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Record Documents:

Start Pg	Doc Type	Doc Date	Title	Box	Package
1	MEMO	7/23/1997	EXTERNAL REVIEW VOLUNTARY CORRECTIVE ACTION PLAN FOR POTENTIAL RELEASE SITE (PRS) 53-008 (COVER LETTER)	184	
2	VCA PLAN	8/1/1997	VOLUNTARY CORRECTIVE ACTION PLAN FOR POTENTIAL RELEASE SITE 53-008 BONEYARD FIELD UNIT 2 AUGUST 1997, LA-UR-97-XXXX	184	

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Privileged: (Y/N) N ***Record Category:*** P ***Record Package No:*** 0

FileFolder: N/A

Correction: (Y/N) N ***Corrected No.*** 0 ***Corrected By Number:*** 0

Administrative Record: (Y/N) Y

Refilmed: (Y/N) N ***Old ER ID Number:*** 0 ***New ER ID Number:*** 0

Miscellaneous Comments:

N/A

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(69)

56384

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memorandum

To/MS: Distribution
From/MS: T.E. Gould, EES-15, MS J495
Phone/FAX: 5-4348/5-1976
Symbol: EES-15: ER-97-038
Date: July 23, 1997

Earth and Environmental Science Division
EES-15, Environmental Science Group
Los Alamos, New Mexico 87545

SUBJECT: EXTERNAL REVIEW - VOLUNTARY CORRECTIVE ACTION PLAN FOR POTENTIAL RELEASE SITE (PRS) 53-008

The VCA plan for PRS 53-008 is attached. Please review this document and return your comments to Nancy Riebe by July 28, 1997. (Comment resolution forms are attached.)

If you have any questions regarding the technical content of this report please contact Tyson Lansford at 661-5232.

TEG/nar

Attachments: (1) VCA Plan
(2) Comment resolution forms

Distribution:
Mike Gilgosch, LAAO, MS A316, w/Attachments 1 and 2
Dave Bradbury, EM/ER, MS M992, w/Attachments 1 and 2
Tom Fogg, ICF/KE, MS M892, w/Attachment 1
Tyson Lansford, ICF/KE, MS J495, w/Attachment 1
VCA File w/Attachment 1
RPF, MS M707, w/Attachment 1
EES-15 Files w/o Attachments

Voluntary Corrective Action Plan for

Potential Release Site
53-008
Boneyard

Field Unit 2

Environmental Restoration Project

August 1997

A Department of Energy
Environmental Cleanup Program

Los Alamos
NATIONAL LABORATORY

LA-UR-97-XXXX

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VOLUNTARY CORRECTIVE ACTION PLAN FOR POTENTIAL RELEASE SITE 53-008 - BONEYARD

1.0 INTRODUCTION

This voluntary corrective action (VCA) plan addresses potential release site (PRS) 53-008, which is located in TA-53. It is a boneyard or storage area for used materials from Los Alamos Meson Physics Facility (LAMPF) physics experiments. The area within this PRS proposed for remediation is adjacent to an inactive emergency overflow drainage ditch, which drains to Los Alamos Canyon and is associated with the surface impoundments at PRS 53-002(a). The emergency overflow drainage ditch and the surface impoundments will be addressed in whatever subsequent action is proposed for PRS 53-002(a). This PRS is on the list of PRS that are in or near a watercourse.

1.1 Site Type and Description

TA-53 is the location of the LAMPF, a 0.5 mile-long proton accelerator with associated experimental and support facilities, used for research with subatomic particles. LAMPF became fully operational in 1974. PRS 53-008 is an approximately 3- to 4-acre storage yard located directly to the north, east, and south of the surface impoundments, PRS 53-002(a). In this area, the LAMPF operating group stores used materials from physics experiments: concrete shielding blocks, steel targets, lead shielding blocks, and other shielding debris. An emergency overflow drainage ditch from the adjacent NE and NW surface impoundments runs through the site. The drainage is fenced off and posted as a radioactively contaminated area. The NE and NW surface impoundments have been removed from service, evaporated dry, and covered with a geotextile cover.

1.1.1 Operational History

PRS 53-008 is currently active and used to store steel targets, lead shielding blocks, and other metal debris. The RCRA facility assessment (RFA) noted that no hazardous materials were present at the site (EPA 1987, 0816). The NE and NW surface impoundments received sanitary, industrial, and radioactive waste from TA-53, and discharged overflow through the emergency overflow drainage ditch on a fairly frequent basis until January 31, 1993.

1.1.2 COPCs and Rationale for Proposed Remedial Action

Based upon the Phase I characterization, the surface soils in the area of the boneyard adjacent to the emergency overflow drainage have cobalt 60 and cesium 134 as COPCs because they exceeded their respective SALs.

Although this VCA is not driven by RCRA/HSWA permit requirements, the removal of the contaminated surface soils eliminates a source of contamination and accomplishes DOE's desire to bring ultimate closure to known areas of concern by cleanups or NFA decisions.

2.0 SITE CHARACTERIZATION

The site consists of 3 to 4 acres located adjacent (north, east, and south) to the surface impoundments at TA-53. The portion of the site that is contaminated is an area located adjacent to the fenced-off emergency overflow drainage ditch associated with the surface impoundments. The contaminated site is approximately 480 square feet in area.

2.1 RFI Information/Other Decision Data

The Phase I investigation took place during the summer of 1995. The objective of the Phase I investigation was to determine the presence or absence of contamination in the soil. Based upon the approved RFI work plan (LANL 1994, 1157), a screening radiological survey was conducted. This consisted of dividing the site into a 20- by 20-ft grid and surveying each grid point with a NaI(Tl) 2- by 2-in. detector. The survey locations near the fenced emergency overflow drainage showed elevated gamma-ray activity. Based upon the results of the of the screening survey, 11 sample locations were chosen for sampling. Sample locations are shown in Figure 7.3-1 (Annex 7.3).

The surface soil samples (0 to 6 in.) were collected using the approved spade and scoop technique (LANL-ER-SOP 6.09).

In accordance with the RFI work plan (LANL 1994, 1157), collected samples were submitted to an offsite laboratory for analysis. Analyses for radionuclides were requested by gamma spectroscopy. Analyses for metals were requested for target analyte list (TAL) metals. According to the chain-of-custody records, the samples were submitted and analyzed within the prescribed holding times.

2.1.1 Data Quality Evaluation

The QA/QC data associated with the analyses at PRS 53-008 (inorganic and radionuclides) indicted that 100% of the data were acceptable and defensible. Less than 1% of the data were qualified as either UJ (undetected estimated) or J (estimated), while none of the data were qualified as R (unusable). The qualified data represents data of good quality and reasonable confidence that are suitable for decision-making purposes (Fribush 1989, ER ID No. 56023). The QA/QC mechanisms were effective in ensuring the reliability of the measured values within the expected limits of sampling and analytical error.

Inorganics

- Manganese in all samples had matrix spike recovery of 53.5%, which is outside of the established limits (75 to 125%), and is qualified as J (Table 7.2-1). The low bias does not affect the data usability because the detected values for manganese are a factor of two or more below the background UTL.

- Lead and manganese had relative percent differences (RPDs) in the duplicate analysis (40.5% and 40.2%, respectively) above EPA's control limits for soil [±35%, ±2X Contract Required Detection Limit (CRDL)] (EPA 1994, 1206). The data are qualified as J (Table 7.2-1) and are usable because the RPDs reflect soil heterogeneity and do not affect method precision.

- The percent recoveries in the analytical spike for arsenic and selenium in one sample each were outside of the established limits (85 to 115%) and are qualified as J and UJ, respectively (Table 7.2-1). The datum for selenium is usable because the recovery (76.8%) was sufficient to detect and quantify the analyte. The recovery was within the range of 40 to 84%, which results in acceptable, but biased low data (EPA 1994, 1206). The low bias due to the low recovery (78.7%) for the arsenic datum does not affect the data usability because the detected value is almost an order of magnitude below the background UTL.

- Cobalt was detected in one of the blanks at a concentration below or equivalent to the method detection limits (MDLs). The data for cobalt were incorrectly qualified as J in the three samples associated with the blank contamination. Because the sample concentrations were less than 5X the blank value, the data should be qualified as U (Table 7.2-1) and are usable as nondetects.

All other inorganic data are considered to be usable as reported.

Radionuclides

There were no QA/QC problems associated with the gamma spectroscopy data collected from this PRS. All of the data are usable as reported.

2.1.2 Sampling Results

FIMAD contains all of the analytical data collected from PRS 53-008. The reported values for detected chemicals were compared with the respective background upper tolerance limits (UTLs) and screening action levels (SALs). Data comparison tables of detected concentrations greater than background UTLs and/or SALs are provided in Annex 7.2. Based on a review of the sampling data, the results are summarized as follows:

- No inorganics were detected at concentrations above their background UTLs and are, therefore, eliminated from further evaluation.

- Cesium-134, cobalt 60, and manganese 54 were detected in the surface soil and carried forward to the SAL comparison stage because they have no background values. All other radionuclides were either undetected or detected at activity levels normally measured in the environment and were eliminated from further evaluation.

- Cesium-134 and cobalt 60 were detected in one surface soil sample at concentrations greater than their SALs (Table 7.2-2) and are retained as COPCs. Manganese-54 was detected in the same surface soil sample at a concentration below its SAL (Table 7.2-2) and is eliminated from further evaluation.

The results of the screening assessment found no inorganics above background and two radionuclides (cesium 134 and cobalt 60) above their SALs. The corrective action will address the remediation of the PRS based on these two COPCs.

2.2 Nature and Extent of Contamination

The contamination at PRS 53-008 is associated with the area encompassing approximately 480 square feet adjacent to the perimeter (north, west, and south side) of the fenced-off emergency overflow drainage ditch. The Phase I sampling indicated that this area contains cobalt 60 and cesium 134 as COPCs.

