ³ U-234     , milk/livestock-intake ratio, (pCi/L)/(pCi/d)    ³ 6.000E-04 ³ 6.000E-04 ³ RTF( 12,3)
 D-34 ³                                                             ³           ³           ³
 D-34 ³ U-235+D   , plant/soil concentration ratio, dimensionless   ³ 2.500E-03 ³ 2.500E-03 ³ RTF( 13,1)
 D-34 ³ U-235+D   , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)   ³ 3.400E-04 ³ 3.400E-04 ³ RTF( 13,2)
 D-34 ³ U-235+D   , milk/livestock-intake ratio, (pCi/L)/(pCi/d)    ³ 6.000E-04 ³ 6.000E-04 ³ RTF( 13,3)
      ³                                                             ³           ³           ³
 D-5  ³ Bioaccumulation factors, fresh water, L/kg:                 ³           ³           ³
 D-5  ³ Ac-227+D  , fish                                            ³ 1.500E+01 ³ 1.500E+01 ³ BIOFAC(  1,1)
 D-5  ³ Ac-227+D  , crustacea and mollusks                          ³ 1.000E+03 ³ 1.000E+03 ³ BIOFAC(  1,2)
 D-5  ³                                                             ³           ³           ³
 D-5  ³ Co-60     , fish                                            ³ 3.000E+02 ³ 3.000E+02 ³ BIOFAC(  2,1)
 D-5  ³ Co-60     , crustacea and mollusks                          ³ 2.000E+02 ³ 2.000E+02 ³ BIOFAC(  2,2)
 D-5  ³                                                             ³           ³           ³
 D-5  ³ Cs-137+D  , fish                                            ³ 2.000E+03 ³ 2.000E+03 ³ BIOFAC(  3,1)
 D-5  ³ Cs-137+D  , crustacea and mollusks                          ³ 1.000E+02 ³ 1.000E+02 ³ BIOFAC(  3,2)
 D-5  ³                                                             ³           ³           ³
 D-5  ³ Pa-231    , fish                                            ³ 1.000E+01 ³ 1.000E+01 ³ BIOFAC(  4,1)
 D-5  ³ Pa-231    , crustacea and mollusks                          ³ 1.100E+02 ³ 1.100E+02 ³ BIOFAC(  4,2)
 D-5  ³                                                             ³           ³           ³
 D-5  ³ Pb-210+D  , fish                                            ³ 3.000E+02 ³ 3.000E+02 ³ BIOFAC(  5,1)
 D-5  ³ Pb-210+D  , crustacea and mollusks                          ³ 1.000E+02 ³ 1.000E+02 ³ BIOFAC(  5,2)
 D-5  ³                                                             ³           ³           ³
 D-5  ³ Pu-238    , fish                                            ³ 3.000E+01 ³ 3.000E+01 ³ BIOFAC(  6,1)
 D-5  ³ Pu-238    , crustacea and mollusks                          ³ 1.000E+02 ³ 1.000E+02 ³ BIOFAC(  6,2)
 D-5  ³                                                             ³           ³           ³
 D-5  ³ Pu-239    , fish                                            ³ 3.000E+01 ³ 3.000E+01 ³ BIOFAC(  8,1)
 D-5  ³ Pu-239    , crustacea and mollusks                          ³ 1.000E+02 ³ 1.000E+02 ³ BIOFAC(  8,2)
 D-5  ³                                                             ³           ³           ³
1RESRAD, Version 6.3      T« Limit = 180 days        05/29/2006  11:37  Page   4
 Summary : CAU 482 Muck                                        File: 482Muck.RAD

                     Dose Conversion Factor (and Related) Parameter Summary (continued)
                                           File: FGR 13 MORBIDITY
0     ³                                                             ³  Current  ³   Base    ³  Parameter
```

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Menu ³                          Parameter                           ³   Value   ³   Case*   ³    Name
ÄÄÄÄÄÅÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÅÄÄÄÄÄÄÄÄÄÄÄÅÄÄÄÄÄÄÄÄÄÄÄÅÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
D-5  ³ Ra-226+D  , fish                                             ³ 5.000E+01 ³ 5.000E+01 ³ BIOFAC(  9,1)
D-5  ³ Ra-226+D  , crustacea and mollusks                           ³ 2.500E+02 ³ 2.500E+02 ³ BIOFAC(  9,2)
D-5  ³                                                              ³           ³           ³
D-5  ³ Sr-90+D   , fish                                             ³ 6.000E+01 ³ 6.000E+01 ³ BIOFAC( 10,1)
D-5  ³ Sr-90+D   , crustacea and mollusks                           ³ 1.000E+02 ³ 1.000E+02 ³ BIOFAC( 10,2)
D-5  ³                                                              ³           ³           ³
D-5  ³ Th-230    , fish                                             ³ 1.000E+02 ³ 1.000E+02 ³ BIOFAC( 11,1)
D-5  ³ Th-230    , crustacea and mollusks                           ³ 5.000E+02 ³ 5.000E+02 ³ BIOFAC( 11,2)
D-5  ³                                                              ³           ³           ³
D-5  ³ U-234     , fish                                             ³ 1.000E+01 ³ 1.000E+01 ³ BIOFAC( 12,1)
D-5  ³ U-234     , crustacea and mollusks                           ³ 6.000E+01 ³ 6.000E+01 ³ BIOFAC( 12,2)
D-5  ³                                                              ³           ³           ³
D-5  ³ U-235+D   , fish                                             ³ 1.000E+01 ³ 1.000E+01 ³ BIOFAC( 13,1)
D-5  ³ U-235+D   , crustacea and mollusks                           ³ 6.000E+01 ³ 6.000E+01 ³ BIOFAC( 13,2)
ÍÍÍÍÍÏÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÏÍÍÍÍÍÍÍÍÍÍÍÏÍÍÍÍÍÍÍÍÍÍÍÏÍÍÍÍÍÍÍÍÍÍÍÍÍÍ
*Base Case means Default.Lib w/o Associate Nuclide contributions.
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                                                    Site-Specific Parameter Summary
0    ³                                                  ³   User    ³           ³         Used by RESRAD         ³  Parameter
 Menu ³                   Parameter                      ³   Input   ³  Default  ³ (If different from user input) ³    Name
 ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 R011 ³ Area of contaminated zone (m**2)                 ³ 1.000E+02 ³ 1.000E+04 ³              ---               ³ AREA
 R011 ³ Thickness of contaminated zone (m)               ³ 1.500E-01 ³ 2.000E+00 ³              ---               ³ THICK0
 R011 ³ Length parallel to aquifer flow (m)              ³ not used  ³ 1.000E+02 ³              ---               ³ LCZPAQ
 R011 ³ Basic radiation dose limit (mrem/yr)             ³ 2.500E+01 ³ 3.000E+01 ³              ---               ³ BRDL
 R011 ³ Time since placement of material (yr)            ³ 0.000E+00 ³ 0.000E+00 ³              ---               ³ TI
 R011 ³ Times for calculations (yr)                      ³ 1.000E+00 ³ 1.000E+00 ³              ---               ³ T( 2)
 R011 ³ Times for calculations (yr)                      ³ 3.000E+00 ³ 3.000E+00 ³              ---               ³ T( 3)
 R011 ³ Times for calculations (yr)                      ³ 1.000E+01 ³ 1.000E+01 ³              ---               ³ T( 4)
 R011 ³ Times for calculations (yr)                      ³ 2.500E+01 ³ 3.000E+01 ³              ---               ³ T( 5)
 R011 ³ Times for calculations (yr)                      ³ 3.000E+01 ³ 1.000E+02 ³              ---               ³ T( 6)
 R011 ³ Times for calculations (yr)                      ³ 5.000E+01 ³ 3.000E+02 ³              ---               ³ T( 7)
 R011 ³ Times for calculations (yr)                      ³ 7.500E+01 ³ 1.000E+03 ³              ---               ³ T( 8)
 R011 ³ Times for calculations (yr)                      ³ 1.000E+02 ³ 0.000E+00 ³              ---               ³ T( 9)
 R011 ³ Times for calculations (yr)                      ³ 3.000E+02 ³ 0.000E+00 ³              ---               ³ T(10)
      ³                                                  ³           ³           ³                                ³
 R012 ³ Initial principal radionuclide (pCi/g):  Co-60   ³ 1.230E-01 ³ 0.000E+00 ³              ---               ³ S1( 2)
 R012 ³ Initial principal radionuclide (pCi/g):  Cs-137  ³ 4.980E+02 ³ 0.000E+00 ³              ---               ³ S1( 3)
 R012 ³ Initial principal radionuclide (pCi/g):  Pu-238  ³ 1.280E+00 ³ 0.000E+00 ³              ---               ³ S1( 6)
 R012 ³ Initial principal radionuclide (pCi/g):  Pu-239  ³ 7.700E+00 ³ 0.000E+00 ³              ---               ³ S1( 8)
 R012 ³ Initial principal radionuclide (pCi/g):  Sr-90   ³ 6.600E+01 ³ 0.000E+00 ³              ---               ³ S1(10)
 R012 ³ Concentration in groundwater   (pCi/L):  Co-60   ³ not used  ³ 0.000E+00 ³              ---               ³ W1( 2)
 R012 ³ Concentration in groundwater   (pCi/L):  Cs-137  ³ not used  ³ 0.000E+00 ³              ---               ³ W1( 3)
 R012 ³ Concentration in groundwater   (pCi/L):  Pu-238  ³ not used  ³ 0.000E+00 ³              ---               ³ W1( 6)
 R012 ³ Concentration in groundwater   (pCi/L):  Pu-239  ³ not used  ³ 0.000E+00 ³              ---               ³ W1( 8)
 R012 ³ Concentration in groundwater   (pCi/L):  Sr-90   ³ not used  ³ 0.000E+00 ³              ---               ³ W1(10)
      ³                                                  ³           ³           ³                                ³
 R013 ³ Cover depth (m)                                  ³ 0.000E+00 ³ 0.000E+00 ³              ---               ³ COVER0
 R013 ³ Density of cover material (g/cm**3)              ³ not used  ³ 1.500E+00 ³              ---               ³ DENSCV
 R013 ³ Cover depth erosion rate (m/yr)                  ³ not used  ³ 1.000E-03 ³              ---               ³ VCV
 R013 ³ Density of contaminated zone (g/cm**3)           ³ 1.500E+00 ³ 1.500E+00 ³              ---               ³ DENSCZ
 R013 ³ Contaminated zone erosion rate (m/yr)            ³ 1.000E-03 ³ 1.000E-03 ³              ---               ³ VCZ
 R013 ³ Contaminated zone total porosity                 ³ 4.000E-01 ³ 4.000E-01 ³              ---               ³ TPCZ
 R013 ³ Contaminated zone field capacity                 ³ 2.000E-01 ³ 2.000E-01 ³              ---               ³ FCCZ
 R013 ³ Contaminated zone hydraulic conductivity (m/yr)  ³ 1.000E+01 ³ 1.000E+01 ³              ---               ³ HCCZ
 R013 ³ Contaminated zone b parameter                    ³ 5.300E+00 ³ 5.300E+00 ³              ---               ³ BCZ
 R013 ³ Average annual wind speed (m/sec)                ³ 3.770E+00 ³ 2.000E+00 ³              ---               ³ WIND
 R013 ³ Humidity in air (g/m**3)                         ³ not used  ³ 8.000E+00 ³              ---               ³ HUMID
 R013 ³ Evapotranspiration coefficient                   ³ 5.000E-01 ³ 5.000E-01 ³              ---               ³ EVAPTR
 R013 ³ Precipitation (m/yr)                             ³ 2.200E-01 ³ 1.000E+00 ³              ---               ³ PRECIP
 R013 ³ Irrigation (m/yr)                                ³ 0.000E+00 ³ 2.000E-01 ³              ---               ³ RI
 R013 ³ Irrigation mode                                  ³ overhead  ³ overhead  ³              ---               ³ IDITCH
 R013 ³ Runoff coefficient                               ³ 4.000E-01 ³ 2.000E-01 ³              ---               ³ RUNOFF
 R013 ³ Watershed area for nearby stream or pond (m**2)  ³ not used  ³ 1.000E+06 ³              ---               ³ WAREA
 R013 ³ Accuracy for water/soil computations             ³ not used  ³ 1.000E-03 ³              ---               ³ EPS
      ³                                                  ³           ³           ³                                ³
 R014 ³ Density of saturated zone (g/cm**3)              ³ not used  ³ 1.500E+00 ³              ---               ³ DENSAQ
 R014 ³ Saturated zone total porosity                    ³ not used  ³ 4.000E-01 ³              ---               ³ TPSZ
 R014 ³ Saturated zone effective porosity                ³ not used  ³ 2.000E-01 ³              ---               ³ EPSZ
 R014 ³ Saturated zone field capacity                    ³ not used  ³ 2.000E-01 ³              ---               ³ FCSZ
 R014 ³ Saturated zone hydraulic conductivity (m/yr)     ³ not used  ³ 1.000E+02 ³              ---               ³ HCSZ
 R014 ³ Saturated zone hydraulic gradient                ³ not used  ³ 2.000E-02 ³              ---               ³ HGWT
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                                           Site-Specific Parameter Summary (continued)
0     ³                                                   ³  User     ³           ³         Used by RESRAD         ³  Parameter
 Menu ³                     Parameter                     ³  Input    ³  Default  ³ (If different from user input) ³    Name
 ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 R014 ³ Saturated zone b parameter                        ³ not used  ³ 5.300E+00 ³             ---                ³ BSZ
 R014 ³ Water table drop rate (m/yr)                      ³ not used  ³ 1.000E-03 ³             ---                ³ VWT
 R014 ³ Well pump intake depth (m below water table)      ³ not used  ³ 1.000E+01 ³             ---                ³ DWIBWT
 R014 ³ Model: Nondispersion (ND) or Mass-Balance (MB)    ³ not used  ³ ND        ³             ---                ³ MODEL
 R014 ³ Well pumping rate (m**3/yr)                       ³ not used  ³ 2.500E+02 ³             ---                ³ UW
      ³                                                   ³           ³           ³                                ³
 R015 ³ Number of unsaturated zone strata                 ³ not used  ³ 1         ³             ---                ³ NS
 R015 ³ Unsat. zone 1, thickness (m)                      ³ not used  ³ 4.000E+00 ³             ---                ³ H(1)
 R015 ³ Unsat. zone 1, soil density (g/cm**3)             ³ not used  ³ 1.500E+00 ³             ---                ³ DENSUZ(1)
 R015 ³ Unsat. zone 1, total porosity                     ³ not used  ³ 4.000E-01 ³             ---                ³ TPUZ(1)
 R015 ³ Unsat. zone 1, effective porosity                 ³ not used  ³ 2.000E-01 ³             ---                ³ EPUZ(1)
 R015 ³ Unsat. zone 1, field capacity                     ³ not used  ³ 2.000E-01 ³             ---                ³ FCUZ(1)
 R015 ³ Unsat. zone 1, soil-specific b parameter          ³ not used  ³ 5.300E+00 ³             ---                ³ BUZ(1)
 R015 ³ Unsat. zone 1, hydraulic conductivity (m/yr)      ³ not used  ³ 1.000E+01 ³             ---                ³ HCUZ(1)
      ³                                                   ³           ³           ³                                ³
 R016 ³ Distribution coefficients for Co-60               ³           ³           ³                                ³
 R016 ³   Contaminated zone (cm**3/g)                     ³ 1.000E+03 ³ 1.000E+03 ³             ---                ³ DCNUCC( 2)
 R016 ³   Unsaturated zone 1 (cm**3/g)                    ³ not used  ³ 1.000E+03 ³             ---                ³ DCNUCU( 2,1)
 R016 ³   Saturated zone (cm**3/g)                        ³ not used  ³ 1.000E+03 ³             ---                ³ DCNUCS( 2)
 R016 ³   Leach rate (/yr)                                ³ 0.000E+00 ³ 0.000E+00 ³          2.933E-04             ³ ALEACH( 2)
 R016 ³   Solubility constant                             ³ 0.000E+00 ³ 0.000E+00 ³          not used              ³ SOLUBK( 2)
      ³                                                   ³           ³           ³                                ³
 R016 ³ Distribution coefficients for Cs-137              ³           ³           ³                                ³
 R016 ³   Contaminated zone (cm**3/g)                     ³ 4.600E+03 ³ 4.600E+03 ³             ---                ³ DCNUCC( 3)
 R016 ³   Unsaturated zone 1 (cm**3/g)                    ³ not used  ³ 4.600E+03 ³             ---                ³ DCNUCU( 3,1)
 R016 ³   Saturated zone (cm**3/g)                        ³ not used  ³ 4.600E+03 ³             ---                ³ DCNUCS( 3)
 R016 ³   Leach rate (/yr)                                ³ 0.000E+00 ³ 0.000E+00 ³          6.377E-05             ³ ALEACH( 3)
 R016 ³   Solubility constant                             ³ 0.000E+00 ³ 0.000E+00 ³          not used              ³ SOLUBK( 3)
      ³                                                   ³           ³           ³                                ³
 R016 ³ Distribution coefficients for Pu-238              ³           ³           ³                                ³
 R016 ³   Contaminated zone (cm**3/g)                     ³ 2.000E+03 ³ 2.000E+03 ³             ---                ³ DCNUCC( 6)
 R016 ³   Unsaturated zone 1 (cm**3/g)                    ³ not used  ³ 2.000E+03 ³             ---                ³ DCNUCU( 6,1)
 R016 ³   Saturated zone (cm**3/g)                        ³ not used  ³ 2.000E+03 ³             ---                ³ DCNUCS( 6)
 R016 ³   Leach rate (/yr)                                ³ 0.000E+00 ³ 0.000E+00 ³          1.467E-04             ³ ALEACH( 6)
 R016 ³   Solubility constant                             ³ 0.000E+00 ³ 0.000E+00 ³          not used              ³ SOLUBK( 6)
      ³                                                   ³           ³           ³                                ³
 R016 ³ Distribution coefficients for Pu-239              ³           ³           ³                                ³
 R016 ³   Contaminated zone (cm**3/g)                     ³ 2.000E+03 ³ 2.000E+03 ³             ---                ³ DCNUCC( 8)
 R016 ³   Unsaturated zone 1 (cm**3/g)                    ³ not used  ³ 2.000E+03 ³             ---                ³ DCNUCU( 8,1)
 R016 ³   Saturated zone (cm**3/g)                        ³ not used  ³ 2.000E+03 ³             ---                ³ DCNUCS( 8)
 R016 ³   Leach rate (/yr)                                ³ 0.000E+00 ³ 0.000E+00 ³          1.467E-04             ³ ALEACH( 8)
 R016 ³   Solubility constant                             ³ 0.000E+00 ³ 0.000E+00 ³          not used              ³ SOLUBK( 8)
      ³                                                   ³           ³           ³                                ³
 R016 ³ Distribution coefficients for Sr-90               ³           ³           ³                                ³
 R016 ³   Contaminated zone (cm**3/g)                     ³ 3.000E+01 ³ 3.000E+01 ³             ---                ³ DCNUCC(10)
 R016 ³   Unsaturated zone 1 (cm**3/g)                    ³ not used  ³ 3.000E+01 ³             ---                ³ DCNUCU(10,1)
 R016 ³   Saturated zone (cm**3/g)                        ³ not used  ³ 3.000E+01 ³             ---                ³ DCNUCS(10)
 R016 ³   Leach rate (/yr)                                ³ 0.000E+00 ³ 0.000E+00 ³          9.718E-03             ³ ALEACH(10)
 R016 ³   Solubility constant                             ³ 0.000E+00 ³ 0.000E+00 ³          not used              ³ SOLUBK(10)
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                                           Site-Specific Parameter Summary (continued)
0     ³                                                  ³   User    ³           ³         Used by RESRAD         ³  Parameter
 Menu ³                      Parameter                   ³   Input   ³  Default  ³ (If different from user input) ³    Name
 ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 R016 ³ Distribution coefficients for daughter Ac-227    ³           ³           ³                                ³
 R016 ³   Contaminated zone (cm**3/g)                    ³ 2.000E+01 ³ 2.000E+01 ³              ---               ³ DCNUCC( 1)
 R016 ³   Unsaturated zone 1 (cm**3/g)                   ³ not used  ³ 2.000E+01 ³              ---               ³ DCNUCU( 1,1)
 R016 ³   Saturated zone (cm**3/g)                       ³ not used  ³ 2.000E+01 ³              ---               ³ DCNUCS( 1)
 R016 ³   Leach rate (/yr)                               ³ 0.000E+00 ³ 0.000E+00 ³           1.453E-02            ³ ALEACH( 1)
 R016 ³   Solubility constant                            ³ 0.000E+00 ³ 0.000E+00 ³           not used             ³ SOLUBK( 1)
      ³                                                  ³           ³           ³                                ³
 R016 ³ Distribution coefficients for daughter Pa-231    ³           ³           ³                                ³
 R016 ³   Contaminated zone (cm**3/g)                    ³ 5.000E+01 ³ 5.000E+01 ³              ---               ³ DCNUCC( 4)
 R016 ³   Unsaturated zone 1 (cm**3/g)                   ³ not used  ³ 5.000E+01 ³              ---               ³ DCNUCU( 4,1)
 R016 ³   Saturated zone (cm**3/g)                       ³ not used  ³ 5.000E+01 ³              ---               ³ DCNUCS( 4)
 R016 ³   Leach rate (/yr)                               ³ 0.000E+00 ³ 0.000E+00 ³           5.845E-03            ³ ALEACH( 4)
 R016 ³   Solubility constant                            ³ 0.000E+00 ³ 0.000E+00 ³           not used             ³ SOLUBK( 4)
      ³                                                  ³           ³           ³                                ³
 R016 ³ Distribution coefficients for daughter Pb-210    ³           ³           ³                                ³
 R016 ³   Contaminated zone (cm**3/g)                    ³ 1.000E+02 ³ 1.000E+02 ³              ---               ³ DCNUCC( 5)
 R016 ³   Unsaturated zone 1 (cm**3/g)                   ³ not used  ³ 1.000E+02 ³              ---               ³ DCNUCU( 5,1)
 R016 ³   Saturated zone (cm**3/g)                       ³ not used  ³ 1.000E+02 ³              ---               ³ DCNUCS( 5)
 R016 ³   Leach rate (/yr)                               ³ 0.000E+00 ³ 0.000E+00 ³           2.928E-03            ³ ALEACH( 5)
 R016 ³   Solubility constant                            ³ 0.000E+00 ³ 0.000E+00 ³           not used             ³ SOLUBK( 5)
      ³                                                  ³           ³           ³                                ³
 R016 ³ Distribution coefficients for daughter Ra-226    ³           ³           ³                                ³
 R016 ³   Contaminated zone (cm**3/g)                    ³ 7.000E+01 ³ 7.000E+01 ³              ---               ³ DCNUCC( 9)
 R016 ³   Unsaturated zone 1 (cm**3/g)                   ³ not used  ³ 7.000E+01 ³              ---               ³ DCNUCU( 9,1)
 R016 ³   Saturated zone (cm**3/g)                       ³ not used  ³ 7.000E+01 ³              ---               ³ DCNUCS( 9)
 R016 ³   Leach rate (/yr)                               ³ 0.000E+00 ³ 0.000E+00 ³           4.179E-03            ³ ALEACH( 9)
 R016 ³   Solubility constant                            ³ 0.000E+00 ³ 0.000E+00 ³           not used             ³ SOLUBK( 9)
      ³                                                  ³           ³           ³                                ³
 R016 ³ Distribution coefficients for daughter Th-230    ³           ³           ³                                ³
 R016 ³   Contaminated zone (cm**3/g)                    ³ 6.000E+04 ³ 6.000E+04 ³              ---               ³ DCNUCC(11)
 R016 ³   Unsaturated zone 1 (cm**3/g)                   ³ not used  ³ 6.000E+04 ³              ---               ³ DCNUCU(11,1)
 R016 ³   Saturated zone (cm**3/g)                       ³ not used  ³ 6.000E+04 ³              ---               ³ DCNUCS(11)
 R016 ³   Leach rate (/yr)                               ³ 0.000E+00 ³ 0.000E+00 ³           4.889E-06            ³ ALEACH(11)
 R016 ³   Solubility constant                            ³ 0.000E+00 ³ 0.000E+00 ³           not used             ³ SOLUBK(11)
      ³                                                  ³           ³           ³                                ³
 R016 ³ Distribution coefficients for daughter U-234     ³           ³           ³                                ³
 R016 ³   Contaminated zone (cm**3/g)                    ³ 5.000E+01 ³ 5.000E+01 ³              ---               ³ DCNUCC(12)
 R016 ³   Unsaturated zone 1 (cm**3/g)                   ³ not used  ³ 5.000E+01 ³              ---               ³ DCNUCU(12,1)
 R016 ³   Saturated zone (cm**3/g)                       ³ not used  ³ 5.000E+01 ³              ---               ³ DCNUCS(12)
 R016 ³   Leach rate (/yr)                               ³ 0.000E+00 ³ 0.000E+00 ³           5.845E-03            ³ ALEACH(12)
 R016 ³   Solubility constant                            ³ 0.000E+00 ³ 0.000E+00 ³           not used             ³ SOLUBK(12)
      ³                                                  ³           ³           ³                                ³
 R016 ³ Distribution coefficients for daughter U-235     ³           ³           ³                                ³
 R016 ³   Contaminated zone (cm**3/g)                    ³ 5.000E+01 ³ 5.000E+01 ³              ---               ³ DCNUCC(13)
 R016 ³   Unsaturated zone 1 (cm**3/g)                   ³ not used  ³ 5.000E+01 ³              ---               ³ DCNUCU(13,1)
 R016 ³   Saturated zone (cm**3/g)                       ³ not used  ³ 5.000E+01 ³              ---               ³ DCNUCS(13)
 R016 ³   Leach rate (/yr)                               ³ 0.000E+00 ³ 0.000E+00 ³           5.845E-03            ³ ALEACH(13)
 R016 ³   Solubility constant                            ³ 0.000E+00 ³ 0.000E+00 ³           not used             ³ SOLUBK(13)
      ³                                                  ³           ³           ³                                ³
 R017 ³ Inhalation rate (m**3/yr)                        ³ 1.230E+04 ³ 8.400E+03 ³              ---               ³ INHALR
 R017 ³ Mass loading for inhalation (g/m**3)             ³ 6.000E-04 ³ 1.000E-04 ³              ---               ³ MLINH
```