3.0 PROPOSED REMEDY

3.1 Description of the Proposed Remedial Action

The remedial action at PRS 53-008 consists of removing the top 6 in. to 1 ft of soil adjacent to the fenced-off emergency overflow drainage ditch out to a width of approximately 3 ft or until it is determined that the soil contains acceptable levels of cobalt 60 and cesium 134.

Following appropriate health and safety screening (see Annex 7.6), the surface soils directly adjacent to the emergency overflow drainage will be field screened for elevated gamma-ray activity, using a NaI(Tl) 2- by 2-in. detector. The field screening will assist the remediation team in more precisely defining the area of contamination and will ensure that all contaminated soil is remediated while minimizing the amount of waste generated. Areas of the site that are identified as being contaminated will be removed with hand-operated shovels and/or a backhoe. The soil will be placed in B-25 containers. During the placement of soil into the containers, portions of each soil placement will be collected in a stainless steel bowl or equivalent so that when the container is full, a representative composite sample of the contents exists. The contents of the bowl will be used for waste characterization analysis as detailed in Annex 7.7.

During the excavation of the soil, dust suppression will be performed using hand-held water sprayers. The application of water will be limited and will not result in runoff or in the generation of a dual-phase (water and soil) waste.

When the radiological contamination is removed to below the established preliminary remediation goals (PRGs), a radiological screening survey of the area will be performed to ensure the removal of the radiological contamination. At this time, confirmatory cleanup samples of the underlying soil will be collected. The results of the radiological screening survey, along with the fixed analytical results, will be provided in the VCA completion report.

After completion of the soil removal and confirmatory sampling, tools and equipment will be decontaminated. The decon fluid will be stored in bung-top 55-gallon drums, sampled for waste characterization, and disposed of accordingly. Personal protective equipment (PPE) will be decontaminated or disposed of as waste. Until the results of the waste characterization are received, all drums will be stored onsite and initially managed as non-RCRA waste. Final disposition of the waste will be determined after the waste characterization results have been received.

3.2 Basis for Cleanup Levels

PRS 53-008 lies within DOE-owned land and is removed from public access roads. In the future, the land is anticipated to be used exclusively for Laboratory operations (i.e., industrial land use). However, PRGs for the COPCs retained from the sampling at this PRS (i.e., cesium 134 and cobalt 60) were calculated based on a conservative land use scenario (residential) because of the potential for migration offsite due to the area's proximity to a watercourse. The site-specific PRGs were calculated to be 3.2 pCi/g for cesium 134 and 1.9 pCi/g for cobalt 60. The derivation of the PRGs was done using RESRAD 5.70 (computer printouts are provided in Annex 7.1) and is based on an exposure of 15 mrem/yr. LANL site-specific exposure input parameters were used in the model and presented in Annex 7.1 (Perona 1996, 1330).

TABLE 3.2-1

SITE-SPECIFIC PRGs FOR PRS 53-008

COPCs	Sample Values	PRGs	Rationale
Cesium 134	6.2 pCi/g	3.2 pCi/g	Radionuclide (based on a dose of 15 mrem/yr)
Cobalt 60	2.7 pCi/g	1.9 pCi/g	Radionuclide (based on a dose of 15 mrem/yr)

The PRGs calculated from RESRAD based on the residential scenario are less than the maximum activity concentrations of cesium 134 and cobalt 60 detected during the Phase I sampling. The remediation of this area will ensure that the activity concentrations will be below the PRGs presented in Table 3.2-1.

3.3 Site Restoration

Following confirmation that the PRS has been remediated in accordance with this plan, the excavated areas will be returned to the original grade and revegetated (i.e., reseeded). Backfill material (if needed) will consist of clean fill obtained from LANL's maintenance contractor.

4.0 WASTE MANAGEMENT

4.1 Estimated Types and Volumes of Waste

Wastes expected to be generated during the VCA are included in Table 4.1-1.

TABLE 4.1-1

ESTIMATED WASTE TYPES AND VOLUMES

Item	Waste Type	Anticipated Volume
Sampling waste/PPE	Solid - potential hazardous	< 2 55-gallon drums
Contaminated soils	Solid - hazardous	4 B-25 containers (3 cubic yards each
Decon waste	Liquid - potential hazardous	< 30 gallons

A Characterization Strategy Form (CSF) has been submitted to EM/SWO and ESH-19. The CSF describes the waste characterization/strategy requirements and all uncertainties in determination of waste types and volumes, which are summarized below.

Soil contaminated with radionuclides (cesium 134 and cobalt 60) will be put in a maximum of four B-25 containers. The containers will be sealed and, after the waste is characterized by specified laboratory analyses, they will be disposed of according to their hazard classification (RCRA, mixed, radioactive, or nonhazardous waste). One composite sample taken from each B-25 container will be analyzed for TCLP metals, SVOCs, VOCs, PCBs, pesticides, tritium, and by gamma spectroscopy.

Visibly contaminated PPE and waste handling equipment will be considered low-level radioactive waste, if the radiological field screening detects radiation above background levels. Visibly uncontaminated or decontaminated items will be considered industrial or radioactive waste depending on the field screening results. The volume generated will be less than two 55-gallon drums. PPE/waste handling equipment will be segregated into visibly contaminated and uncontaminated categories and placed in separate, sealed plastic bags inside 55-gallon drums. These items will not be directly sampled.

Decontamination liquids consist of Liquinox® detergent, tap water, and distilled water and may be low-level radioactive waste. A total volume of less than 30 gallons will be generated. The decontamination liquids will be labeled with the PRS number and put inside a 55-gallon drum.

Decontamination liquids will be classified as RCRA, mixed, radioactive, or nonhazardous waste based on the results of a composite liquid waste sample analyzed for TAL metals, SVOCs, and by gamma spectroscopy.

4.2 Method of Management and Disposal

Waste soil will be stored/handled in accordance with 20 NMAC Generator and DOE Order 5820.2A (Radioactive Waste Management) requirements. This waste will be stored at the site in B-25 containers until all analyses are completed for the soil in each container. The soil will then be disposed of as radioactive, mixed, or nonhazardous waste based on the analytical results. Each container will be labeled with a completed and attached Radioactive Materials Tag. The storage area will be roped off and labeled as a radioactive materials storage area.

Visibly contaminated PPE/waste handling equipment will be segregated and managed as low-level radioactive waste. The total volume expected is less than two 55-gallon drums. It will be stored onsite until the soil analyses are completed and then it will be disposed in a similar manner as the B-25 container with the highest level of RCRA, mixed, or radioactive wastes. Visibly uncontaminated or decontaminated PPE/waste handling equipment with no elevated radiation levels will be disposed as industrial waste.

Decontamination liquids (30 gallons or less total volume) will be managed as low-level radioactive waste. A grab sample of the waste liquids generated during the VCA will be analyzed to determine the final disposal site. Analyses include TAL metals, SVOCs, and gamma spectroscopy. Further analyses may be required to meet the waste acceptance criteria of a treatment, storage, and disposal (TSD) facility after the hazardous and radioactive determination is made for the decontamination liquids. If the liquids are nonhazardous and nonradioactive, disposal sites could be the TA-46 SWSC sewer plant. If they are either hazardous or radioactive, their disposal may be at the TA-50 TSD or at another approved TSD.

EM/SWO personnel will help in determining the final disposal location for all the generated wastes. If required, they will help find the necessary TSD space for the generated wastes.

5.0 DESCRIPTION OF CONFIRMATORY/VERIFICATION SAMPLING

Field screening with a sodium iodide detector will be conducted during the remediation to ensure that all areas that are contaminated above the PRGs are remediated. After initial cleanup, the soil remaining in the approximately 480-square-foot cleanup area will be sampled for the COPCs in six random locations. The samples will be submitted to a fixed analytical laboratory for analysis to confirm that cleanup PRGs have been met. Remediation standards for the site will be attained when the results of the confirmatory sampling exhibit concentrations below the residential PRGs.

6.0 ESTIMATED TIME TO COMPLETE THE ACTION AND UNCERTAINTIES

The estimated completion time at PRS 53-008 is one week (five working days). This estimate is based on one day to mobilize, three days to complete the removal of contaminated soil and to ship the confirmatory samples, and one day to demobilize. The analytical results from the confirmation sampling are expected to be received within 7 days, the waste characterization sampling results are expected within 30 days, and waste removal from onsite storage is expected within another 60 days. The total time from mobilization to removal of waste is estimated at 90 days. There is one major uncertainty with this cleanup: although the area containing the waste is easily identifiable and the equipment is available to perform the VCA, the actual waste determination (i.e., mixed, RCRA, or rad only) is uncertain.