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                                           Site-Specific Parameter Summary (continued)
0     ³                                                  ³   User    ³           ³         Used by RESRAD         ³  Parameter
 Menu ³                     Parameter                    ³   Input   ³  Default  ³ (If different from user input) ³    Name
 ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 R017 ³ Exposure duration                                ³ 2.500E+01 ³ 3.000E+01 ³              ---               ³ ED
 R017 ³ Shielding factor, inhalation                     ³ 1.000E+00 ³ 4.000E-01 ³              ---               ³ SHF3
 R017 ³ Shielding factor, external gamma                 ³ 1.000E+00 ³ 7.000E-01 ³              ---               ³ SHF1
 R017 ³ Fraction of time spent indoors                   ³ 0.000E+00 ³ 5.000E-01 ³              ---               ³ FIND
 R017 ³ Fraction of time spent outdoors (on site)        ³ 3.800E-02 ³ 2.500E-01 ³              ---               ³ FOTD
 R017 ³ Shape factor flag, external gamma                ³ 1.000E+00 ³ 1.000E+00 ³    >0 shows circular AREA.     ³ FS
 R017 ³ Radii of shape factor array (used if FS = -1):   ³           ³           ³                                ³
 R017 ³   Outer annular radius (m), ring  1:             ³ not used  ³ 5.000E+01 ³              ---               ³ RAD_SHAPE( 1)
 R017 ³   Outer annular radius (m), ring  2:             ³ not used  ³ 7.071E+01 ³              ---               ³ RAD_SHAPE( 2)
 R017 ³   Outer annular radius (m), ring  3:             ³ not used  ³ 0.000E+00 ³              ---               ³ RAD_SHAPE( 3)
 R017 ³   Outer annular radius (m), ring  4:             ³ not used  ³ 0.000E+00 ³              ---               ³ RAD_SHAPE( 4)
 R017 ³   Outer annular radius (m), ring  5:             ³ not used  ³ 0.000E+00 ³              ---               ³ RAD_SHAPE( 5)
 R017 ³   Outer annular radius (m), ring  6:             ³ not used  ³ 0.000E+00 ³              ---               ³ RAD_SHAPE( 6)
 R017 ³   Outer annular radius (m), ring  7:             ³ not used  ³ 0.000E+00 ³              ---               ³ RAD_SHAPE( 7)
 R017 ³   Outer annular radius (m), ring  8:             ³ not used  ³ 0.000E+00 ³              ---               ³ RAD_SHAPE( 8)
 R017 ³   Outer annular radius (m), ring  9:             ³ not used  ³ 0.000E+00 ³              ---               ³ RAD_SHAPE( 9)
 R017 ³   Outer annular radius (m), ring 10:             ³ not used  ³ 0.000E+00 ³              ---               ³ RAD_SHAPE(10)
 R017 ³   Outer annular radius (m), ring 11:             ³ not used  ³ 0.000E+00 ³              ---               ³ RAD_SHAPE(11)
 R017 ³   Outer annular radius (m), ring 12:             ³ not used  ³ 0.000E+00 ³              ---               ³ RAD_SHAPE(12)
      ³                                                  ³           ³           ³                                ³
 R017 ³ Fractions of annular areas within AREA:          ³           ³           ³                                ³
 R017 ³   Ring  1                                        ³ not used  ³ 1.000E+00 ³              ---               ³ FRACA( 1)
 R017 ³   Ring  2                                        ³ not used  ³ 2.732E-01 ³              ---               ³ FRACA( 2)
 R017 ³   Ring  3                                        ³ not used  ³ 0.000E+00 ³              ---               ³ FRACA( 3)
 R017 ³   Ring  4                                        ³ not used  ³ 0.000E+00 ³              ---               ³ FRACA( 4)
 R017 ³   Ring  5                                        ³ not used  ³ 0.000E+00 ³              ---               ³ FRACA( 5)
 R017 ³   Ring  6                                        ³ not used  ³ 0.000E+00 ³              ---               ³ FRACA( 6)
 R017 ³   Ring  7                                        ³ not used  ³ 0.000E+00 ³              ---               ³ FRACA( 7)
 R017 ³   Ring  8                                        ³ not used  ³ 0.000E+00 ³              ---               ³ FRACA( 8)
 R017 ³   Ring  9                                        ³ not used  ³ 0.000E+00 ³              ---               ³ FRACA( 9)
 R017 ³   Ring 10                                        ³ not used  ³ 0.000E+00 ³              ---               ³ FRACA(10)
 R017 ³   Ring 11                                        ³ not used  ³ 0.000E+00 ³              ---               ³ FRACA(11)
 R017 ³   Ring 12                                        ³ not used  ³ 0.000E+00 ³              ---               ³ FRACA(12)
      ³                                                  ³           ³           ³                                ³
 R018 ³ Fruits, vegetables and grain consumption (kg/yr) ³ not used  ³ 1.600E+02 ³              ---               ³ DIET(1)
 R018 ³ Leafy vegetable consumption (kg/yr)              ³ not used  ³ 1.400E+01 ³              ---               ³ DIET(2)
 R018 ³ Milk consumption (L/yr)                          ³ not used  ³ 9.200E+01 ³              ---               ³ DIET(3)
 R018 ³ Meat and poultry consumption (kg/yr)             ³ not used  ³ 6.300E+01 ³              ---               ³ DIET(4)
 R018 ³ Fish consumption (kg/yr)                         ³ not used  ³ 5.400E+00 ³              ---               ³ DIET(5)
 R018 ³ Other seafood consumption (kg/yr)                ³ not used  ³ 9.000E-01 ³              ---               ³ DIET(6)
 R018 ³ Soil ingestion rate (g/yr)                       ³ 1.752E+02 ³ 3.650E+01 ³              ---               ³ SOIL
 R018 ³ Drinking water intake (L/yr)                     ³ not used  ³ 5.100E+02 ³              ---               ³ DWI
 R018 ³ Contamination fraction of drinking water         ³ not used  ³ 1.000E+00 ³              ---               ³ FDW
 R018 ³ Contamination fraction of household water        ³ not used  ³ 1.000E+00 ³              ---               ³ FHHW
 R018 ³ Contamination fraction of livestock water        ³ not used  ³ 1.000E+00 ³              ---               ³ FLW
 R018 ³ Contamination fraction of irrigation water       ³ not used  ³ 1.000E+00 ³              ---               ³ FIRW
 R018 ³ Contamination fraction of aquatic food           ³ not used  ³ 5.000E-01 ³              ---               ³ FR9
 R018 ³ Contamination fraction of plant food             ³ not used  ³-1         ³              ---               ³ FPLANT
 R018 ³ Contamination fraction of meat                   ³ not used  ³-1         ³              ---               ³ FMEAT
 R018 ³ Contamination fraction of milk                   ³ not used  ³-1         ³              ---               ³ FMILK
      ³                                                  ³           ³           ³                                ³
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                                           Site-Specific Parameter Summary (continued)
0     ³                                                  ³   User    ³           ³         Used by RESRAD         ³  Parameter
 Menu ³                     Parameter                    ³   Input   ³  Default  ³ (If different from user input) ³    Name
 ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 R019 ³ Livestock fodder intake for meat (kg/day)        ³ not used  ³ 6.800E+01 ³              ---               ³ LFI5
 R019 ³ Livestock fodder intake for milk (kg/day)        ³ not used  ³ 5.500E+01 ³              ---               ³ LFI6
 R019 ³ Livestock water intake for meat (L/day)          ³ not used  ³ 5.000E+01 ³              ---               ³ LWI5
 R019 ³ Livestock water intake for milk (L/day)          ³ not used  ³ 1.600E+02 ³              ---               ³ LWI6
 R019 ³ Livestock soil intake (kg/day)                   ³ not used  ³ 5.000E-01 ³              ---               ³ LSI
 R019 ³ Mass loading for foliar deposition (g/m**3)      ³ not used  ³ 1.000E-04 ³              ---               ³ MLFD
 R019 ³ Depth of soil mixing layer (m)                   ³ 1.500E-01 ³ 1.500E-01 ³              ---               ³ DM
 R019 ³ Depth of roots (m)                               ³ not used  ³ 9.000E-01 ³              ---               ³ DROOT
 R019 ³ Drinking water fraction from ground water        ³ not used  ³ 1.000E+00 ³              ---               ³ FGWDW
 R019 ³ Household water fraction from ground water       ³ not used  ³ 1.000E+00 ³              ---               ³ FGWHH
 R019 ³ Livestock water fraction from ground water       ³ not used  ³ 1.000E+00 ³              ---               ³ FGWLW
 R019 ³ Irrigation fraction from ground water            ³ not used  ³ 1.000E+00 ³              ---               ³ FGWIR
      ³                                                  ³           ³           ³                                ³
 R19B ³ Wet weight crop yield for Non-Leafy (kg/m**2)    ³ not used  ³ 7.000E-01 ³              ---               ³ YV(1)
 R19B ³ Wet weight crop yield for Leafy     (kg/m**2)    ³ not used  ³ 1.500E+00 ³              ---               ³ YV(2)
 R19B ³ Wet weight crop yield for Fodder    (kg/m**2)    ³ not used  ³ 1.100E+00 ³              ---               ³ YV(3)
 R19B ³ Growing Season for  Non-Leafy (years)            ³ not used  ³ 1.700E-01 ³              ---               ³ TE(1)
 R19B ³ Growing Season for  Leafy     (years)            ³ not used  ³ 2.500E-01 ³              ---               ³ TE(2)
 R19B ³ Growing Season for  Fodder    (years)            ³ not used  ³ 8.000E-02 ³              ---               ³ TE(3)
 R19B ³ Translocation Factor for  Non-Leafy              ³ not used  ³ 1.000E-01 ³              ---               ³ TIV(1)
 R19B ³ Translocation Factor for  Leafy                  ³ not used  ³ 1.000E+00 ³              ---               ³ TIV(2)
 R19B ³ Translocation Factor for  Fodder                 ³ not used  ³ 1.000E+00 ³              ---               ³ TIV(3)
 R19B ³ Dry Foliar Interception Fraction for  Non-Leafy  ³ not used  ³ 2.500E-01 ³              ---               ³ RDRY(1)
 R19B ³ Dry Foliar Interception Fraction for  Leafy      ³ not used  ³ 2.500E-01 ³              ---               ³ RDRY(2)
 R19B ³ Dry Foliar Interception Fraction for  Fodder     ³ not used  ³ 2.500E-01 ³              ---               ³ RDRY(3)
 R19B ³ Wet Foliar Interception Fraction for  Non-Leafy  ³ not used  ³ 2.500E-01 ³              ---               ³ RWET(1)
 R19B ³ Wet Foliar Interception Fraction for  Leafy      ³ not used  ³ 2.500E-01 ³              ---               ³ RWET(2)
 R19B ³ Wet Foliar Interception Fraction for  Fodder     ³ not used  ³ 2.500E-01 ³              ---               ³ RWET(3)
 R19B ³ Weathering Removal Constant for Vegetation       ³ not used  ³ 2.000E+01 ³              ---               ³ WLAM
      ³                                                  ³           ³           ³                                ³
 C14  ³ C-12 concentration in water (g/cm**3)            ³ not used  ³ 2.000E-05 ³              ---               ³ C12WTR
 C14  ³ C-12 concentration in contaminated soil (g/g)    ³ not used  ³ 3.000E-02 ³              ---               ³ C12CZ
 C14  ³ Fraction of vegetation carbon from soil          ³ not used  ³ 2.000E-02 ³              ---               ³ CSOIL
 C14  ³ Fraction of vegetation carbon from air           ³ not used  ³ 9.800E-01 ³              ---               ³ CAIR
 C14  ³ C-14 evasion layer thickness in soil (m)         ³ not used  ³ 3.000E-01 ³              ---               ³ DMC
 C14  ³ C-14 evasion flux rate from soil (1/sec)         ³ not used  ³ 7.000E-07 ³              ---               ³ EVSN
 C14  ³ C-12 evasion flux rate from soil (1/sec)         ³ not used  ³ 1.000E-10 ³              ---               ³ REVSN
 C14  ³ Fraction of grain in beef cattle feed            ³ not used  ³ 8.000E-01 ³              ---               ³ AVFG4
 C14  ³ Fraction of grain in milk cow feed               ³ not used  ³ 2.000E-01 ³              ---               ³ AVFG5
 C14  ³ DCF correction factor for gaseous forms of C14   ³ not used  ³ 0.000E+00 ³              ---               ³ CO2F
      ³                                                  ³           ³           ³                                ³
 STOR ³ Storage times of contaminated foodstuffs (days): ³           ³           ³                                ³
 STOR ³   Fruits, non-leafy vegetables, and grain        ³ 1.400E+01 ³ 1.400E+01 ³              ---               ³ STOR_T(1)
 STOR ³   Leafy vegetables                               ³ 1.000E+00 ³ 1.000E+00 ³              ---               ³ STOR_T(2)
 STOR ³   Milk                                           ³ 1.000E+00 ³ 1.000E+00 ³              ---               ³ STOR_T(3)
 STOR ³   Meat and poultry                               ³ 2.000E+01 ³ 2.000E+01 ³              ---               ³ STOR_T(4)
 STOR ³   Fish                                           ³ 7.000E+00 ³ 7.000E+00 ³              ---               ³ STOR_T(5)
 STOR ³   Crustacea and mollusks                         ³ 7.000E+00 ³ 7.000E+00 ³              ---               ³ STOR_T(6)
 STOR ³   Well water                                     ³ 1.000E+00 ³ 1.000E+00 ³              ---               ³ STOR_T(7)
 STOR ³   Surface water                                  ³ 1.000E+00 ³ 1.000E+00 ³              ---               ³ STOR_T(8)
 STOR ³   Livestock fodder                               ³ 4.500E+01 ³ 4.500E+01 ³              ---               ³ STOR_T(9)
```

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                                              Site-Specific Parameter Summary (continued)
0     ³                                                 ³   User    ³           ³         Used by RESRAD         ³  Parameter
 Menu ³                      Parameter                  ³   Input   ³  Default  ³ (If different from user input) ³    Name
 ÄÄÄÄÄÅÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÅÄÄÄÄÄÄÄÄÄÄÄÅÄÄÄÄÄÄÄÄÄÄÄÅÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÅÄÄÄÄÄÄÄÄÄÄÄÄ
 R021 ³ Thickness of building foundation (m)            ³ not used  ³ 1.500E-01 ³              ---               ³ FLOOR1
 R021 ³ Bulk density of building foundation (g/cm**3)    ³ not used  ³ 2.400E+00 ³              ---               ³ DENSFL
 R021 ³ Total porosity of the cover material            ³ not used  ³ 4.000E-01 ³              ---               ³ TPCV
 R021 ³ Total porosity of the building foundation       ³ not used  ³ 1.000E-01 ³              ---               ³ TPFL
 R021 ³ Volumetric water content of the cover material   ³ not used  ³ 5.000E-02 ³              ---               ³ PH2OCV
 R021 ³ Volumetric water content of the foundation      ³ not used  ³ 3.000E-02 ³              ---               ³ PH2OFL
 R021 ³ Diffusion coefficient for radon gas (m/sec):     ³           ³           ³                                ³
 R021 ³   in cover material                             ³ not used  ³ 2.000E-06 ³              ---               ³ DIFCV
 R021 ³   in foundation material                        ³ not used  ³ 3.000E-07 ³              ---               ³ DIFFL
 R021 ³   in contaminated zone soil                     ³ not used  ³ 2.000E-06 ³              ---               ³ DIFCZ
 R021 ³ Radon vertical dimension of mixing (m)          ³ not used  ³ 2.000E+00 ³              ---               ³ HMIX
 R021 ³ Average building air exchange rate (1/hr)       ³ not used  ³ 5.000E-01 ³              ---               ³ REXG
 R021 ³ Height of the building (room) (m)               ³ not used  ³ 2.500E+00 ³              ---               ³ HRM
 R021 ³ Building interior area factor                   ³ not used  ³ 0.000E+00 ³              ---               ³ FAI
 R021 ³ Building depth below ground surface (m)         ³ not used  ³-1.000E+00 ³              ---               ³ DMFL
 R021 ³ Emanating power of Rn-222 gas                   ³ not used  ³ 2.500E-01 ³              ---               ³ EMANA(1)
 R021 ³ Emanating power of Rn-220 gas                   ³ not used  ³ 1.500E-01 ³              ---               ³ EMANA(2)
      ³                                                 ³           ³           ³                                ³
 TITL ³ Number of graphical time points                 ³     32    ³    ---    ³              ---               ³ NPTS
 TITL ³ Maximum number of integration points for dose    ³     17    ³    ---    ³              ---               ³ LYMAX
 TITL ³ Maximum number of integration points for risk    ³    257    ³    ---    ³              ---               ³ KYMAX
 ÍÍÍÍÍÏÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÏÍÍÍÍÍÍÍÍÍÍÍÏÍÍÍÍÍÍÍÍÍÍÍÏÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÏÍÍÍÍÍÍÍÍÍÍÍÍ



                      Summary of Pathway Selections

                     Pathway             ³   User Selection
           ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÅÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
              1 -- external gamma        ³       active
              2 -- inhalation (w/o radon)³       active
              3 -- plant ingestion       ³     suppressed
              4 -- meat ingestion        ³     suppressed
              5 -- milk ingestion        ³     suppressed
              6 -- aquatic foods         ³     suppressed
              7 -- drinking water        ³     suppressed
              8 -- soil ingestion        ³       active
              9 -- radon                 ³     suppressed
              Find peak pathway doses    ³     suppressed
           ÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÏÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ
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1RESRAD, Version 6.3      T« Limit = 180 days        05/29/2006  11:37  Page  11
 Summary : CAU 482 Muck                                        File: 482Muck.RAD

      Contaminated Zone Dimensions            Initial Soil Concentrations, pCi/g
      ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ            ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
        Area:    100.00 square meters              Co-60      1.230E-01
   Thickness:      0.15 meters                     Cs-137     4.980E+02
 Cover Depth:      0.00 meters                     Pu-238     1.280E+00
                                                   Pu-239     7.700E+00
                                                   Sr-90      6.600E+01
0
                                                Total Dose TDOSE(t), mrem/yr
                                          Basic Radiation Dose Limit = 2.500E+01 mrem/yr
                         Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)
                         ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
    t (years):  0.000E+00  1.000E+00  3.000E+00  1.000E+01  2.500E+01  3.000E+01  5.000E+01  7.500E+01  1.000E+02  3.000E+02
     TDOSE(t):  4.543E+01  4.425E+01  4.198E+01  3.488E+01  2.332E+01  2.035E+01  1.163E+01  5.523E+00  2.382E+00  0.000E+00
         M(t):  1.817E+00  1.770E+00  1.679E+00  1.395E+00  9.327E-01  8.138E-01  4.653E-01  2.209E-01  9.528E-02  0.000E+00
0Maximum TDOSE(t):  4.543E+01 mrem/yr   at t = 0.000E+00 years
```

```
                        Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
                                     As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years
0                                       Water Independent Pathways (Inhalation excludes radon)
0              Ground          Inhalation             Radon              Plant              Meat               Milk               Soil
 Radio-  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Nuclide  mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.
 ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ
 Co-60   4.705E-02 0.0010  4.484E-07 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.057E-06 0.0000
 Cs-137  4.523E+01 0.9955  2.790E-04 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.633E-02 0.0004
 Pu-238  6.630E-06 0.0000  8.878E-03 0.0002  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.707E-03 0.0001
 Pu-239  6.916E-05 0.0000  5.868E-02 0.0013  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.809E-02 0.0004
 Sr-90   4.535E-02 0.0010  1.509E-03 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  6.581E-03 0.0001
 ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ
 Total   4.532E+01 0.9975  6.934E-02 0.0015  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  4.371E-02 0.0010
0
                        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
0                                                          Water Dependent Pathways
0               Water              Fish              Radon              Plant              Meat               Milk          All Pathways*
 Radio-  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Nuclide  mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.
 ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ
 Co-60   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  4.705E-02 0.0010
 Cs-137  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  4.524E+01 0.9958
 Pu-238  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.159E-02 0.0003
 Pu-239  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  7.683E-02 0.0017
 Sr-90   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  5.344E-02 0.0012
 ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ
 Total   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  4.543E+01 1.0000
0*Sum of all water independent and dependent pathways.
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1RESRAD, Version 6.3      T« Limit = 180 days        05/29/2006  11:37  Page  13
 Summary : CAU 482 Muck                                  File: 482Muck.RAD

                        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
0                                       Water Independent Pathways (Inhalation excludes radon)
0            Ground          Inhalation           Radon             Plant             Meat              Milk              Soil
 Radio-  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Nuclide  mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.
 ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ
 Co-60   4.109E-02 0.0009  3.904E-07 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.791E-06 0.0000
 Cs-137  4.405E+01 0.9956  2.708E-04 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.585E-02 0.0004
 Pu-238  6.577E-06 0.0000  8.748E-03 0.0002  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.667E-03 0.0001
 Pu-239  6.903E-05 0.0000  5.827E-02 0.0013  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.796E-02 0.0004
 Sr-90   4.375E-02 0.0010  1.449E-03 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  6.321E-03 0.0001
 ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ
 Total   4.414E+01 0.9975  6.874E-02 0.0016  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  4.280E-02 0.0010
0
                        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
0                                                      Water Dependent Pathways
0              Water             Fish             Radon             Plant             Meat              Milk          All Pathways*
 Radio-  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Nuclide  mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.
 ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ
 Co-60   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  4.109E-02 0.0009
 Cs-137  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  4.407E+01 0.9959
 Pu-238  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.142E-02 0.0003
 Pu-239  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  7.630E-02 0.0017
 Sr-90   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  5.152E-02 0.0012
 ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ
 Total   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  4.425E+01 1.0000
0*Sum of all water independent and dependent pathways.
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1RESRAD, Version 6.3      T« Limit = 180 days        05/29/2006  11:37  Page  14
 Summary : CAU 482 Muck                                         File: 482Muck.RAD

                        Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
                                     As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years
0                                       Water Independent Pathways (Inhalation excludes radon)
0             Ground          Inhalation           Radon             Plant             Meat              Milk              Soil
 Radio-  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Nuclide  mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.
 ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ
 Co-60   3.133E-02 0.0007  2.959E-07 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.357E-06 0.0000
 Cs-137  4.180E+01 0.9957  2.550E-04 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.493E-02 0.0004
 Pu-238  6.470E-06 0.0000  8.492E-03 0.0002  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.589E-03 0.0001
 Pu-239  6.876E-05 0.0000  5.747E-02 0.0014  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.771E-02 0.0004
 Sr-90   4.070E-02 0.0010  1.337E-03 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  5.832E-03 0.0001
 ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ
 Total   4.187E+01 0.9974  6.755E-02 0.0016  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  4.107E-02 0.0010
0
                        Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
                                     As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years
0                                                      Water Dependent Pathways
0              Water             Fish              Radon             Plant             Meat              Milk          All Pathways*
 Radio-  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Nuclide  mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.
 ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ
 Co-60   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  3.133E-02 0.0007
 Cs-137  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  4.181E+01 0.9961
 Pu-238  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.109E-02 0.0003
 Pu-239  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  7.525E-02 0.0018
 Sr-90   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  4.786E-02 0.0011
 ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ
 Total   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  4.198E+01 1.0000
0*Sum of all water independent and dependent pathways.
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1RESRAD, Version 6.3      T« Limit = 180 days        05/29/2006  11:37  Page  15
 Summary : CAU 482 Muck                                        File: 482Muck.RAD

                        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
0                                       Water Independent Pathways (Inhalation excludes radon)
0             Ground          Inhalation           Radon             Plant             Meat              Milk              Soil
 Radio-  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Nuclide  mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.
 ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ
 Co-60   1.212E-02 0.0003  1.120E-07 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  5.138E-07 0.0000
 Cs-137  3.473E+01 0.9959  2.065E-04 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.209E-02 0.0003
 Pu-238  6.112E-06 0.0000  7.643E-03 0.0002  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.331E-03 0.0001
 Pu-239  6.778E-05 0.0000  5.465E-02 0.0016  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.685E-02 0.0005
 Sr-90   3.157E-02 0.0009  1.007E-03 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  4.392E-03 0.0001
 ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ
 Total   3.478E+01 0.9972  6.351E-02 0.0018  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  3.566E-02 0.0010
0
                        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
0                                                      Water Dependent Pathways
0              Water             Fish              Radon             Plant             Meat              Milk          All Pathways*
 Radio-  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Nuclide  mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.
 ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ
 Co-60   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.212E-02 0.0003
 Cs-137  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  3.474E+01 0.9963
 Pu-238  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  9.980E-03 0.0003
 Pu-239  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  7.157E-02 0.0021
 Sr-90   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  3.697E-02 0.0011
 ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ
 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  3.488E+01 1.0000
0*Sum of all water independent and dependent pathways.
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1RESRAD, Version 6.3      T« Limit = 180 days        05/29/2006  11:37  Page  16
 Summary : CAU 482 Muck                                        File: 482Muck.RAD

                        Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
                                     As mrem/yr and Fraction of Total Dose At t = 2.500E+01 years
0                                       Water Independent Pathways (Inhalation excludes radon)
0             Ground          Inhalation           Radon             Plant             Meat              Milk              Soil
 Radio-  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Nuclide  mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.
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 Co-60   1.573E-03 0.0001  1.384E-08 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  6.351E-08 0.0000
 Cs-137  2.321E+01 0.9956  1.302E-04 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  7.621E-03 0.0003
 Pu-238  5.404E-06 0.0000  6.046E-03 0.0003  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.844E-03 0.0001
 Pu-239  6.549E-05 0.0000  4.865E-02 0.0021  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.500E-02 0.0006
 Sr-90   1.823E-02 0.0008  5.435E-04 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.371E-03 0.0001
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 Total   2.323E+01 0.9965  5.537E-02 0.0024  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.683E-02 0.0012
0
                        Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
                                     As mrem/yr and Fraction of Total Dose At t = 2.500E+01 years
0                                                      Water Dependent Pathways
0              Water             Fish              Radon             Plant             Meat              Milk          All Pathways*
 Radio-  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Nuclide  mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.
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 Co-60   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.573E-03 0.0001
 Cs-137  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.322E+01 0.9960
 Pu-238  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  7.895E-03 0.0003
 Pu-239  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  6.371E-02 0.0027
 Sr-90   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.115E-02 0.0009
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 Total   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.332E+01 1.0000
0*Sum of all water independent and dependent pathways.
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                        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
0                                       Water Independent Pathways (Inhalation excludes radon)
0             Ground          Inhalation           Radon             Plant             Meat              Milk              Soil
 Radio-  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Nuclide  mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.
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 Co-60   7.947E-04 0.0000  6.874E-09 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  3.154E-08 0.0000
 Cs-137  2.025E+01 0.9954  1.113E-04 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  6.515E-03 0.0003
 Pu-238  5.186E-06 0.0000  5.574E-03 0.0003  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.700E-03 0.0001
 Pu-239  6.465E-05 0.0000  4.665E-02 0.0023  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.438E-02 0.0007
 Sr-90   1.516E-02 0.0007  4.411E-04 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.924E-03 0.0001
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 Total   2.027E+01 0.9962  5.278E-02 0.0026  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.452E-02 0.0012
0
                        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
0                                                      Water Dependent Pathways
0              Water             Fish              Radon             Plant             Meat              Milk          All Pathways*
 Radio-  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Nuclide  mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.
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 Co-60   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  7.948E-04 0.0000
 Cs-137  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.026E+01 0.9957
 Pu-238  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  7.279E-03 0.0004
 Pu-239  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  6.110E-02 0.0030
 Sr-90   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.752E-02 0.0009
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 Total   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.035E+01 1.0000
0*Sum of all water independent and dependent pathways.
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1RESRAD, Version 6.3      T« Limit = 180 days        05/29/2006  11:37  Page  18
 Summary : CAU 482 Muck                                        File: 482Muck.RAD

                        Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
                                     As mrem/yr and Fraction of Total Dose At t = 5.000E+01 years
0                                       Water Independent Pathways (Inhalation excludes radon)
0             Ground          Inhalation           Radon             Plant             Meat              Milk              Soil
 Radio-  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Nuclide  mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.
 ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ
 Co-60   5.097E-05 0.0000  4.101E-10 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.882E-09 0.0000
 Cs-137  1.156E+01 0.9942  5.830E-05 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  3.413E-03 0.0003
 Pu-238  4.387E-06 0.0000  3.952E-03 0.0003  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.205E-03 0.0001
 Pu-239  6.083E-05 0.0000  3.871E-02 0.0033  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.193E-02 0.0010
 Sr-90   7.143E-03 0.0006  1.879E-04 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  8.195E-04 0.0001
 ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ
 Total   1.157E+01 0.9948  4.291E-02 0.0037  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.737E-02 0.0015
0
                        Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
                                     As mrem/yr and Fraction of Total Dose At t = 5.000E+01 years
0                                                      Water Dependent Pathways
0              Water             Fish              Radon             Plant             Meat              Milk          All Pathways*
 Radio-  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Nuclide  mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.
 ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ
 Co-60   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  5.097E-05 0.0000
 Cs-137  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.157E+01 0.9945
 Pu-238  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  5.161E-03 0.0004
 Pu-239  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  5.070E-02 0.0044
 Sr-90   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  8.151E-03 0.0007
 ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ
 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  1.163E+01 1.0000
0*Sum of all water independent and dependent pathways.
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                        Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
                                     As mrem/yr and Fraction of Total Dose At t = 7.500E+01 years
0                                       Water Independent Pathways (Inhalation excludes radon)
0             Ground          Inhalation           Radon             Plant             Meat              Milk              Soil
 Radio-  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Nuclide  mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.
 ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ
 Co-60   1.568E-06 0.0000  1.138E-11 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  5.223E-11 0.0000
 Cs-137  5.478E+00 0.9918  2.446E-05 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.432E-03 0.0003
 Pu-238  3.531E-06 0.0000  2.420E-03 0.0004  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  7.378E-04 0.0001
 Pu-239  5.459E-05 0.0000  2.886E-02 0.0052  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  8.895E-03 0.0016
 Sr-90   2.674E-03 0.0005  6.085E-05 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.654E-04 0.0000
 ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ
 Total   5.481E+00 0.9923  3.136E-02 0.0057  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.133E-02 0.0021
0
                        Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
                                     As mrem/yr and Fraction of Total Dose At t = 7.500E+01 years
0                                                      Water Dependent Pathways
0              Water             Fish              Radon             Plant             Meat              Milk          All Pathways*
 Radio-  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Nuclide  mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.
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 Co-60   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.568E-06 0.0000
 Cs-137  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  5.479E+00 0.9920
 Pu-238  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  3.161E-03 0.0006
 Pu-239  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  3.781E-02 0.0068
 Sr-90   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  3.000E-03 0.0005
 ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ
 Total   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  5.523E+00 1.0000
0*Sum of all water independent and dependent pathways.
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 Summary : CAU 482 Muck                                        File: 482Muck.RAD

                        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
0                                       Water Independent Pathways (Inhalation excludes radon)
0             Ground          Inhalation           Radon             Plant             Meat              Milk              Soil
 Radio-  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Nuclide  mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.
 ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ
 Co-60   4.378E-08 0.0000  2.804E-13 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.287E-12 0.0000
 Cs-137  2.354E+00 0.9881  9.106E-06 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  5.331E-04 0.0002
 Pu-238  2.789E-06 0.0000  1.315E-03 0.0006  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  4.009E-04 0.0002
 Pu-239  4.566E-05 0.0000  1.909E-02 0.0080  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  5.884E-03 0.0025
 Sr-90   9.138E-04 0.0004  1.749E-05 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  7.629E-05 0.0000
 ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ
 Total   2.355E+00 0.9885  2.043E-02 0.0086  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  6.894E-03 0.0029
0
                        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
0                                                      Water Dependent Pathways
0              Water             Fish              Radon             Plant             Meat              Milk          All Pathways*
 Radio-  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Nuclide  mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.
 ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ
 Co-60   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  4.378E-08 0.0000
 Cs-137  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.354E+00 0.9884
 Pu-238  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.718E-03 0.0007
 Pu-239  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.502E-02 0.0105
 Sr-90   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.008E-03 0.0004
 ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ
 Total   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.382E+00 1.0000
0*Sum of all water independent and dependent pathways.
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                        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
0                                       Water Independent Pathways (Inhalation excludes radon)
0             Ground          Inhalation           Radon             Plant             Meat              Milk              Soil
 Radio-  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Nuclide  mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.
 ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ
 Co-60   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000
 Cs-137  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000
 Pu-238  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000
 Pu-239  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000
 Sr-90   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000
 ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ
 Total   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000
0
                        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
0                                                      Water Dependent Pathways
0              Water             Fish              Radon             Plant             Meat              Milk          All Pathways*
 Radio-  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Nuclide  mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.
 ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ
 Co-60   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000
 Cs-137  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000
 Pu-238  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000
 Pu-239  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000
 Sr-90   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000
 ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ
 Total   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000
0*Sum of all water independent and dependent pathways.
```

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                                             Dose/Source Ratios Summed Over All Pathways
                                  Parent and Progeny Principal Radionuclide Contributions Indicated
0  Parent    Product    Thread                           DSR(j,t) At Time in Years   (mrem/yr)/(pCi/g)
    (i)        (j)     Fraction   0.000E+00 1.000E+00 3.000E+00 1.000E+01 2.500E+01 3.000E+01 5.000E+01 7.500E+01 1.000E+02 3.000E+02
 ÄÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ
 Co-60      Co-60      1.000E+00  3.825E-01 3.341E-01 2.548E-01 9.855E-02 1.279E-02 6.462E-03 4.144E-04 1.275E-05 3.559E-07 0.000E+00
0Cs-137+D   Cs-137+D   1.000E+00  9.085E-02 8.849E-02 8.396E-02 6.977E-02 4.663E-02 4.068E-02 2.323E-02 1.100E-02 4.727E-03 0.000E+00
0Pu-238     Pu-238     1.840E-09  1.666E-11 1.642E-11 1.594E-11 1.435E-11 1.135E-11 1.046E-11 7.418E-12 4.544E-12 2.470E-12 0.000E+00
0Pu-238     Pu-238     1.000E+00  9.056E-03 8.923E-03 8.662E-03 7.797E-03 6.168E-03 5.687E-03 4.032E-03 2.469E-03 1.342E-03 0.000E+00
 Pu-238     U-234      1.000E+00  3.587E-09 1.063E-08 2.415E-08 6.574E-08 1.285E-07 1.425E-07 1.712E-07 1.615E-07 1.205E-07 0.000E+00
 Pu-238     Th-230     1.000E+00  2.620E-14 1.817E-13 9.392E-13 7.751E-12 3.809E-11 5.114E-11 1.068E-10 1.602E-10 1.696E-10 0.000E+00
 Pu-238     Ra-226+D   1.000E+00  1.300E-16 1.936E-15 2.223E-14 5.559E-13 6.961E-12 1.137E-11 4.225E-11 1.051E-10 1.681E-10 0.000E+00
 Pu-238     Pb-210+D   1.000E+00  1.537E-20 4.696E-19 1.145E-17 7.950E-16 2.121E-14 3.971E-14 2.063E-13 6.205E-13 1.061E-12 0.000E+00
 Pu-238     äDSR(j)               9.056E-03 8.923E-03 8.662E-03 7.797E-03 6.168E-03 5.687E-03 4.032E-03 2.469E-03 1.343E-03 0.000E+00
0Pu-239     Pu-239     1.000E+00  9.978E-03 9.909E-03 9.773E-03 9.295E-03 8.274E-03 7.935E-03 6.585E-03 4.910E-03 3.249E-03 0.000E+00
 Pu-239     U-235+D    1.000E+00  1.235E-11 3.687E-11 8.513E-11 2.458E-10 5.474E-10 6.351E-10 9.214E-10 1.124E-09 1.115E-09 0.000E+00
 Pu-239     Pa-231     1.000E+00  1.220E-16 8.467E-16 4.389E-15 3.655E-14 1.834E-13 2.479E-13 5.333E-13 8.343E-13 9.275E-13 0.000E+00
 Pu-239     Ac-227+D   1.000E+00  5.114E-18 7.542E-17 8.471E-16 1.959E-14 2.092E-13 3.249E-13 9.987E-13 2.003E-12 2.621E-12 0.000E+00
 Pu-239     äDSR(j)               9.978E-03 9.909E-03 9.773E-03 9.295E-03 8.274E-03 7.935E-03 6.585E-03 4.910E-03 3.249E-03 0.000E+00
0Sr-90+D    Sr-90+D    1.000E+00  8.097E-04 7.805E-04 7.252E-04 5.602E-04 3.204E-04 2.655E-04 1.235E-04 4.546E-05 1.527E-05 0.000E+00
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 The DSR includes contributions from associated (half-life ó 180 days) daughters.
0
                                          Single Radionuclide Soil Guidelines G(i,t) in pCi/g
                                             Basic Radiation Dose Limit = 2.500E+01 mrem/yr
0Nuclide
   (i)    t= 0.000E+00   1.000E+00   3.000E+00   1.000E+01   2.500E+01   3.000E+01   5.000E+01   7.500E+01   1.000E+02   3.000E+02
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 Co-60       6.536E+01   7.484E+01   9.813E+01   2.537E+02   1.954E+03   3.869E+03   6.033E+04   1.962E+06   7.024E+07  *1.132E+15
 Cs-137      2.752E+02   2.825E+02   2.978E+02   3.583E+02   5.361E+02   6.145E+02   1.076E+03   2.272E+03   5.288E+03  *8.704E+13
 Pu-238      2.761E+03   2.802E+03   2.886E+03   3.206E+03   4.053E+03   4.396E+03   6.201E+03   1.012E+04   1.862E+04  *1.712E+13
 Pu-239      2.506E+03   2.523E+03   2.558E+03   2.690E+03   3.021E+03   3.151E+03   3.797E+03   5.092E+03   7.694E+03  *6.214E+10
 Sr-90       3.087E+04   3.203E+04   3.447E+04   4.463E+04   7.802E+04   9.417E+04   2.024E+05   5.499E+05   1.638E+06  *1.365E+14
 ÍÍÍÍÍÍÍ     ÍÍÍÍÍÍÍÍÍ   ÍÍÍÍÍÍÍÍÍ   ÍÍÍÍÍÍÍÍÍ   ÍÍÍÍÍÍÍÍÍ   ÍÍÍÍÍÍÍÍÍ   ÍÍÍÍÍÍÍÍÍ   ÍÍÍÍÍÍÍÍÍ   ÍÍÍÍÍÍÍÍÍ   ÍÍÍÍÍÍÍÍÍ   ÍÍÍÍÍÍÍÍÍ
 *At specific activity limit
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             Summed Dose/Source Ratios DSR(i,t) in (mrem/yr)/(pCi/g)
             and Single Radionuclide Soil Guidelines G(i,t) in pCi/g
          at tmin = time of minimum single radionuclide soil guideline
      and at tmax = time of maximum total dose = 0.000E+00 years
0Nuclide  Initial         tmin       DSR(i,tmin) G(i,tmin) DSR(i,tmax) G(i,tmax)
   (i)    (pCi/g)       (years)                   (pCi/g)                (pCi/g)
 ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ
 Co-60   1.230E-01     0.000E+00      3.825E-01  6.536E+01  3.825E-01  6.536E+01
 Cs-137  4.980E+02     0.000E+00      9.085E-02  2.752E+02  9.085E-02  2.752E+02
 Pu-238  1.280E+00     0.000E+00      9.056E-03  2.761E+03  9.056E-03  2.761E+03
 Pu-239  7.700E+00     0.000E+00      9.978E-03  2.506E+03  9.978E-03  2.506E+03
 Sr-90   6.600E+01     0.000E+00      8.097E-04  3.087E+04  8.097E-04  3.087E+04
 ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ
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1RESRAD, Version 6.3      T« Limit = 180 days        05/29/2006  11:37  Page  24
 Summary : CAU 482 Muck                                        File: 482Muck.RAD

                                         Individual Nuclide Dose Summed Over All Pathways
                                           Parent Nuclide and Branch Fraction Indicated
0Nuclide Parent   THF(i)                                             DOSE(j,t), mrem/yr
   (j)     (i)             t= 0.000E+00 1.000E+00 3.000E+00 1.000E+01 2.500E+01 3.000E+01 5.000E+01 7.500E+01 1.000E+02 3.000E+02
 ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ    ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ
 Co-60   Co-60   1.000E+00    4.705E-02 4.109E-02 3.133E-02 1.212E-02 1.573E-03 7.948E-04 5.097E-05 1.568E-06 4.378E-08 0.000E+00
0Cs-137  Cs-137  1.000E+00    4.524E+01 4.407E+01 4.181E+01 3.474E+01 2.322E+01 2.026E+01 1.157E+01 5.479E+00 2.354E+00 0.000E+00
0Pu-238  Pu-238  1.840E-09    2.133E-11 2.102E-11 2.040E-11 1.836E-11 1.453E-11 1.339E-11 9.496E-12 5.816E-12 3.162E-12 0.000E+00
 Pu-238  Pu-238  1.000E+00    1.159E-02 1.142E-02 1.109E-02 9.980E-03 7.895E-03 7.279E-03 5.161E-03 3.161E-03 1.718E-03 0.000E+00
 Pu-238  äDOSE(j)             1.159E-02 1.142E-02 1.109E-02 9.980E-03 7.895E-03 7.279E-03 5.161E-03 3.161E-03 1.718E-03 0.000E+00
0U-234   Pu-238  1.000E+00    4.592E-09 1.361E-08 3.091E-08 8.415E-08 1.645E-07 1.824E-07 2.192E-07 2.067E-07 1.543E-07 0.000E+00
0Th-230  Pu-238  1.000E+00    3.354E-14 2.325E-13 1.202E-12 9.921E-12 4.876E-11 6.546E-11 1.367E-10 2.051E-10 2.171E-10 0.000E+00
0Ra-226  Pu-238  1.000E+00    1.663E-16 2.478E-15 2.845E-14 7.115E-13 8.910E-12 1.455E-11 5.408E-11 1.345E-10 2.151E-10 0.000E+00
0Pb-210  Pu-238  1.000E+00    1.968E-20 6.011E-19 1.466E-17 1.018E-15 2.715E-14 5.083E-14 2.641E-13 7.942E-13 1.358E-12 0.000E+00
0Pu-239  Pu-239  1.000E+00    7.683E-02 7.630E-02 7.525E-02 7.157E-02 6.371E-02 6.110E-02 5.070E-02 3.781E-02 2.502E-02 0.000E+00
0U-235   Pu-239  1.000E+00    9.510E-11 2.839E-10 6.555E-10 1.892E-09 4.215E-09 4.890E-09 7.095E-09 8.652E-09 8.584E-09 0.000E+00
0Pa-231  Pu-239  1.000E+00    9.395E-16 6.520E-15 3.380E-14 2.815E-13 1.412E-12 1.909E-12 4.106E-12 6.424E-12 7.142E-12 0.000E+00
0Ac-227  Pu-239  1.000E+00    3.938E-17 5.807E-16 6.523E-15 1.508E-13 1.611E-12 2.502E-12 7.690E-12 1.542E-11 2.018E-11 0.000E+00
0Sr-90   Sr-90   1.000E+00    5.344E-02 5.152E-02 4.786E-02 3.697E-02 2.115E-02 1.752E-02 8.151E-03 3.000E-03 1.008E-03 0.000E+00
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 THF(i) is the thread fraction of the parent nuclide.
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                                              Individual Nuclide Soil Concentration
                                           Parent Nuclide and Branch Fraction Indicated
0Nuclide Parent   THF(i)                                                S(j,t), pCi/g
   (j)     (i)             t= 0.000E+00 1.000E+00 3.000E+00 1.000E+01 2.500E+01 3.000E+01 5.000E+01 7.500E+01 1.000E+02 3.000E+02
 ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ    ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ
 Co-60   Co-60   1.000E+00    1.230E-01 1.078E-01 8.283E-02 3.292E-02 4.560E-03 2.359E-03 1.690E-04 6.267E-06 2.323E-07 8.289E-19
0Cs-137  Cs-137  1.000E+00    4.980E+02 4.866E+02 4.646E+02 3.950E+02 2.790E+02 2.485E+02 1.564E+02 8.761E+01 4.909E+01 4.771E-01
0Pu-238  Pu-238  1.840E-09    2.355E-09 2.336E-09 2.299E-09 2.173E-09 1.926E-09 1.850E-09 1.575E-09 1.288E-09 1.053E-09 2.107E-10
 Pu-238  Pu-238  1.000E+00    1.280E+00 1.270E+00 1.249E+00 1.181E+00 1.047E+00 1.005E+00 8.560E-01 7.000E-01 5.725E-01 1.145E-01
 Pu-238  äS(j):               1.280E+00 1.270E+00 1.249E+00 1.181E+00 1.047E+00 1.005E+00 8.560E-01 7.000E-01 5.725E-01 1.145E-01
0U-234   Pu-238  1.000E+00    0.000E+00 3.604E-06 1.066E-05 3.385E-05 7.626E-05 8.840E-05 1.283E-04 1.618E-04 1.815E-04 1.379E-04
0Th-230  Pu-238  1.000E+00    0.000E+00 1.626E-11 1.450E-10 1.560E-09 9.099E-09 1.281E-08 3.250E-08 6.542E-08 1.043E-07 4.190E-07
0Ra-226  Pu-238  1.000E+00    0.000E+00 2.348E-15 6.280E-14 2.252E-12 3.284E-11 5.547E-11 2.344E-10 7.066E-10 1.497E-09 1.722E-08
0Pb-210  Pu-238  1.000E+00    0.000E+00 1.814E-17 1.439E-15 1.652E-13 5.546E-12 1.095E-11 6.966E-11 2.802E-10 7.113E-10 1.311E-08
0Pu-239  Pu-239  1.000E+00    7.700E+00 7.699E+00 7.696E+00 7.687E+00 7.666E+00 7.660E+00 7.633E+00 7.599E+00 7.566E+00 7.305E+00
0U-235   Pu-239  1.000E+00    0.000E+00 7.561E-09 2.255E-08 7.360E-08 1.760E-07 2.081E-07 3.273E-07 4.572E-07 5.688E-07 1.037E-06
0Pa-231  Pu-239  1.000E+00    0.000E+00 7.991E-14 7.135E-13 7.712E-12 4.544E-11 6.416E-11 1.649E-10 3.370E-10 5.448E-10 2.397E-09
0Ac-227  Pu-239  1.000E+00    0.000E+00 8.391E-16 2.201E-14 7.384E-13 9.431E-12 1.528E-11 5.545E-11 1.416E-10 2.603E-10 1.522E-09
0Sr-90   Sr-90   1.000E+00    6.600E+01 6.382E+01 5.969E+01 4.720E+01 2.855E+01 2.414E+01 1.235E+01 5.342E+00 2.311E+00 2.832E-03
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 THF(i) is the thread fraction of the parent nuclide.
0RESCALC.EXE execution time =    1.61 seconds
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Exhibit 2

RESRAD Summary Report:
CAU 482 CAS 15-38-01
Area 15U 15a/e Ponds

(26 Pages)

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                        Table of Contents
                        ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
    Part I: Mixture Sums and Single Radionuclide Guidelines
    ÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ
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                           Dose Conversion Factor (and Related) Parameter Summary
                                           File: FGR 13 MORBIDITY
0     ³                                                             ³  Current  ³   Base    ³  Parameter
 Menu ³                          Parameter                          ³   Value   ³   Case*   ³    Name
 ÄÄÄÄÄÅÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÅÄÄÄÄÄÄÄÄÄÄÄÅÄÄÄÄÄÄÄÄÄÄÄÅÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 B-1  ³ Dose conversion factors for inhalation, mrem/pCi:          ³           ³           ³
 B-1  ³ Ac-227+D                                                    ³ 6.724E+00 ³ 6.700E+00 ³ DCF2(  1)
 B-1  ³ Am-241                                                      ³ 4.440E-01 ³ 4.440E-01 ³ DCF2(  2)
 B-1  ³ Cs-137+D                                                    ³ 3.190E-05 ³ 3.190E-05 ³ DCF2(  3)
 B-1  ³ Np-237+D                                                    ³ 5.400E-01 ³ 5.400E-01 ³ DCF2(  4)
 B-1  ³ Pa-231                                                      ³ 1.280E+00 ³ 1.280E+00 ³ DCF2(  5)
 B-1  ³ Pb-210+D                                                    ³ 2.320E-02 ³ 1.360E-02 ³ DCF2(  6)
 B-1  ³ Pu-238                                                      ³ 3.920E-01 ³ 3.920E-01 ³ DCF2(  7)
 B-1  ³ Pu-239                                                      ³ 4.290E-01 ³ 4.290E-01 ³ DCF2(  9)
 B-1  ³ Ra-226+D                                                    ³ 8.594E-03 ³ 8.580E-03 ³ DCF2( 10)
 B-1  ³ Sr-90+D                                                     ³ 1.308E-03 ³ 1.300E-03 ³ DCF2( 11)
 B-1  ³ Th-229+D                                                    ³ 2.169E+00 ³ 2.150E+00 ³ DCF2( 12)
 B-1  ³ Th-230                                                      ³ 3.260E-01 ³ 3.260E-01 ³ DCF2( 13)
 B-1  ³ U-233                                                       ³ 1.350E-01 ³ 1.350E-01 ³ DCF2( 14)
 B-1  ³ U-234                                                       ³ 1.320E-01 ³ 1.320E-01 ³ DCF2( 15)
 B-1  ³ U-235+D                                                     ³ 1.230E-01 ³ 1.230E-01 ³ DCF2( 16)
      ³                                                             ³           ³           ³
 D-1  ³ Dose conversion factors for ingestion, mrem/pCi:            ³           ³           ³
 D-1  ³ Ac-227+D                                                    ³ 1.480E-02 ³ 1.410E-02 ³ DCF3(  1)
 D-1  ³ Am-241                                                      ³ 3.640E-03 ³ 3.640E-03 ³ DCF3(  2)
 D-1  ³ Cs-137+D                                                    ³ 5.000E-05 ³ 5.000E-05 ³ DCF3(  3)
 D-1  ³ Np-237+D                                                    ³ 4.444E-03 ³ 4.440E-03 ³ DCF3(  4)
 D-1  ³ Pa-231                                                      ³ 1.060E-02 ³ 1.060E-02 ³ DCF3(  5)
 D-1  ³ Pb-210+D                                                    ³ 7.276E-03 ³ 5.370E-03 ³ DCF3(  6)
 D-1  ³ Pu-238                                                      ³ 3.200E-03 ³ 3.200E-03 ³ DCF3(  7)
 D-1  ³ Pu-239                                                      ³ 3.540E-03 ³ 3.540E-03 ³ DCF3(  9)
 D-1  ³ Ra-226+D                                                    ³ 1.321E-03 ³ 1.320E-03 ³ DCF3( 10)
 D-1  ³ Sr-90+D                                                     ³ 1.528E-04 ³ 1.420E-04 ³ DCF3( 11)
 D-1  ³ Th-229+D                                                    ³ 4.027E-03 ³ 3.530E-03 ³ DCF3( 12)
 D-1  ³ Th-230                                                      ³ 5.480E-04 ³ 5.480E-04 ³ DCF3( 13)
 D-1  ³ U-233                                                       ³ 2.890E-04 ³ 2.890E-04 ³ DCF3( 14)
 D-1  ³ U-234                                                       ³ 2.830E-04 ³ 2.830E-04 ³ DCF3( 15)
 D-1  ³ U-235+D                                                     ³ 2.673E-04 ³ 2.660E-04 ³ DCF3( 16)
      ³                                                             ³           ³           ³
 D-34 ³ Food transfer factors:                                      ³           ³           ³
 D-34 ³ Ac-227+D  , plant/soil concentration ratio, dimensionless   ³ 2.500E-03 ³ 2.500E-03 ³ RTF(  1,1)
 D-34 ³ Ac-227+D  , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)   ³ 2.000E-05 ³ 2.000E-05 ³ RTF(  1,2)
 D-34 ³ Ac-227+D  , milk/livestock-intake ratio, (pCi/L)/(pCi/d)    ³ 2.000E-05 ³ 2.000E-05 ³ RTF(  1,3)
 D-34 ³                                                             ³           ³           ³
 D-34 ³ Am-241    , plant/soil concentration ratio, dimensionless   ³ 1.000E-03 ³ 1.000E-03 ³ RTF(  2,1)
 D-34 ³ Am-241    , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)   ³ 5.000E-05 ³ 5.000E-05 ³ RTF(  2,2)
 D-34 ³ Am-241    , milk/livestock-intake ratio, (pCi/L)/(pCi/d)    ³ 2.000E-06 ³ 2.000E-06 ³ RTF(  2,3)
 D-34 ³                                                             ³           ³           ³
 D-34 ³ Cs-137+D  , plant/soil concentration ratio, dimensionless   ³ 4.000E-02 ³ 4.000E-02 ³ RTF(  3,1)
 D-34 ³ Cs-137+D  , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)   ³ 3.000E-02 ³ 3.000E-02 ³ RTF(  3,2)
 D-34 ³ Cs-137+D  , milk/livestock-intake ratio, (pCi/L)/(pCi/d)    ³ 8.000E-03 ³ 8.000E-03 ³ RTF(  3,3)
 D-34 ³                                                             ³           ³           ³
 D-34 ³ Np-237+D  , plant/soil concentration ratio, dimensionless   ³ 2.000E-02 ³ 2.000E-02 ³ RTF(  4,1)
 D-34 ³ Np-237+D  , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)   ³ 1.000E-03 ³ 1.000E-03 ³ RTF(  4,2)
 D-34 ³ Np-237+D  , milk/livestock-intake ratio, (pCi/L)/(pCi/d)    ³ 5.000E-06 ³ 5.000E-06 ³ RTF(  4,3)
 D-34 ³                                                             ³           ³           ³
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1RESRAD, Version 6.3      T« Limit = 180 days        05/29/2006  11:30  Page   3
 Summary : CAU 482 Ponds                                      File: 482Ponds.RAD

                     Dose Conversion Factor (and Related) Parameter Summary (continued)
                                           File: FGR 13 MORBIDITY
0     ³                                                             ³  Current  ³   Base    ³  Parameter
 Menu ³                           Parameter                         ³   Value   ³   Case*   ³    Name
 ÄÄÄÄÄÅÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÅÄÄÄÄÄÄÄÄÄÄÄÅÄÄÄÄÄÄÄÄÄÄÄÅÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 D-34 ³ Pa-231    , plant/soil concentration ratio, dimensionless   ³ 1.000E-02 ³ 1.000E-02 ³ RTF(  5,1)
 D-34 ³ Pa-231    , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)   ³ 5.000E-03 ³ 5.000E-03 ³ RTF(  5,2)
 D-34 ³ Pa-231    , milk/livestock-intake ratio, (pCi/L)/(pCi/d)    ³ 5.000E-06 ³ 5.000E-06 ³ RTF(  5,3)
 D-34 ³                                                             ³           ³           ³
 D-34 ³ Pb-210+D  , plant/soil concentration ratio, dimensionless   ³ 1.000E-02 ³ 1.000E-02 ³ RTF(  6,1)
 D-34 ³ Pb-210+D  , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)   ³ 8.000E-04 ³ 8.000E-04 ³ RTF(  6,2)
 D-34 ³ Pb-210+D  , milk/livestock-intake ratio, (pCi/L)/(pCi/d)    ³ 3.000E-04 ³ 3.000E-04 ³ RTF(  6,3)
 D-34 ³                                                             ³           ³           ³
 D-34 ³ Pu-238    , plant/soil concentration ratio, dimensionless   ³ 1.000E-03 ³ 1.000E-03 ³ RTF(  7,1)
 D-34 ³ Pu-238    , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)   ³ 1.000E-04 ³ 1.000E-04 ³ RTF(  7,2)
 D-34 ³ Pu-238    , milk/livestock-intake ratio, (pCi/L)/(pCi/d)    ³ 1.000E-06 ³ 1.000E-06 ³ RTF(  7,3)
 D-34 ³                                                             ³           ³           ³
 D-34 ³ Pu-239    , plant/soil concentration ratio, dimensionless   ³ 1.000E-03 ³ 1.000E-03 ³ RTF(  9,1)
 D-34 ³ Pu-239    , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)   ³ 1.000E-04 ³ 1.000E-04 ³ RTF(  9,2)
 D-34 ³ Pu-239    , milk/livestock-intake ratio, (pCi/L)/(pCi/d)    ³ 1.000E-06 ³ 1.000E-06 ³ RTF(  9,3)
 D-34 ³                                                             ³           ³           ³
 D-34 ³ Ra-226+D  , plant/soil concentration ratio, dimensionless   ³ 4.000E-02 ³ 4.000E-02 ³ RTF( 10,1)
 D-34 ³ Ra-226+D  , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)   ³ 1.000E-03 ³ 1.000E-03 ³ RTF( 10,2)
 D-34 ³ Ra-226+D  , milk/livestock-intake ratio, (pCi/L)/(pCi/d)    ³ 1.000E-03 ³ 1.000E-03 ³ RTF( 10,3)
 D-34 ³                                                             ³           ³           ³
 D-34 ³ Sr-90+D   , plant/soil concentration ratio, dimensionless   ³ 3.000E-01 ³ 3.000E-01 ³ RTF( 11,1)
 D-34 ³ Sr-90+D   , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)   ³ 8.000E-03 ³ 8.000E-03 ³ RTF( 11,2)
 D-34 ³ Sr-90+D   , milk/livestock-intake ratio, (pCi/L)/(pCi/d)    ³ 2.000E-03 ³ 2.000E-03 ³ RTF( 11,3)
 D-34 ³                                                             ³           ³           ³
 D-34 ³ Th-229+D  , plant/soil concentration ratio, dimensionless   ³ 1.000E-03 ³ 1.000E-03 ³ RTF( 12,1)
 D-34 ³ Th-229+D  , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)   ³ 1.000E-04 ³ 1.000E-04 ³ RTF( 12,2)
 D-34 ³ Th-229+D  , milk/livestock-intake ratio, (pCi/L)/(pCi/d)    ³ 5.000E-06 ³ 5.000E-06 ³ RTF( 12,3)
 D-34 ³                                                             ³           ³           ³
 D-34 ³ Th-230    , plant/soil concentration ratio, dimensionless   ³ 1.000E-03 ³ 1.000E-03 ³ RTF( 13,1)
 D-34 ³ Th-230    , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)   ³ 1.000E-04 ³ 1.000E-04 ³ RTF( 13,2)
 D-34 ³ Th-230    , milk/livestock-intake ratio, (pCi/L)/(pCi/d)    ³ 5.000E-06 ³ 5.000E-06 ³ RTF( 13,3)
 D-34 ³                                                             ³           ³           ³
 D-34 ³ U-233     , plant/soil concentration ratio, dimensionless   ³ 2.500E-03 ³ 2.500E-03 ³ RTF( 14,1)
 D-34 ³ U-233     , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)   ³ 3.400E-04 ³ 3.400E-04 ³ RTF( 14,2)
 D-34 ³ U-233     , milk/livestock-intake ratio, (pCi/L)/(pCi/d)    ³ 6.000E-04 ³ 6.000E-04 ³ RTF( 14,3)
 D-34 ³                                                             ³           ³           ³
 D-34 ³ U-234     , plant/soil concentration ratio, dimensionless   ³ 2.500E-03 ³ 2.500E-03 ³ RTF( 15,1)
 D-34 ³ U-234     , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)   ³ 3.400E-04 ³ 3.400E-04 ³ RTF( 15,2)
 D-34 ³ U-234     , milk/livestock-intake ratio, (pCi/L)/(pCi/d)    ³ 6.000E-04 ³ 6.000E-04 ³ RTF( 15,3)
 D-34 ³                                                             ³           ³           ³
 D-34 ³ U-235+D   , plant/soil concentration ratio, dimensionless   ³ 2.500E-03 ³ 2.500E-03 ³ RTF( 16,1)
 D-34 ³ U-235+D   , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)   ³ 3.400E-04 ³ 3.400E-04 ³ RTF( 16,2)
 D-34 ³ U-235+D   , milk/livestock-intake ratio, (pCi/L)/(pCi/d)    ³ 6.000E-04 ³ 6.000E-04 ³ RTF( 16,3)
      ³                                                             ³           ³           ³
 D-5  ³ Bioaccumulation factors, fresh water, L/kg:                 ³           ³           ³
 D-5  ³ Ac-227+D  , fish                                            ³ 1.500E+01 ³ 1.500E+01 ³ BIOFAC(  1,1)
 D-5  ³ Ac-227+D  , crustacea and mollusks                          ³ 1.000E+03 ³ 1.000E+03 ³ BIOFAC(  1,2)
 D-5  ³                                                             ³           ³           ³
 D-5  ³ Am-241    , fish                                            ³ 3.000E+01 ³ 3.000E+01 ³ BIOFAC(  2,1)
 D-5  ³ Am-241    , crustacea and mollusks                          ³ 1.000E+03 ³ 1.000E+03 ³ BIOFAC(  2,2)
 D-5  ³                                                             ³           ³           ³
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                     Dose Conversion Factor (and Related) Parameter Summary (continued)
                                           File: FGR 13 MORBIDITY
0     ³                                                             ³  Current  ³   Base    ³  Parameter
 Menu ³                          Parameter                          ³   Value   ³   Case*   ³    Name
 ÄÄÄÄÄÅÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÅÄÄÄÄÄÄÄÄÄÄÄÅÄÄÄÄÄÄÄÄÄÄÄÅÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 D-5  ³ Cs-137+D  , fish                                            ³ 2.000E+03 ³ 2.000E+03 ³ BIOFAC(  3,1)
 D-5  ³ Cs-137+D  , crustacea and mollusks                          ³ 1.000E+02 ³ 1.000E+02 ³ BIOFAC(  3,2)
 D-5  ³                                                             ³           ³           ³
 D-5  ³ Np-237+D  , fish                                            ³ 3.000E+01 ³ 3.000E+01 ³ BIOFAC(  4,1)
 D-5  ³ Np-237+D  , crustacea and mollusks                          ³ 4.000E+02 ³ 4.000E+02 ³ BIOFAC(  4,2)
 D-5  ³                                                             ³           ³           ³
 D-5  ³ Pa-231    , fish                                            ³ 1.000E+01 ³ 1.000E+01 ³ BIOFAC(  5,1)
 D-5  ³ Pa-231    , crustacea and mollusks                          ³ 1.100E+02 ³ 1.100E+02 ³ BIOFAC(  5,2)
 D-5  ³                                                             ³           ³           ³
 D-5  ³ Pb-210+D  , fish                                            ³ 3.000E+02 ³ 3.000E+02 ³ BIOFAC(  6,1)
 D-5  ³ Pb-210+D  , crustacea and mollusks                          ³ 1.000E+02 ³ 1.000E+02 ³ BIOFAC(  6,2)
 D-5  ³                                                             ³           ³           ³
 D-5  ³ Pu-238    , fish                                            ³ 3.000E+01 ³ 3.000E+01 ³ BIOFAC(  7,1)
 D-5  ³ Pu-238    , crustacea and mollusks                          ³ 1.000E+02 ³ 1.000E+02 ³ BIOFAC(  7,2)
 D-5  ³                                                             ³           ³           ³
 D-5  ³ Pu-239    , fish                                            ³ 3.000E+01 ³ 3.000E+01 ³ BIOFAC(  9,1)
 D-5  ³ Pu-239    , crustacea and mollusks                          ³ 1.000E+02 ³ 1.000E+02 ³ BIOFAC(  9,2)
 D-5  ³                                                             ³           ³           ³
 D-5  ³ Ra-226+D  , fish                                            ³ 5.000E+01 ³ 5.000E+01 ³ BIOFAC( 10,1)
 D-5  ³ Ra-226+D  , crustacea and mollusks                          ³ 2.500E+02 ³ 2.500E+02 ³ BIOFAC( 10,2)
 D-5  ³                                                             ³           ³           ³
 D-5  ³ Sr-90+D   , fish                                            ³ 6.000E+01 ³ 6.000E+01 ³ BIOFAC( 11,1)
 D-5  ³ Sr-90+D   , crustacea and mollusks                          ³ 1.000E+02 ³ 1.000E+02 ³ BIOFAC( 11,2)
 D-5  ³                                                             ³           ³           ³
 D-5  ³ Th-229+D  , fish                                            ³ 1.000E+02 ³ 1.000E+02 ³ BIOFAC( 12,1)
 D-5  ³ Th-229+D  , crustacea and mollusks                          ³ 5.000E+02 ³ 5.000E+02 ³ BIOFAC( 12,2)
 D-5  ³                                                             ³           ³           ³
 D-5  ³ Th-230    , fish                                            ³ 1.000E+02 ³ 1.000E+02 ³ BIOFAC( 13,1)
 D-5  ³ Th-230    , crustacea and mollusks                          ³ 5.000E+02 ³ 5.000E+02 ³ BIOFAC( 13,2)
 D-5  ³                                                             ³           ³           ³
 D-5  ³ U-233     , fish                                            ³ 1.000E+01 ³ 1.000E+01 ³ BIOFAC( 14,1)
 D-5  ³ U-233     , crustacea and mollusks                          ³ 6.000E+01 ³ 6.000E+01 ³ BIOFAC( 14,2)
 D-5  ³                                                             ³           ³           ³
 D-5  ³ U-234     , fish                                            ³ 1.000E+01 ³ 1.000E+01 ³ BIOFAC( 15,1)
 D-5  ³ U-234     , crustacea and mollusks                          ³ 6.000E+01 ³ 6.000E+01 ³ BIOFAC( 15,2)
 D-5  ³                                                             ³           ³           ³
 D-5  ³ U-235+D   , fish                                            ³ 1.000E+01 ³ 1.000E+01 ³ BIOFAC( 16,1)
 D-5  ³ U-235+D   , crustacea and mollusks                          ³ 6.000E+01 ³ 6.000E+01 ³ BIOFAC( 16,2)
 ÍÍÍÍÍÏÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÏÍÍÍÍÍÍÍÍÍÍÍÏÍÍÍÍÍÍÍÍÍÍÍÏÍÍÍÍÍÍÍÍÍÍÍÍÍÍ
 *Base Case means Default.Lib w/o Associate Nuclide contributions.
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                                                 Site-Specific Parameter Summary
0     ³                                                  ³   User    ³           ³         Used by RESRAD         ³  Parameter
 Menu ³                     Parameter                    ³   Input   ³  Default  ³ (If different from user input) ³    Name
 ÄÄÄÄÄÅÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÅÄÄÄÄÄÄÄÄÄÄÄÅÄÄÄÄÄÄÄÄÄÄÄÅÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÅÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 R011 ³ Area of contaminated zone (m**2)                 ³ 1.000E+02 ³ 1.000E+04 ³              ---               ³ AREA
 R011 ³ Thickness of contaminated zone (m)               ³ 1.500E-01 ³ 2.000E+00 ³              ---               ³ THICK0
 R011 ³ Length parallel to aquifer flow (m)              ³ not used  ³ 1.000E+02 ³              ---               ³ LCZPAQ
 R011 ³ Basic radiation dose limit (mrem/yr)             ³ 2.500E+01 ³ 3.000E+01 ³              ---               ³ BRDL
 R011 ³ Time since placement of material (yr)            ³ 0.000E+00 ³ 0.000E+00 ³              ---               ³ TI
 R011 ³ Times for calculations (yr)                      ³ 1.000E+00 ³ 1.000E+00 ³              ---               ³ T( 2)
 R011 ³ Times for calculations (yr)                      ³ 3.000E+00 ³ 3.000E+00 ³              ---               ³ T( 3)
 R011 ³ Times for calculations (yr)                      ³ 1.000E+01 ³ 1.000E+01 ³              ---               ³ T( 4)
 R011 ³ Times for calculations (yr)                      ³ 3.000E+01 ³ 3.000E+01 ³              ---               ³ T( 5)
 R011 ³ Times for calculations (yr)                      ³ 5.000E+01 ³ 1.000E+02 ³              ---               ³ T( 6)
 R011 ³ Times for calculations (yr)                      ³ 6.000E+01 ³ 3.000E+02 ³              ---               ³ T( 7)
 R011 ³ Times for calculations (yr)                      ³ 1.000E+02 ³ 1.000E+03 ³              ---               ³ T( 8)
 R011 ³ Times for calculations (yr)                      ³ 3.000E+02 ³ 0.000E+00 ³              ---               ³ T( 9)
 R011 ³ Times for calculations (yr)                      ³ 1.000E+03 ³ 0.000E+00 ³              ---               ³ T(10)
      ³                                                  ³           ³           ³                                ³
 R012 ³ Initial principal radionuclide (pCi/g):  Am-241  ³ 1.820E+02 ³ 0.000E+00 ³              ---               ³ S1( 2)
 R012 ³ Initial principal radionuclide (pCi/g):  Cs-137  ³ 8.300E+02 ³ 0.000E+00 ³              ---               ³ S1( 3)
 R012 ³ Initial principal radionuclide (pCi/g):  Pu-238  ³ 1.830E+01 ³ 0.000E+00 ³              ---               ³ S1( 7)
 R012 ³ Initial principal radionuclide (pCi/g):  Pu-239  ³ 1.000E+03 ³ 0.000E+00 ³              ---               ³ S1( 9)
 R012 ³ Initial principal radionuclide (pCi/g):  Sr-90   ³ 6.500E+01 ³ 0.000E+00 ³              ---               ³ S1(11)
 R012 ³ Concentration in groundwater   (pCi/L):  Am-241  ³ not used  ³ 0.000E+00 ³              ---               ³ W1( 2)
 R012 ³ Concentration in groundwater   (pCi/L):  Cs-137  ³ not used  ³ 0.000E+00 ³              ---               ³ W1( 3)
 R012 ³ Concentration in groundwater   (pCi/L):  Pu-238  ³ not used  ³ 0.000E+00 ³              ---               ³ W1( 7)
 R012 ³ Concentration in groundwater   (pCi/L):  Pu-239  ³ not used  ³ 0.000E+00 ³              ---               ³ W1( 9)
 R012 ³ Concentration in groundwater   (pCi/L):  Sr-90   ³ not used  ³ 0.000E+00 ³              ---               ³ W1(11)
      ³                                                  ³           ³           ³                                ³
 R013 ³ Cover depth (m)                                  ³ 0.000E+00 ³ 0.000E+00 ³              ---               ³ COVER0
 R013 ³ Density of cover material (g/cm**3)              ³ not used  ³ 1.500E+00 ³              ---               ³ DENSCV
 R013 ³ Cover depth erosion rate (m/yr)                  ³ not used  ³ 1.000E-03 ³              ---               ³ VCV
 R013 ³ Density of contaminated zone (g/cm**3)           ³ 1.500E+00 ³ 1.500E+00 ³              ---               ³ DENSCZ
 R013 ³ Contaminated zone erosion rate (m/yr)            ³ 1.000E-03 ³ 1.000E-03 ³              ---               ³ VCZ
 R013 ³ Contaminated zone total porosity                 ³ 4.000E-01 ³ 4.000E-01 ³              ---               ³ TPCZ
 R013 ³ Contaminated zone field capacity                 ³ 2.000E-01 ³ 2.000E-01 ³              ---               ³ FCCZ
 R013 ³ Contaminated zone hydraulic conductivity (m/yr)  ³ 1.000E+01 ³ 1.000E+01 ³              ---               ³ HCCZ
 R013 ³ Contaminated zone b parameter                    ³ 5.300E+00 ³ 5.300E+00 ³              ---               ³ BCZ
 R013 ³ Average annual wind speed (m/sec)                ³ 3.770E+00 ³ 2.000E+00 ³              ---               ³ WIND
 R013 ³ Humidity in air (g/m**3)                         ³ not used  ³ 8.000E+00 ³              ---               ³ HUMID
 R013 ³ Evapotranspiration coefficient                   ³ 5.000E-01 ³ 5.000E-01 ³              ---               ³ EVAPTR
 R013 ³ Precipitation (m/yr)                             ³ 2.200E-01 ³ 1.000E+00 ³              ---               ³ PRECIP
 R013 ³ Irrigation (m/yr)                                ³ 0.000E+00 ³ 2.000E-01 ³              ---               ³ RI
 R013 ³ Irrigation mode                                  ³ overhead  ³ overhead  ³              ---               ³ IDITCH
 R013 ³ Runoff coefficient                               ³ 4.000E-01 ³ 2.000E-01 ³              ---               ³ RUNOFF
 R013 ³ Watershed area for nearby stream or pond (m**2)  ³ not used  ³ 1.000E+06 ³              ---               ³ WAREA
 R013 ³ Accuracy for water/soil computations             ³ not used  ³ 1.000E-03 ³              ---               ³ EPS
      ³                                                  ³           ³           ³                                ³
 R014 ³ Density of saturated zone (g/cm**3)              ³ not used  ³ 1.500E+00 ³              ---               ³ DENSAQ
 R014 ³ Saturated zone total porosity                    ³ not used  ³ 4.000E-01 ³              ---               ³ TPSZ
 R014 ³ Saturated zone effective porosity                ³ not used  ³ 2.000E-01 ³              ---               ³ EPSZ
 R014 ³ Saturated zone field capacity                    ³ not used  ³ 2.000E-01 ³              ---               ³ FCSZ
 R014 ³ Saturated zone hydraulic conductivity (m/yr)     ³ not used  ³ 1.000E+02 ³              ---               ³ HCSZ
 R014 ³ Saturated zone hydraulic gradient                ³ not used  ³ 2.000E-02 ³              ---               ³ HGWT
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                                           Site-Specific Parameter Summary (continued)
0     ³                                                  ³   User    ³           ³         Used by RESRAD         ³  Parameter
 Menu ³                     Parameter                    ³   Input   ³  Default  ³ (If different from user input) ³    Name
 ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 R014 ³ Saturated zone b parameter                       ³ not used  ³ 5.300E+00 ³              ---               ³ BSZ
 R014 ³ Water table drop rate (m/yr)                     ³ not used  ³ 1.000E-03 ³              ---               ³ VWT
 R014 ³ Well pump intake depth (m below water table)     ³ not used  ³ 1.000E+01 ³              ---               ³ DWIBWT
 R014 ³ Model: Nondispersion (ND) or Mass-Balance (MB)   ³ not used  ³ ND        ³              ---               ³ MODEL
 R014 ³ Well pumping rate (m**3/yr)                      ³ not used  ³ 2.500E+02 ³              ---               ³ UW
      ³                                                  ³           ³           ³                                ³
 R015 ³ Number of unsaturated zone strata                ³ not used  ³ 1         ³              ---               ³ NS
 R015 ³ Unsat. zone 1, thickness (m)                     ³ not used  ³ 4.000E+00 ³              ---               ³ H(1)
 R015 ³ Unsat. zone 1, soil density (g/cm**3)            ³ not used  ³ 1.500E+00 ³              ---               ³ DENSUZ(1)
 R015 ³ Unsat. zone 1, total porosity                    ³ not used  ³ 4.000E-01 ³              ---               ³ TPUZ(1)
 R015 ³ Unsat. zone 1, effective porosity                ³ not used  ³ 2.000E-01 ³              ---               ³ EPUZ(1)
 R015 ³ Unsat. zone 1, field capacity                    ³ not used  ³ 2.000E-01 ³              ---               ³ FCUZ(1)
 R015 ³ Unsat. zone 1, soil-specific b parameter         ³ not used  ³ 5.300E+00 ³              ---               ³ BUZ(1)
 R015 ³ Unsat. zone 1, hydraulic conductivity (m/yr)     ³ not used  ³ 1.000E+01 ³              ---               ³ HCUZ(1)
      ³                                                  ³           ³           ³                                ³
 R016 ³ Distribution coefficients for Am-241             ³           ³           ³                                ³
 R016 ³   Contaminated zone (cm**3/g)                    ³ 2.000E+01 ³ 2.000E+01 ³              ---               ³ DCNUCC( 2)
 R016 ³   Unsaturated zone 1 (cm**3/g)                   ³ not used  ³ 2.000E+01 ³              ---               ³ DCNUCU( 2,1)
 R016 ³   Saturated zone (cm**3/g)                       ³ not used  ³ 2.000E+01 ³              ---               ³ DCNUCS( 2)
 R016 ³   Leach rate (/yr)                               ³ 0.000E+00 ³ 0.000E+00 ³           1.453E-02            ³ ALEACH( 2)
 R016 ³   Solubility constant                            ³ 0.000E+00 ³ 0.000E+00 ³           not used             ³ SOLUBK( 2)
      ³                                                  ³           ³           ³                                ³
 R016 ³ Distribution coefficients for Cs-137             ³           ³           ³                                ³
 R016 ³   Contaminated zone (cm**3/g)                    ³ 4.600E+03 ³ 4.600E+03 ³              ---               ³ DCNUCC( 3)
 R016 ³   Unsaturated zone 1 (cm**3/g)                   ³ not used  ³ 4.600E+03 ³              ---               ³ DCNUCU( 3,1)
 R016 ³   Saturated zone (cm**3/g)                       ³ not used  ³ 4.600E+03 ³              ---               ³ DCNUCS( 3)
 R016 ³   Leach rate (/yr)                               ³ 0.000E+00 ³ 0.000E+00 ³           6.377E-05            ³ ALEACH( 3)
 R016 ³   Solubility constant                            ³ 0.000E+00 ³ 0.000E+00 ³           not used             ³ SOLUBK( 3)
      ³                                                  ³           ³           ³                                ³
 R016 ³ Distribution coefficients for Pu-238             ³           ³           ³                                ³
 R016 ³   Contaminated zone (cm**3/g)                    ³ 2.000E+03 ³ 2.000E+03 ³              ---               ³ DCNUCC( 7)
 R016 ³   Unsaturated zone 1 (cm**3/g)                   ³ not used  ³ 2.000E+03 ³              ---               ³ DCNUCU( 7,1)
 R016 ³   Saturated zone (cm**3/g)                       ³ not used  ³ 2.000E+03 ³              ---               ³ DCNUCS( 7)
 R016 ³   Leach rate (/yr)                               ³ 0.000E+00 ³ 0.000E+00 ³           1.467E-04            ³ ALEACH( 7)
 R016 ³   Solubility constant                            ³ 0.000E+00 ³ 0.000E+00 ³           not used             ³ SOLUBK( 7)
      ³                                                  ³           ³           ³                                ³
 R016 ³ Distribution coefficients for Pu-239             ³           ³           ³                                ³
 R016 ³   Contaminated zone (cm**3/g)                    ³ 2.000E+03 ³ 2.000E+03 ³              ---               ³ DCNUCC( 9)
 R016 ³   Unsaturated zone 1 (cm**3/g)                   ³ not used  ³ 2.000E+03 ³              ---               ³ DCNUCU( 9,1)
 R016 ³   Saturated zone (cm**3/g)                       ³ not used  ³ 2.000E+03 ³              ---               ³ DCNUCS( 9)
 R016 ³   Leach rate (/yr)                               ³ 0.000E+00 ³ 0.000E+00 ³           1.467E-04            ³ ALEACH( 9)
 R016 ³   Solubility constant                            ³ 0.000E+00 ³ 0.000E+00 ³           not used             ³ SOLUBK( 9)
      ³                                                  ³           ³           ³                                ³
 R016 ³ Distribution coefficients for Sr-90              ³           ³           ³                                ³
 R016 ³   Contaminated zone (cm**3/g)                    ³ 3.000E+01 ³ 3.000E+01 ³              ---               ³ DCNUCC(11)
 R016 ³   Unsaturated zone 1 (cm**3/g)                   ³ not used  ³ 3.000E+01 ³              ---               ³ DCNUCU(11,1)
 R016 ³   Saturated zone (cm**3/g)                       ³ not used  ³ 3.000E+01 ³              ---               ³ DCNUCS(11)
 R016 ³   Leach rate (/yr)                               ³ 0.000E+00 ³ 0.000E+00 ³           9.718E-03            ³ ALEACH(11)
 R016 ³   Solubility constant                            ³ 0.000E+00 ³ 0.000E+00 ³           not used             ³ SOLUBK(11)
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                                           Site-Specific Parameter Summary (continued)
0     ³                                                  ³   User    ³           ³         Used by RESRAD         ³  Parameter
 Menu ³                     Parameter                    ³   Input   ³  Default  ³ (If different from user input) ³    Name
 ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 R016 ³ Distribution coefficients for daughter Ac-227    ³           ³           ³                                ³
 R016 ³   Contaminated zone (cm**3/g)                    ³ 2.000E+01 ³ 2.000E+01 ³              ---               ³ DCNUCC( 1)
 R016 ³   Unsaturated zone 1 (cm**3/g)                   ³ not used  ³ 2.000E+01 ³              ---               ³ DCNUCU( 1,1)
 R016 ³   Saturated zone (cm**3/g)                       ³ not used  ³ 2.000E+01 ³              ---               ³ DCNUCS( 1)
 R016 ³   Leach rate (/yr)                               ³ 0.000E+00 ³ 0.000E+00 ³           1.453E-02            ³ ALEACH( 1)
 R016 ³   Solubility constant                            ³ 0.000E+00 ³ 0.000E+00 ³           not used             ³ SOLUBK( 1)
      ³                                                  ³           ³           ³                                ³
 R016 ³ Distribution coefficients for daughter Np-237    ³           ³           ³                                ³
 R016 ³   Contaminated zone (cm**3/g)                    ³-1.000E+00 ³-1.000E+00 ³           2.574E+02            ³ DCNUCC( 4)
 R016 ³   Unsaturated zone 1 (cm**3/g)                   ³ not used  ³-1.000E+00 ³              ---               ³ DCNUCU( 4,1)
 R016 ³   Saturated zone (cm**3/g)                       ³ not used  ³-1.000E+00 ³              ---               ³ DCNUCS( 4)
 R016 ³   Leach rate (/yr)                               ³ 0.000E+00 ³ 0.000E+00 ³           1.139E-03            ³ ALEACH( 4)
 R016 ³   Solubility constant                            ³ 0.000E+00 ³ 0.000E+00 ³           not used             ³ SOLUBK( 4)
      ³                                                  ³           ³           ³                                ³
 R016 ³ Distribution coefficients for daughter Pa-231    ³           ³           ³                                ³
 R016 ³   Contaminated zone (cm**3/g)                    ³ 5.000E+01 ³ 5.000E+01 ³              ---               ³ DCNUCC( 5)
 R016 ³   Unsaturated zone 1 (cm**3/g)                   ³ not used  ³ 5.000E+01 ³              ---               ³ DCNUCU( 5,1)
 R016 ³   Saturated zone (cm**3/g)                       ³ not used  ³ 5.000E+01 ³              ---               ³ DCNUCS( 5)
 R016 ³   Leach rate (/yr)                               ³ 0.000E+00 ³ 0.000E+00 ³           5.845E-03            ³ ALEACH( 5)
 R016 ³   Solubility constant                            ³ 0.000E+00 ³ 0.000E+00 ³           not used             ³ SOLUBK( 5)
      ³                                                  ³           ³           ³                                ³
 R016 ³ Distribution coefficients for daughter Pb-210    ³           ³           ³                                ³
 R016 ³   Contaminated zone (cm**3/g)                    ³ 1.000E+02 ³ 1.000E+02 ³              ---               ³ DCNUCC( 6)
 R016 ³   Unsaturated zone 1 (cm**3/g)                   ³ not used  ³ 1.000E+02 ³              ---               ³ DCNUCU( 6,1)
 R016 ³   Saturated zone (cm**3/g)                       ³ not used  ³ 1.000E+02 ³              ---               ³ DCNUCS( 6)
 R016 ³   Leach rate (/yr)                               ³ 0.000E+00 ³ 0.000E+00 ³           2.928E-03            ³ ALEACH( 6)
 R016 ³   Solubility constant                            ³ 0.000E+00 ³ 0.000E+00 ³           not used             ³ SOLUBK( 6)
      ³                                                  ³           ³           ³                                ³
 R016 ³ Distribution coefficients for daughter Ra-226    ³           ³           ³                                ³
 R016 ³   Contaminated zone (cm**3/g)                    ³ 7.000E+01 ³ 7.000E+01 ³              ---               ³ DCNUCC(10)
 R016 ³   Unsaturated zone 1 (cm**3/g)                   ³ not used  ³ 7.000E+01 ³              ---               ³ DCNUCU(10,1)
 R016 ³   Saturated zone (cm**3/g)                       ³ not used  ³ 7.000E+01 ³              ---               ³ DCNUCS(10)
 R016 ³   Leach rate (/yr)                               ³ 0.000E+00 ³ 0.000E+00 ³           4.179E-03            ³ ALEACH(10)
 R016 ³   Solubility constant                            ³ 0.000E+00 ³ 0.000E+00 ³           not used             ³ SOLUBK(10)
      ³                                                  ³           ³           ³                                ³
 R016 ³ Distribution coefficients for daughter Th-229    ³           ³           ³                                ³
 R016 ³   Contaminated zone (cm**3/g)                    ³ 6.000E+04 ³ 6.000E+04 ³              ---               ³ DCNUCC(12)
 R016 ³   Unsaturated zone 1 (cm**3/g)                   ³ not used  ³ 6.000E+04 ³              ---               ³ DCNUCU(12,1)
 R016 ³   Saturated zone (cm**3/g)                       ³ not used  ³ 6.000E+04 ³              ---               ³ DCNUCS(12)
 R016 ³   Leach rate (/yr)                               ³ 0.000E+00 ³ 0.000E+00 ³           4.889E-06            ³ ALEACH(12)
 R016 ³   Solubility constant                            ³ 0.000E+00 ³ 0.000E+00 ³           not used             ³ SOLUBK(12)
      ³                                                  ³           ³           ³                                ³
 R016 ³ Distribution coefficients for daughter Th-230    ³           ³           ³                                ³
 R016 ³   Contaminated zone (cm**3/g)                    ³ 6.000E+04 ³ 6.000E+04 ³              ---               ³ DCNUCC(13)
 R016 ³   Unsaturated zone 1 (cm**3/g)                   ³ not used  ³ 6.000E+04 ³              ---               ³ DCNUCU(13,1)
 R016 ³   Saturated zone (cm**3/g)                       ³ not used  ³ 6.000E+04 ³              ---               ³ DCNUCS(13)
 R016 ³   Leach rate (/yr)                               ³ 0.000E+00 ³ 0.000E+00 ³           4.889E-06            ³ ALEACH(13)
 R016 ³   Solubility constant                            ³ 0.000E+00 ³ 0.000E+00 ³           not used             ³ SOLUBK(13)
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 Summary : CAU 482 Ponds                                      File: 482Ponds.RAD