7.0 ANNEXES

ANNEX 7.1

RISK-BASED CLEANUP LEVEL ASSUMPTIONS AND CALCULATIONS

Cs-134

Table of Contents

Part I: Mixture Sums and Single Radionuclide Guidelines

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

Menu	Parameter	Current Value	Default	Parameter Name
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	Cs-134	4.630E-05	4.630E-05	DCF2(1)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	Cs-134	7.330E-05	7.330E-05	DCF3(1)
D-34	Food transfer factors:			
D-34	Cs-134 , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(1,1)
D-34	Cs-134 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.000E-02	3.000E-02	RTF(1,2)
D-34	Cs-134 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	8.000E-03	8.000E-03	RTF(1,3)
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-5	Cs-134 , fish	2.000E+03	2.000E+03	BIOFAC(1,1)
D-5	Cs-134 , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(1,2)

Site-Specific Parameter Summary

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R011	Area of contaminated zone (m**2)	1.000E+02	1.000E+04	—	AREA
R011	Thickness of contaminated zone (m)	3.000E-01	2.000E+00	—	THICK0
R011	Length parallel to aquifer flow (m)	1.000E+02	1.000E+02	—	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	1.500E+01	3.000E+01	—	BRDL
R011	Time since placement of material (yr)	0.000E+00	0.000E+00	—	TI
R011	Times for calculations (yr)	1.000E+00	1.000E+00	—	T(2)
R011	Times for calculations (yr)	3.000E+00	3.000E+00	—	T(3)
R011	Times for calculations (yr)	1.000E+01	1.000E+01	—	T(4)
R011	Times for calculations (yr)	3.000E+01	3.000E+01	—	T(5)
R011	Times for calculations (yr)	1.000E+02	1.000E+02	—	T(6)
R011	Times for calculations (yr)	3.000E+02	3.000E+02	—	T(7)
R011	Times for calculations (yr)	1.000E+03	1.000E+03	—	T(8)
R011	Times for calculations (yr)	not used	0.000E+00	—	T(9)
R011	Times for calculations (yr)	not used	0.000E+00	—	T(10)
R012	Initial principal radionuclide (pCi/g): Ce-134	1.000E+00	0.000E+00	—	S1(1)
R012	Concentration in groundwater (pCi/L): Ce-134	not used	0.000E+00	—	W1(1)
R013	Cover depth (m)	0.000E+00	0.000E+00	—	COVER0
R013	Density of cover material (g/cm**3)	not used	1.500E+00	—	DENSCV
R013	Cover depth erosion rate (m/yr)	not used	1.000E-03	—	VCV
R013	Density of contaminated zone (g/cm**3)	1.600E+00	1.500E+00	—	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	—	VCZ
R013	Contaminated zone total porosity	4.000E-01	4.000E-01	—	TPCZ
R013	Contaminated zone effective porosity	2.000E-01	2.000E-01	—	EPCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	4.400E+02	1.000E+01	—	HCCZ
R013	Contaminated zone b parameter	4.050E+00	5.300E+00	—	BCZ
R013	Humidity in air (g/cm**3)	not used	8.000E+00	—	HUMID
R013	Evapotranspiration coefficient	9.990E-01	5.000E-01	—	EVAPTR
R013	Precipitation (m/yr)	4.800E-01	1.000E+00	—	PRECIP
R013	Irrigation (m/yr)	0.000E+00	2.000E-01	—	RI
R013	Irrigation mode	overhead	overhead	—	IDITCH
R013	Runoff coefficient	5.200E-01	2.000E-01	—	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	2.700E+07	1.000E+06	—	WAREA
R013	Accuracy for water/soil computations	1.000E-03	1.000E-03	—	EPS
R014	Density of saturated zone (g/cm**3)	1.600E+00	1.500E+00	—	DENSAQ
R014	Saturated zone total porosity	3.000E-01	4.000E-01	—	TPSZ
R014	Saturated zone effective porosity	3.000E-01	2.000E-01	—	EPSZ
R014	Saturated zone hydraulic conductivity (m/yr)	1.000E+02	1.000E+02	—	HCSZ
R014	Saturated zone hydraulic gradient	2.000E-02	2.000E-02	—	HGWT
R014	Saturated zone b parameter	4.050E+00	5.300E+00	—	BSZ
R014	Water table drop rate (m/yr)	3.000E-01	1.000E-03	—	VWT
R014	Well pump intake depth (m below water table)	1.000E+01	1.000E+01	—	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	—	MODEL
R014	Well pumping rate (m**3/yr)	2.500E+02	2.500E+02	—	UW
R015	Number of unsaturated zone strata	2	1	—	NS

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (if different from user input)	Parameter Name
R015	Unsat. zone 1, thickness (m)	2.600E+02	4.000E+00	—	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	1.600E+00	1.500E+00	—	DENSUZ(1)
R015	Unsat. zone 1, total porosity	5.000E-01	4.000E-01	—	TPUZ(1)
R015	Unsat. zone 1, effective porosity	4.000E-01	2.000E-01	—	EPUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	4.050E+00	5.300E+00	—	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	3.000E+00	1.000E+01	—	HCUZ(1)
R015	Unsat. zone 2, thickness (m)	1.000E+02	0.000E+00	—	H(2)
R015	Unsat. zone 2, soil density (g/cm**3)	1.600E+00	1.500E+00	—	DENSUZ(2)
R015	Unsat. zone 2, total porosity	5.000E-01	4.000E-01	—	TPUZ(2)
R015	Unsat. zone 2, effective porosity	4.000E-01	2.000E-01	—	EPUZ(2)
R015	Unsat. zone 2, soil-specific b parameter	4.050E+00	5.300E+00	—	BUZ(2)
R015	Unsat. zone 2, hydraulic conductivity (m/yr)	3.700E+02	1.000E+01	—	HCUZ(2)
R016	Distribution coefficients for Cs-134				
R016	Contaminated zone (cm**3/g)	1.000E+03	1.000E+03	—	DCNUCC(1)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+03	1.000E+03	—	DCNUCU(1,1)
R016	Unsaturated zone 2 (cm**3/g)	1.000E+03	1.000E+03	—	DCNUCU(1,2)
R016	Saturated zone (cm**3/g)	1.000E+03	1.000E+03	—	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.800E-07	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R017	Inhalation rate (m**3/yr)	7.300E+03	8.400E+03	—	INHALR
R017	Mass loading for inhalation (g/m**3)	9.000E-05	2.000E-04	—	MLINH
R017	Dilution length for airborne dust, inhalation (m)	3.000E+00	3.000E+00	—	LM
R017	Exposure duration	3.000E+01	3.000E+01	—	ED
R017	Shielding factor, inhalation	4.000E-01	4.000E-01	—	SHF3
R017	Shielding factor, external gamma	7.000E-01	7.000E-01	—	SHF1
R017	Fraction of time spent indoors	8.000E-01	5.000E-01	—	FIND
R017	Fraction of time spent outdoors (on site)	8.000E-02	2.500E-01	—	FOTD
R017	Shape factor flag, external gamma	1.000E+00	1.000E+00	1 shows circular AREA.	FS
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	not used	5.000E+01	—	RAD_SHAPE(1)
R017	Outer annular radius (m), ring 2:	not used	7.071E+01	—	RAD_SHAPE(2)
R017	Outer annular radius (m), ring 3:	not used	0.000E+00	—	RAD_SHAPE(3)
R017	Outer annular radius (m), ring 4:	not used	0.000E+00	—	RAD_SHAPE(4)
R017	Outer annular radius (m), ring 5:	not used	0.000E+00	—	RAD_SHAPE(5)
R017	Outer annular radius (m), ring 6:	not used	0.000E+00	—	RAD_SHAPE(6)
R017	Outer annular radius (m), ring 7:	not used	0.000E+00	—	RAD_SHAPE(7)
R017	Outer annular radius (m), ring 8:	not used	0.000E+00	—	RAD_SHAPE(8)
R017	Outer annular radius (m), ring 9:	not used	0.000E+00	—	RAD_SHAPE(9)
R017	Outer annular radius (m), ring 10:	not used	0.000E+00	—	RAD_SHAPE(10)
R017	Outer annular radius (m), ring 11:	not used	0.000E+00	—	RAD_SHAPE(11)
R017	Outer annular radius (m), ring 12:	not used	0.000E+00	—	RAD_SHAPE(12)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (if different from user input)	Parameter Name
R017	Fractions of annular areas within AREA:				
R017	Ring 1	not used	1.000E+00	—	FRACA(1)
R017	Ring 2	not used	2.732E-01	—	FRACA(2)
R017	Ring 3	not used	0.000E+00	—	FRACA(3)
R017	Ring 4	not used	0.000E+00	—	FRACA(4)
R017	Ring 5	not used	0.000E+00	—	FRACA(5)
R017	Ring 6	not used	0.000E+00	—	FRACA(6)
R017	Ring 7	not used	0.000E+00	—	FRACA(7)
R017	Ring 8	not used	0.000E+00	—	FRACA(8)
R017	Ring 9	not used	0.000E+00	—	FRACA(9)
R017	Ring 10	not used	0.000E+00	—	FRACA(10)
R017	Ring 11	not used	0.000E+00	—	FRACA(11)
R017	Ring 12	not used	0.000E+00	—	FRACA(12)
R018	Fruits, vegetables and grain consumption (kg/yr)	0.000E+00	1.600E+02	—	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	0.000E+00	1.400E+01	—	DIET(2)
R018	Milk consumption (L/yr)	0.000E+00	9.200E+01	—	DIET(3)
R018	Meat and poultry consumption (kg/yr)	0.000E+00	6.300E+01	—	DIET(4)
R018	Fish consumption (kg/yr)	0.000E+00	5.400E+00	—	DIET(5)
R018	Other seafood consumption (kg/yr)	0.000E+00	9.000E-01	—	DIET(6)
R018	Soil ingestion rate (g/yr)	3.650E+01	3.650E+01	—	SOIL
R018	Drinking water intake (L/yr)	0.000E+00	5.100E+02	—	DWI
R018	Contamination fraction of drinking water	0.000E+00	1.000E+00	—	FDW
R018	Contamination fraction of household water	not used	1.000E+00	—	FHHW
R018	Contamination fraction of livestock water	0.000E+00	1.000E+00	—	FLW
R018	Contamination fraction of irrigation water	0.000E+00	1.000E+00	—	FIRW
R018	Contamination fraction of aquatic food	0.000E+00	5.000E-01	—	FR9
R018	Contamination fraction of plant food	0.000E+00	-1	—	FPLANT
R018	Contamination fraction of meat	0.000E+00	-1	—	FMEAT
R018	Contamination fraction of milk	0.000E+00	-1	—	FMILK
R019	Livestock fodder intake for meat (kg/day)	0.000E+00	6.800E+01	—	LFI5
R019	Livestock fodder intake for milk (kg/day)	0.000E+00	5.500E+01	—	LFI6
R019	Livestock water intake for meat (L/day)	0.000E+00	5.000E+01	—	LWI5
R019	Livestock water intake for milk (L/day)	0.000E+00	1.600E+02	—	LWI6
R019	Livestock soil intake (kg/day)	0.000E+00	5.000E-01	—	LSI
R019	Mass loading for foliar deposition (g/m**3)	0.000E+00	1.000E-04	—	MLFD
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	—	DM
R019	Depth of roots (m)	0.000E+00	9.000E-01	—	DROOT
R019	Drinking water fraction from ground water	0.000E+00	1.000E+00	—	FGWDW
R019	Household water fraction from ground water	0.000E+00	1.000E+00	—	FGWHH
R019	Livestock water fraction from ground water	not used	1.000E+00	—	FGWLW
R019	Irrigation fraction from ground water	0.000E+00	1.000E+00	—	FGWIR
C14	C-12 concentration in water (g/cm**3)	not used	2.000E-05	—	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	—	C12CZ
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	—	CSOIL
C14	Fraction of vegetation carbon from air	not used	9.800E-01	—	CAIR
C14	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	—	DMC
C14	C-14 evasion flux rate from soil (1/sec)	not used	7.000E-07	—	EVSN
C14	C-12 evasion flux rate from soil (1/sec)	not used	1.000E-10	—	REVSN