                                           Site-Specific Parameter Summary (continued)
0     ³                                                  ³   User    ³           ³         Used by RESRAD          ³  Parameter
 Menu ³                     Parameter                    ³   Input   ³  Default  ³ (If different from user input) ³    Name
 ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 R016 ³ Distribution coefficients for daughter U-233     ³           ³           ³                                ³
 R016 ³   Contaminated zone (cm**3/g)                    ³ 5.000E+01 ³ 5.000E+01 ³              ---               ³ DCNUCC(14)
 R016 ³   Unsaturated zone 1 (cm**3/g)                   ³ not used  ³ 5.000E+01 ³              ---               ³ DCNUCU(14,1)
 R016 ³   Saturated zone (cm**3/g)                       ³ not used  ³ 5.000E+01 ³              ---               ³ DCNUCS(14)
 R016 ³   Leach rate (/yr)                               ³ 0.000E+00 ³ 0.000E+00 ³           5.845E-03            ³ ALEACH(14)
 R016 ³   Solubility constant                            ³ 0.000E+00 ³ 0.000E+00 ³           not used             ³ SOLUBK(14)
      ³                                                  ³           ³           ³                                ³
 R016 ³ Distribution coefficients for daughter U-234     ³           ³           ³                                ³
 R016 ³   Contaminated zone (cm**3/g)                    ³ 5.000E+01 ³ 5.000E+01 ³              ---               ³ DCNUCC(15)
 R016 ³   Unsaturated zone 1 (cm**3/g)                   ³ not used  ³ 5.000E+01 ³              ---               ³ DCNUCU(15,1)
 R016 ³   Saturated zone (cm**3/g)                       ³ not used  ³ 5.000E+01 ³              ---               ³ DCNUCS(15)
 R016 ³   Leach rate (/yr)                               ³ 0.000E+00 ³ 0.000E+00 ³           5.845E-03            ³ ALEACH(15)
 R016 ³   Solubility constant                            ³ 0.000E+00 ³ 0.000E+00 ³           not used             ³ SOLUBK(15)
      ³                                                  ³           ³           ³                                ³
 R016 ³ Distribution coefficients for daughter U-235     ³           ³           ³                                ³
 R016 ³   Contaminated zone (cm**3/g)                    ³ 5.000E+01 ³ 5.000E+01 ³              ---               ³ DCNUCC(16)
 R016 ³   Unsaturated zone 1 (cm**3/g)                   ³ not used  ³ 5.000E+01 ³              ---               ³ DCNUCU(16,1)
 R016 ³   Saturated zone (cm**3/g)                       ³ not used  ³ 5.000E+01 ³              ---               ³ DCNUCS(16)
 R016 ³   Leach rate (/yr)                               ³ 0.000E+00 ³ 0.000E+00 ³           5.845E-03            ³ ALEACH(16)
 R016 ³   Solubility constant                            ³ 0.000E+00 ³ 0.000E+00 ³           not used             ³ SOLUBK(16)
      ³                                                  ³           ³           ³                                ³
 R017 ³ Inhalation rate (m**3/yr)                        ³ 1.230E+04 ³ 8.400E+03 ³              ---               ³ INHALR
 R017 ³ Mass loading for inhalation (g/m**3)             ³ 6.000E-04 ³ 1.000E-04 ³              ---               ³ MLINH
 R017 ³ Exposure duration                                ³ 2.500E+01 ³ 3.000E+01 ³              ---               ³ ED
 R017 ³ Shielding factor, inhalation                     ³ 1.000E+00 ³ 4.000E-01 ³              ---               ³ SHF3
 R017 ³ Shielding factor, external gamma                 ³ 1.000E+00 ³ 7.000E-01 ³              ---               ³ SHF1
 R017 ³ Fraction of time spent indoors                   ³ 0.000E+00 ³ 5.000E-01 ³              ---               ³ FIND
 R017 ³ Fraction of time spent outdoors (on site)        ³ 3.800E-02 ³ 2.500E-01 ³              ---               ³ FOTD
 R017 ³ Shape factor flag, external gamma                ³ 1.000E+00 ³ 1.000E+00 ³    >0 shows circular AREA.     ³ FS
 R017 ³ Radii of shape factor array (used if FS = -1):   ³           ³           ³                                ³
 R017 ³   Outer annular radius (m), ring  1:             ³ not used  ³ 5.000E+01 ³              ---               ³ RAD_SHAPE( 1)
 R017 ³   Outer annular radius (m), ring  2:             ³ not used  ³ 7.071E+01 ³              ---               ³ RAD_SHAPE( 2)
 R017 ³   Outer annular radius (m), ring  3:             ³ not used  ³ 0.000E+00 ³              ---               ³ RAD_SHAPE( 3)
 R017 ³   Outer annular radius (m), ring  4:             ³ not used  ³ 0.000E+00 ³              ---               ³ RAD_SHAPE( 4)
 R017 ³   Outer annular radius (m), ring  5:             ³ not used  ³ 0.000E+00 ³              ---               ³ RAD_SHAPE( 5)
 R017 ³   Outer annular radius (m), ring  6:             ³ not used  ³ 0.000E+00 ³              ---               ³ RAD_SHAPE( 6)
 R017 ³   Outer annular radius (m), ring  7:             ³ not used  ³ 0.000E+00 ³              ---               ³ RAD_SHAPE( 7)
 R017 ³   Outer annular radius (m), ring  8:             ³ not used  ³ 0.000E+00 ³              ---               ³ RAD_SHAPE( 8)
 R017 ³   Outer annular radius (m), ring  9:             ³ not used  ³ 0.000E+00 ³              ---               ³ RAD_SHAPE( 9)
 R017 ³   Outer annular radius (m), ring 10:             ³ not used  ³ 0.000E+00 ³              ---               ³ RAD_SHAPE(10)
 R017 ³   Outer annular radius (m), ring 11:             ³ not used  ³ 0.000E+00 ³              ---               ³ RAD_SHAPE(11)
 R017 ³   Outer annular radius (m), ring 12:             ³ not used  ³ 0.000E+00 ³              ---               ³ RAD_SHAPE(12)
      ³                                                  ³           ³           ³                                ³
```

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                                           Site-Specific Parameter Summary (continued)
0     ³                                                  ³   User    ³           ³         Used by RESRAD         ³  Parameter
 Menu ³                     Parameter                    ³   Input   ³  Default  ³ (If different from user input) ³    Name
 ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 R017 ³ Fractions of annular areas within AREA:          ³           ³           ³                                ³
 R017 ³   Ring  1                                        ³ not used  ³ 1.000E+00 ³              ---               ³ FRACA( 1)
 R017 ³   Ring  2                                        ³ not used  ³ 2.732E-01 ³              ---               ³ FRACA( 2)
 R017 ³   Ring  3                                        ³ not used  ³ 0.000E+00 ³              ---               ³ FRACA( 3)
 R017 ³   Ring  4                                        ³ not used  ³ 0.000E+00 ³              ---               ³ FRACA( 4)
 R017 ³   Ring  5                                        ³ not used  ³ 0.000E+00 ³              ---               ³ FRACA( 5)
 R017 ³   Ring  6                                        ³ not used  ³ 0.000E+00 ³              ---               ³ FRACA( 6)
 R017 ³   Ring  7                                        ³ not used  ³ 0.000E+00 ³              ---               ³ FRACA( 7)
 R017 ³   Ring  8                                        ³ not used  ³ 0.000E+00 ³              ---               ³ FRACA( 8)
 R017 ³   Ring  9                                        ³ not used  ³ 0.000E+00 ³              ---               ³ FRACA( 9)
 R017 ³   Ring 10                                        ³ not used  ³ 0.000E+00 ³              ---               ³ FRACA(10)
 R017 ³   Ring 11                                        ³ not used  ³ 0.000E+00 ³              ---               ³ FRACA(11)
 R017 ³   Ring 12                                        ³ not used  ³ 0.000E+00 ³              ---               ³ FRACA(12)
      ³                                                  ³           ³           ³                                ³
 R018 ³ Fruits, vegetables and grain consumption (kg/yr) ³ not used  ³ 1.600E+02 ³              ---               ³ DIET(1)
 R018 ³ Leafy vegetable consumption (kg/yr)              ³ not used  ³ 1.400E+01 ³              ---               ³ DIET(2)
 R018 ³ Milk consumption (L/yr)                          ³ not used  ³ 9.200E+01 ³              ---               ³ DIET(3)
 R018 ³ Meat and poultry consumption (kg/yr)             ³ not used  ³ 6.300E+01 ³              ---               ³ DIET(4)
 R018 ³ Fish consumption (kg/yr)                         ³ not used  ³ 5.400E+00 ³              ---               ³ DIET(5)
 R018 ³ Other seafood consumption (kg/yr)                ³ not used  ³ 9.000E-01 ³              ---               ³ DIET(6)
 R018 ³ Soil ingestion rate (g/yr)                       ³ 1.752E+02 ³ 3.650E+01 ³              ---               ³ SOIL
 R018 ³ Drinking water intake (L/yr)                     ³ not used  ³ 5.100E+02 ³              ---               ³ DWI
 R018 ³ Contamination fraction of drinking water         ³ not used  ³ 1.000E+00 ³              ---               ³ FDW
 R018 ³ Contamination fraction of household water        ³ not used  ³ 1.000E+00 ³              ---               ³ FHHW
 R018 ³ Contamination fraction of livestock water        ³ not used  ³ 1.000E+00 ³              ---               ³ FLW
 R018 ³ Contamination fraction of irrigation water       ³ not used  ³ 1.000E+00 ³              ---               ³ FIRW
 R018 ³ Contamination fraction of aquatic food           ³ not used  ³ 5.000E-01 ³              ---               ³ FR9
 R018 ³ Contamination fraction of plant food             ³ not used  ³-1         ³              ---               ³ FPLANT
 R018 ³ Contamination fraction of meat                   ³ not used  ³-1         ³              ---               ³ FMEAT
 R018 ³ Contamination fraction of milk                   ³ not used  ³-1         ³              ---               ³ FMILK
      ³                                                  ³           ³           ³                                ³
 R019 ³ Livestock fodder intake for meat (kg/day)        ³ not used  ³ 6.800E+01 ³              ---               ³ LFI5
 R019 ³ Livestock fodder intake for milk (kg/day)        ³ not used  ³ 5.500E+01 ³              ---               ³ LFI6
 R019 ³ Livestock water intake for meat (L/day)          ³ not used  ³ 5.000E+01 ³              ---               ³ LWI5
 R019 ³ Livestock water intake for milk (L/day)          ³ not used  ³ 1.600E+02 ³              ---               ³ LWI6
 R019 ³ Livestock soil intake (kg/day)                   ³ not used  ³ 5.000E-01 ³              ---               ³ LSI
 R019 ³ Mass loading for foliar deposition (g/m**3)      ³ not used  ³ 1.000E-04 ³              ---               ³ MLFD
 R019 ³ Depth of soil mixing layer (m)                   ³ 1.500E-01 ³ 1.500E-01 ³              ---               ³ DM
 R019 ³ Depth of roots (m)                               ³ not used  ³ 9.000E-01 ³              ---               ³ DROOT
 R019 ³ Drinking water fraction from ground water        ³ not used  ³ 1.000E+00 ³              ---               ³ FGWDW
 R019 ³ Household water fraction from ground water       ³ not used  ³ 1.000E+00 ³              ---               ³ FGWHH
 R019 ³ Livestock water fraction from ground water       ³ not used  ³ 1.000E+00 ³              ---               ³ FGWLW
 R019 ³ Irrigation fraction from ground water            ³ not used  ³ 1.000E+00 ³              ---               ³ FGWIR
      ³                                                  ³           ³           ³                                ³
 R19B ³ Wet weight crop yield for Non-Leafy (kg/m**2)    ³ not used  ³ 7.000E-01 ³              ---               ³ YV(1)
 R19B ³ Wet weight crop yield for Leafy     (kg/m**2)    ³ not used  ³ 1.500E+00 ³              ---               ³ YV(2)
 R19B ³ Wet weight crop yield for Fodder    (kg/m**2)    ³ not used  ³ 1.100E+00 ³              ---               ³ YV(3)
 R19B ³ Growing Season for  Non-Leafy (years)            ³ not used  ³ 1.700E-01 ³              ---               ³ TE(1)
 R19B ³ Growing Season for  Leafy     (years)            ³ not used  ³ 2.500E-01 ³              ---               ³ TE(2)
 R19B ³ Growing Season for  Fodder    (years)            ³ not used  ³ 8.000E-02 ³              ---               ³ TE(3)
 R19B ³ Translocation Factor for  Non-Leafy              ³ not used  ³ 1.000E-01 ³              ---               ³ TIV(1)
```

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                                           Site-Specific Parameter Summary (continued)
0     ³                                                  ³   User    ³           ³         Used by RESRAD         ³  Parameter
 Menu ³                     Parameter                    ³   Input   ³  Default  ³ (If different from user input) ³    Name
 ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 R19B ³ Translocation Factor for  Leafy                  ³ not used  ³ 1.000E+00 ³              ---               ³ TIV(2)
 R19B ³ Translocation Factor for  Fodder                 ³ not used  ³ 1.000E+00 ³              ---               ³ TIV(3)
 R19B ³ Dry Foliar Interception Fraction for  Non-Leafy  ³ not used  ³ 2.500E-01 ³              ---               ³ RDRY(1)
 R19B ³ Dry Foliar Interception Fraction for  Leafy      ³ not used  ³ 2.500E-01 ³              ---               ³ RDRY(2)
 R19B ³ Dry Foliar Interception Fraction for  Fodder     ³ not used  ³ 2.500E-01 ³              ---               ³ RDRY(3)
 R19B ³ Wet Foliar Interception Fraction for  Non-Leafy  ³ not used  ³ 2.500E-01 ³              ---               ³ RWET(1)
 R19B ³ Wet Foliar Interception Fraction for  Leafy      ³ not used  ³ 2.500E-01 ³              ---               ³ RWET(2)
 R19B ³ Wet Foliar Interception Fraction for  Fodder     ³ not used  ³ 2.500E-01 ³              ---               ³ RWET(3)
 R19B ³ Weathering Removal Constant for Vegetation       ³ not used  ³ 2.000E+01 ³              ---               ³ WLAM
      ³                                                  ³           ³           ³                                ³
 C14  ³ C-12 concentration in water (g/cm**3)            ³ not used  ³ 2.000E-05 ³              ---               ³ C12WTR
 C14  ³ C-12 concentration in contaminated soil (g/g)    ³ not used  ³ 3.000E-02 ³              ---               ³ C12CZ
 C14  ³ Fraction of vegetation carbon from soil          ³ not used  ³ 2.000E-02 ³              ---               ³ CSOIL
 C14  ³ Fraction of vegetation carbon from air           ³ not used  ³ 9.800E-01 ³              ---               ³ CAIR
 C14  ³ C-14 evasion layer thickness in soil (m)         ³ not used  ³ 3.000E-01 ³              ---               ³ DMC
 C14  ³ C-14 evasion flux rate from soil (1/sec)         ³ not used  ³ 7.000E-07 ³              ---               ³ EVSN
 C14  ³ C-12 evasion flux rate from soil (1/sec)         ³ not used  ³ 1.000E-10 ³              ---               ³ REVSN
 C14  ³ Fraction of grain in beef cattle feed            ³ not used  ³ 8.000E-01 ³              ---               ³ AVFG4
 C14  ³ Fraction of grain in milk cow feed               ³ not used  ³ 2.000E-01 ³              ---               ³ AVFG5
 C14  ³ DCF correction factor for gaseous forms of C14   ³ not used  ³ 0.000E+00 ³              ---               ³ CO2F
      ³                                                  ³           ³           ³                                ³
 STOR ³ Storage times of contaminated foodstuffs (days): ³           ³           ³                                ³
 STOR ³   Fruits, non-leafy vegetables, and grain        ³ 1.400E+01 ³ 1.400E+01 ³              ---               ³ STOR_T(1)
 STOR ³   Leafy vegetables                               ³ 1.000E+00 ³ 1.000E+00 ³              ---               ³ STOR_T(2)
 STOR ³   Milk                                           ³ 1.000E+00 ³ 1.000E+00 ³              ---               ³ STOR_T(3)
 STOR ³   Meat and poultry                               ³ 2.000E+01 ³ 2.000E+01 ³              ---               ³ STOR_T(4)
 STOR ³   Fish                                           ³ 7.000E+00 ³ 7.000E+00 ³              ---               ³ STOR_T(5)
 STOR ³   Crustacea and mollusks                         ³ 7.000E+00 ³ 7.000E+00 ³              ---               ³ STOR_T(6)
 STOR ³   Well water                                     ³ 1.000E+00 ³ 1.000E+00 ³              ---               ³ STOR_T(7)
 STOR ³   Surface water                                  ³ 1.000E+00 ³ 1.000E+00 ³              ---               ³ STOR_T(8)
 STOR ³   Livestock fodder                               ³ 4.500E+01 ³ 4.500E+01 ³              ---               ³ STOR_T(9)
      ³                                                  ³           ³           ³                                ³
 R021 ³ Thickness of building foundation (m)             ³ not used  ³ 1.500E-01 ³              ---               ³ FLOOR1
 R021 ³ Bulk density of building foundation (g/cm**3)    ³ not used  ³ 2.400E+00 ³              ---               ³ DENSFL
 R021 ³ Total porosity of the cover material             ³ not used  ³ 4.000E-01 ³              ---               ³ TPCV
 R021 ³ Total porosity of the building foundation        ³ not used  ³ 1.000E-01 ³              ---               ³ TPFL
 R021 ³ Volumetric water content of the cover material   ³ not used  ³ 5.000E-02 ³              ---               ³ PH2OCV
 R021 ³ Volumetric water content of the foundation       ³ not used  ³ 3.000E-02 ³              ---               ³ PH2OFL
 R021 ³ Diffusion coefficient for radon gas (m/sec):     ³           ³           ³                                ³
 R021 ³   in cover material                              ³ not used  ³ 2.000E-06 ³              ---               ³ DIFCV
 R021 ³   in foundation material                         ³ not used  ³ 3.000E-07 ³              ---               ³ DIFFL
 R021 ³   in contaminated zone soil                      ³ not used  ³ 2.000E-06 ³              ---               ³ DIFCZ
 R021 ³ Radon vertical dimension of mixing (m)           ³ not used  ³ 2.000E+00 ³              ---               ³ HMIX
 R021 ³ Average building air exchange rate (1/hr)        ³ not used  ³ 5.000E-01 ³              ---               ³ REXG
 R021 ³ Height of the building (room) (m)                ³ not used  ³ 2.500E+00 ³              ---               ³ HRM
 R021 ³ Building interior area factor                    ³ not used  ³ 0.000E+00 ³              ---               ³ FAI
 R021 ³ Building depth below ground surface (m)          ³ not used  ³-1.000E+00 ³              ---               ³ DMFL
 R021 ³ Emanating power of Rn-222 gas                    ³ not used  ³ 2.500E-01 ³              ---               ³ EMANA(1)
 R021 ³ Emanating power of Rn-220 gas                    ³ not used  ³ 1.500E-01 ³              ---               ³ EMANA(2)
      ³                                                  ³           ³           ³                                ³
 TITL ³ Number of graphical time points                  ³     32    ³    ---    ³              ---               ³ NPTS
 TITL ³ Maximum number of integration points for dose    ³     17    ³    ---    ³              ---               ³ LYMAX
```

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                                              Site-Specific Parameter Summary (continued)
0     ³                                                  ³   User    ³           ³         Used by RESRAD         ³  Parameter
 Menu ³                       Parameter                  ³   Input   ³  Default  ³ (If different from user input) ³    Name
 ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 TITL ³ Maximum number of integration points for risk    ³    257    ³    ---    ³              ---               ³ KYMAX
 ÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ



                      Summary of Pathway Selections

                     Pathway              ³   User Selection
           ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
              1 -- external gamma         ³       active
              2 -- inhalation (w/o radon)³       active
              3 -- plant ingestion        ³     suppressed
              4 -- meat ingestion         ³     suppressed
              5 -- milk ingestion         ³     suppressed
              6 -- aquatic foods          ³     suppressed
              7 -- drinking water         ³     suppressed
              8 -- soil ingestion         ³       active
              9 -- radon                  ³     suppressed
              Find peak pathway doses     ³     suppressed
           ÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ
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1RESRAD, Version 6.3      T« Limit = 180 days        05/29/2006  11:30  Page  12
 Summary : CAU 482 Ponds                                         File: 482Ponds.RAD

      Contaminated Zone Dimensions            Initial Soil Concentrations, pCi/g
      ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ            ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
        Area:    100.00 square meters               Am-241     1.820E+02
   Thickness:      0.15 meters                      Cs-137     8.300E+02
 Cover Depth:      0.00 meters                      Pu-238     1.830E+01
                                                    Pu-239     1.000E+03
                                                    Sr-90      6.500E+01
0
                                                Total Dose TDOSE(t), mrem/yr
                                          Basic Radiation Dose Limit = 2.500E+01 mrem/yr
                         Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)
                         ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
    t (years):  0.000E+00  1.000E+00  3.000E+00  1.000E+01  3.000E+01  5.000E+01  6.000E+01  1.000E+02  3.000E+02  1.000E+03
     TDOSE(t):  8.771E+01  8.564E+01  8.164E+01  6.907E+01  4.289E+01  2.661E+01  2.091E+01  7.367E+00  0.000E+00  0.000E+00
         M(t):  3.508E+00  3.425E+00  3.266E+00  2.763E+00  1.716E+00  1.064E+00  8.362E-01  2.947E-01  0.000E+00  0.000E+00
0Maximum TDOSE(t):  8.771E+01 mrem/yr   at t = 0.000E+00 years
```