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
C14	Fraction of grain in beef cattle feed	not used	8.000E-01	—	AVFG4
C14	Fraction of grain in milk cow feed	not used	2.000E-01	—	AVFG5
STOR	Storage times of contaminated foodstuffs (days):				
STOR	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	—	STOR_T(1)
STOR	Leafy vegetables	1.000E+00	1.000E+00	—	STOR_T(2)
STOR	Milk	0.000E+00	1.000E+00	—	STOR_T(3)
STOR	Meat and poultry	0.000E+00	2.000E+01	—	STOR_T(4)
STOR	Fish	0.000E+00	7.000E+00	—	STOR_T(5)
STOR	Crustacea and mollusks	0.000E+00	7.000E+00	—	STOR_T(6)
STOR	Well water	0.000E+00	1.000E+00	—	STOR_T(7)
STOR	Surface water	0.000E+00	1.000E+00	—	STOR_T(8)
STOR	Livestock fodder	0.000E+00	4.500E+01	—	STOR_T(9)
R021	Thickness of building foundation (m)	not used	1.500E-01	—	FLOOR
R021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	—	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	—	TPCV
R021	Total porosity of the building foundation	not used	1.000E-01	—	TPFL
R021	Volumetric water content of the cover material	not used	5.000E-02	—	PH2OCV
R021	Volumetric water content of the foundation	not used	3.000E-02	—	PH2OFL
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	not used	2.000E-06	—	DIFCV
R021	in foundation material	not used	3.000E-07	—	DIFFL
R021	in contaminated zone soil	not used	2.000E-06	—	DIFCZ
R021	Radon vertical dimension of mixing (m)	not used	2.000E+00	—	HMIX
R021	Average annual wind speed (m/sec)	not used	2.000E+00	—	WIND
R021	Average building air exchange rate (1/hr)	not used	5.000E-01	—	REXG
R021	Height of the building (room) (m)	not used	2.500E+00	—	HRM
R021	Building interior area factor	not used	0.000E+00	—	FAI
R021	Building depth below ground surface (m)	not used	-1.000E+00	—	DMFL
R021	Emanating power of Rn-222 gas	not used	2.500E-01	—	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	—	EMANA(2)

Summary of Pathway Selections

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

Contaminated Zone Dimensions
Area: 100.00 square meters
Thickness: 0.30 meters
over Depth: 0.00 meters

Initial Soil Concentrations, pCi/g
Cs-134 1.000E+00

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 15 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
TDOSE(t):	4.751E+00	3.394E+00	1.732E+00	1.845E-01	1.972E-04	1.157E-14	0.000E+00	0.000E+00
M(t):	3.167E-01	2.263E-01	1.155E-01	1.097E-02	1.315E-05	7.710E-16	0.000E+00	0.000E+00

Maximum TDOSE(t): 4.751E+00 mrem/yr at t = 0.000E+00 years

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

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Cs-134	4.751E+00	0.9999	9.360E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.354E-04	0.0000
Total	4.751E+00	0.9999	9.360E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.354E-04	0.0000

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

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Cs-134	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.751E+00	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.751E+00	1.0000

*Sum of all water independent and dependent pathways.

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

Water Independent Pathways (Inhalation excludes radon)

Radionuclide	Ground mrem/yr	Ground fract.	Inhalation mrem/yr	Inhalation fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	Soil mrem/yr	Soil fract.
Cs-134	3.394E+00	0.9999	6.688E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.682E-04	0.0000
Total	3.394E+00	0.9999	6.688E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.682E-04	0.0000

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

Water Dependent Pathways

Radionuclide	Water mrem/yr	Water fract.	Fish mrem/yr	Fish fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	All Pathways* mrem/yr	All Pathways* fract.
Cs-134	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.394E+00	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.394E+00	1.0000

*Sum of all water independent and dependent pathways.

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

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Cs-134	1.732E+00	0.9999	3.414E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.588E-05	0.0000
Total	1.732E+00	0.9999	3.414E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.588E-05	0.0000

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

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Cs-134	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.732E+00	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.732E+00	1.0000

*Sum of all water independent and dependent pathways.

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

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Cs-134	1.645E-01	0.9999	3.246E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.166E-06	0.0000
Total	1.645E-01	0.9999	3.246E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.166E-06	0.0000

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

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Cs-134	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.645E-01	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.645E-01	1.0000

*Sum of all water independent and dependent pathways.

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

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Cs-134	1.972E-04	0.9999	3.905E-10	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.822E-09	0.0000
Total	1.972E-04	0.9999	3.905E-10	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.822E-09	0.0000

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

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Cs-134	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.972E-04	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.972E-04	1.0000

*Sum of all water independent and dependent pathways.

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

Water Independent Pathways (Inhalation excludes radon)

Radionuclide	Ground mrem/yr	Ground fract.	Inhalation mrem/yr	Inhalation fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	Soil mrem/yr	Soil fract.
Cs-134	1.156E-14	0.9999	2.357E-20	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.928E-19	0.0001
Total	1.156E-14	0.9999	2.357E-20	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.928E-19	0.0001

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

Water Dependent Pathways

Radionuclide	Water mrem/yr	Water fract.	Fish mrem/yr	Fish fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	All Pathways* mrem/yr	All Pathways* fract.
Cs-134	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.157E-14	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.157E-14	1.0000

*Sum of all water independent and dependent pathways.

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

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Cs-134	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

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

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Cs-134	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

*Sum of all water independent and dependent pathways.

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

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Cs-134	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

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

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Cs-134	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

*Sum of all water independent and dependent pathways.

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

Parent (i)	Product (j)	Branch Fraction	DSR(j,t) (mrem/yr)/(pCi/g) t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Cs-134	Cs-134	1.000E+00	4.751E+00	3.394E+00	1.732E+00	1.645E-01	1.972E-04	1.157E-14	0.000E+00	0.000E+00

Branch Fraction is the cumulative factor for the j'th principal radionuclide daughter: CUMBRF(j) = BRF(1)*BRF(2)* ... BRF(j).
The DSR includes contributions from associated (half-life ≥ 0.5 yr) daughters.

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 15 mrem/yr

Nuclide (i)	t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Cs-134	3.157E+00	4.419E+00	8.659E+00	9.116E+01	7.606E+04	*1.294E+15	*1.294E+15	*1.294E+15

*At specific activity limit

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

Nuclide (i)	Initial pCi/g	tmin (years)	DSR(i,tmin) (pCi/g)	G(i,tmin) (pCi/g)	DSR(i,tmax) (pCi/g)	G(i,tmax) (pCi/g)
Cs-134	1.000E+00	0.000E+00	4.751E+00	3.157E+00	4.751E+00	3.157E+00

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

Nuclide (j)	Parent (i)	BRF(i)	DOSE(j,t), mrem/yr							
		t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Cs-134	Cs-134	1.000E+00	4.751E+00	3.394E+00	1.732E+00	1.645E-01	1.972E-04	1.157E-14	0.000E+00	0.000E+00

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

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	BRF(i)	S(j,t), pCi/g							
		t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Cs-134	Cs-134	1.000E+00	1.000E+00	7.145E-01	3.648E-01	3.466E-02	4.172E-05	2.518E-15	1.541E-44	0.000E+00

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

Co-60

Table of Contents

Part I: Mixture Sums and Single Radionuclide Guidelines

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

Menu	Parameter	Current Value	Parameter Default	Parameter Name
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	Co-60	2.190E-04	2.190E-04	DCF2(1)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	Co-60	2.690E-05	2.690E-05	DCF3(1)
D-34	Food transfer factors:			
D-34	Co-60 , plant/soil concentration ratio, dimensionless	8.000E-02	8.000E-02	RTF(1,1)
D-34	Co-60 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-02	2.000E-02	RTF(1,2)
D-34	Co-60 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-03	2.000E-03	RTF(1,3)
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-5	Co-60 , fish	3.000E+02	3.000E+02	BIOFAC(1,1)
D-5	Co-60 , crustacea and mollusks	2.000E+02	2.000E+02	BIOFAC(1,2)

Site-Specific Parameter Summary

Menu	Parameter	User Input	Default	Used by RESRAD (if different from user input)	Parameter Name
R011	Area of contaminated zone (m**2)	1.000E+02	1.000E+04	—	AREA
R011	Thickness of contaminated zone (m)	3.000E-01	2.000E+00	—	THICK0
R011	Length parallel to aquifer flow (m)	1.000E+02	1.000E+02	—	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	1.500E+01	3.000E+01	—	BRDL
R011	Time since placement of material (yr)	0.000E+00	0.000E+00	—	TI
R011	Times for calculations (yr)	1.000E+00	1.000E+00	—	T(2)
R011	Times for calculations (yr)	3.000E+00	3.000E+00	—	T(3)
R011	Times for calculations (yr)	1.000E+01	1.000E+01	—	T(4)
R011	Times for calculations (yr)	3.000E+01	3.000E+01	—	T(5)
R011	Times for calculations (yr)	1.000E+02	1.000E+02	—	T(6)
R011	Times for calculations (yr)	3.000E+02	3.000E+02	—	T(7)
R011	Times for calculations (yr)	1.000E+03	1.000E+03	—	T(8)
R011	Times for calculations (yr)	not used	0.000E+00	—	T(9)
R011	Times for calculations (yr)	not used	0.000E+00	—	T(10)
R012	Initial principal radionuclide (pCi/g): Co-60	1.000E+00	0.000E+00	—	S1(1)
R012	Concentration in groundwater (pCi/L): Co-60	not used	0.000E+00	—	W1(1)
R013	Cover depth (m)	0.000E+00	0.000E+00	—	COVER0
R013	Density of cover material (g/cm**3)	not used	1.500E+00	—	DENSCV
R013	Cover depth erosion rate (m/yr)	not used	1.000E-03	—	VCV
R013	Density of contaminated zone (g/cm**3)	1.600E+00	1.500E+00	—	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	—	VCZ
R013	Contaminated zone total porosity	4.000E-01	4.000E-01	—	TPCZ
R013	Contaminated zone effective porosity	2.000E-01	2.000E-01	—	EPCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	4.400E+02	1.000E+01	—	HCCZ
R013	Contaminated zone b parameter	4.050E+00	5.300E+00	—	BCZ
R013	Humidity in air (g/cm**3)	not used	8.000E+00	—	HUMID
R013	Evapotranspiration coefficient	9.990E-01	5.000E-01	—	EVAPTR
R013	Precipitation (m/yr)	4.800E-01	1.000E+00	—	PRECIP
R013	Irrigation (m/yr)	0.000E+00	2.000E-01	—	RI
R013	Irrigation mode	overhead	overhead	—	IDITCH
R013	Runoff coefficient	5.200E-01	2.000E-01	—	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	2.700E+07	1.000E+06	—	WAREA
R013	Accuracy for water/soil computations	1.000E-03	1.000E-03	—	EPS
R014	Density of saturated zone (g/cm**3)	1.600E+00	1.500E+00	—	DENSAQ
R014	Saturated zone total porosity	3.000E-01	4.000E-01	—	TPSZ
R014	Saturated zone effective porosity	3.000E-01	2.000E-01	—	EPSZ
R014	Saturated zone hydraulic conductivity (m/yr)	1.000E+02	1.000E+02	—	HCSZ
R014	Saturated zone hydraulic gradient	2.000E-02	2.000E-02	—	HGWT
R014	Saturated zone b parameter	4.050E+00	5.300E+00	—	BSZ
R014	Water table drop rate (m/yr)	3.000E-01	1.000E-03	—	VWT
R014	Well pump intake depth (m below water table)	1.000E+01	1.000E+01	—	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	—	MODEL
R014	Well pumping rate (m**3/yr)	2.500E+02	2.500E+02	—	UW
R015	Number of unsaturated zone strata	2	1	—	NS

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R015	Unsat. zone 1, thickness (m)	2.600E+02	4.000E+00	—	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	1.600E+00	1.500E+00	—	DENSUZ(1)
R015	Unsat. zone 1, total porosity	5.000E-01	4.000E-01	—	TPUZ(1)
R015	Unsat. zone 1, effective porosity	4.000E-01	2.000E-01	—	EPUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	4.050E+00	5.300E+00	—	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	3.000E+00	1.000E+01	—	HCUZ(1)
R015	Unsat. zone 2, thickness (m)	1.000E+02	0.000E+00	—	H(2)
R015	Unsat. zone 2, soil density (g/cm**3)	1.600E+00	1.500E+00	—	DENSUZ(2)
R015	Unsat. zone 2, total porosity	5.000E-01	4.000E-01	—	TPUZ(2)
R015	Unsat. zone 2, effective porosity	4.000E-01	2.000E-01	—	EPUZ(2)
R015	Unsat. zone 2, soil-specific b parameter	4.050E+00	5.300E+00	—	BUZ(2)
R015	Unsat. zone 2, hydraulic conductivity (m/yr)	3.700E+02	1.000E+01	—	HCUZ(2)
R016	Distribution coefficients for Co-60				
R016	Contaminated zone (cm**3/g)	1.000E+03	1.000E+03	—	DCNUCC(1)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+03	1.000E+03	—	DCNUCU(1,1)
R016	Unsaturated zone 2 (cm**3/g)	1.000E+03	1.000E+03	—	DCNUCU(1,2)
R016	Saturated zone (cm**3/g)	1.000E+03	1.000E+03	—	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.800E-07	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R017	Inhalation rate (m**3/yr)	7.300E+03	8.400E+03	—	INHALR
R017	Mass loading for inhalation (g/m**3)	9.000E-05	2.000E-04	—	MLINH
R017	Dilution length for airborne dust, inhalation (m)	3.000E+00	3.000E+00	—	LM
R017	Exposure duration	3.000E+01	3.000E+01	—	ED
R017	Shielding factor, inhalation	4.000E-01	4.000E-01	—	SHF3
R017	Shielding factor, external gamma	7.000E-01	7.000E-01	—	SHF1
R017	Fraction of time spent indoors	8.000E-01	5.000E-01	—	FIND
R017	Fraction of time spent outdoors (on site)	8.000E-02	2.500E-01	—	FOTD
R017	Shape factor flag, external gamma	1.000E+00	1.000E+00	1 shows circular AREA.	FS
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	not used	5.000E+01	—	RAD_SHAPE(1)
R017	Outer annular radius (m), ring 2:	not used	7.071E+01	—	RAD_SHAPE(2)
R017	Outer annular radius (m), ring 3:	not used	0.000E+00	—	RAD_SHAPE(3)
R017	Outer annular radius (m), ring 4:	not used	0.000E+00	—	RAD_SHAPE(4)
R017	Outer annular radius (m), ring 5:	not used	0.000E+00	—	RAD_SHAPE(5)
R017	Outer annular radius (m), ring 6:	not used	0.000E+00	—	RAD_SHAPE(6)
R017	Outer annular radius (m), ring 7:	not used	0.000E+00	—	RAD_SHAPE(7)
R017	Outer annular radius (m), ring 8:	not used	0.000E+00	—	RAD_SHAPE(8)
R017	Outer annular radius (m), ring 9:	not used	0.000E+00	—	RAD_SHAPE(9)
R017	Outer annular radius (m), ring 10:	not used	0.000E+00	—	RAD_SHAPE(10)
R017	Outer annular radius (m), ring 11:	not used	0.000E+00	—	RAD_SHAPE(11)
R017	Outer annular radius (m), ring 12:	not used	0.000E+00	—	RAD_SHAPE(12)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (if different from user input)	Parameter Name
R017	Fractions of annular areas within AREA:				
R017	Ring 1	not used	1.000E+00	—	FRACA(1)
R017	Ring 2	not used	2.732E-01	—	FRACA(2)
R017	Ring 3	not used	0.000E+00	—	FRACA(3)
R017	Ring 4	not used	0.000E+00	—	FRACA(4)
R017	Ring 5	not used	0.000E+00	—	FRACA(5)
R017	Ring 6	not used	0.000E+00	—	FRACA(6)
R017	Ring 7	not used	0.000E+00	—	FRACA(7)
R017	Ring 8	not used	0.000E+00	—	FRACA(8)
R017	Ring 9	not used	0.000E+00	—	FRACA(9)
R017	Ring 10	not used	0.000E+00	—	FRACA(10)
R017	Ring 11	not used	0.000E+00	—	FRACA(11)
R017	Ring 12	not used	0.000E+00	—	FRACA(12)
R018	Fruits, vegetables and grain consumption (kg/yr)	0.000E+00	1.600E+02	—	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	0.000E+00	1.400E+01	—	DIET(2)
R018	Milk consumption (L/yr)	not used	9.200E+01	—	DIET(3)
R018	Meat and poultry consumption (kg/yr)	not used	6.300E+01	—	DIET(4)
R018	Fish consumption (kg/yr)	not used	5.400E+00	—	DIET(5)
R018	Other seafood consumption (kg/yr)	not used	9.000E-01	—	DIET(6)
R018	Soil ingestion rate (g/yr)	3.650E+01	3.650E+01	—	SOIL
R018	Drinking water intake (L/yr)	0.000E+00	5.100E+02	—	DWI
R018	Contamination fraction of drinking water	0.000E+00	1.000E+00	—	FDW
R018	Contamination fraction of household water	not used	1.000E+00	—	FHHW
R018	Contamination fraction of livestock water	not used	1.000E+00	—	FLW
R018	Contamination fraction of irrigation water	0.000E+00	1.000E+00	—	FIRW
R018	Contamination fraction of aquatic food	not used	5.000E-01	—	FR9
R018	Contamination fraction of plant food	0.000E+00	-1	—	FPLANT
R018	Contamination fraction of meat	not used	-1	—	FMEAT
R018	Contamination fraction of milk	not used	-1	—	FMILK
R019	Livestock fodder intake for meat (kg/day)	not used	6.800E+01	—	LFI5
R019	Livestock fodder intake for milk (kg/day)	not used	5.500E+01	—	LFI6
R019	Livestock water intake for meat (L/day)	not used	5.000E+01	—	LWI5
R019	Livestock water intake for milk (L/day)	not used	1.600E+02	—	LWI6
R019	Livestock soil intake (kg/day)	not used	5.000E-01	—	LSI
R019	Mass loading for foliar deposition (g/m**3)	0.000E+00	1.000E-04	—	MLFD
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	—	DM
R019	Depth of roots (m)	0.000E+00	9.000E-01	—	DROOT
R019	Drinking water fraction from ground water	0.000E+00	1.000E+00	—	FGWDW
R019	Household water fraction from ground water	0.000E+00	1.000E+00	—	FGWHH
R019	Livestock water fraction from ground water	not used	1.000E+00	—	FGWLW
R019	Irrigation fraction from ground water	not used	1.000E+00	—	FGWIR
C14	C-12 concentration in water (g/cm**3)	not used	2.000E-05	—	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	—	C12CZ
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	—	CSOIL
C14	Fraction of vegetation carbon from air	not used	9.800E-01	—	CAIR
C14	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	—	DMC
C14	C-14 evasion flux rate from soil (1/sec)	not used	7.000E-07	—	EVSN
C14	C-12 evasion flux rate from soil (1/sec)	not used	1.000E-10	—	REVSN