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1RESRAD, Version 6.3      T« Limit = 180 days        05/29/2006  11:30  Page  13
 Summary : CAU 482 Ponds                                      File: 482Ponds.RAD

                        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
0                                       Water Independent Pathways (Inhalation excludes radon)
0             Ground            Inhalation             Radon              Plant              Meat               Milk               Soil
 Radio-  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Nuclide  mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.
 ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ
 Am-241  2.495E-01 0.0028  1.424E+00 0.0162  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  4.361E-01 0.0050
 Cs-137  7.538E+01 0.8594  4.649E-04 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.722E-02 0.0003
 Pu-238  9.479E-05 0.0000  1.269E-01 0.0014  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  3.870E-02 0.0004
 Pu-239  8.982E-03 0.0001  7.620E+00 0.0869  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.349E+00 0.0268
 Sr-90   4.467E-02 0.0005  1.486E-03 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  6.481E-03 0.0001
 ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ
 Total   7.568E+01 0.8628  9.173E+00 0.1046  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.857E+00 0.0326
0
                        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
0                                                      Water Dependent Pathways
0              Water              Fish               Radon              Plant              Meat               Milk            All Pathways*
 Radio-  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Nuclide  mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.
 ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ
 Am-241  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.110E+00 0.0241
 Cs-137  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  7.540E+01 0.8597
 Pu-238  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.657E-01 0.0019
 Pu-239  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  9.978E+00 0.1138
 Sr-90   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  5.263E-02 0.0006
 ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ
 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  8.771E+01 1.0000
0*Sum of all water independent and dependent pathways.
```

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1RESRAD, Version 6.3      T« Limit = 180 days        05/29/2006  11:30  Page  14
 Summary : CAU 482 Ponds                                      File: 482Ponds.RAD

                        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
0                                       Water Independent Pathways (Inhalation excludes radon)
0             Ground          Inhalation           Radon             Plant             Meat              Milk              Soil
 Radio-  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Nuclide  mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.
 ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ
 Am-241  2.455E-01 0.0029  1.392E+00 0.0163  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  4.262E-01 0.0050
 Cs-137  7.342E+01 0.8574  4.513E-04 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.642E-02 0.0003
 Pu-238  9.403E-05 0.0000  1.251E-01 0.0015  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  3.813E-02 0.0004
 Pu-239  8.965E-03 0.0001  7.568E+00 0.0884  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.333E+00 0.0272
 Sr-90   4.308E-02 0.0005  1.427E-03 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  6.226E-03 0.0001
 ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ
 Total   7.372E+01 0.8609  9.087E+00 0.1061  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.830E+00 0.0330
0
                        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
0                                                      Water Dependent Pathways
0              Water             Fish              Radon             Plant             Meat              Milk          All Pathways*
 Radio-  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Nuclide  mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.
 ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ
 Am-241  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.064E+00 0.0241
 Cs-137  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  7.345E+01 0.8577
 Pu-238  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.633E-01 0.0019
 Pu-239  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  9.909E+00 0.1157
 Sr-90   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  5.074E-02 0.0006
 ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ
 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  8.564E+01 1.0000
0*Sum of all water independent and dependent pathways.
```

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1RESRAD, Version 6.3      T« Limit = 180 days        05/29/2006  11:30  Page  15
 Summary : CAU 482 Ponds                                      File: 482Ponds.RAD

                        Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
                                     As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years
0                                       Water Independent Pathways (Inhalation excludes radon)
0             Ground          Inhalation           Radon             Plant             Meat              Milk              Soil
 Radio-  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Nuclide  mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.
 ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ
 Am-241  2.377E-01 0.0029  1.329E+00 0.0163  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  4.071E-01 0.0050
 Cs-137  6.966E+01 0.8533  4.250E-04 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.488E-02 0.0003
 Pu-238  9.251E-05 0.0000  1.214E-01 0.0015  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  3.702E-02 0.0005
 Pu-239  8.930E-03 0.0001  7.463E+00 0.0914  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.300E+00 0.0282
 Sr-90   4.008E-02 0.0005  1.317E-03 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  5.743E-03 0.0001
 ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ
 Total   6.995E+01 0.8568  8.916E+00 0.1092  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.775E+00 0.0340
0
                        Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
                                     As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years
0                                                      Water Dependent Pathways
0              Water             Fish              Radon             Plant             Meat              Milk          All Pathways*
 Radio-  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Nuclide  mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.
 ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ
 Am-241  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.974E+00 0.0242
 Cs-137  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  6.969E+01 0.8536
 Pu-238  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.585E-01 0.0019
 Pu-239  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  9.773E+00 0.1197
 Sr-90   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  4.714E-02 0.0006
 ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ
 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  8.164E+01 1.0000
0*Sum of all water independent and dependent pathways.
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1RESRAD, Version 6.3      T« Limit = 180 days        05/29/2006  11:30  Page  16
 Summary : CAU 482 Ponds                                      File: 482Ponds.RAD

                        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
0                                       Water Independent Pathways (Inhalation excludes radon)
0             Ground          Inhalation           Radon             Plant             Meat              Milk              Soil
 Radio-  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Nuclide  mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.
 ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ
 Am-241  2.123E-01 0.0031  1.131E+00 0.0164  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  3.463E-01 0.0050
 Cs-137  5.789E+01 0.8381  3.441E-04 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.015E-02 0.0003
 Pu-238  8.738E-05 0.0000  1.093E-01 0.0016  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  3.332E-02 0.0005
 Pu-239  8.803E-03 0.0001  7.098E+00 0.1028  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.188E+00 0.0317
 Sr-90   3.109E-02 0.0005  9.916E-04 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  4.325E-03 0.0001
 ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ
 Total   5.814E+01 0.8417  8.339E+00 0.1207  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.592E+00 0.0375
0
                        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
0                                                      Water Dependent Pathways
0              Water             Fish              Radon             Plant             Meat              Milk          All Pathways*
 Radio-  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Nuclide  mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.
 ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ
 Am-241  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.689E+00 0.0245
 Cs-137  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  5.791E+01 0.8384
 Pu-238  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.427E-01 0.0021
 Pu-239  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  9.295E+00 0.1346
 Sr-90   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  3.641E-02 0.0005
 ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ
 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  6.907E+01 1.0000
0*Sum of all water independent and dependent pathways.
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                        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
0                                       Water Independent Pathways (Inhalation excludes radon)
0             Ground          Inhalation           Radon             Plant             Meat              Milk              Soil
 Radio-  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Nuclide  mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.
 ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ
 Am-241  1.536E-01 0.0036  7.015E-01 0.0164  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.148E-01 0.0050
 Cs-137  3.375E+01 0.7870  1.855E-04 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.086E-02 0.0003
 Pu-238  7.414E-05 0.0000  7.970E-02 0.0019  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.430E-02 0.0006
 Pu-239  8.396E-03 0.0002  6.059E+00 0.1413  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.868E+00 0.0435
 Sr-90   1.493E-02 0.0003  4.345E-04 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.895E-03 0.0000
 ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ
 Total   3.393E+01 0.7911  6.841E+00 0.1595  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.119E+00 0.0494
0
                        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
0                                                      Water Dependent Pathways
0              Water             Fish              Radon             Plant             Meat              Milk          All Pathways*
 Radio-  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Nuclide  mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.
 ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ
 Am-241  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.070E+00 0.0249
 Cs-137  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  3.377E+01 0.7872
 Pu-238  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.041E-01 0.0024
 Pu-239  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  7.935E+00 0.1850
 Sr-90   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.726E-02 0.0004
 ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ
 Total   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  4.289E+01 1.0000
0*Sum of all water independent and dependent pathways.
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                        Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
                                     As mrem/yr and Fraction of Total Dose At t = 5.000E+01 years
0                                       Water Independent Pathways (Inhalation excludes radon)
0                Ground            Inhalation             Radon              Plant               Meat               Milk               Soil
 Radio-  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Nuclide  mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.
 ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ
 Am-241  1.108E-01 0.0042  4.230E-01 0.0159  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.295E-01 0.0049
 Cs-137  1.927E+01 0.7243  9.716E-05 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  5.688E-03 0.0002
 Pu-238  6.272E-05 0.0000  5.650E-02 0.0021  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.723E-02 0.0006
 Pu-239  7.900E-03 0.0003  5.027E+00 0.1889  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.550E+00 0.0582
 Sr-90   7.035E-03 0.0003  1.850E-04 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  8.071E-04 0.0000
 ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ
 Total   1.940E+01 0.7291  5.507E+00 0.2070  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.703E+00 0.0640
0
                        Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
                                     As mrem/yr and Fraction of Total Dose At t = 5.000E+01 years
0                                                        Water Dependent Pathways
0                 Water              Fish              Radon              Plant               Meat               Milk         All Pathways*
 Radio-  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Nuclide  mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.
 ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ
 Am-241  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  6.632E-01 0.0249
 Cs-137  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.928E+01 0.7245
 Pu-238  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  7.378E-02 0.0028
 Pu-239  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  6.585E+00 0.2475
 Sr-90   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  8.027E-03 0.0003
 ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ
 Total   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.661E+01 1.0000
0*Sum of all water independent and dependent pathways.
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                        Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
                                     As mrem/yr and Fraction of Total Dose At t = 6.000E+01 years
0                                       Water Independent Pathways (Inhalation excludes radon)
0             Ground          Inhalation           Radon             Plant             Meat              Milk              Soil
 Radio-  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Nuclide  mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.
 ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ
 Am-241  9.385E-02 0.0045  3.238E-01 0.0155  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  9.914E-02 0.0047
 Cs-137  1.441E+01 0.6891  6.932E-05 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  4.058E-03 0.0002
 Pu-238  5.759E-05 0.0000  4.689E-02 0.0022  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.430E-02 0.0007
 Pu-239  7.606E-03 0.0004  4.514E+00 0.2159  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.391E+00 0.0666
 Sr-90   4.783E-03 0.0002  1.190E-04 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  5.192E-04 0.0000
 ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ
 Total   1.451E+01 0.6941  4.885E+00 0.2337  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.509E+00 0.0722
0
                        Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
                                     As mrem/yr and Fraction of Total Dose At t = 6.000E+01 years
0                                                      Water Dependent Pathways
0              Water             Fish              Radon             Plant             Meat              Milk          All Pathways*
 Radio-  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Nuclide  mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.
 ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ
 Am-241  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  5.168E-01 0.0247
 Cs-137  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.441E+01 0.6892
 Pu-238  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  6.124E-02 0.0029
 Pu-239  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  5.913E+00 0.2828
 Sr-90   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  5.421E-03 0.0003
 ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ
 Total   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.091E+01 1.0000
0*Sum of all water independent and dependent pathways.
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1RESRAD, Version 6.3      T« Limit = 180 days        05/29/2006  11:30  Page  20
 Summary : CAU 482 Ponds                                      File: 482Ponds.RAD

                        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
0                                       Water Independent Pathways (Inhalation excludes radon)
0              Ground           Inhalation            Radon              Plant              Meat               Milk               Soil
 Radio-  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Nuclide  mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.
 ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ
 Am-241  4.578E-02 0.0062  9.391E-02 0.0127  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.876E-02 0.0039
 Cs-137  3.923E+00 0.5325  1.518E-05 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  8.885E-04 0.0001
 Pu-238  3.987E-05 0.0000  1.880E-02 0.0026  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  5.731E-03 0.0008
 Pu-239  5.930E-03 0.0008  2.479E+00 0.3365  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  7.641E-01 0.1037
 Sr-90   8.999E-04 0.0001  1.722E-05 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  7.513E-05 0.0000
 ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ
 Total   3.975E+00 0.5396  2.592E+00 0.3518  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  7.996E-01 0.1085
0
                        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
0                                                      Water Dependent Pathways
0               Water              Fish              Radon              Plant              Meat               Milk          All Pathways*
 Radio-  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Nuclide  mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.
 ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ
 Am-241  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.685E-01 0.0229
 Cs-137  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  3.924E+00 0.5326
 Pu-238  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.457E-02 0.0033
 Pu-239  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  3.249E+00 0.4411
 Sr-90   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  9.923E-04 0.0001
 ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ
 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  7.367E+00 1.0000
0*Sum of all water independent and dependent pathways.
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                        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
0                                       Water Independent Pathways (Inhalation excludes radon)
0             Ground          Inhalation           Radon             Plant             Meat              Milk              Soil
 Radio-  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Nuclide  mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.
 ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ
 Am-241  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000
 Cs-137  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000
 Pu-238  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000
 Pu-239  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000
 Sr-90   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000
 ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ
 Total   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000
0
                        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
0                                                      Water Dependent Pathways
0              Water             Fish              Radon             Plant             Meat              Milk          All Pathways*
 Radio-  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Nuclide  mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.
 ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ
 Am-241  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000
 Cs-137  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000
 Pu-238  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000
 Pu-239  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000
 Sr-90   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000
 ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ
 Total   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000
0*Sum of all water independent and dependent pathways.
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                        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
0                                       Water Independent Pathways (Inhalation excludes radon)
0             Ground          Inhalation           Radon             Plant             Meat              Milk              Soil
 Radio-  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Nuclide  mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.
 ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ
 Am-241  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000
 Cs-137  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000
 Pu-238  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000
 Pu-239  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000
 Sr-90   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000
 ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ
 Total   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000
0
                        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
0                                                      Water Dependent Pathways
0              Water             Fish              Radon             Plant             Meat              Milk          All Pathways*
 Radio-  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Nuclide  mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.
 ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ
 Am-241  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000
 Cs-137  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000
 Pu-238  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000
 Pu-239  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000
 Sr-90   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000
 ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ
 Total   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000
0*Sum of all water independent and dependent pathways.
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                                             Dose/Source Ratios Summed Over All Pathways
                                  Parent and Progeny Principal Radionuclide Contributions Indicated
0  Parent    Product    Thread                                DSR(j,t) At Time in Years   (mrem/yr)/(pCi/g)
    (i)        (j)     Fraction   0.000E+00 1.000E+00 3.000E+00 1.000E+01 3.000E+01 5.000E+01 6.000E+01 1.000E+02 3.000E+02 1.000E+03
 ÄÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ
 Am-241     Am-241     1.000E+00  1.159E-02 1.134E-02 1.085E-02 9.282E-03 5.878E-03 3.644E-03 2.839E-03 9.252E-04 0.000E+00 0.000E+00
 Am-241     Np-237+D   1.000E+00  7.183E-09 2.132E-08 4.856E-08 1.338E-07 3.031E-07 3.872E-07 4.045E-07 3.475E-07 0.000E+00 0.000E+00
 Am-241     U-233      1.000E+00  6.168E-16 4.265E-15 2.192E-14 1.772E-13 1.104E-12 2.182E-12 2.625E-12 3.058E-12 0.000E+00 0.000E+00
 Am-241     Th-229+D   1.000E+00  4.780E-19 7.108E-18 8.129E-17 2.005E-15 3.946E-14 1.417E-13 2.146E-13 5.235E-13 0.000E+00 0.000E+00
 Am-241     äDSR(j)               1.159E-02 1.134E-02 1.085E-02 9.282E-03 5.878E-03 3.644E-03 2.839E-03 9.256E-04 0.000E+00 0.000E+00
0Cs-137+D   Cs-137+D   1.000E+00  9.085E-02 8.849E-02 8.396E-02 6.977E-02 4.068E-02 2.323E-02 1.736E-02 4.727E-03 0.000E+00 0.000E+00
0Pu-238     Pu-238     1.840E-09  1.666E-11 1.642E-11 1.594E-11 1.435E-11 1.046E-11 7.418E-12 6.158E-12 2.470E-12 0.000E+00 0.000E+00
0Pu-238     Pu-238     1.000E+00  9.056E-03 8.923E-03 8.662E-03 7.797E-03 5.687E-03 4.032E-03 3.346E-03 1.342E-03 0.000E+00 0.000E+00
 Pu-238     U-234      1.000E+00  3.587E-09 1.063E-08 2.415E-08 6.574E-08 1.425E-07 1.712E-07 1.723E-07 1.205E-07 0.000E+00 0.000E+00
 Pu-238     Th-230     1.000E+00  2.620E-14 1.817E-13 9.392E-13 7.751E-12 5.114E-11 1.068E-10 1.319E-10 1.696E-10 0.000E+00 0.000E+00
 Pu-238     Ra-226+D   1.000E+00  1.300E-16 1.936E-15 2.223E-14 5.559E-13 1.137E-11 4.225E-11 6.503E-11 1.681E-10 0.000E+00 0.000E+00
 Pu-238     Pb-210+D   1.000E+00  1.537E-20 4.696E-19 1.145E-17 7.950E-16 3.971E-14 2.063E-13 3.496E-13 1.061E-12 0.000E+00 0.000E+00
 Pu-238     äDSR(j)               9.056E-03 8.923E-03 8.662E-03 7.797E-03 5.687E-03 4.032E-03 3.347E-03 1.343E-03 0.000E+00 0.000E+00
0Pu-239     Pu-239     1.000E+00  9.978E-03 9.909E-03 9.773E-03 9.295E-03 7.935E-03 6.585E-03 5.913E-03 3.249E-03 0.000E+00 0.000E+00
 Pu-239     U-235+D    1.000E+00  1.235E-11 3.687E-11 8.513E-11 2.458E-10 6.351E-10 9.214E-10 1.024E-09 1.115E-09 0.000E+00 0.000E+00
 Pu-239     Pa-231     1.000E+00  1.220E-16 8.467E-16 4.389E-15 3.655E-14 2.479E-13 5.333E-13 6.695E-13 9.275E-13 0.000E+00 0.000E+00
 Pu-239     Ac-227+D   1.000E+00  5.114E-18 7.542E-17 8.471E-16 1.959E-14 3.249E-13 9.987E-13 1.407E-12 2.621E-12 0.000E+00 0.000E+00
 Pu-239     äDSR(j)               9.978E-03 9.909E-03 9.773E-03 9.295E-03 7.935E-03 6.585E-03 5.913E-03 3.249E-03 0.000E+00 0.000E+00
0Sr-90+D    Sr-90+D    1.000E+00  8.097E-04 7.805E-04 7.252E-04 5.602E-04 2.655E-04 1.235E-04 8.340E-05 1.527E-05 0.000E+00 0.000E+00
 ÍÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ
 The DSR includes contributions from associated (half-life ó 180 days) daughters.
0
                                        Single Radionuclide Soil Guidelines G(i,t) in pCi/g
                                           Basic Radiation Dose Limit = 2.500E+01 mrem/yr
0Nuclide
   (i)    t= 0.000E+00   1.000E+00   3.000E+00   1.000E+01   3.000E+01   5.000E+01   6.000E+01   1.000E+02   3.000E+02   1.000E+03
 ÄÄÄÄÄÄÄ     ÄÄÄÄÄÄÄÄÄ   ÄÄÄÄÄÄÄÄÄ   ÄÄÄÄÄÄÄÄÄ   ÄÄÄÄÄÄÄÄÄ   ÄÄÄÄÄÄÄÄÄ   ÄÄÄÄÄÄÄÄÄ   ÄÄÄÄÄÄÄÄÄ   ÄÄÄÄÄÄÄÄÄ   ÄÄÄÄÄÄÄÄÄ   ÄÄÄÄÄÄÄÄÄ
 Am-241      2.157E+03   2.205E+03   2.305E+03   2.693E+03   4.253E+03   6.860E+03   8.805E+03   2.701E+04  *3.431E+12  *3.431E+12
 Cs-137      2.752E+02   2.825E+02   2.978E+02   3.583E+02   6.145E+02   1.076E+03   1.440E+03   5.288E+03  *8.704E+13  *8.704E+13
 Pu-238      2.761E+03   2.802E+03   2.886E+03   3.206E+03   4.396E+03   6.201E+03   7.470E+03   1.862E+04  *1.712E+13  *1.712E+13
 Pu-239      2.506E+03   2.523E+03   2.558E+03   2.690E+03   3.151E+03   3.797E+03   4.228E+03   7.694E+03  *6.214E+10  *6.214E+10
 Sr-90       3.087E+04   3.203E+04   3.447E+04   4.463E+04   9.417E+04   2.024E+05   2.998E+05   1.638E+06  *1.365E+14  *1.365E+14
 ÍÍÍÍÍÍÍ     ÍÍÍÍÍÍÍÍÍ   ÍÍÍÍÍÍÍÍÍ   ÍÍÍÍÍÍÍÍÍ   ÍÍÍÍÍÍÍÍÍ   ÍÍÍÍÍÍÍÍÍ   ÍÍÍÍÍÍÍÍÍ   ÍÍÍÍÍÍÍÍÍ   ÍÍÍÍÍÍÍÍÍ   ÍÍÍÍÍÍÍÍÍ   ÍÍÍÍÍÍÍÍÍ
 *At specific activity limit
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             Summed Dose/Source Ratios DSR(i,t) in (mrem/yr)/(pCi/g)
             and Single Radionuclide Soil Guidelines G(i,t) in pCi/g
          at tmin = time of minimum single radionuclide soil guideline
      and at tmax = time of maximum total dose = 0.000E+00 years
0Nuclide  Initial         tmin       DSR(i,tmin) G(i,tmin) DSR(i,tmax) G(i,tmax)
   (i)    (pCi/g)       (years)                   (pCi/g)                (pCi/g)
 ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ
 Am-241  1.820E+02     0.000E+00      1.159E-02  2.157E+03  1.159E-02  2.157E+03
 Cs-137  8.300E+02     0.000E+00      9.085E-02  2.752E+02  9.085E-02  2.752E+02
 Pu-238  1.830E+01     0.000E+00      9.056E-03  2.761E+03  9.056E-03  2.761E+03
 Pu-239  1.000E+03     0.000E+00      9.978E-03  2.506E+03  9.978E-03  2.506E+03
 Sr-90   6.500E+01     0.000E+00      8.097E-04  3.087E+04  8.097E-04  3.087E+04
 ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ
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1RESRAD, Version 6.3      T« Limit = 180 days        05/29/2006  11:30  Page  25
 Summary : CAU 482 Ponds                                      File: 482Ponds.RAD

                                         Individual Nuclide Dose Summed Over All Pathways
                                           Parent Nuclide and Branch Fraction Indicated
0Nuclide Parent   THF(i)                                              DOSE(j,t), mrem/yr
   (j)     (i)             t= 0.000E+00 1.000E+00 3.000E+00 1.000E+01 3.000E+01 5.000E+01 6.000E+01 1.000E+02 3.000E+02 1.000E+03
 ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ    ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ
 Am-241  Am-241  1.000E+00    2.110E+00 2.064E+00 1.974E+00 1.689E+00 1.070E+00 6.632E-01 5.167E-01 1.684E-01 0.000E+00 0.000E+00
0Np-237  Am-241  1.000E+00    1.307E-06 3.880E-06 8.839E-06 2.435E-05 5.517E-05 7.046E-05 7.361E-05 6.324E-05 0.000E+00 0.000E+00
0U-233   Am-241  1.000E+00    1.123E-13 7.762E-13 3.990E-12 3.225E-11 2.009E-10 3.970E-10 4.777E-10 5.566E-10 0.000E+00 0.000E+00
0Th-229  Am-241  1.000E+00    8.700E-17 1.294E-15 1.480E-14 3.648E-13 7.182E-12 2.579E-11 3.907E-11 9.528E-11 0.000E+00 0.000E+00
0Cs-137  Cs-137  1.000E+00    7.540E+01 7.345E+01 6.969E+01 5.791E+01 3.377E+01 1.928E+01 1.441E+01 3.924E+00 0.000E+00 0.000E+00
0Pu-238  Pu-238  1.840E-09    3.049E-10 3.005E-10 2.917E-10 2.625E-10 1.915E-10 1.358E-10 1.127E-10 4.520E-11 0.000E+00 0.000E+00
 Pu-238  Pu-238  1.000E+00    1.657E-01 1.633E-01 1.585E-01 1.427E-01 1.041E-01 7.378E-02 6.124E-02 2.457E-02 0.000E+00 0.000E+00
 Pu-238  äDOSE(j)             1.657E-01 1.633E-01 1.585E-01 1.427E-01 1.041E-01 7.378E-02 6.124E-02 2.457E-02 0.000E+00 0.000E+00
0U-234   Pu-238  1.000E+00    6.565E-08 1.946E-07 4.419E-07 1.203E-06 2.608E-06 3.133E-06 3.153E-06 2.206E-06 0.000E+00 0.000E+00
0Th-230  Pu-238  1.000E+00    4.795E-13 3.324E-12 1.719E-11 1.418E-10 9.359E-10 1.954E-09 2.414E-09 3.104E-09 0.000E+00 0.000E+00
0Ra-226  Pu-238  1.000E+00    2.378E-15 3.542E-14 4.068E-13 1.017E-11 2.080E-10 7.732E-10 1.190E-09 3.075E-09 0.000E+00 0.000E+00
0Pb-210  Pu-238  1.000E+00    2.813E-19 8.594E-18 2.096E-16 1.455E-14 7.267E-13 3.775E-12 6.398E-12 1.941E-11 0.000E+00 0.000E+00
0Pu-239  Pu-239  1.000E+00    9.978E+00 9.909E+00 9.773E+00 9.295E+00 7.935E+00 6.585E+00 5.913E+00 3.249E+00 0.000E+00 0.000E+00
0U-235   Pu-239  1.000E+00    1.235E-08 3.687E-08 8.513E-08 2.458E-07 6.351E-07 9.214E-07 1.024E-06 1.115E-06 0.000E+00 0.000E+00
0Pa-231  Pu-239  1.000E+00    1.220E-13 8.467E-13 4.389E-12 3.655E-11 2.479E-10 5.333E-10 6.695E-10 9.275E-10 0.000E+00 0.000E+00
0Ac-227  Pu-239  1.000E+00    5.114E-15 7.542E-14 8.471E-13 1.959E-11 3.249E-10 9.987E-10 1.407E-09 2.621E-09 0.000E+00 0.000E+00
0Sr-90   Sr-90   1.000E+00    5.263E-02 5.074E-02 4.714E-02 3.641E-02 1.726E-02 8.027E-03 5.421E-03 9.923E-04 0.000E+00 0.000E+00
 ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ    ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ
 THF(i) is the thread fraction of the parent nuclide.
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 Summary : CAU 482 Ponds                                      File: 482Ponds.RAD

                                              Individual Nuclide Soil Concentration
                                           Parent Nuclide and Branch Fraction Indicated
0Nuclide Parent   THF(i)                                                S(j,t), pCi/g
   (j)     (i)             t= 0.000E+00 1.000E+00 3.000E+00 1.000E+01 3.000E+01 5.000E+01 6.000E+01 1.000E+02 3.000E+02 1.000E+03
 ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ    ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ
 Am-241  Am-241  1.000E+00    1.820E+02 1.791E+02 1.734E+02 1.549E+02 1.122E+02 8.122E+01 6.912E+01 3.625E+01 1.438E+00 1.787E-05
0Np-237  Am-241  1.000E+00    0.000E+00 5.844E-05 1.723E-04 5.412E-04 1.376E-03 1.959E-03 2.178E-03 2.725E-03 2.762E-03 1.258E-03
0U-233   Am-241  1.000E+00    0.000E+00 1.279E-10 1.134E-09 1.194E-08 9.246E-08 2.218E-07 2.973E-07 6.251E-07 1.686E-06 1.153E-06
0Th-229  Am-241  1.000E+00    0.000E+00 4.034E-15 1.077E-13 3.830E-12 9.237E-11 3.831E-10 6.273E-10 2.358E-09 2.598E-08 1.241E-07
0Cs-137  Cs-137  1.000E+00    8.300E+02 8.110E+02 7.743E+02 6.584E+02 4.142E+02 2.606E+02 2.067E+02 8.182E+01 7.952E-01 7.195E-08
0Pu-238  Pu-238  1.840E-09    3.367E-08 3.340E-08 3.287E-08 3.107E-08 2.645E-08 2.252E-08 2.078E-08 1.506E-08 3.012E-09 1.078E-11
 Pu-238  Pu-238  1.000E+00    1.830E+01 1.815E+01 1.786E+01 1.689E+01 1.438E+01 1.224E+01 1.129E+01 8.184E+00 1.637E+00 5.859E-03
 Pu-238  äS(j):               1.830E+01 1.815E+01 1.786E+01 1.689E+01 1.438E+01 1.224E+01 1.129E+01 8.184E+00 1.637E+00 5.859E-03
0U-234   Pu-238  1.000E+00    0.000E+00 5.152E-05 1.524E-04 4.840E-04 1.264E-03 1.834E-03 2.053E-03 2.595E-03 1.972E-03 6.054E-05
0Th-230  Pu-238  1.000E+00    0.000E+00 2.324E-10 2.073E-09 2.230E-08 1.831E-07 4.647E-07 6.398E-07 1.490E-06 5.990E-06 9.731E-06
0Ra-226  Pu-238  1.000E+00    0.000E+00 3.356E-14 8.979E-13 3.220E-11 7.930E-10 3.351E-09 5.534E-09 2.141E-08 2.463E-07 8.587E-07
0Pb-210  Pu-238  1.000E+00    0.000E+00 2.593E-16 2.057E-14 2.362E-12 1.565E-10 9.960E-10 1.881E-09 1.017E-08 1.874E-07 7.770E-07
0Pu-239  Pu-239  1.000E+00    1.000E+03 9.998E+02 9.995E+02 9.982E+02 9.948E+02 9.913E+02 9.895E+02 9.826E+02 9.487E+02 8.391E+02
0U-235   Pu-239  1.000E+00    0.000E+00 9.819E-07 2.928E-06 9.558E-06 2.703E-05 4.250E-05 4.957E-05 7.387E-05 1.347E-04 1.453E-04
0Pa-231  Pu-239  1.000E+00    0.000E+00 1.038E-11 9.266E-11 1.002E-09 8.333E-09 2.141E-08 2.967E-08 7.075E-08 3.113E-07 5.296E-07
0Ac-227  Pu-239  1.000E+00    0.000E+00 1.090E-13 2.858E-12 9.590E-11 1.985E-09 7.201E-09 1.110E-08 3.381E-08 1.977E-07 3.640E-07
0Sr-90   Sr-90   1.000E+00    6.500E+01 6.286E+01 5.878E+01 4.649E+01 2.378E+01 1.216E+01 8.698E+00 2.276E+00 2.789E-03 1.798E-13
 ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ    ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ
 THF(i) is the thread fraction of the parent nuclide.
0RESCALC.EXE execution time =    1.42 seconds
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Exhibit 3

RESRAD Summary Report:
CAU 482 Drainage Channel

(26 Pages)

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1RESRAD, Version 6.3      T« Limit = 180 days        05/29/2006  11:23  Page   1
 Summary : CAU 482 Drainage                                   File: 482Drain.RAD

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      Time = 0.000E+00 ....................................   13
      Time = 1.000E+00 ....................................   14
      Time = 3.000E+00 ....................................   15
      Time = 1.000E+01 ....................................   16
      Time = 2.500E+01 ....................................   17
      Time = 3.000E+01 ....................................   18
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1RESRAD, Version 6.3      T« Limit = 180 days        05/29/2006  11:23  Page   2
 Summary : CAU 482 Drainage                                   File: 482Drain.RAD