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
C14	Fraction of grain in beef cattle feed	not used	8.000E-01	—	AVFG4
C14	Fraction of grain in milk cow feed	not used	2.000E-01	—	AVFG5
STOR	Storage times of contaminated foodstuffs (days):				
STOR	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	—	STOR_T(1)
STOR	Leafy vegetables	1.000E+00	1.000E+00	—	STOR_T(2)
STOR	Milk	not used	1.000E+00	—	STOR_T(3)
STOR	Meat and poultry	not used	2.000E+01	—	STOR_T(4)
STOR	Fish	not used	7.000E+00	—	STOR_T(5)
STOR	Crustacea and mollusks	not used	7.000E+00	—	STOR_T(6)
STOR	Well water	0.000E+00	1.000E+00	—	STOR_T(7)
STOR	Surface water	0.000E+00	1.000E+00	—	STOR_T(8)
STOR	Livestock fodder	not used	4.500E+01	—	STOR_T(9)
R021	Thickness of building foundation (m)	not used	1.500E-01	—	FLOOR
R021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	—	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	—	TPCV
R021	Total porosity of the building foundation	not used	1.000E-01	—	TPFL
R021	Volumetric water content of the cover material	not used	5.000E-02	—	PH2OCV
R021	Volumetric water content of the foundation	not used	3.000E-02	—	PH2OFL
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	not used	2.000E-06	—	DIFCV
R021	in foundation material	not used	3.000E-07	—	DIFFL
R021	in contaminated zone soil	not used	2.000E-06	—	DIFCZ
R021	Radon vertical dimension of mixing (m)	not used	2.000E+00	—	HMIX
R021	Average annual wind speed (m/sec)	not used	2.000E+00	—	WIND
R021	Average building air exchange rate (1/hr)	not used	5.000E-01	—	REXG
R021	Height of the building (room) (m)	not used	2.500E+00	—	HRM
R021	Building interior area factor	not used	0.000E+00	—	FAI
R021	Building depth below ground surface (m)	not used	-1.000E+00	—	DMFL
R021	Emanating power of Rn-222 gas	not used	2.500E-01	—	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	—	EMANA(2)

Summary of Pathway Selections

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

Contaminated Zone Dimensions
Area: 100.00 square meters
Thickness: 0.30 meters
Cover Depth: 0.00 meters

Initial Soil Concentrations, pCi/g
Co-60 1.000E+00

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 15 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
TDOSE(t):	8.006E+00	7.017E+00	5.391E+00	2.143E+00	1.534E-01	1.472E-05	0.000E+00	0.000E+00
M(t):	5.337E-01	4.678E-01	3.594E-01	1.429E-01	1.023E-02	9.816E-07	0.000E+00	0.000E+00

Maximum TDOSE(t): 8.006E+00 mrem/yr at t = 0.000E+00 years

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

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Co-60	8.006E+00	1.0000	4.427E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.640E-05	0.0000
Total	8.006E+00	1.0000	4.427E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.640E-05	0.0000

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

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
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	8.006E+00	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.006E+00	1.0000

*Sum of all water independent and dependent pathways.

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

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Co-60	7.017E+00	1.0000	3.882E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.576E-05	0.0000
Total	7.017E+00	1.0000	3.882E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.576E-05	0.0000

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

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
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	7.017E+00	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.017E+00	1.0000

*Sum of all water independent and dependent pathways.

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

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground mrem/yr	fract.	Inhalation mrem/yr	fract.	Radon mrem/yr	fract.	Plant mrem/yr	fract.	Meat mrem/yr	fract.	Milk mrem/yr	fract.	Soil mrem/yr	fract.
Co-60	5.391E+00	1.0000	2.984E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.824E-05	0.0000
Total	5.391E+00	1.0000	2.984E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.824E-05	0.0000

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

Water Dependent Pathways

Radio- Nuclide	Water mrem/yr	fract.	Fish mrem/yr	fract.	Radon mrem/yr	fract.	Plant mrem/yr	fract.	Meat mrem/yr	fract.	Milk mrem/yr	fract.	All Pathways* mrem/yr	fract.
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	5.391E+00	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.391E+00	1.0000

*Sum of all water independent and dependent pathways.

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

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Co-60	2.143E+00	1.0000	1.189E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.320E-05	0.0000
Total	2.143E+00	1.0000	1.189E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.320E-05	0.0000

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

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
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	2.143E+00	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.143E+00	1.0000

*Sum of all water independent and dependent pathways.

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

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Co-60	1.534E-01	1.0000	8.566E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.672E-06	0.0000
Total	1.534E-01	1.0000	8.566E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.672E-06	0.0000

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

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
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	1.534E-01	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.534E-01	1.0000

*Sum of all water independent and dependent pathways.

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

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Co-60	1.472E-05	1.0000	8.611E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.681E-10	0.0000
Total	1.472E-05	1.0000	8.611E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.681E-10	0.0000

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

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
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	1.472E-05	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.472E-05	1.0000

*Sum of all water independent and dependent pathways.

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

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
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
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

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

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
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
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

*Sum of all water independent and dependent pathways.

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

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
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
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

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

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
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
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

*Sum of all water independent and dependent pathways.

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

Parent (i)	Product (j)	Branch Fraction	DSR(j,t) (mrem/yr)/(pCi/g) t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Co-60	Co-60	1.000E+00	8.006E+00	7.017E+00	5.391E+00	2.143E+00	1.534E-01	1.472E-05	0.000E+00	0.000E+00

Branch Fraction is the cumulative factor for the j'th principal radionuclide daughter: CUMBRF(j) = BRF(1)*BRF(2)* ... BRF(j).
The DSR includes contributions from associated (half-life ≥ 0.5 yr) daughters.

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 15 mrem/yr

Nuclide (i)	t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Co-60	1.874E+00	2.138E+00	2.782E+00	6.999E+00	9.779E+01	1.019E+06	*1.131E+15	*1.131E+15

*At specific activity limit

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

Nuclide (i)	Initial pCi/g	tmin (years)	DSR(i,tmin) (pCi/g)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax)
Co-60	1.000E+00	0.000E+00	8.006E+00	1.874E+00	8.006E+00	1.874E+00

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

Nuclide (j)	Parent (i)	BRF(i)	DOSE(j,t), mrem/yr t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Co-60	Co-60	1.000E+00	8.006E+00	7.017E+00	5.391E+00	2.143E+00	1.534E-01	1.472E-05	0.000E+00	0.000E+00

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

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	BRF(i)	S(j,t), pCi/g t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Co-60	Co-60	1.000E+00	1.000E+00	8.768E-01	6.740E-01	2.685E-01	1.935E-02	1.945E-06	7.358E-18	0.000E+00

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

ANNEX 7.2

RFI ANALYTICAL RESULTS

All analytical data are available on FIMAD. If FIMAD is not accessible, data will be provided on request.

TABLE 7.2-1

DATA QUALITY EVALUATION FOR SAMPLES FROM PRS 53-008

Request Number	Sample ID	Suite	Comments
220	0253-95-0028, -0029, -0030, -0031, -0032, -0033, -0034, -0035, -0036, -0037, -0038	Inorganics	Manganese in all samples had percent recovery in the matrix spike sample outside of established limits (75%-125%). The data are qualified as J and are usable because the detected values for manganese are a factor of two or more below the background UTL. The low bias (53.5%) does not affect the data comparisons.
			Lead and manganese in all samples are qualified as J because the duplicate relative percent differences (RPDs) (40.5% and 40.2%, respectively) being above EPA's control limits for soil (±35% RPD, ±2X CRDL). The data are usable because the RPDs reflect soil heterogeneity and do not affect method precision.
	0253-95-0034		Arsenic in one sample had percent recovery in the analytical spike outside established limits (85 to 115%). The datum is qualified as J and is usable because the detected value is almost an order of magnitude below the background UTL. The low bias (78.7%) does not affect the data comparison.
	0253-95-0036		Selenium in one sample had percent recovery in the analytical spike outside established limits (85 to 115%). The datum is qualified as UJ and is usable because the recovery (76.8%) was sufficient to detect and quantify the analyte.
	0253-95-0028, -0030, -0032		Cobalt was detected in one of the blanks at a concentration below or equivalent to the method detection limits (MDLs). The sample concentrations in three samples are incorrectly qualified as J. However, the sample concentrations were less than 5X the blank value and should be qualified as U. The data are usable as nondetects.

TABLE 7.2-2

RADIONUCLIDES WITH CONCENTRATIONS AT OR ABOVE BACKGROUND SCREENING VALUES FOR PRS 53-008

Sample ID	Location ID	Depth (in.)	Cesium-134 (pCi/g)	Cobalt-60 (pCi/g)	Manganese-54 (pCi/g)
SALs	N/A	N/A	1.9	1.1	3.5
0253-95-0028	53-1069	0-6	-0.05(U)	0.01(U)	-0.02(U)
0253-95-0029	53-1070	0-6	6.2	2.7	0.5
0253-95-0030	53-1071	0-6	-0.02(U)	0.09(U)	0.03(U)
0253-95-0031	53-1072	0-6	0.05(U)	0.09(U)	0.07(U)
0253-95-0032	53-1073	0-6	-0.004(U)	-0.007(U)	0.04(U)
0253-95-0033	53-1074	0-6	0.003(U)	0.1	0.05(U)
0253-95-0034	53-1075	0-6	-0.03(U)	0.009(U)	0.02(U)
0253-95-0035	53-1076	0-6	0.02(U)	-0.005(U)	0.1(U)
0253-95-0036	53-1077	0-6	0.03(U)	0.05(U)	-0.02(U)
0253-95-0037	53-1078	0-6	0.005(U)	0.02(U)	0.04(U)
0253-95-0038	53-1079	0-6	-0.003(U)	0.02(U)	-0.009(U)

Note: Boxes with dark borders indicate detects and darkened boxes indicate detects above SALs.

ANNEX 7.3

SITE MAP

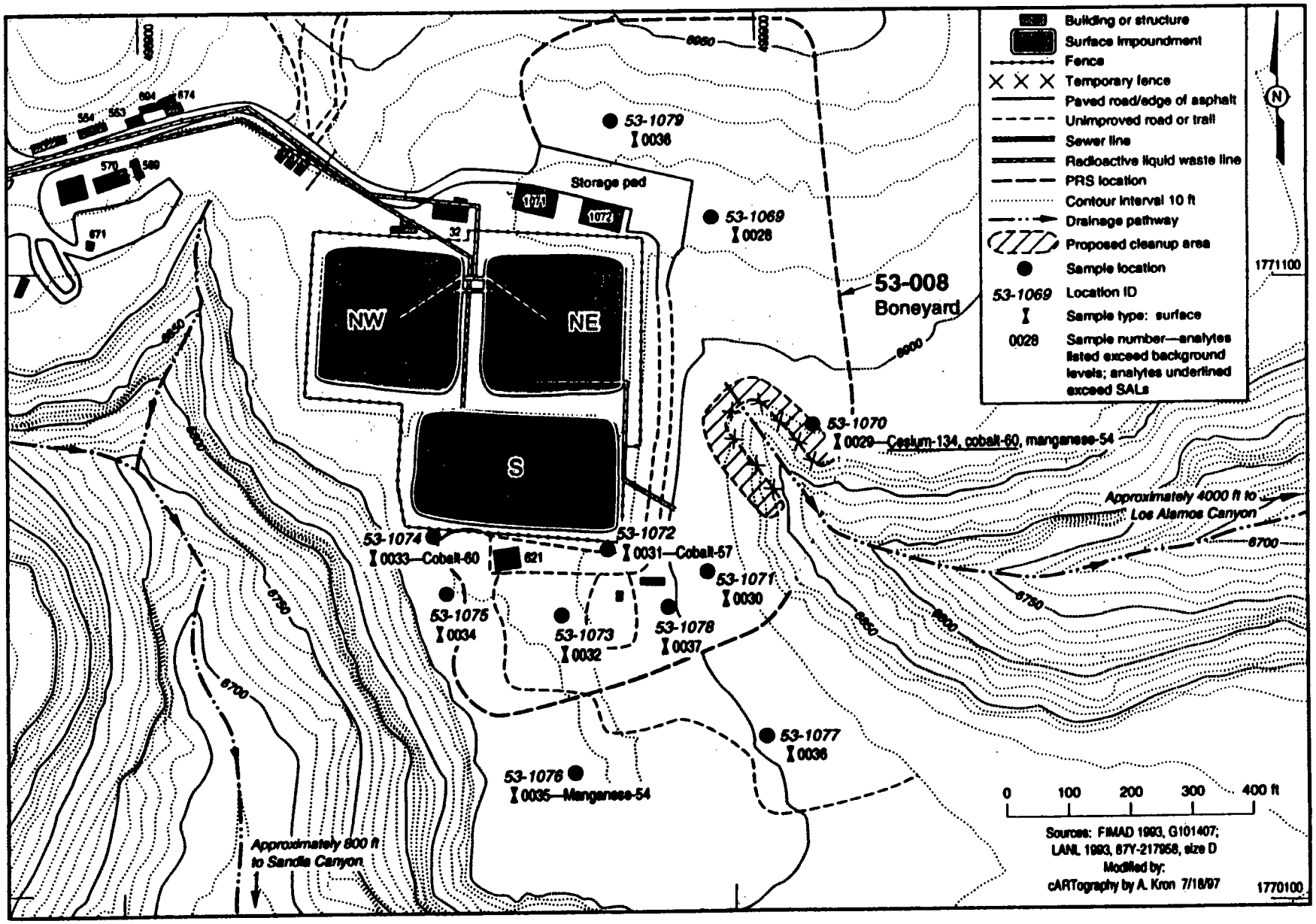

Figure 7.3-1. Site Map for PRS 53-008.

ANNEX 7.4

IMPLEMENTATION SOPS

See Environmental Restoration Standard Operating Procedures, Volumes I and II, November 17, 1993, Los Alamos National Laboratory

ANNEX 7.5

QUALITY ASSURANCE PLAN

See Quality Program Plan and Quality Assurance Project Plan for Environmental Restoration, February 1995 revision, Los Alamos National Laboratory.

ANNEX 7.6

SITE-SPECIFIC HEALTH AND SAFETY PLAN

Prior to initiation of any work, a completed Site Specific Health and Safety Plan (SSHASP) will be approved by LANL representatives, including the Explosives Review Committee. This Site-Specific Health and Safety Plan (SSHASP) will be developed for the Environmental Restoration (ER) Project at the Los Alamos National Laboratory (LANL) to comply with applicable federal and state occupational health and safety (HS) requirements, including those of the US Department of Energy (DOE). The DOE requires LANL to comply with the federal Occupational Safety and Health Administration (OSHA) requirements, although operations at LANL are not subject to the jurisdiction of OSHA. The ER Project has developed a generic Health and Safety Plan, the ER Project Health and Safety Plan (HASP), which establishes HS information and requirements applicable to ER field operations project wide. The SSHASP establishes site-specific HS information and requirements applicable to the scope of work described in Section 2.

ER participants are responsible for conducting work in accordance with applicable regulations. The term "ER participants" refers to anyone performing ER work, including LANL, subcontractors to LANL and their lower-tier contractors, consultants, and agents. In some cases within this document, LANL has chosen to invoke OSHA and LANL requirements that ordinarily may not apply to ER field operations (e.g., OSHA's general industry standards in Part 1910 of Title 29 of the Code of Federal Regulations [29 CFR 1910]). These choices were made on a case-by-case basis to maintain consistency with LANL's as low as reasonably achievable (ALARA) policy and to clarify LANL's expectations with regard to interpretable requirements of the multiple agencies governing ER work. Where there is concern that implementation of work orders or HS requirements would conflict with contract terms, or that they could unreasonably compromise the safety or health of an individual or the environment, such concerns should immediately be brought to the attention of the Contract Administrator and the Field Unit HS Representative. Failure to comply with terms of HS plans may constitute cause to stop an activity or to issue a stop work order, as specified in Section 3.4.2 of the HASP, without cost or penalty to LANL.

This SSHASP shall be reviewed and approved in accordance with Section 1.2 of the HASP. Once this SSHASP has been approved, revisions will be tracked using a SSHASP modification form (Appendix B of the HASP) per Section 1.3 of the HASP. Modifications to this SSHASP may result in a change to the terms or scope of a subcontract. Completion of an SSHASP modification form is <u>not</u> the means for modifying the scope or terms of the project contract. To modify a contract, the Subcontractor shall notify the Contract Administrator and Field Unit HS Representative under the changes clause and shall not proceed with the change until a change order has been mutually agreed upon by all parties, or unless unilateral direction is given by the Contract Administrator.

The SSHASP will be presented in a format similar to this example:

1.0 Introduction

2.0 Background Information

Table 2-1 Site Description(s)
Table 2-2 Scope of Work

3.0 Organization, Responsibilities and Authority

4.0 Hazard Analysis
4.1 Personnel by Task
4.2 Hazard Substances of Occupational Health Concern
4.3 Hazard Assessment and Administrative/Engineering Controls

5.0 Site Controls

6.0 Exposure Monitoring and Corresponding Actions

6.1 Direct-Reading Monitoring
6.2 Personal Dosimetry
6.3 Area Sampling

7.0 Personal Protective Equipment

8.0 Decontamination

9.0 Emergency/Incident Action Plan

10.0 Training

11.0 Medical Surveillance

12.0 Quality Control and Quality Assurance (QC/QA)

13.0 Recordkeeping

Appendixes

A Map(s) of Site Locations and Site Control Zones/Facilities
B Hazardous Substance - Hazard Assessment
C Chemical, Physical, and Toxicological Properties of Hazardous Chemical Substances
D Emergency Contacts and Route(s) to Medical Services

ANNEX 7.7

WASTE MANAGEMENT CHECKLIST

WASTE CHARACTERIZATION STRATEGY FORM

OU Number/FU	PRS/SWMU Number	Title
1100/FU2	53-008	Boneyard (surface storage area)
All Waste Types or Wastestreams: Soil, PPE and waste handling equipment, and decontamination liquids		

Completed By: J. W. Heyser	Date: July 18, 1997
FPL: T. E. Gene Gould	WMC: Jeff Bingham EES-15
Type of Activity (site investigation, EC, etc.): VCA	

Description of the Activity (e.g., drilling, surface sampling, excavation and recontouring, soil washing, etc.)

At PRS 53-008, soil contaminated with radionuclides (see description below) will be put in B-25 containers. The soil removed will be analyzed for TCLP metals, SVOCs, VOAs, PCBs, pesticides, tritium, and by a gamma scan.

Acceptable Knowledge

Site Description, Site History, and Historical Waste Generating Processes or Activities: (Include dates for site history):

PRS 53-008 is a 3 to 4 acre boneyard (surface storage area) located adjacent to the surface impoundments PRSs 53-002(a) and (b). It can be accessed by road only through a locked gate. Over time the area has contained several trailers and drums with unknown contents described as radioactively contaminated. The RFA inspection in September 1993 observed shielding blocks (both magnetite and steel), concrete, steel and other metallic debris. No hazardous chemicals were observed, except in Building TA-53-621 at the south end of the boneyard, which was identified as a "Lead Shed." No signs identified the boneyard as a radiological controlled area. Any radioactive contamination present was probably limited to the reinforcing steel and concrete shielding blocks that may have become internally activated by the LAMPF beam line. This PRS is recommended for NFA status for RCRA constituents.