                           Dose Conversion Factor (and Related) Parameter Summary
                                           File: FGR 13 MORBIDITY
0     ³                                                              ³  Current  ³   Base    ³  Parameter
 Menu ³                                 Parameter                    ³   Value   ³   Case*   ³    Name
 ÄÄÄÄÄÅÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÅÄÄÄÄÄÄÄÄÄÄÄÅÄÄÄÄÄÄÄÄÄÄÄÅÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 B-1  ³ Dose conversion factors for inhalation, mrem/pCi:           ³           ³           ³
 B-1  ³ Ac-227+D                                                     ³ 6.724E+00 ³ 6.700E+00 ³ DCF2(  1)
 B-1  ³ Am-241                                                       ³ 4.440E-01 ³ 4.440E-01 ³ DCF2(  2)
 B-1  ³ Co-60                                                        ³ 2.190E-04 ³ 2.190E-04 ³ DCF2(  3)
 B-1  ³ Cs-137+D                                                     ³ 3.190E-05 ³ 3.190E-05 ³ DCF2(  4)
 B-1  ³ Np-237+D                                                     ³ 5.400E-01 ³ 5.400E-01 ³ DCF2(  5)
 B-1  ³ Pa-231                                                       ³ 1.280E+00 ³ 1.280E+00 ³ DCF2(  6)
 B-1  ³ Pb-210+D                                                     ³ 2.320E-02 ³ 1.360E-02 ³ DCF2(  7)
 B-1  ³ Pu-238                                                       ³ 3.920E-01 ³ 3.920E-01 ³ DCF2(  8)
 B-1  ³ Pu-239                                                       ³ 4.290E-01 ³ 4.290E-01 ³ DCF2( 10)
 B-1  ³ Ra-226+D                                                     ³ 8.594E-03 ³ 8.580E-03 ³ DCF2( 11)
 B-1  ³ Sr-90+D                                                      ³ 1.308E-03 ³ 1.300E-03 ³ DCF2( 12)
 B-1  ³ Th-229+D                                                     ³ 2.169E+00 ³ 2.150E+00 ³ DCF2( 13)
 B-1  ³ Th-230                                                       ³ 3.260E-01 ³ 3.260E-01 ³ DCF2( 14)
 B-1  ³ U-233                                                        ³ 1.350E-01 ³ 1.350E-01 ³ DCF2( 15)
 B-1  ³ U-234                                                        ³ 1.320E-01 ³ 1.320E-01 ³ DCF2( 16)
 B-1  ³ U-235+D                                                      ³ 1.230E-01 ³ 1.230E-01 ³ DCF2( 17)
      ³                                                              ³           ³           ³
 D-1  ³ Dose conversion factors for ingestion, mrem/pCi:             ³           ³           ³
 D-1  ³ Ac-227+D                                                     ³ 1.480E-02 ³ 1.410E-02 ³ DCF3(  1)
 D-1  ³ Am-241                                                       ³ 3.640E-03 ³ 3.640E-03 ³ DCF3(  2)
 D-1  ³ Co-60                                                        ³ 2.690E-05 ³ 2.690E-05 ³ DCF3(  3)
 D-1  ³ Cs-137+D                                                     ³ 5.000E-05 ³ 5.000E-05 ³ DCF3(  4)
 D-1  ³ Np-237+D                                                     ³ 4.444E-03 ³ 4.440E-03 ³ DCF3(  5)
 D-1  ³ Pa-231                                                       ³ 1.060E-02 ³ 1.060E-02 ³ DCF3(  6)
 D-1  ³ Pb-210+D                                                     ³ 7.276E-03 ³ 5.370E-03 ³ DCF3(  7)
 D-1  ³ Pu-238                                                       ³ 3.200E-03 ³ 3.200E-03 ³ DCF3(  8)
 D-1  ³ Pu-239                                                       ³ 3.540E-03 ³ 3.540E-03 ³ DCF3( 10)
 D-1  ³ Ra-226+D                                                     ³ 1.321E-03 ³ 1.320E-03 ³ DCF3( 11)
 D-1  ³ Sr-90+D                                                      ³ 1.528E-04 ³ 1.420E-04 ³ DCF3( 12)
 D-1  ³ Th-229+D                                                     ³ 4.027E-03 ³ 3.530E-03 ³ DCF3( 13)
 D-1  ³ Th-230                                                       ³ 5.480E-04 ³ 5.480E-04 ³ DCF3( 14)
 D-1  ³ U-233                                                        ³ 2.890E-04 ³ 2.890E-04 ³ DCF3( 15)
 D-1  ³ U-234                                                        ³ 2.830E-04 ³ 2.830E-04 ³ DCF3( 16)
 D-1  ³ U-235+D                                                      ³ 2.673E-04 ³ 2.660E-04 ³ DCF3( 17)
      ³                                                              ³           ³           ³
 D-34 ³ Food transfer factors:                                       ³           ³           ³
 D-34 ³ Ac-227+D  , plant/soil concentration ratio, dimensionless    ³ 2.500E-03 ³ 2.500E-03 ³ RTF(  1,1)
 D-34 ³ Ac-227+D  , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)    ³ 2.000E-05 ³ 2.000E-05 ³ RTF(  1,2)
 D-34 ³ Ac-227+D  , milk/livestock-intake ratio, (pCi/L)/(pCi/d)     ³ 2.000E-05 ³ 2.000E-05 ³ RTF(  1,3)
 D-34 ³                                                              ³           ³           ³
 D-34 ³ Am-241    , plant/soil concentration ratio, dimensionless    ³ 1.000E-03 ³ 1.000E-03 ³ RTF(  2,1)
 D-34 ³ Am-241    , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)    ³ 5.000E-05 ³ 5.000E-05 ³ RTF(  2,2)
 D-34 ³ Am-241    , milk/livestock-intake ratio, (pCi/L)/(pCi/d)     ³ 2.000E-06 ³ 2.000E-06 ³ RTF(  2,3)
 D-34 ³                                                              ³           ³           ³
 D-34 ³ Co-60     , plant/soil concentration ratio, dimensionless    ³ 8.000E-02 ³ 8.000E-02 ³ RTF(  3,1)
 D-34 ³ Co-60     , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)    ³ 2.000E-02 ³ 2.000E-02 ³ RTF(  3,2)
 D-34 ³ Co-60     , milk/livestock-intake ratio, (pCi/L)/(pCi/d)     ³ 2.000E-03 ³ 2.000E-03 ³ RTF(  3,3)
 D-34 ³                                                              ³           ³           ³
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1RESRAD, Version 6.3      T« Limit = 180 days        05/29/2006  11:23  Page   3
 Summary : CAU 482 Drainage                                  File: 482Drain.RAD

                     Dose Conversion Factor (and Related) Parameter Summary (continued)
                                           File: FGR 13 MORBIDITY
0     ³                                                             ³  Current  ³   Base    ³  Parameter
 Menu ³                            Parameter                        ³   Value   ³   Case*   ³    Name
 ÄÄÄÄÄÅÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÅÄÄÄÄÄÄÄÄÄÄÄÅÄÄÄÄÄÄÄÄÄÄÄÅÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 D-34 ³ Cs-137+D  , plant/soil concentration ratio, dimensionless   ³ 4.000E-02 ³ 4.000E-02 ³ RTF(  4,1)
 D-34 ³ Cs-137+D  , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)   ³ 3.000E-02 ³ 3.000E-02 ³ RTF(  4,2)
 D-34 ³ Cs-137+D  , milk/livestock-intake ratio, (pCi/L)/(pCi/d)    ³ 8.000E-03 ³ 8.000E-03 ³ RTF(  4,3)
 D-34 ³                                                             ³           ³           ³
 D-34 ³ Np-237+D  , plant/soil concentration ratio, dimensionless   ³ 2.000E-02 ³ 2.000E-02 ³ RTF(  5,1)
 D-34 ³ Np-237+D  , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)   ³ 1.000E-03 ³ 1.000E-03 ³ RTF(  5,2)
 D-34 ³ Np-237+D  , milk/livestock-intake ratio, (pCi/L)/(pCi/d)    ³ 5.000E-06 ³ 5.000E-06 ³ RTF(  5,3)
 D-34 ³                                                             ³           ³           ³
 D-34 ³ Pa-231    , plant/soil concentration ratio, dimensionless   ³ 1.000E-02 ³ 1.000E-02 ³ RTF(  6,1)
 D-34 ³ Pa-231    , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)   ³ 5.000E-03 ³ 5.000E-03 ³ RTF(  6,2)
 D-34 ³ Pa-231    , milk/livestock-intake ratio, (pCi/L)/(pCi/d)    ³ 5.000E-06 ³ 5.000E-06 ³ RTF(  6,3)
 D-34 ³                                                             ³           ³           ³
 D-34 ³ Pb-210+D  , plant/soil concentration ratio, dimensionless   ³ 1.000E-02 ³ 1.000E-02 ³ RTF(  7,1)
 D-34 ³ Pb-210+D  , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)   ³ 8.000E-04 ³ 8.000E-04 ³ RTF(  7,2)
 D-34 ³ Pb-210+D  , milk/livestock-intake ratio, (pCi/L)/(pCi/d)    ³ 3.000E-04 ³ 3.000E-04 ³ RTF(  7,3)
 D-34 ³                                                             ³           ³           ³
 D-34 ³ Pu-238    , plant/soil concentration ratio, dimensionless   ³ 1.000E-03 ³ 1.000E-03 ³ RTF(  8,1)
 D-34 ³ Pu-238    , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)   ³ 1.000E-04 ³ 1.000E-04 ³ RTF(  8,2)
 D-34 ³ Pu-238    , milk/livestock-intake ratio, (pCi/L)/(pCi/d)    ³ 1.000E-06 ³ 1.000E-06 ³ RTF(  8,3)
 D-34 ³                                                             ³           ³           ³
 D-34 ³ Pu-239    , plant/soil concentration ratio, dimensionless   ³ 1.000E-03 ³ 1.000E-03 ³ RTF( 10,1)
 D-34 ³ Pu-239    , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)   ³ 1.000E-04 ³ 1.000E-04 ³ RTF( 10,2)
 D-34 ³ Pu-239    , milk/livestock-intake ratio, (pCi/L)/(pCi/d)    ³ 1.000E-06 ³ 1.000E-06 ³ RTF( 10,3)
 D-34 ³                                                             ³           ³           ³
 D-34 ³ Ra-226+D  , plant/soil concentration ratio, dimensionless   ³ 4.000E-02 ³ 4.000E-02 ³ RTF( 11,1)
 D-34 ³ Ra-226+D  , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)   ³ 1.000E-03 ³ 1.000E-03 ³ RTF( 11,2)
 D-34 ³ Ra-226+D  , milk/livestock-intake ratio, (pCi/L)/(pCi/d)    ³ 1.000E-03 ³ 1.000E-03 ³ RTF( 11,3)
 D-34 ³                                                             ³           ³           ³
 D-34 ³ Sr-90+D   , plant/soil concentration ratio, dimensionless   ³ 3.000E-01 ³ 3.000E-01 ³ RTF( 12,1)
 D-34 ³ Sr-90+D   , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)   ³ 8.000E-03 ³ 8.000E-03 ³ RTF( 12,2)
 D-34 ³ Sr-90+D   , milk/livestock-intake ratio, (pCi/L)/(pCi/d)    ³ 2.000E-03 ³ 2.000E-03 ³ RTF( 12,3)
 D-34 ³                                                             ³           ³           ³
 D-34 ³ Th-229+D  , plant/soil concentration ratio, dimensionless   ³ 1.000E-03 ³ 1.000E-03 ³ RTF( 13,1)
 D-34 ³ Th-229+D  , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)   ³ 1.000E-04 ³ 1.000E-04 ³ RTF( 13,2)
 D-34 ³ Th-229+D  , milk/livestock-intake ratio, (pCi/L)/(pCi/d)    ³ 5.000E-06 ³ 5.000E-06 ³ RTF( 13,3)
 D-34 ³                                                             ³           ³           ³
 D-34 ³ Th-230    , plant/soil concentration ratio, dimensionless   ³ 1.000E-03 ³ 1.000E-03 ³ RTF( 14,1)
 D-34 ³ Th-230    , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)   ³ 1.000E-04 ³ 1.000E-04 ³ RTF( 14,2)
 D-34 ³ Th-230    , milk/livestock-intake ratio, (pCi/L)/(pCi/d)    ³ 5.000E-06 ³ 5.000E-06 ³ RTF( 14,3)
 D-34 ³                                                             ³           ³           ³
 D-34 ³ U-233     , plant/soil concentration ratio, dimensionless   ³ 2.500E-03 ³ 2.500E-03 ³ RTF( 15,1)
 D-34 ³ U-233     , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)   ³ 3.400E-04 ³ 3.400E-04 ³ RTF( 15,2)
 D-34 ³ U-233     , milk/livestock-intake ratio, (pCi/L)/(pCi/d)    ³ 6.000E-04 ³ 6.000E-04 ³ RTF( 15,3)
 D-34 ³                                                             ³           ³           ³
 D-34 ³ U-234     , plant/soil concentration ratio, dimensionless   ³ 2.500E-03 ³ 2.500E-03 ³ RTF( 16,1)
 D-34 ³ U-234     , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)   ³ 3.400E-04 ³ 3.400E-04 ³ RTF( 16,2)
 D-34 ³ U-234     , milk/livestock-intake ratio, (pCi/L)/(pCi/d)    ³ 6.000E-04 ³ 6.000E-04 ³ RTF( 16,3)
 D-34 ³                                                             ³           ³           ³
 D-34 ³ U-235+D   , plant/soil concentration ratio, dimensionless   ³ 2.500E-03 ³ 2.500E-03 ³ RTF( 17,1)
 D-34 ³ U-235+D   , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)   ³ 3.400E-04 ³ 3.400E-04 ³ RTF( 17,2)
 D-34 ³ U-235+D   , milk/livestock-intake ratio, (pCi/L)/(pCi/d)    ³ 6.000E-04 ³ 6.000E-04 ³ RTF( 17,3)
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                     Dose Conversion Factor (and Related) Parameter Summary (continued)
                                           File: FGR 13 MORBIDITY
0     ³                                                          ³  Current  ³   Base    ³  Parameter
 Menu ³                                Parameter                 ³   Value   ³   Case*   ³    Name
 ÄÄÄÄÄÅÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÅÄÄÄÄÄÄÄÄÄÄÄÅÄÄÄÄÄÄÄÄÄÄÄÅÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 D-5  ³ Bioaccumulation factors, fresh water, L/kg:               ³           ³           ³
 D-5  ³ Ac-227+D  , fish                                          ³ 1.500E+01 ³ 1.500E+01 ³ BIOFAC(  1,1)
 D-5  ³ Ac-227+D  , crustacea and mollusks                        ³ 1.000E+03 ³ 1.000E+03 ³ BIOFAC(  1,2)
 D-5  ³                                                           ³           ³           ³
 D-5  ³ Am-241    , fish                                          ³ 3.000E+01 ³ 3.000E+01 ³ BIOFAC(  2,1)
 D-5  ³ Am-241    , crustacea and mollusks                        ³ 1.000E+03 ³ 1.000E+03 ³ BIOFAC(  2,2)
 D-5  ³                                                           ³           ³           ³
 D-5  ³ Co-60     , fish                                          ³ 3.000E+02 ³ 3.000E+02 ³ BIOFAC(  3,1)
 D-5  ³ Co-60     , crustacea and mollusks                        ³ 2.000E+02 ³ 2.000E+02 ³ BIOFAC(  3,2)
 D-5  ³                                                           ³           ³           ³
 D-5  ³ Cs-137+D  , fish                                          ³ 2.000E+03 ³ 2.000E+03 ³ BIOFAC(  4,1)
 D-5  ³ Cs-137+D  , crustacea and mollusks                        ³ 1.000E+02 ³ 1.000E+02 ³ BIOFAC(  4,2)
 D-5  ³                                                           ³           ³           ³
 D-5  ³ Np-237+D  , fish                                          ³ 3.000E+01 ³ 3.000E+01 ³ BIOFAC(  5,1)
 D-5  ³ Np-237+D  , crustacea and mollusks                        ³ 4.000E+02 ³ 4.000E+02 ³ BIOFAC(  5,2)
 D-5  ³                                                           ³           ³           ³
 D-5  ³ Pa-231    , fish                                          ³ 1.000E+01 ³ 1.000E+01 ³ BIOFAC(  6,1)
 D-5  ³ Pa-231    , crustacea and mollusks                        ³ 1.100E+02 ³ 1.100E+02 ³ BIOFAC(  6,2)
 D-5  ³                                                           ³           ³           ³
 D-5  ³ Pb-210+D  , fish                                          ³ 3.000E+02 ³ 3.000E+02 ³ BIOFAC(  7,1)
 D-5  ³ Pb-210+D  , crustacea and mollusks                        ³ 1.000E+02 ³ 1.000E+02 ³ BIOFAC(  7,2)
 D-5  ³                                                           ³           ³           ³
 D-5  ³ Pu-238    , fish                                          ³ 3.000E+01 ³ 3.000E+01 ³ BIOFAC(  8,1)
 D-5  ³ Pu-238    , crustacea and mollusks                        ³ 1.000E+02 ³ 1.000E+02 ³ BIOFAC(  8,2)
 D-5  ³                                                           ³           ³           ³
 D-5  ³ Pu-239    , fish                                          ³ 3.000E+01 ³ 3.000E+01 ³ BIOFAC( 10,1)
 D-5  ³ Pu-239    , crustacea and mollusks                        ³ 1.000E+02 ³ 1.000E+02 ³ BIOFAC( 10,2)
 D-5  ³                                                           ³           ³           ³
 D-5  ³ Ra-226+D  , fish                                          ³ 5.000E+01 ³ 5.000E+01 ³ BIOFAC( 11,1)
 D-5  ³ Ra-226+D  , crustacea and mollusks                        ³ 2.500E+02 ³ 2.500E+02 ³ BIOFAC( 11,2)
 D-5  ³                                                           ³           ³           ³
 D-5  ³ Sr-90+D   , fish                                          ³ 6.000E+01 ³ 6.000E+01 ³ BIOFAC( 12,1)
 D-5  ³ Sr-90+D   , crustacea and mollusks                        ³ 1.000E+02 ³ 1.000E+02 ³ BIOFAC( 12,2)
 D-5  ³                                                           ³           ³           ³
 D-5  ³ Th-229+D  , fish                                          ³ 1.000E+02 ³ 1.000E+02 ³ BIOFAC( 13,1)
 D-5  ³ Th-229+D  , crustacea and mollusks                        ³ 5.000E+02 ³ 5.000E+02 ³ BIOFAC( 13,2)
 D-5  ³                                                           ³           ³           ³
 D-5  ³ Th-230    , fish                                          ³ 1.000E+02 ³ 1.000E+02 ³ BIOFAC( 14,1)
 D-5  ³ Th-230    , crustacea and mollusks                        ³ 5.000E+02 ³ 5.000E+02 ³ BIOFAC( 14,2)
 D-5  ³                                                           ³           ³           ³
 D-5  ³ U-233     , fish                                          ³ 1.000E+01 ³ 1.000E+01 ³ BIOFAC( 15,1)
 D-5  ³ U-233     , crustacea and mollusks                        ³ 6.000E+01 ³ 6.000E+01 ³ BIOFAC( 15,2)
 D-5  ³                                                           ³           ³           ³
 D-5  ³ U-234     , fish                                          ³ 1.000E+01 ³ 1.000E+01 ³ BIOFAC( 16,1)
 D-5  ³ U-234     , crustacea and mollusks                        ³ 6.000E+01 ³ 6.000E+01 ³ BIOFAC( 16,2)
 D-5  ³                                                           ³           ³           ³
 D-5  ³ U-235+D   , fish                                          ³ 1.000E+01 ³ 1.000E+01 ³ BIOFAC( 17,1)
 D-5  ³ U-235+D   , crustacea and mollusks                        ³ 6.000E+01 ³ 6.000E+01 ³ BIOFAC( 17,2)
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 *Base Case means Default.Lib w/o Associate Nuclide contributions.
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1RESRAD, Version 6.3      T« Limit = 180 days        05/29/2006  11:23  Page   5
 Summary : CAU 482 Drainage                                File: 482Drain.RAD

                                                   Site-Specific Parameter Summary
0     ³                                                ³   User    ³           ³         Used by RESRAD         ³  Parameter
 Menu ³                   Parameter                    ³   Input   ³  Default  ³ (If different from user input) ³    Name
 ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 R011 ³ Area of contaminated zone (m**2)               ³ 1.000E+02 ³ 1.000E+04 ³              ---               ³ AREA
 R011 ³ Thickness of contaminated zone (m)             ³ 1.500E-01 ³ 2.000E+00 ³              ---               ³ THICK0
 R011 ³ Length parallel to aquifer flow (m)            ³ not used  ³ 1.000E+02 ³              ---               ³ LCZPAQ
 R011 ³ Basic radiation dose limit (mrem/yr)           ³ 2.500E+01 ³ 3.000E+01 ³              ---               ³ BRDL
 R011 ³ Time since placement of material (yr)          ³ 0.000E+00 ³ 0.000E+00 ³              ---               ³ TI
 R011 ³ Times for calculations (yr)                    ³ 1.000E+00 ³ 1.000E+00 ³              ---               ³ T( 2)
 R011 ³ Times for calculations (yr)                    ³ 3.000E+00 ³ 3.000E+00 ³              ---               ³ T( 3)
 R011 ³ Times for calculations (yr)                    ³ 1.000E+01 ³ 1.000E+01 ³              ---               ³ T( 4)
 R011 ³ Times for calculations (yr)                    ³ 2.500E+01 ³ 3.000E+01 ³              ---               ³ T( 5)
 R011 ³ Times for calculations (yr)                    ³ 3.000E+01 ³ 1.000E+02 ³              ---               ³ T( 6)
 R011 ³ Times for calculations (yr)                    ³ 5.000E+01 ³ 3.000E+02 ³              ---               ³ T( 7)
 R011 ³ Times for calculations (yr)                    ³ 7.500E+01 ³ 1.000E+03 ³              ---               ³ T( 8)
 R011 ³ Times for calculations (yr)                    ³ 1.000E+02 ³ 0.000E+00 ³              ---               ³ T( 9)
 R011 ³ Times for calculations (yr)                    ³ 3.000E+02 ³ 0.000E+00 ³              ---               ³ T(10)
      ³                                                ³           ³           ³                                ³
 R012 ³ Initial principal radionuclide (pCi/g):  Am-241 ³ 3.100E+00 ³ 0.000E+00 ³              ---               ³ S1( 2)
 R012 ³ Initial principal radionuclide (pCi/g):  Co-60  ³ 3.230E-01 ³ 0.000E+00 ³              ---               ³ S1( 3)
 R012 ³ Initial principal radionuclide (pCi/g):  Cs-137 ³ 4.720E+02 ³ 0.000E+00 ³              ---               ³ S1( 4)
 R012 ³ Initial principal radionuclide (pCi/g):  Pu-238 ³ 3.960E+00 ³ 0.000E+00 ³              ---               ³ S1( 8)
 R012 ³ Initial principal radionuclide (pCi/g):  Pu-239 ³ 2.330E+01 ³ 0.000E+00 ³              ---               ³ S1(10)
 R012 ³ Initial principal radionuclide (pCi/g):  Sr-90  ³ 4.380E+01 ³ 0.000E+00 ³              ---               ³ S1(12)
 R012 ³ Concentration in groundwater   (pCi/L):  Am-241 ³ not used  ³ 0.000E+00 ³              ---               ³ W1( 2)
 R012 ³ Concentration in groundwater   (pCi/L):  Co-60  ³ not used  ³ 0.000E+00 ³              ---               ³ W1( 3)
 R012 ³ Concentration in groundwater   (pCi/L):  Cs-137 ³ not used  ³ 0.000E+00 ³              ---               ³ W1( 4)
 R012 ³ Concentration in groundwater   (pCi/L):  Pu-238 ³ not used  ³ 0.000E+00 ³              ---               ³ W1( 8)
 R012 ³ Concentration in groundwater   (pCi/L):  Pu-239 ³ not used  ³ 0.000E+00 ³              ---               ³ W1(10)
 R012 ³ Concentration in groundwater   (pCi/L):  Sr-90  ³ not used  ³ 0.000E+00 ³              ---               ³ W1(12)
      ³                                                ³           ³           ³                                ³
 R013 ³ Cover depth (m)                                ³ 0.000E+00 ³ 0.000E+00 ³              ---               ³ COVER0
 R013 ³ Density of cover material (g/cm**3)            ³ not used  ³ 1.500E+00 ³              ---               ³ DENSCV
 R013 ³ Cover depth erosion rate (m/yr)                ³ not used  ³ 1.000E-03 ³              ---               ³ VCV
 R013 ³ Density of contaminated zone (g/cm**3)         ³ 1.500E+00 ³ 1.500E+00 ³              ---               ³ DENSCZ
 R013 ³ Contaminated zone erosion rate (m/yr)          ³ 1.000E-03 ³ 1.000E-03 ³              ---               ³ VCZ
 R013 ³ Contaminated zone total porosity               ³ 4.000E-01 ³ 4.000E-01 ³              ---               ³ TPCZ
 R013 ³ Contaminated zone field capacity               ³ 2.000E-01 ³ 2.000E-01 ³              ---               ³ FCCZ
 R013 ³ Contaminated zone hydraulic conductivity (m/yr) ³ 1.000E+01 ³ 1.000E+01 ³              ---               ³ HCCZ
 R013 ³ Contaminated zone b parameter                  ³ 5.300E+00 ³ 5.300E+00 ³              ---               ³ BCZ
 R013 ³ Average annual wind speed (m/sec)              ³ 3.770E+00 ³ 2.000E+00 ³              ---               ³ WIND
 R013 ³ Humidity in air (g/m**3)                       ³ not used  ³ 8.000E+00 ³              ---               ³ HUMID
 R013 ³ Evapotranspiration coefficient                 ³ 5.000E-01 ³ 5.000E-01 ³              ---               ³ EVAPTR
 R013 ³ Precipitation (m/yr)                           ³ 2.200E-01 ³ 1.000E+00 ³              ---               ³ PRECIP
 R013 ³ Irrigation (m/yr)                              ³ 0.000E+00 ³ 2.000E-01 ³              ---               ³ RI
 R013 ³ Irrigation mode                                ³ overhead  ³ overhead  ³              ---               ³ IDITCH
 R013 ³ Runoff coefficient                             ³ 4.000E-01 ³ 2.000E-01 ³              ---               ³ RUNOFF
 R013 ³ Watershed area for nearby stream or pond (m**2) ³ not used  ³ 1.000E+06 ³              ---               ³ WAREA
 R013 ³ Accuracy for water/soil computations           ³ not used  ³ 1.000E-03 ³              ---               ³ EPS
      ³                                                ³           ³           ³                                ³
 R014 ³ Density of saturated zone (g/cm**3)            ³ not used  ³ 1.500E+00 ³              ---               ³ DENSAQ
 R014 ³ Saturated zone total porosity                  ³ not used  ³ 4.000E-01 ³              ---               ³ TPSZ
 R014 ³ Saturated zone effective porosity              ³ not used  ³ 2.000E-01 ³              ---               ³ EPSZ
 R014 ³ Saturated zone field capacity                  ³ not used  ³ 2.000E-01 ³              ---               ³ FCSZ
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                                           Site-Specific Parameter Summary (continued)
0     ³                                                  ³  User     ³           ³         Used by RESRAD          ³  Parameter
 Menu ³                     Parameter                    ³  Input    ³  Default  ³ (If different from user input)  ³    Name
 ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 R014 ³ Saturated zone hydraulic conductivity (m/yr)     ³ not used  ³ 1.000E+02 ³              ---                ³ HCSZ
 R014 ³ Saturated zone hydraulic gradient                ³ not used  ³ 2.000E-02 ³              ---                ³ HGWT
 R014 ³ Saturated zone b parameter                       ³ not used  ³ 5.300E+00 ³              ---                ³ BSZ
 R014 ³ Water table drop rate (m/yr)                     ³ not used  ³ 1.000E-03 ³              ---                ³ VWT
 R014 ³ Well pump intake depth (m below water table)     ³ not used  ³ 1.000E+01 ³              ---                ³ DWIBWT
 R014 ³ Model: Nondispersion (ND) or Mass-Balance (MB)   ³ not used  ³ ND        ³              ---                ³ MODEL
 R014 ³ Well pumping rate (m**3/yr)                      ³ not used  ³ 2.500E+02 ³              ---                ³ UW
      ³                                                  ³           ³           ³                                 ³
 R015 ³ Number of unsaturated zone strata                ³ not used  ³ 1         ³              ---                ³ NS
 R015 ³ Unsat. zone 1, thickness (m)                     ³ not used  ³ 4.000E+00 ³              ---                ³ H(1)
 R015 ³ Unsat. zone 1, soil density (g/cm**3)            ³ not used  ³ 1.500E+00 ³              ---                ³ DENSUZ(1)
 R015 ³ Unsat. zone 1, total porosity                    ³ not used  ³ 4.000E-01 ³              ---                ³ TPUZ(1)
 R015 ³ Unsat. zone 1, effective porosity                ³ not used  ³ 2.000E-01 ³              ---                ³ EPUZ(1)
 R015 ³ Unsat. zone 1, field capacity                    ³ not used  ³ 2.000E-01 ³              ---                ³ FCUZ(1)
 R015 ³ Unsat. zone 1, soil-specific b parameter         ³ not used  ³ 5.300E+00 ³              ---                ³ BUZ(1)
 R015 ³ Unsat. zone 1, hydraulic conductivity (m/yr)     ³ not used  ³ 1.000E+01 ³              ---                ³ HCUZ(1)
      ³                                                  ³           ³           ³                                 ³
 R016 ³ Distribution coefficients for Am-241             ³           ³           ³                                 ³
 R016 ³   Contaminated zone (cm**3/g)                    ³ 2.000E+01 ³ 2.000E+01 ³              ---                ³ DCNUCC( 2)
 R016 ³   Unsaturated zone 1 (cm**3/g)                   ³ not used  ³ 2.000E+01 ³              ---                ³ DCNUCU( 2,1)
 R016 ³   Saturated zone (cm**3/g)                       ³ not used  ³ 2.000E+01 ³              ---                ³ DCNUCS( 2)
 R016 ³   Leach rate (/yr)                               ³ 0.000E+00 ³ 0.000E+00 ³           1.453E-02             ³ ALEACH( 2)
 R016 ³   Solubility constant                            ³ 0.000E+00 ³ 0.000E+00 ³           not used              ³ SOLUBK( 2)
      ³                                                  ³           ³           ³                                 ³
 R016 ³ Distribution coefficients for Co-60              ³           ³           ³                                 ³
 R016 ³   Contaminated zone (cm**3/g)                    ³ 1.000E+03 ³ 1.000E+03 ³              ---                ³ DCNUCC( 3)
 R016 ³   Unsaturated zone 1 (cm**3/g)                   ³ not used  ³ 1.000E+03 ³              ---                ³ DCNUCU( 3,1)
 R016 ³   Saturated zone (cm**3/g)                       ³ not used  ³ 1.000E+03 ³              ---                ³ DCNUCS( 3)
 R016 ³   Leach rate (/yr)                               ³ 0.000E+00 ³ 0.000E+00 ³           2.933E-04             ³ ALEACH( 3)
 R016 ³   Solubility constant                            ³ 0.000E+00 ³ 0.000E+00 ³           not used              ³ SOLUBK( 3)
      ³                                                  ³           ³           ³                                 ³
 R016 ³ Distribution coefficients for Cs-137             ³           ³           ³                                 ³
 R016 ³   Contaminated zone (cm**3/g)                    ³ 4.600E+03 ³ 4.600E+03 ³              ---                ³ DCNUCC( 4)
 R016 ³   Unsaturated zone 1 (cm**3/g)                   ³ not used  ³ 4.600E+03 ³              ---                ³ DCNUCU( 4,1)
 R016 ³   Saturated zone (cm**3/g)                       ³ not used  ³ 4.600E+03 ³              ---                ³ DCNUCS( 4)
 R016 ³   Leach rate (/yr)                               ³ 0.000E+00 ³ 0.000E+00 ³           6.377E-05             ³ ALEACH( 4)
 R016 ³   Solubility constant                            ³ 0.000E+00 ³ 0.000E+00 ³           not used              ³ SOLUBK( 4)
      ³                                                  ³           ³           ³                                 ³
 R016 ³ Distribution coefficients for Pu-238             ³           ³           ³                                 ³
 R016 ³   Contaminated zone (cm**3/g)                    ³ 2.000E+03 ³ 2.000E+03 ³              ---                ³ DCNUCC( 8)
 R016 ³   Unsaturated zone 1 (cm**3/g)                   ³ not used  ³ 2.000E+03 ³              ---                ³ DCNUCU( 8,1)
 R016 ³   Saturated zone (cm**3/g)                       ³ not used  ³ 2.000E+03 ³              ---                ³ DCNUCS( 8)
 R016 ³   Leach rate (/yr)                               ³ 0.000E+00 ³ 0.000E+00 ³           1.467E-04             ³ ALEACH( 8)
 R016 ³   Solubility constant                            ³ 0.000E+00 ³ 0.000E+00 ³           not used              ³ SOLUBK( 8)
      ³                                                  ³           ³           ³                                 ³
 R016 ³ Distribution coefficients for Pu-239             ³           ³           ³                                 ³
 R016 ³   Contaminated zone (cm**3/g)                    ³ 2.000E+03 ³ 2.000E+03 ³              ---                ³ DCNUCC(10)
 R016 ³   Unsaturated zone 1 (cm**3/g)                   ³ not used  ³ 2.000E+03 ³              ---                ³ DCNUCU(10,1)
 R016 ³   Saturated zone (cm**3/g)                       ³ not used  ³ 2.000E+03 ³              ---                ³ DCNUCS(10)
 R016 ³   Leach rate (/yr)                               ³ 0.000E+00 ³ 0.000E+00 ³           1.467E-04             ³ ALEACH(10)
 R016 ³   Solubility constant                            ³ 0.000E+00 ³ 0.000E+00 ³           not used              ³ SOLUBK(10)
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                                           Site-Specific Parameter Summary (continued)
0     ³                                                  ³   User    ³           ³         Used by RESRAD         ³  Parameter
 Menu ³                     Parameter                    ³   Input   ³  Default  ³ (If different from user input) ³    Name
 ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 R016 ³ Distribution coefficients for Sr-90              ³           ³           ³                                ³
 R016 ³   Contaminated zone (cm**3/g)                    ³ 3.000E+01 ³ 3.000E+01 ³              ---               ³ DCNUCC(12)
 R016 ³   Unsaturated zone 1 (cm**3/g)                   ³ not used  ³ 3.000E+01 ³              ---               ³ DCNUCU(12,1)
 R016 ³   Saturated zone (cm**3/g)                       ³ not used  ³ 3.000E+01 ³              ---               ³ DCNUCS(12)
 R016 ³   Leach rate (/yr)                               ³ 0.000E+00 ³ 0.000E+00 ³           9.718E-03            ³ ALEACH(12)
 R016 ³   Solubility constant                            ³ 0.000E+00 ³ 0.000E+00 ³           not used             ³ SOLUBK(12)
      ³                                                  ³           ³           ³                                ³
 R016 ³ Distribution coefficients for daughter Ac-227    ³           ³           ³                                ³
 R016 ³   Contaminated zone (cm**3/g)                    ³ 2.000E+01 ³ 2.000E+01 ³              ---               ³ DCNUCC( 1)
 R016 ³   Unsaturated zone 1 (cm**3/g)                   ³ not used  ³ 2.000E+01 ³              ---               ³ DCNUCU( 1,1)
 R016 ³   Saturated zone (cm**3/g)                       ³ not used  ³ 2.000E+01 ³              ---               ³ DCNUCS( 1)
 R016 ³   Leach rate (/yr)                               ³ 0.000E+00 ³ 0.000E+00 ³           1.453E-02            ³ ALEACH( 1)
 R016 ³   Solubility constant                            ³ 0.000E+00 ³ 0.000E+00 ³           not used             ³ SOLUBK( 1)
      ³                                                  ³           ³           ³                                ³
 R016 ³ Distribution coefficients for daughter Np-237    ³           ³           ³                                ³
 R016 ³   Contaminated zone (cm**3/g)                    ³-1.000E+00 ³-1.000E+00 ³           2.574E+02            ³ DCNUCC( 5)
 R016 ³   Unsaturated zone 1 (cm**3/g)                   ³ not used  ³-1.000E+00 ³              ---               ³ DCNUCU( 5,1)
 R016 ³   Saturated zone (cm**3/g)                       ³ not used  ³-1.000E+00 ³              ---               ³ DCNUCS( 5)
 R016 ³   Leach rate (/yr)                               ³ 0.000E+00 ³ 0.000E+00 ³           1.139E-03            ³ ALEACH( 5)
 R016 ³   Solubility constant                            ³ 0.000E+00 ³ 0.000E+00 ³           not used             ³ SOLUBK( 5)
      ³                                                  ³           ³           ³                                ³
 R016 ³ Distribution coefficients for daughter Pa-231    ³           ³           ³                                ³
 R016 ³   Contaminated zone (cm**3/g)                    ³ 5.000E+01 ³ 5.000E+01 ³              ---               ³ DCNUCC( 6)
 R016 ³   Unsaturated zone 1 (cm**3/g)                   ³ not used  ³ 5.000E+01 ³              ---               ³ DCNUCU( 6,1)
 R016 ³   Saturated zone (cm**3/g)                       ³ not used  ³ 5.000E+01 ³              ---               ³ DCNUCS( 6)
 R016 ³   Leach rate (/yr)                               ³ 0.000E+00 ³ 0.000E+00 ³           5.845E-03            ³ ALEACH( 6)
 R016 ³   Solubility constant                            ³ 0.000E+00 ³ 0.000E+00 ³           not used             ³ SOLUBK( 6)
      ³                                                  ³           ³           ³                                ³
 R016 ³ Distribution coefficients for daughter Pb-210    ³           ³           ³                                ³
 R016 ³   Contaminated zone (cm**3/g)                    ³ 1.000E+02 ³ 1.000E+02 ³              ---               ³ DCNUCC( 7)
 R016 ³   Unsaturated zone 1 (cm**3/g)                   ³ not used  ³ 1.000E+02 ³              ---               ³ DCNUCU( 7,1)
 R016 ³   Saturated zone (cm**3/g)                       ³ not used  ³ 1.000E+02 ³              ---               ³ DCNUCS( 7)
 R016 ³   Leach rate (/yr)                               ³ 0.000E+00 ³ 0.000E+00 ³           2.928E-03            ³ ALEACH( 7)
 R016 ³   Solubility constant                            ³ 0.000E+00 ³ 0.000E+00 ³           not used             ³ SOLUBK( 7)
      ³                                                  ³           ³           ³                                ³
 R016 ³ Distribution coefficients for daughter Ra-226    ³           ³           ³                                ³
 R016 ³   Contaminated zone (cm**3/g)                    ³ 7.000E+01 ³ 7.000E+01 ³              ---               ³ DCNUCC(11)
 R016 ³   Unsaturated zone 1 (cm**3/g)                   ³ not used  ³ 7.000E+01 ³              ---               ³ DCNUCU(11,1)
 R016 ³   Saturated zone (cm**3/g)                       ³ not used  ³ 7.000E+01 ³              ---               ³ DCNUCS(11)
 R016 ³   Leach rate (/yr)                               ³ 0.000E+00 ³ 0.000E+00 ³           4.179E-03            ³ ALEACH(11)
 R016 ³   Solubility constant                            ³ 0.000E+00 ³ 0.000E+00 ³           not used             ³ SOLUBK(11)
      ³                                                  ³           ³           ³                                ³
 R016 ³ Distribution coefficients for daughter Th-229    ³           ³           ³                                ³
 R016 ³   Contaminated zone (cm**3/g)                    ³ 6.000E+04 ³ 6.000E+04 ³              ---               ³ DCNUCC(13)
 R016 ³   Unsaturated zone 1 (cm**3/g)                   ³ not used  ³ 6.000E+04 ³              ---               ³ DCNUCU(13,1)
 R016 ³   Saturated zone (cm**3/g)                       ³ not used  ³ 6.000E+04 ³              ---               ³ DCNUCS(13)
 R016 ³   Leach rate (/yr)                               ³ 0.000E+00 ³ 0.000E+00 ³           4.889E-06            ³ ALEACH(13)
 R016 ³   Solubility constant                            ³ 0.000E+00 ³ 0.000E+00 ³           not used             ³ SOLUBK(13)
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                                           Site-Specific Parameter Summary (continued)
0     ³                                                  ³   User    ³           ³         Used by RESRAD         ³  Parameter
 Menu ³                     Parameter                    ³   Input   ³  Default  ³ (If different from user input) ³    Name
 ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 R016 ³ Distribution coefficients for daughter Th-230    ³           ³           ³                                ³
 R016 ³   Contaminated zone (cm**3/g)                    ³ 6.000E+04 ³ 6.000E+04 ³              ---               ³ DCNUCC(14)
 R016 ³   Unsaturated zone 1 (cm**3/g)                   ³ not used  ³ 6.000E+04 ³              ---               ³ DCNUCU(14,1)
 R016 ³   Saturated zone (cm**3/g)                       ³ not used  ³ 6.000E+04 ³              ---               ³ DCNUCS(14)
 R016 ³   Leach rate (/yr)                               ³ 0.000E+00 ³ 0.000E+00 ³           4.889E-06            ³ ALEACH(14)
 R016 ³   Solubility constant                            ³ 0.000E+00 ³ 0.000E+00 ³           not used             ³ SOLUBK(14)
      ³                                                  ³           ³           ³                                ³
 R016 ³ Distribution coefficients for daughter U-233     ³           ³           ³                                ³
 R016 ³   Contaminated zone (cm**3/g)                    ³ 5.000E+01 ³ 5.000E+01 ³              ---               ³ DCNUCC(15)
 R016 ³   Unsaturated zone 1 (cm**3/g)                   ³ not used  ³ 5.000E+01 ³              ---               ³ DCNUCU(15,1)
 R016 ³   Saturated zone (cm**3/g)                       ³ not used  ³ 5.000E+01 ³              ---               ³ DCNUCS(15)
 R016 ³   Leach rate (/yr)                               ³ 0.000E+00 ³ 0.000E+00 ³           5.845E-03            ³ ALEACH(15)
 R016 ³   Solubility constant                            ³ 0.000E+00 ³ 0.000E+00 ³           not used             ³ SOLUBK(15)
      ³                                                  ³           ³           ³                                ³
 R016 ³ Distribution coefficients for daughter U-234     ³           ³           ³                                ³
 R016 ³   Contaminated zone (cm**3/g)                    ³ 5.000E+01 ³ 5.000E+01 ³              ---               ³ DCNUCC(16)
 R016 ³   Unsaturated zone 1 (cm**3/g)                   ³ not used  ³ 5.000E+01 ³              ---               ³ DCNUCU(16,1)
 R016 ³   Saturated zone (cm**3/g)                       ³ not used  ³ 5.000E+01 ³              ---               ³ DCNUCS(16)
 R016 ³   Leach rate (/yr)                               ³ 0.000E+00 ³ 0.000E+00 ³           5.845E-03            ³ ALEACH(16)
 R016 ³   Solubility constant                            ³ 0.000E+00 ³ 0.000E+00 ³           not used             ³ SOLUBK(16)
      ³                                                  ³           ³           ³                                ³
 R016 ³ Distribution coefficients for daughter U-235     ³           ³           ³                                ³
 R016 ³   Contaminated zone (cm**3/g)                    ³ 5.000E+01 ³ 5.000E+01 ³              ---               ³ DCNUCC(17)
 R016 ³   Unsaturated zone 1 (cm**3/g)                   ³ not used  ³ 5.000E+01 ³              ---               ³ DCNUCU(17,1)
 R016 ³   Saturated zone (cm**3/g)                       ³ not used  ³ 5.000E+01 ³              ---               ³ DCNUCS(17)
 R016 ³   Leach rate (/yr)                               ³ 0.000E+00 ³ 0.000E+00 ³           5.845E-03            ³ ALEACH(17)
 R016 ³   Solubility constant                            ³ 0.000E+00 ³ 0.000E+00 ³           not used             ³ SOLUBK(17)
      ³                                                  ³           ³           ³                                ³
 R017 ³ Inhalation rate (m**3/yr)                        ³ 1.230E+04 ³ 8.400E+03 ³              ---               ³ INHALR
 R017 ³ Mass loading for inhalation (g/m**3)             ³ 6.000E-04 ³ 1.000E-04 ³              ---               ³ MLINH
 R017 ³ Exposure duration                                ³ 2.500E+01 ³ 3.000E+01 ³              ---               ³ ED
 R017 ³ Shielding factor, inhalation                     ³ 1.000E+00 ³ 4.000E-01 ³              ---               ³ SHF3
 R017 ³ Shielding factor, external gamma                 ³ 1.000E+00 ³ 7.000E-01 ³              ---               ³ SHF1
 R017 ³ Fraction of time spent indoors                   ³ 0.000E+00 ³ 5.000E-01 ³              ---               ³ FIND
 R017 ³ Fraction of time spent outdoors (on site)        ³ 3.800E-02 ³ 2.500E-01 ³              ---               ³ FOTD
 R017 ³ Shape factor flag, external gamma                ³ 1.000E+00 ³ 1.000E+00 ³    >0 shows circular AREA.     ³ FS
 R017 ³ Radii of shape factor array (used if FS = -1):   ³           ³           ³                                ³
 R017 ³   Outer annular radius (m), ring  1:             ³ not used  ³ 5.000E+01 ³              ---               ³ RAD_SHAPE( 1)
 R017 ³   Outer annular radius (m), ring  2:             ³ not used  ³ 7.071E+01 ³              ---               ³ RAD_SHAPE( 2)
 R017 ³   Outer annular radius (m), ring  3:             ³ not used  ³ 0.000E+00 ³              ---               ³ RAD_SHAPE( 3)
 R017 ³   Outer annular radius (m), ring  4:             ³ not used  ³ 0.000E+00 ³              ---               ³ RAD_SHAPE( 4)
 R017 ³   Outer annular radius (m), ring  5:             ³ not used  ³ 0.000E+00 ³              ---               ³ RAD_SHAPE( 5)
 R017 ³   Outer annular radius (m), ring  6:             ³ not used  ³ 0.000E+00 ³              ---               ³ RAD_SHAPE( 6)
 R017 ³   Outer annular radius (m), ring  7:             ³ not used  ³ 0.000E+00 ³              ---               ³ RAD_SHAPE( 7)
 R017 ³   Outer annular radius (m), ring  8:             ³ not used  ³ 0.000E+00 ³              ---               ³ RAD_SHAPE( 8)
 R017 ³   Outer annular radius (m), ring  9:             ³ not used  ³ 0.000E+00 ³              ---               ³ RAD_SHAPE( 9)
 R017 ³   Outer annular radius (m), ring 10:             ³ not used  ³ 0.000E+00 ³              ---               ³ RAD_SHAPE(10)
 R017 ³   Outer annular radius (m), ring 11:             ³ not used  ³ 0.000E+00 ³              ---               ³ RAD_SHAPE(11)
 R017 ³   Outer annular radius (m), ring 12:             ³ not used  ³ 0.000E+00 ³              ---               ³ RAD_SHAPE(12)
      ³                                                  ³           ³           ³                                ³
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                                           Site-Specific Parameter Summary (continued)
0     ³                                                  ³   User    ³           ³         Used by RESRAD         ³  Parameter
 Menu ³                     Parameter                    ³   Input   ³  Default  ³ (If different from user input) ³    Name
 ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 R017 ³ Fractions of annular areas within AREA:          ³           ³           ³                                ³
 R017 ³   Ring  1                                        ³ not used  ³ 1.000E+00 ³              ---               ³ FRACA( 1)
 R017 ³   Ring  2                                        ³ not used  ³ 2.732E-01 ³              ---               ³ FRACA( 2)
 R017 ³   Ring  3                                        ³ not used  ³ 0.000E+00 ³              ---               ³ FRACA( 3)
 R017 ³   Ring  4                                        ³ not used  ³ 0.000E+00 ³              ---               ³ FRACA( 4)
 R017 ³   Ring  5                                        ³ not used  ³ 0.000E+00 ³              ---               ³ FRACA( 5)
 R017 ³   Ring  6                                        ³ not used  ³ 0.000E+00 ³              ---               ³ FRACA( 6)
 R017 ³   Ring  7                                        ³ not used  ³ 0.000E+00 ³              ---               ³ FRACA( 7)
 R017 ³   Ring  8                                        ³ not used  ³ 0.000E+00 ³              ---               ³ FRACA( 8)
 R017 ³   Ring  9                                        ³ not used  ³ 0.000E+00 ³              ---               ³ FRACA( 9)
 R017 ³   Ring 10                                        ³ not used  ³ 0.000E+00 ³              ---               ³ FRACA(10)
 R017 ³   Ring 11                                        ³ not used  ³ 0.000E+00 ³              ---               ³ FRACA(11)
 R017 ³   Ring 12                                        ³ not used  ³ 0.000E+00 ³              ---               ³ FRACA(12)
      ³                                                  ³           ³           ³                                ³
 R018 ³ Fruits, vegetables and grain consumption (kg/yr) ³ not used  ³ 1.600E+02 ³              ---               ³ DIET(1)
 R018 ³ Leafy vegetable consumption (kg/yr)              ³ not used  ³ 1.400E+01 ³              ---               ³ DIET(2)
 R018 ³ Milk consumption (L/yr)                          ³ not used  ³ 9.200E+01 ³              ---               ³ DIET(3)
 R018 ³ Meat and poultry consumption (kg/yr)             ³ not used  ³ 6.300E+01 ³              ---               ³ DIET(4)
 R018 ³ Fish consumption (kg/yr)                         ³ not used  ³ 5.400E+00 ³              ---               ³ DIET(5)
 R018 ³ Other seafood consumption (kg/yr)                ³ not used  ³ 9.000E-01 ³              ---               ³ DIET(6)
 R018 ³ Soil ingestion rate (g/yr)                       ³ 1.752E+02 ³ 3.650E+01 ³              ---               ³ SOIL
 R018 ³ Drinking water intake (L/yr)                     ³ not used  ³ 5.100E+02 ³              ---               ³ DWI
 R018 ³ Contamination fraction of drinking water         ³ not used  ³ 1.000E+00 ³              ---               ³ FDW
 R018 ³ Contamination fraction of household water        ³ not used  ³ 1.000E+00 ³              ---               ³ FHHW
 R018 ³ Contamination fraction of livestock water        ³ not used  ³ 1.000E+00 ³              ---               ³ FLW
 R018 ³ Contamination fraction of irrigation water       ³ not used  ³ 1.000E+00 ³              ---               ³ FIRW
 R018 ³ Contamination fraction of aquatic food           ³ not used  ³ 5.000E-01 ³              ---               ³ FR9
 R018 ³ Contamination fraction of plant food             ³ not used  ³-1         ³              ---               ³ FPLANT
 R018 ³ Contamination fraction of meat                   ³ not used  ³-1         ³              ---               ³ FMEAT
 R018 ³ Contamination fraction of milk                   ³ not used  ³-1         ³              ---               ³ FMILK
      ³                                                  ³           ³           ³                                ³
 R019 ³ Livestock fodder intake for meat (kg/day)        ³ not used  ³ 6.800E+01 ³              ---               ³ LFI5
 R019 ³ Livestock fodder intake for milk (kg/day)        ³ not used  ³ 5.500E+01 ³              ---               ³ LFI6
 R019 ³ Livestock water intake for meat (L/day)          ³ not used  ³ 5.000E+01 ³              ---               ³ LWI5
 R019 ³ Livestock water intake for milk (L/day)          ³ not used  ³ 1.600E+02 ³              ---               ³ LWI6
 R019 ³ Livestock soil intake (kg/day)                   ³ not used  ³ 5.000E-01 ³              ---               ³ LSI
 R019 ³ Mass loading for foliar deposition (g/m**3)      ³ not used  ³ 1.000E-04 ³              ---               ³ MLFD
 R019 ³ Depth of soil mixing layer (m)                   ³ 1.500E-01 ³ 1.500E-01 ³              ---               ³ DM
 R019 ³ Depth of roots (m)                               ³ not used  ³ 9.000E-01 ³              ---               ³ DROOT
 R019 ³ Drinking water fraction from ground water        ³ not used  ³ 1.000E+00 ³              ---               ³ FGWDW
 R019 ³ Household water fraction from ground water       ³ not used  ³ 1.000E+00 ³              ---               ³ FGWHH
 R019 ³ Livestock water fraction from ground water       ³ not used  ³ 1.000E+00 ³              ---               ³ FGWLW
 R019 ³ Irrigation fraction from ground water            ³ not used  ³ 1.000E+00 ³              ---               ³ FGWIR
      ³                                                  ³           ³           ³                                ³
 R19B ³ Wet weight crop yield for Non-Leafy (kg/m**2)    ³ not used  ³ 7.000E-01 ³              ---               ³ YV(1)
 R19B ³ Wet weight crop yield for Leafy     (kg/m**2)    ³ not used  ³ 1.500E+00 ³              ---               ³ YV(2)
 R19B ³ Wet weight crop yield for Fodder    (kg/m**2)    ³ not used  ³ 1.100E+00 ³              ---               ³ YV(3)
 R19B ³ Growing Season for  Non-Leafy (years)            ³ not used  ³ 1.700E-01 ³              ---               ³ TE(1)
 R19B ³ Growing Season for  Leafy     (years)            ³ not used  ³ 2.500E-01 ³              ---               ³ TE(2)
 R19B ³ Growing Season for  Fodder    (years)            ³ not used  ³ 8.000E-02 ³              ---               ³ TE(3)
 R19B ³ Translocation Factor for  Non-Leafy              ³ not used  ³ 1.000E-01 ³              ---               ³ TIV(1)
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                                           Site-Specific Parameter Summary (continued)
0     ³                                                  ³   User    ³           ³         Used by RESRAD         ³  Parameter
 Menu ³                     Parameter                    ³   Input   ³  Default  ³ (If different from user input) ³    Name
 ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 R19B ³ Translocation Factor for  Leafy                  ³ not used  ³ 1.000E+00 ³              ---               ³ TIV(2)
 R19B ³ Translocation Factor for  Fodder                 ³ not used  ³ 1.000E+00 ³              ---               ³ TIV(3)
 R19B ³ Dry Foliar Interception Fraction for  Non-Leafy  ³ not used  ³ 2.500E-01 ³              ---               ³ RDRY(1)
 R19B ³ Dry Foliar Interception Fraction for  Leafy      ³ not used  ³ 2.500E-01 ³              ---               ³ RDRY(2)
 R19B ³ Dry Foliar Interception Fraction for  Fodder     ³ not used  ³ 2.500E-01 ³              ---               ³ RDRY(3)
 R19B ³ Wet Foliar Interception Fraction for  Non-Leafy  ³ not used  ³ 2.500E-01 ³              ---               ³ RWET(1)
 R19B ³ Wet Foliar Interception Fraction for  Leafy      ³ not used  ³ 2.500E-01 ³              ---               ³ RWET(2)
 R19B ³ Wet Foliar Interception Fraction for  Fodder     ³ not used  ³ 2.500E-01 ³              ---               ³ RWET(3)
 R19B ³ Weathering Removal Constant for Vegetation       ³ not used  ³ 2.000E+01 ³              ---               ³ WLAM
      ³                                                  ³           ³           ³                                ³
 C14  ³ C-12 concentration in water (g/cm**3)            ³ not used  ³ 2.000E-05 ³              ---               ³ C12WTR
 C14  ³ C-12 concentration in contaminated soil (g/g)    ³ not used  ³ 3.000E-02 ³              ---               ³ C12CZ
 C14  ³ Fraction of vegetation carbon from soil          ³ not used  ³ 2.000E-02 ³              ---               ³ CSOIL
 C14  ³ Fraction of vegetation carbon from air           ³ not used  ³ 9.800E-01 ³              ---               ³ CAIR
 C14  ³ C-14 evasion layer thickness in soil (m)         ³ not used  ³ 3.000E-01 ³              ---               ³ DMC
 C14  ³ C-14 evasion flux rate from soil (1/sec)         ³ not used  ³ 7.000E-07 ³              ---               ³ EVSN
 C14  ³ C-12 evasion flux rate from soil (1/sec)         ³ not used  ³ 1.000E-10 ³              ---               ³ REVSN
 C14  ³ Fraction of grain in beef cattle feed            ³ not used  ³ 8.000E-01 ³              ---               ³ AVFG4
 C14  ³ Fraction of grain in milk cow feed               ³ not used  ³ 2.000E-01 ³              ---               ³ AVFG5
 C14  ³ DCF correction factor for gaseous forms of C14   ³ not used  ³ 0.000E+00 ³              ---               ³ CO2F
      ³                                                  ³           ³           ³                                ³
 STOR ³ Storage times of contaminated foodstuffs (days): ³           ³           ³                                ³
 STOR ³   Fruits, non-leafy vegetables, and grain        ³ 1.400E+01 ³ 1.400E+01 ³              ---               ³ STOR_T(1)
 STOR ³   Leafy vegetables                               ³ 1.000E+00 ³ 1.000E+00 ³              ---               ³ STOR_T(2)
 STOR ³   Milk                                           ³ 1.000E+00 ³ 1.000E+00 ³              ---               ³ STOR_T(3)
 STOR ³   Meat and poultry                               ³ 2.000E+01 ³ 2.000E+01 ³              ---               ³ STOR_T(4)
 STOR ³   Fish                                           ³ 7.000E+00 ³ 7.000E+00 ³              ---               ³ STOR_T(5)
 STOR ³   Crustacea and mollusks                         ³ 7.000E+00 ³ 7.000E+00 ³              ---               ³ STOR_T(6)
 STOR ³   Well water                                     ³ 1.000E+00 ³ 1.000E+00 ³              ---               ³ STOR_T(7)
 STOR ³   Surface water                                  ³ 1.000E+00 ³ 1.000E+00 ³              ---               ³ STOR_T(8)
 STOR ³   Livestock fodder                               ³ 4.500E+01 ³ 4.500E+01 ³              ---               ³ STOR_T(9)
      ³                                                  ³           ³           ³                                ³
 R021 ³ Thickness of building foundation (m)             ³ not used  ³ 1.500E-01 ³              ---               ³ FLOOR1
 R021 ³ Bulk density of building foundation (g/cm**3)    ³ not used  ³ 2.400E+00 ³              ---               ³ DENSFL
 R021 ³ Total porosity of the cover material             ³ not used  ³ 4.000E-01 ³              ---               ³ TPCV
 R021 ³ Total porosity of the building foundation        ³ not used  ³ 1.000E-01 ³              ---               ³ TPFL
 R021 ³ Volumetric water content of the cover material   ³ not used  ³ 5.000E-02 ³              ---               ³ PH2OCV
 R021 ³ Volumetric water content of the foundation       ³ not used  ³ 3.000E-02 ³              ---               ³ PH2OFL
 R021 ³ Diffusion coefficient for radon gas (m/sec):     ³           ³           ³                                ³
 R021 ³   in cover material                              ³ not used  ³ 2.000E-06 ³              ---               ³ DIFCV
 R021 ³   in foundation material                         ³ not used  ³ 3.000E-07 ³              ---               ³ DIFFL
 R021 ³   in contaminated zone soil                      ³ not used  ³ 2.000E-06 ³              ---               ³ DIFCZ
 R021 ³ Radon vertical dimension of mixing (m)           ³ not used  ³ 2.000E+00 ³              ---               ³ HMIX
 R021 ³ Average building air exchange rate (1/hr)        ³ not used  ³ 5.000E-01 ³              ---               ³ REXG
 R021 ³ Height of the building (room) (m)                ³ not used  ³ 2.500E+00 ³              ---               ³ HRM
 R021 ³ Building interior area factor                    ³ not used  ³ 0.000E+00 ³              ---               ³ FAI
 R021 ³ Building depth below ground surface (m)          ³ not used  ³-1.000E+00 ³              ---               ³ DMFL
 R021 ³ Emanating power of Rn-222 gas                    ³ not used  ³ 2.500E-01 ³              ---               ³ EMANA(1)
 R021 ³ Emanating power of Rn-220 gas                    ³ not used  ³ 1.500E-01 ³              ---               ³ EMANA(2)
      ³                                                  ³           ³           ³                                ³
 TITL ³ Number of graphical time points                  ³     32    ³    ---    ³              ---               ³ NPTS
 TITL ³ Maximum number of integration points for dose    ³     17    ³    ---    ³              ---               ³ LYMAX
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                                           Site-Specific Parameter Summary (continued)
0     ³                                                    ³   User    ³           ³         Used by RESRAD         ³  Parameter
 Menu ³                          Parameter                 ³   Input   ³  Default  ³ (If different from user input) ³    Name
 ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 TITL ³ Maximum number of integration points for risk    ³    257    ³    ---    ³              ---               ³ KYMAX
 ÍÍÍÍÍÏÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÏÍÍÍÍÍÍÍÍÍÍÍÏÍÍÍÍÍÍÍÍÍÍÍÏÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÏÍÍÍÍÍÍÍÍÍÍÍÍÍÍ



                      Summary of Pathway Selections

                     Pathway             ³   User Selection
           ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÅÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
              1 -- external gamma        ³       active
              2 -- inhalation (w/o radon)³       active
              3 -- plant ingestion       ³     suppressed
              4 -- meat ingestion        ³     suppressed
              5 -- milk ingestion        ³     suppressed
              6 -- aquatic foods         ³     suppressed
              7 -- drinking water        ³     suppressed
              8 -- soil ingestion        ³       active
              9 -- radon                 ³     suppressed
              Find peak pathway doses    ³     suppressed
           ÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÏÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ
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      Contaminated Zone Dimensions            Initial Soil Concentrations, pCi/g
      ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ            ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
        Area:    100.00 square meters                Am-241     3.100E+00
   Thickness:      0.15 meters                       Co-60      3.230E-01
 Cover Depth:      0.00 meters                       Cs-137     4.720E+02
                                                     Pu-238     3.960E+00
                                                     Pu-239     2.330E+01
                                                     Sr-90      4.380E+01
0
                                                Total Dose TDOSE(t), mrem/yr
                                          Basic Radiation Dose Limit = 2.500E+01 mrem/yr
                         Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)
                         ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
    t (years):  0.000E+00  1.000E+00  3.000E+00  1.000E+01  2.500E+01  3.000E+01  5.000E+01  7.500E+01  1.000E+02  3.000E+02
     TDOSE(t):  4.334E+01  4.221E+01  4.004E+01  3.326E+01  2.227E+01  1.944E+01  1.115E+01  5.325E+00  2.316E+00  0.000E+00
         M(t):  1.734E+00  1.688E+00  1.602E+00  1.331E+00  8.906E-01  7.776E-01  4.460E-01  2.130E-01  9.264E-02  0.000E+00
0Maximum TDOSE(t):  4.334E+01 mrem/yr   at t = 0.000E+00 years
```

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                        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
0                                       Water Independent Pathways (Inhalation excludes radon)
0             Ground          Inhalation            Radon             Plant             Meat              Milk              Soil
 Radio-  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Nuclide  mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.
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 Am-241  4.250E-03 0.0001  2.425E-02 0.0006  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  7.427E-03 0.0002
 Co-60   1.235E-01 0.0029  1.177E-06 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  5.402E-06 0.0000
 Cs-137  4.286E+01 0.9889  2.644E-04 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.548E-02 0.0004
 Pu-238  2.051E-05 0.0000  2.747E-02 0.0006  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  8.375E-03 0.0002
 Pu-239  2.093E-04 0.0000  1.776E-01 0.0041  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  5.473E-02 0.0013
 Sr-90   3.010E-02 0.0007  1.001E-03 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  4.367E-03 0.0001
 ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ
 Total   4.302E+01 0.9926  2.305E-01 0.0053  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  9.038E-02 0.0021
0
                        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
0                                                      Water Dependent Pathways
0              Water             Fish               Radon             Plant             Meat              Milk          All Pathways*
 Radio-  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Nuclide  mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.
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 Am-241  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  3.593E-02 0.0008
 Co-60   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.236E-01 0.0029
 Cs-137  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  4.288E+01 0.9893
 Pu-238  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  3.586E-02 0.0008
 Pu-239  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.325E-01 0.0054
 Sr-90   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  3.547E-02 0.0008
 ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ
 Total   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  4.334E+01 1.0000
0*Sum of all water independent and dependent pathways.
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1RESRAD, Version 6.3      T« Limit = 180 days        05/29/2006  11:23  Page  14
 Summary : CAU 482 Drainage                                  File: 482Drain.RAD

                        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
0                                       Water Independent Pathways (Inhalation excludes radon)
0             Ground              Inhalation            Radon               Plant               Meat                Milk                Soil
 Radio-  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Nuclide  mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.
 ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ
 Am-241  4.182E-03 0.0001  2.371E-02 0.0006  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  7.260E-03 0.0002
 Co-60   1.079E-01 0.0026  1.025E-06 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  4.703E-06 0.0000
 Cs-137  4.175E+01 0.9891  2.566E-04 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.502E-02 0.0004
 Pu-238  2.035E-05 0.0000  2.706E-02 0.0006  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  8.252E-03 0.0002
 Pu-239  2.089E-04 0.0000  1.763E-01 0.0042  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  5.435E-02 0.0013
 Sr-90   2.903E-02 0.0007  9.617E-04 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  4.195E-03 0.0001
 ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ
 Total   4.189E+01 0.9925  2.283E-01 0.0054  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  8.909E-02 0.0021
0
                        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
0                                                      Water Dependent Pathways
0              Water               Fish                Radon               Plant               Meat                Milk            All Pathways*
 Radio-  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Nuclide  mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.
 ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ
 Am-241  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  3.515E-02 0.0008
 Co-60   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.079E-01 0.0026
 Cs-137  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  4.177E+01 0.9895
 Pu-238  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  3.534E-02 0.0008
 Pu-239  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.309E-01 0.0055
 Sr-90   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  3.419E-02 0.0008
 ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ
 Total   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  4.221E+01 1.0000
0*Sum of all water independent and dependent pathways.
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                        Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
                                     As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years
0                                       Water Independent Pathways (Inhalation excludes radon)
0             Ground            Inhalation             Radon              Plant              Meat               Milk               Soil
 Radio-  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Nuclide  mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.
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 Am-241  4.049E-03 0.0001  2.264E-02 0.0006  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  6.934E-03 0.0002
 Co-60   8.228E-02 0.0021  7.770E-07 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  3.565E-06 0.0000
 Cs-137  3.961E+01 0.9894  2.417E-04 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.415E-02 0.0004
 Pu-238  2.002E-05 0.0000  2.627E-02 0.0007  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  8.011E-03 0.0002
 Pu-239  2.081E-04 0.0000  1.739E-01 0.0043  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  5.360E-02 0.0013
 Sr-90   2.701E-02 0.0007  8.873E-04 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  3.870E-03 0.0001
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 Total   3.973E+01 0.9922  2.239E-01 0.0056  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  8.657E-02 0.0022
0
                        Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
                                     As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years
0                                                          Water Dependent Pathways
0              Water              Fish             Radon              Plant              Meat               Milk          All Pathways*
 Radio-  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Nuclide  mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.
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 Am-241  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  3.363E-02 0.0008
 Co-60   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  8.229E-02 0.0021
 Cs-137  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  3.963E+01 0.9898
 Pu-238  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  3.430E-02 0.0009
 Pu-239  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.277E-01 0.0057
 Sr-90   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  3.176E-02 0.0008
 ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ
 Total   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  4.004E+01 1.0000
0*Sum of all water independent and dependent pathways.
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1RESRAD, Version 6.3      T« Limit = 180 days        05/29/2006  11:23  Page  16
 Summary : CAU 482 Drainage                                   File: 482Drain.RAD

                        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
0                                       Water Independent Pathways (Inhalation excludes radon)
0             Ground            Inhalation            Radon             Plant              Meat              Milk              Soil
 Radio-  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Nuclide  mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.
 ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ
 Am-241  3.616E-03 0.0001  1.926E-02 0.0006  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  5.898E-03 0.0002
 Co-60   3.183E-02 0.0010  2.941E-07 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.349E-06 0.0000
 Cs-137  3.292E+01 0.9897  1.957E-04 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.146E-02 0.0003
 Pu-238  1.891E-05 0.0000  2.365E-02 0.0007  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  7.210E-03 0.0002
 Pu-239  2.051E-04 0.0000  1.654E-01 0.0050  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  5.098E-02 0.0015
 Sr-90   2.095E-02 0.0006  6.682E-04 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.915E-03 0.0001
 ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ
 Total   3.298E+01 0.9914  2.092E-01 0.0063  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  7.846E-02 0.0024
0
                        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
0                                                     Water Dependent Pathways
0              Water              Fish              Radon             Plant              Meat              Milk          All Pathways*
 Radio-  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Nuclide  mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.
 ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ
 Am-241  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.877E-02 0.0009
 Co-60   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  3.183E-02 0.0010
 Cs-137  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  3.293E+01 0.9900
 Pu-238  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  3.088E-02 0.0009
 Pu-239  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.166E-01 0.0065
 Sr-90   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.454E-02 0.0007
 ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ
 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  3.326E+01 1.0000
0*Sum of all water independent and dependent pathways.
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1RESRAD, Version 6.3      T« Limit = 180 days        05/29/2006  11:23  Page  17
 Summary : CAU 482 Drainage                                   File: 482Drain.RAD

                        Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
                                     As mrem/yr and Fraction of Total Dose At t = 2.500E+01 years
0                                       Water Independent Pathways (Inhalation excludes radon)
0             Ground           Inhalation          Radon             Plant             Meat              Milk              Soil
 Radio-  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Nuclide  mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.
 ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ
 Am-241  2.837E-03 0.0001  1.349E-02 0.0006  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  4.132E-03 0.0002
 Co-60   4.132E-03 0.0002  3.635E-08 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.668E-07 0.0000
 Cs-137  2.200E+01 0.9882  1.234E-04 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  7.223E-03 0.0003
 Pu-238  1.672E-05 0.0000  1.871E-02 0.0008  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  5.703E-03 0.0003
 Pu-239  1.982E-04 0.0000  1.472E-01 0.0066  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  4.537E-02 0.0020
 Sr-90   1.210E-02 0.0005  3.607E-04 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.573E-03 0.0001
 ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ
 Total   2.202E+01 0.9890  1.799E-01 0.0081  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  6.401E-02 0.0029
0
                        Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
                                     As mrem/yr and Fraction of Total Dose At t = 2.500E+01 years
0                                                      Water Dependent Pathways
0              Water             Fish              Radon             Plant             Meat              Milk          All Pathways*
 Radio-  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Nuclide  mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.
 ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ
 Am-241  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.046E-02 0.0009
 Co-60   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  4.132E-03 0.0002
 Cs-137  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.201E+01 0.9885
 Pu-238  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.443E-02 0.0011
 Pu-239  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.928E-01 0.0087
 Sr-90   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.403E-02 0.0006
 ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ
 Total   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.227E+01 1.0000
0*Sum of all water independent and dependent pathways.
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1RESRAD, Version 6.3      T« Limit = 180 days       05/29/2006  11:23  Page  18
 Summary : CAU 482 Drainage                                  File: 482Drain.RAD

                        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
0                                       Water Independent Pathways (Inhalation excludes radon)
0             Ground          Inhalation           Radon             Plant             Meat              Milk              Soil
 Radio-  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Nuclide  mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.
 ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ
 Am-241  2.616E-03 0.0001  1.195E-02 0.0006  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  3.659E-03 0.0002
 Co-60   2.087E-03 0.0001  1.805E-08 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  8.282E-08 0.0000
 Cs-137  1.920E+01 0.9874  1.055E-04 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  6.175E-03 0.0003
 Pu-238  1.604E-05 0.0000  1.725E-02 0.0009  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  5.258E-03 0.0003
 Pu-239  1.956E-04 0.0000  1.412E-01 0.0073  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  4.351E-02 0.0022
 Sr-90   1.006E-02 0.0005  2.928E-04 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.277E-03 0.0001
 ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ
 Total   1.921E+01 0.9881  1.708E-01 0.0088  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  5.988E-02 0.0031
0
                        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
0                                                      Water Dependent Pathways
0              Water             Fish              Radon             Plant             Meat              Milk          All Pathways*
 Radio-  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Nuclide  mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.
 ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ
 Am-241  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.822E-02 0.0009
 Co-60   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.087E-03 0.0001
 Cs-137  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.920E+01 0.9877
 Pu-238  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.252E-02 0.0012
 Pu-239  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.849E-01 0.0095
 Sr-90   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.163E-02 0.0006
 ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ
 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  1.944E+01 1.0000
0*Sum of all water independent and dependent pathways.
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                        Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
                                     As mrem/yr and Fraction of Total Dose At t = 5.000E+01 years
0                                       Water Independent Pathways (Inhalation excludes radon)
0             Ground          Inhalation           Radon             Plant              Meat              Milk              Soil
 Radio-  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Nuclide  mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.
 ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ
 Am-241  1.887E-03 0.0002  7.204E-03 0.0006  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.206E-03 0.0002
 Co-60   1.338E-04 0.0000  1.077E-09 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  4.941E-09 0.0000
 Cs-137  1.096E+01 0.9830  5.525E-05 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  3.235E-03 0.0003
 Pu-238  1.357E-05 0.0000  1.223E-02 0.0011  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  3.728E-03 0.0003
 Pu-239  1.841E-04 0.0000  1.171E-01 0.0105  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  3.610E-02 0.0032
 Sr-90   4.740E-03 0.0004  1.247E-04 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  5.439E-04 0.0000
 ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ
 Total   1.097E+01 0.9836  1.367E-01 0.0123  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  4.582E-02 0.0041
0
                        Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
                                     As mrem/yr and Fraction of Total Dose At t = 5.000E+01 years
0                                                      Water Dependent Pathways
0              Water             Fish              Radon             Plant              Meat              Milk          All Pathways*
 Radio-  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Nuclide  mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.
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 Am-241  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.130E-02 0.0010
 Co-60   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.338E-04 0.0000
 Cs-137  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.096E+01 0.9833
 Pu-238  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.597E-02 0.0014
 Pu-239  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.534E-01 0.0138
 Sr-90   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  5.409E-03 0.0005
 ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ
 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  1.115E+01 1.0000
0*Sum of all water independent and dependent pathways.
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1RESRAD, Version 6.3      T« Limit = 180 days        05/29/2006  11:23  Page  20
 Summary : CAU 482 Drainage                                   File: 482Drain.RAD

                        Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
                                     As mrem/yr and Fraction of Total Dose At t = 7.500E+01 years
0                                       Water Independent Pathways (Inhalation excludes radon)
0             Ground          Inhalation           Radon             Plant             Meat              Milk              Soil
 Radio-  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Nuclide  mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.
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 Am-241  1.239E-03 0.0002  3.604E-03 0.0007  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.104E-03 0.0002
 Co-60   4.117E-06 0.0000  2.990E-11 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.372E-10 0.0000
 Cs-137  5.192E+00 0.9749  2.318E-05 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.357E-03 0.0003
 Pu-238  1.092E-05 0.0000  7.486E-03 0.0014  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.282E-03 0.0004
 Pu-239  1.652E-04 0.0000  8.732E-02 0.0164  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.691E-02 0.0051
 Sr-90   1.775E-03 0.0003  4.038E-05 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.762E-04 0.0000
 ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ
 Total   5.195E+00 0.9755  9.847E-02 0.0185  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  3.183E-02 0.0060
0
                        Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
                                     As mrem/yr and Fraction of Total Dose At t = 7.500E+01 years
0                                                      Water Dependent Pathways
0              Water             Fish              Radon             Plant             Meat              Milk          All Pathways*
 Radio-  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Nuclide  mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.
 ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ
 Am-241  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  5.947E-03 0.0011
 Co-60   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  4.117E-06 0.0000
 Cs-137  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  5.193E+00 0.9752
 Pu-238  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  9.779E-03 0.0018
 Pu-239  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.144E-01 0.0215
 Sr-90   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.991E-03 0.0004
 ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ
 Total   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  5.325E+00 1.0000
0*Sum of all water independent and dependent pathways.
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                        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
0                                       Water Independent Pathways (Inhalation excludes radon)
0              Ground             Inhalation             Radon              Plant              Meat               Milk               Soil
 Radio-  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Nuclide  mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.
 ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ
 Am-241  7.798E-04 0.0003  1.600E-03 0.0007  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  4.898E-04 0.0002
 Co-60   1.150E-07 0.0000  7.365E-13 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  3.379E-12 0.0000
 Cs-137  2.231E+00 0.9633  8.631E-06 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  5.053E-04 0.0002
 Pu-238  8.629E-06 0.0000  4.068E-03 0.0018  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.240E-03 0.0005
 Pu-239  1.382E-04 0.0001  5.777E-02 0.0249  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.780E-02 0.0077
 Sr-90   6.064E-04 0.0003  1.161E-05 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  5.063E-05 0.0000
 ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ
 Total   2.232E+00 0.9639  6.345E-02 0.0274  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.009E-02 0.0087
0
                        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
0                                                          Water Dependent Pathways
0               Water              Fish               Radon              Plant              Meat               Milk          All Pathways*
 Radio-  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Nuclide  mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.
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 Am-241  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.869E-03 0.0012
 Co-60   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.150E-07 0.0000
 Cs-137  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.231E+00 0.9635
 Pu-238  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  5.316E-03 0.0023
 Pu-239  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  7.571E-02 0.0327
 Sr-90   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  6.686E-04 0.0003
 ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ
 Total   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.316E+00 1.0000
0*Sum of all water independent and dependent pathways.
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1RESRAD, Version 6.3      T« Limit = 180 days        05/29/2006  11:23  Page  22
 Summary : CAU 482 Drainage                                   File: 482Drain.RAD

                        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
0                                       Water Independent Pathways (Inhalation excludes radon)
0             Ground          Inhalation           Radon             Plant             Meat              Milk              Soil
 Radio-  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Nuclide  mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.
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 Am-241  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000
 Co-60   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000
 Cs-137  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000
 Pu-238  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000
 Pu-239  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000
 Sr-90   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000
 ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ
 Total   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000
0
                        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
0                                                      Water Dependent Pathways
0              Water             Fish              Radon             Plant             Meat              Milk          All Pathways*
 Radio-  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 Nuclide  mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.   mrem/yr  fract.
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 Am-241  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000
 Co-60   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000
 Cs-137  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000
 Pu-238  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000
 Pu-239  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000
 Sr-90   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000
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 Total   0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000
0*Sum of all water independent and dependent pathways.
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                                             Dose/Source Ratios Summed Over All Pathways
                                  Parent and Progeny Principal Radionuclide Contributions Indicated
0  Parent    Product    Thread                          DSR(j,t) At Time in Years   (mrem/yr)/(pCi/g)
    (i)        (j)     Fraction   0.000E+00 1.000E+00 3.000E+00 1.000E+01 2.500E+01 3.000E+01 5.000E+01 7.500E+01 1.000E+02 3.000E+02
 ÄÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ
 Am-241     Am-241     1.000E+00  1.159E-02 1.134E-02 1.085E-02 9.282E-03 6.601E-03 5.878E-03 3.644E-03 1.918E-03 9.252E-04 0.000E+00
 Am-241     Np-237+D   1.000E+00  7.183E-09 2.132E-08 4.856E-08 1.338E-07 2.699E-07 3.031E-07 3.872E-07 4.051E-07 3.475E-07 0.000E+00
 Am-241     U-233      1.000E+00  6.168E-16 4.265E-15 2.192E-14 1.772E-13 8.339E-13 1.104E-12 2.182E-12 3.068E-12 3.058E-12 0.000E+00
 Am-241     Th-229+D   1.000E+00  4.780E-19 7.108E-18 8.129E-17 2.005E-15 2.438E-14 3.946E-14 1.417E-13 3.391E-13 5.235E-13 0.000E+00
 Am-241     äDSR(j)               1.159E-02 1.134E-02 1.085E-02 9.282E-03 6.601E-03 5.878E-03 3.644E-03 1.918E-03 9.256E-04 0.000E+00
0Co-60      Co-60      1.000E+00  3.825E-01 3.341E-01 2.548E-01 9.855E-02 1.279E-02 6.462E-03 4.144E-04 1.275E-05 3.559E-07 0.000E+00
0Cs-137+D   Cs-137+D   1.000E+00  9.085E-02 8.849E-02 8.396E-02 6.977E-02 4.663E-02 4.068E-02 2.323E-02 1.100E-02 4.727E-03 0.000E+00
0Pu-238     Pu-238     1.840E-09  1.666E-11 1.642E-11 1.594E-11 1.435E-11 1.135E-11 1.046E-11 7.418E-12 4.544E-12 2.470E-12 0.000E+00
0Pu-238     Pu-238     1.000E+00  9.056E-03 8.923E-03 8.662E-03 7.797E-03 6.168E-03 5.687E-03 4.032E-03 2.469E-03 1.342E-03 0.000E+00
 Pu-238     U-234      1.000E+00  3.587E-09 1.063E-08 2.415E-08 6.574E-08 1.285E-07 1.425E-07 1.712E-07 1.615E-07 1.205E-07 0.000E+00
 Pu-238     Th-230     1.000E+00  2.620E-14 1.817E-13 9.392E-13 7.751E-12 3.809E-11 5.114E-11 1.068E-10 1.602E-10 1.696E-10 0.000E+00
 Pu-238     Ra-226+D   1.000E+00  1.300E-16 1.936E-15 2.223E-14 5.559E-13 6.961E-12 1.137E-11 4.225E-11 1.051E-10 1.681E-10 0.000E+00
 Pu-238     Pb-210+D   1.000E+00  1.537E-20 4.696E-19 1.145E-17 7.950E-16 2.121E-14 3.971E-14 2.063E-13 6.205E-13 1.061E-12 0.000E+00
 Pu-238     äDSR(j)               9.056E-03 8.923E-03 8.662E-03 7.797E-03 6.168E-03 5.687E-03 4.032E-03 2.469E-03 1.343E-03 0.000E+00
0Pu-239     Pu-239     1.000E+00  9.978E-03 9.909E-03 9.773E-03 9.295E-03 8.274E-03 7.935E-03 6.585E-03 4.910E-03 3.249E-03 0.000E+00
 Pu-239     U-235+D    1.000E+00  1.235E-11 3.687E-11 8.513E-11 2.458E-10 5.474E-10 6.351E-10 9.214E-10 1.124E-09 1.115E-09 0.000E+00
 Pu-239     Pa-231     1.000E+00  1.220E-16 8.467E-16 4.389E-15 3.655E-14 1.834E-13 2.479E-13 5.333E-13 8.343E-13 9.275E-13 0.000E+00
 Pu-239     Ac-227+D   1.000E+00  5.114E-18 7.542E-17 8.471E-16 1.959E-14 2.092E-13 3.249E-13 9.987E-13 2.003E-12 2.621E-12 0.000E+00
 Pu-239     äDSR(j)               9.978E-03 9.909E-03 9.773E-03 9.295E-03 8.274E-03 7.935E-03 6.585E-03 4.910E-03 3.249E-03 0.000E+00
0Sr-90+D    Sr-90+D    1.000E+00  8.097E-04 7.805E-04 7.252E-04 5.602E-04 3.204E-04 2.655E-04 1.235E-04 4.546E-05 1.527E-05 0.000E+00
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 The DSR includes contributions from associated (half-life ó 180 days) daughters.
0
                                            Single Radionuclide Soil Guidelines G(i,t) in pCi/g
                                               Basic Radiation Dose Limit = 2.500E+01 mrem/yr
0Nuclide
   (i)    t= 0.000E+00   1.000E+00   3.000E+00   1.000E+01   2.500E+01   3.000E+01   5.000E+01   7.500E+01   1.000E+02   3.000E+02
 ÄÄÄÄÄÄÄ     ÄÄÄÄÄÄÄÄÄ   ÄÄÄÄÄÄÄÄÄ   ÄÄÄÄÄÄÄÄÄ   ÄÄÄÄÄÄÄÄÄ   ÄÄÄÄÄÄÄÄÄ   ÄÄÄÄÄÄÄÄÄ   ÄÄÄÄÄÄÄÄÄ   ÄÄÄÄÄÄÄÄÄ   ÄÄÄÄÄÄÄÄÄ   ÄÄÄÄÄÄÄÄÄ
 Am-241      2.157E+03   2.205E+03   2.305E+03   2.693E+03   3.787E+03   4.253E+03   6.860E+03   1.303E+04   2.701E+04  *3.431E+12
 Co-60       6.536E+01   7.484E+01   9.813E+01   2.537E+02   1.954E+03   3.869E+03   6.033E+04   1.962E+06   7.024E+07  *1.132E+15
 Cs-137      2.752E+02   2.825E+02   2.978E+02   3.583E+02   5.361E+02   6.145E+02   1.076E+03   2.272E+03   5.288E+03  *8.704E+13
 Pu-238      2.761E+03   2.802E+03   2.886E+03   3.206E+03   4.053E+03   4.396E+03   6.201E+03   1.012E+04   1.862E+04  *1.712E+13
 Pu-239      2.506E+03   2.523E+03   2.558E+03   2.690E+03   3.021E+03   3.151E+03   3.797E+03   5.092E+03   7.694E+03  *6.214E+10
 Sr-90       3.087E+04   3.203E+04   3.447E+04   4.463E+04   7.802E+04   9.417E+04   2.024E+05   5.499E+05   1.638E+06  *1.365E+14
 ÍÍÍÍÍÍÍ     ÍÍÍÍÍÍÍÍÍ   ÍÍÍÍÍÍÍÍÍ   ÍÍÍÍÍÍÍÍÍ   ÍÍÍÍÍÍÍÍÍ   ÍÍÍÍÍÍÍÍÍ   ÍÍÍÍÍÍÍÍÍ   ÍÍÍÍÍÍÍÍÍ   ÍÍÍÍÍÍÍÍÍ   ÍÍÍÍÍÍÍÍÍ   ÍÍÍÍÍÍÍÍÍ
 *At specific activity limit
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1RESRAD, Version 6.3      T« Limit = 180 days        05/29/2006  11:23  Page  24
 Summary : CAU 482 Drainage                                   File: 482Drain.RAD

             Summed Dose/Source Ratios DSR(i,t) in (mrem/yr)/(pCi/g)
             and Single Radionuclide Soil Guidelines G(i,t) in pCi/g
          at tmin = time of minimum single radionuclide soil guideline
      and at tmax = time of maximum total dose = 0.000E+00 years
0Nuclide  Initial         tmin       DSR(i,tmin) G(i,tmin) DSR(i,tmax) G(i,tmax)
   (i)    (pCi/g)       (years)                   (pCi/g)               (pCi/g)
 ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ  ÄÄÄÄÄÄÄÄÄ
 Am-241  3.100E+00     0.000E+00      1.159E-02  2.157E+03  1.159E-02  2.157E+03
 Co-60   3.230E-01     0.000E+00      3.825E-01  6.536E+01  3.825E-01  6.536E+01
 Cs-137  4.720E+02     0.000E+00      9.085E-02  2.752E+02  9.085E-02  2.752E+02
 Pu-238  3.960E+00     0.000E+00      9.056E-03  2.761E+03  9.056E-03  2.761E+03
 Pu-239  2.330E+01     0.000E+00      9.978E-03  2.506E+03  9.978E-03  2.506E+03
 Sr-90   4.380E+01     0.000E+00      8.097E-04  3.087E+04  8.097E-04  3.087E+04
 ÍÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ  ÍÍÍÍÍÍÍÍÍ
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1RESRAD, Version 6.3      T« Limit = 180 days        05/29/2006  11:23  Page  25
 Summary : CAU 482 Drainage                                   File: 482Drain.RAD

                                         Individual Nuclide Dose Summed Over All Pathways
                                           Parent Nuclide and Branch Fraction Indicated
0Nuclide Parent   THF(i)                                              DOSE(j,t), mrem/yr
   (j)     (i)              t= 0.000E+00 1.000E+00 3.000E+00 1.000E+01 2.500E+01 3.000E+01 5.000E+01 7.500E+01 1.000E+02 3.000E+02
 ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ    ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ
 Am-241  Am-241  1.000E+00    3.593E-02 3.515E-02 3.363E-02 2.877E-02 2.046E-02 1.822E-02 1.130E-02 5.945E-03 2.868E-03 0.000E+00
0Np-237  Am-241  1.000E+00    2.227E-08 6.609E-08 1.505E-07 4.147E-07 8.366E-07 9.396E-07 1.200E-06 1.256E-06 1.077E-06 0.000E+00
0U-233   Am-241  1.000E+00    1.912E-15 1.322E-14 6.796E-14 5.493E-13 2.585E-12 3.422E-12 6.763E-12 9.512E-12 9.481E-12 0.000E+00
0Th-229  Am-241  1.000E+00    1.482E-18 2.203E-17 2.520E-16 6.214E-15 7.559E-14 1.223E-13 4.392E-13 1.051E-12 1.623E-12 0.000E+00
0Co-60   Co-60   1.000E+00    1.236E-01 1.079E-01 8.229E-02 3.183E-02 4.132E-03 2.087E-03 1.338E-04 4.117E-06 1.150E-07 0.000E+00
0Cs-137  Cs-137  1.000E+00    4.288E+01 4.177E+01 3.963E+01 3.293E+01 2.201E+01 1.920E+01 1.096E+01 5.193E+00 2.231E+00 0.000E+00
0Pu-238  Pu-238  1.840E-09    6.598E-11 6.502E-11 6.312E-11 5.681E-11 4.494E-11 4.144E-11 2.938E-11 1.799E-11 9.781E-12 0.000E+00
 Pu-238  Pu-238  1.000E+00    3.586E-02 3.534E-02 3.430E-02 3.088E-02 2.442E-02 2.252E-02 1.597E-02 9.779E-03 5.316E-03 0.000E+00
 Pu-238  äDOSE(j)             3.586E-02 3.534E-02 3.430E-02 3.088E-02 2.442E-02 2.252E-02 1.597E-02 9.779E-03 5.316E-03 0.000E+00
0U-234   Pu-238  1.000E+00    1.421E-08 4.211E-08 9.563E-08 2.603E-07 5.088E-07 5.643E-07 6.780E-07 6.396E-07 4.774E-07 0.000E+00
0Th-230  Pu-238  1.000E+00    1.038E-13 7.194E-13 3.719E-12 3.069E-11 1.509E-10 2.025E-10 4.228E-10 6.344E-10 6.716E-10 0.000E+00
0Ra-226  Pu-238  1.000E+00    5.146E-16 7.665E-15 8.802E-14 2.201E-12 2.756E-11 4.502E-11 1.673E-10 4.161E-10 6.655E-10 0.000E+00
0Pb-210  Pu-238  1.000E+00    6.088E-20 1.860E-18 4.536E-17 3.148E-15 8.401E-14 1.573E-13 8.169E-13 2.457E-12 4.200E-12 0.000E+00
0Pu-239  Pu-239  1.000E+00    2.325E-01 2.309E-01 2.277E-01 2.166E-01 1.928E-01 1.849E-01 1.534E-01 1.144E-01 7.571E-02 0.000E+00
0U-235   Pu-239  1.000E+00    2.878E-10 8.592E-10 1.984E-09 5.726E-09 1.275E-08 1.480E-08 2.147E-08 2.618E-08 2.597E-08 0.000E+00
0Pa-231  Pu-239  1.000E+00    2.843E-15 1.973E-14 1.023E-13 8.517E-13 4.272E-12 5.777E-12 1.243E-11 1.944E-11 2.161E-11 0.000E+00
0Ac-227  Pu-239  1.000E+00    1.192E-16 1.757E-15 1.974E-14 4.564E-13 4.874E-12 7.570E-12 2.327E-11 4.666E-11 6.108E-11 0.000E+00
0Sr-90   Sr-90   1.000E+00    3.547E-02 3.419E-02 3.176E-02 2.454E-02 1.403E-02 1.163E-02 5.409E-03 1.991E-03 6.686E-04 0.000E+00
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 THF(i) is the thread fraction of the parent nuclide.
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                                              Individual Nuclide Soil Concentration
                                           Parent Nuclide and Branch Fraction Indicated
0Nuclide Parent   THF(i)                                                S(j,t), pCi/g
   (j)     (i)             t= 0.000E+00 1.000E+00 3.000E+00 1.000E+01 2.500E+01 3.000E+01 5.000E+01 7.500E+01 1.000E+02 3.000E+02
 ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ    ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ
 Am-241  Am-241  1.000E+00    3.100E+00 3.050E+00 2.954E+00 2.638E+00 2.071E+00 1.910E+00 1.383E+00 9.242E-01 6.174E-01 2.449E-02
0Np-237  Am-241  1.000E+00    0.000E+00 9.955E-07 2.935E-06 9.219E-06 2.035E-05 2.344E-05 3.337E-05 4.151E-05 4.641E-05 4.704E-05
0U-233   Am-241  1.000E+00    0.000E+00 2.179E-12 1.931E-11 2.034E-10 1.135E-09 1.575E-09 3.778E-09 7.116E-09 1.065E-08 2.872E-08
0Th-229  Am-241  1.000E+00    0.000E+00 6.871E-17 1.834E-15 6.524E-14 9.363E-13 1.573E-12 6.526E-12 1.928E-11 4.017E-11 4.425E-10
0Co-60   Co-60   1.000E+00    3.230E-01 2.831E-01 2.175E-01 8.646E-02 1.197E-02 6.195E-03 4.439E-04 1.646E-05 6.101E-07 2.177E-18
0Cs-137  Cs-137  1.000E+00    4.720E+02 4.612E+02 4.403E+02 3.744E+02 2.645E+02 2.355E+02 1.482E+02 8.304E+01 4.653E+01 4.522E-01
0Pu-238  Pu-238  1.840E-09    7.286E-09 7.228E-09 7.113E-09 6.723E-09 5.959E-09 5.724E-09 4.873E-09 3.985E-09 3.259E-09 6.518E-10
 Pu-238  Pu-238  1.000E+00    3.960E+00 3.928E+00 3.866E+00 3.654E+00 3.238E+00 3.111E+00 2.648E+00 2.166E+00 1.771E+00 3.542E-01
 Pu-238  äS(j):               3.960E+00 3.928E+00 3.866E+00 3.654E+00 3.238E+00 3.111E+00 2.648E+00 2.166E+00 1.771E+00 3.542E-01
0U-234   Pu-238  1.000E+00    0.000E+00 1.115E-05 3.298E-05 1.047E-04 2.359E-04 2.735E-04 3.968E-04 5.006E-04 5.616E-04 4.266E-04
0Th-230  Pu-238  1.000E+00    0.000E+00 5.030E-11 4.485E-10 4.825E-09 2.815E-08 3.962E-08 1.006E-07 2.024E-07 3.225E-07 1.296E-06
0Ra-226  Pu-238  1.000E+00    0.000E+00 7.263E-15 1.943E-13 6.967E-12 1.016E-10 1.716E-10 7.252E-10 2.186E-09 4.633E-09 5.329E-08
0Pb-210  Pu-238  1.000E+00    0.000E+00 5.611E-17 4.451E-15 5.111E-13 1.716E-11 3.386E-11 2.155E-10 8.670E-10 2.201E-09 4.055E-08
0Pu-239  Pu-239  1.000E+00    2.330E+01 2.330E+01 2.329E+01 2.326E+01 2.320E+01 2.318E+01 2.310E+01 2.300E+01 2.289E+01 2.211E+01
0U-235   Pu-239  1.000E+00    0.000E+00 2.288E-08 6.822E-08 2.227E-07 5.325E-07 6.297E-07 9.903E-07 1.384E-06 1.721E-06 3.139E-06
0Pa-231  Pu-239  1.000E+00    0.000E+00 2.418E-13 2.159E-12 2.334E-11 1.375E-10 1.942E-10 4.990E-10 1.020E-09 1.649E-09 7.253E-09
0Ac-227  Pu-239  1.000E+00    0.000E+00 2.539E-15 6.660E-14 2.234E-12 2.854E-11 4.625E-11 1.678E-10 4.286E-10 7.878E-10 4.606E-09
0Sr-90   Sr-90   1.000E+00    4.380E+01 4.236E+01 3.961E+01 3.133E+01 1.895E+01 1.602E+01 8.195E+00 3.545E+00 1.533E+00 1.880E-03
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 THF(i) is the thread fraction of the parent nuclide.
0RESCALC.EXE execution time =    1.88 seconds
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Appendix E

Closure Summary

E.1.0 Closure Summary

A land-use restriction will be applied as part of the closure in place for CAU 482. The restriction will be applied to control use and limit access to the site to prevent inadvertent exposure to the Am-241, Cs-137, Pu-238, and Pu239 contaminated soil identified in CAS 15-06-02, CAS 15-38-01, and the drainage below CAS 15-06-02. These contaminants were identified in the surface and subsurface at levels which exceed the Final Action Levels. The completed land-use restriction form and map are included in this appendix.

The following sign will appear on the 15-2C barricade which controls access to CAU 482:

WARNING

Radiologically Contaminated Areas

Beyond This Point

FFACO Site

CAU 482: Area 15, U15a/e Muckpiles and Ponds

CAS 15-06-02, U15a Muckpile

CAS 15-38-01, U15a/e Ponds

Drainage below CAS 15-06-02

Access to this area is not permitted without

U.S. Government permission

Before working in this area,

Contact Real Estate Services at 295-2528

This site can be closed without further action.

CAU Use Restriction Information

CAU Number/Description: CAU 482, Area 15 U15a/e Muckpiles and Ponds

Applicable CAS Numbers/Descriptions: CAS 15-06-01 (U15e Muckpile), CAS 15-06-02 (U15a Muckpile), CAS 15-38-01 (Area 15 U15a/e Ponds)

Contact (organization/project): NNSA/NSO, Environmental Management

Surveyed Area (UTM, Zone 11, NAD 27, meters): See attached figure

Northwest Corner:	N=4119968.33	E=583445.38
Northeast Corner:	N=4119725.62	E=583750.96
East Side Mid Point:	N=4119725.63	E=583750.96
Southeast Corner:	N=4119116.18	E=583753.11
Southwest Corner:	N=4119420.58	E=583660.62
West Side Mid Point:	N=4119846.44	E=583445.81

Survey Date: 7/27/2004 **Survey Method (GPS, etc):** GPS

Site Monitoring Requirements: Certify that posting is in place, in tact, and readable

Required Frequency (quarterly, annually?): Annually
If Monitoring Has Started, Indicate last Completion Date: ____________

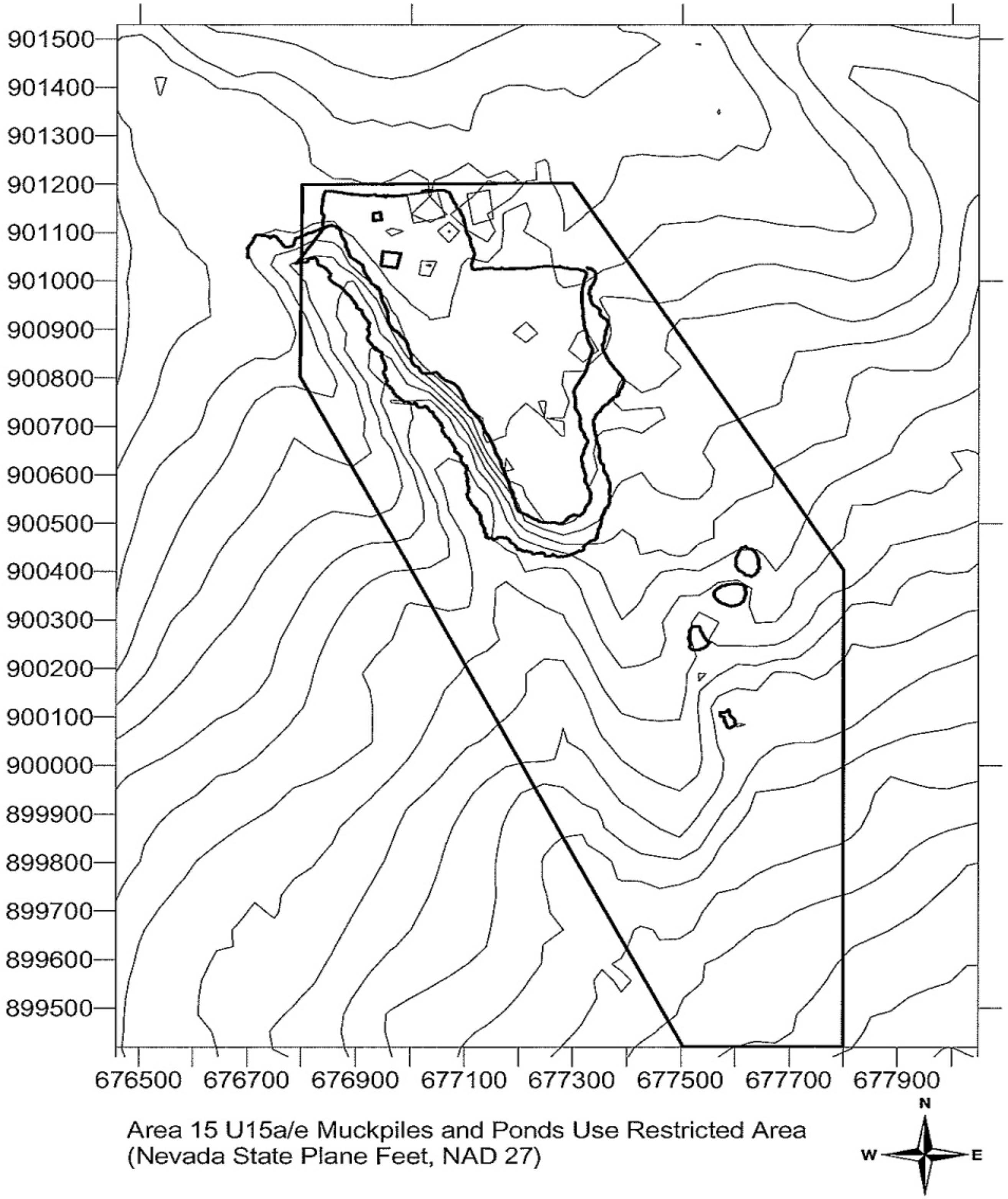
Use Restrictions

The future use of any land related to this Corrective Action Unit (CAU), as described by the above surveyed location, is restricted from any DOE or Air Force activity that may alter or modify the containment control as approved by the state and identified in the CAU Closure Report or other CAU documentation unless appropriate concurrence is obtained in advance.

Comments: Am-241, Cs-137, Pu-238, and Pu-239 concentrations that pose an unacceptable risk to human health and environment are in the U15a Muckpile, the U15a/e Ponds, and the drainage below the U15a Muckpile soils from 0 to 14 feet below ground surface. Therefore, use restrictions will be applied to the surface area from 0 to 150 ft below ground surface over these areas. See the CADD/CR for additional information on the condition of the site(s) and any monitoring and/or inspection requirements.

Submitted By: Peter Sanders For Kevin Cabble **Date:** 05/15/2007

cc with copy of survey map (paper and digital (dgn) formats):



Area 15 U15a/e Muckpiles and Ponds Use Restricted Area
(Nevada State Plane Feet, NAD 27)