Previous Investigation Analytical Results: (Report the analytical methods and results above background levels)

During Phase I, seven samples were analyzed for TAL metals and/or by a gamma scan. Maximum TAL metals detected were arsenic (4.0 mg/kg), barium (97 mg/kg), cadmium (3.0 mg/kg), chromium (8.1 mg/kg), lead (13.9 mg/kg), mercury (0.80 mg/kg), selenium (4.0 mg/kg) and silver (2.0 mg/kg). Maximum radionuclides detected were cesium-134 (6.22 pCi/g), cobalt-57 (0.075 pCi/g), cobalt-60 (2.69 pCi/g) and manganese-54 (0.46 pCi/g).

WASTE CHARACTERIZATION STRATEGY FORM

OU Number/FU	PRS/SWMU Number	Title
1100/FU2	53-008	Boneyard (surface storage area)
Specific Waste Type: Soil		

Waste Description

Description of Waste Type, Potential Contaminants, Volume Estimate, and Waste Packaging:

Waste Type Description: Soil.
Potential Regulatory Status: Low-level radioactive waste.
Volume Estimate: Four B-25 containers (3 cu. yds each).
Waste Packaging: Soil will be placed directly in the B-25 containers located onsite.

Characterization Strategy

Description of Strategy:

One representative sample will be taken from each B-25 container. The soil will be analyzed for TCLP metals, SVOCs, VOAs, PCBs, pesticides, tritium, and by a gamma scan. Field screening with hand-held instruments will be used to monitor for alpha, beta and gamma radiation.

Waste Sampling*: (If sampling will be used, indicate how many grab or composite samples will be collected per container or volume of waste and whether the waste is considered homogeneous or heterogeneous.)

Composite sampling will be used, because the waste is fairly homogenous. Each composite sample will consist of at least five subsamples. VOAs will be analyzed from separate grab samples.

* Grab sampling is appropriate for wastes that are fairly homogeneous, such as liquid wastes.
* Composite sampling is appropriate for wastes that are heterogeneous, such as soil, sediment, and debris.

Analytical Strategy

Analyte Category	Analytical Method	May be Present (yes, no, unknown)	Direct Sampling of Containerized Waste	Acceptable Knowledge Existing Information	Acceptable Knowledge Data from Proposed Site Characterization
Volatile Organic Constituents	SW 846 8260	Unk	X		
Semivolatile Constituents	SW 846 8270	Unk	X		
Organic Pesticides		Unk	X		
Organic Herbicides		No		X	

WASTE CHARACTERIZATION STRATEGY FORM

OU Number/FU	PRS/SWMU Number	Title
1100/FU2	53-008	Boneyard (surface storage area)
Specific Waste Type: Soil		

Analyte Category	Analytical Method	May be Present (yes, no, unknown)	Direct Sampling of Containerized Waste	Acceptable Knowledge Existing Information	Acceptable Knowledge Data from Proposed Site Characterization
Pesticides and PCBs		No		X	
PCBs		Unk	X		
Total Metals		Yes		X	
Total Cyanide		No		X	
Other Inorganic Constit.(specify)		No		X	
High Explosive Con.		No		X	
Asbestos		No		X	
TPH		No		X	
TCLP Metals	SW 846 1311, 6010	Yes	X		
TCLP Organics		No		X	
TCLP Pest. & Herb.		No		X	
Gross Alpha	Field	Yes	X	X	
Gross Beta	screen	Yes	X		
Gross Gamma	"	Yes	X		
Tritium[1]	HASL300	Unk	X		
Gamma Spectro.	HASL300	Yes	X		
Isotopic Plutonium		No		X	
Total Plutonium		No		X	
Isotopic Uranium		No		X	
Total Uranium		No		X	
Strontium-90		No		X	
Americium-241		No		X	

[1] If tritium is not expected, attach a statement signed by the FPL stating that, based on a review of the available information and professional judgment, it is not necessary to sample for tritium at this site.

WASTE CHARACTERIZATION STRATEGY FORM

OU Number/FU	PRS/SWMU Number	Title
1100/FU2	53-008	Boneyard(surface storage area)
Specific Waste Type: Soil		

Preliminary RCRA Determination

Based on available information, indicate the waste and whether it could potentially be any of the wastes as defined in 40 CFR 261. List the F-, D-, K-, P-, or U- category and number.

In Phase I sampling, TAL metals were all below their respective TC screening levels. Radionuclides were present in the soil and their removal is the reason for this VCA. The waste is expected to be non-RCRA but low-level radioactive. A final RCRA determination will be made after the soil sample results are evaluated.

Preliminary RCRA Status

_X_ Non-RCRA: (No 90-Day Storage Requirement)
Describe how waste will be stored/handled:
Soil wastes will be stored onsite in a sealed B-25 containers until the soil analyses are evaluated.

____ RCRA: (90-Day Storage Requirement)
Waste will be stored/handled in accordance with 20 NMAC Generator Requirements

Preliminary Determination for Radioactivity

Based on available information, indicate the amount and type of radiation contamination expected in the waste.

In Phase I sampling, several radionuclides were detected including cesium-134, cobalt-57 and -60, and manganese-54. The soil is expected to be low-level radioactive waste. A final determination as to its radioactive status will be based on an evaluation of the soil results.

Preliminary Radioactivity Status

____ Material is not radioactive
Describe how waste will be stored/handled

_X_ Material is radioactive
Describe the controlled area, labeling, and protection against inadvertent contamination
The B-25 containers will be labeled as a storage area for radioactive materials.

WASTE CHARACTERIZATION STRATEGY FORM

OU Number/FU	PRS/SWMU Number	Title
1100/FU2	53-008	Boneyard (surface storage area)
Specific Waste Type: PPE and waste handling equipment		

Waste Description

Description of Waste Type, Potential Contaminants, Volume Estimate, and Waste Packaging:

Waste Type Description: PPE & waste handling equipment.
Potential Regulatory Status: Visibly contaminated items will be considered low-level radioactive or non-hazardous waste (based on the radiological field screening results of the soil removed). Visibly uncontaminated items will be considered non-hazardous or radioactive waste based on the field screening results.
Volume Estimate: The volume generated will be less than two 55-gal. drums.
Waste Packaging: The PPE will be placed in sealed plastic bags labeled with the PRS number, and then placed inside 55-gal drums.

Characterization Strategy

Description of Strategy: If possible, the PPE/waste handling equipment will be decontaminated prior to disposal. After decontamination the PPE/sampling equipment will be field screened for gross alpha, gross beta and gross gamma radiation in accordance with LANL-ER-SOP-10.07, "Field Monitoring for Surface and Volume Radioactivity Levels." Gross alpha radiation will be screened using an alpha probe, gross beta radiation will be screened using a beta/gamma probe, and gross gamma radiation will be screened using a Ludlum Model 2221 Scaler/Ratemeter with a Ludlum Model 44-10 2" x 2" Gamma Scintillator (SPA-3), which is equivalent to micro-R. The waste will be inspected to determine if there is any visible contamination. If it is not visibly contaminated and does not have readings above background radioactivity, it will be placed in plastic bags, segregated by PRS, and disposed of as non-hazardous waste.
If the PPE/sampling equipment is not decontaminated or if decontamination is not effective, the contaminated piece(s) will be placed in separate plastic bags, segregated by PRS. Each plastic bag will be labeled with the PRS number. The RCRA and radioactivity status of the contaminated items will be based the analytical results of soil samples associated with this PRS (See Analyte Suite section of this form). Visibly contaminated PPE/sampling equipment will be assumed to have a similar level of contamination as the highest level reported in a single soil sample at this PRS.
Waste Sampling*: (If sampling will be used, indicate how many grab or composite samples will be collected per container or volume of waste and whether the waste is considered homogeneous or heterogeneous.)
The PPE/sampling equipment will not be directly sampled, but will be characterized as described above.

* Grab sampling is appropriate for wastes that are fairly homogeneous, such as liquid wastes.
* Composite sampling is appropriate for wastes that are heterogeneous, such as soil, sediment, and debris.

Analytical Strategy

Analyte Category	Analytical Method	May be Present (yes, no, unknown)	Direct Sampling of Containerized Waste	Acceptable Knowledge Existing Information	Acceptable Knowledge Data from Proposed Site Characterization
Volatile Organic Cons.		Unk			X
Semivolatile Cons.		Unk			X
Organic Pesticides		Unk			X
Organic Herbicides		No		X	

WASTE CHARACTERIZATION STRATEGY FORM

OU Number/FU	PRS/SWMU Number	Title
1100/FU2	53-008	Boneyard (surface storage area)
Specific Waste Type: PPE and waste handling Equipment		

Analyte Category	Analytical Method	May be Present (yes, no, unknown)	Direct Sampling of Containerized Waste	Acceptable Knowledge Existing Information	Acceptable Knowledge Data from Proposed Site Characterization
Pesticides and PCBs		No		X	
PCBs		Unk			X
Total Metals		Yes		X	
Total Cyanide		No		X	
Other Inorganic Constit.(specify)		No		X	
High Explosive Con.		No		X	
Asbestos		No		X	
TPH		No		X	
TCLP Metals		Yes			X
TCLP Organics		No		X	
TCLP Pest. & Herb.		No		X	
Gross Alpha	Field	Yes	X		
Gross Beta	Screen	Yes	X		
Gross Gamma	"	Yes	X		
Tritium[2]		Unk			X
Gamma Spectro.		Yes			X
Isotopic Plutonium		No		X	
Total Plutonium		No		X	
Isotopic Uranium		No		X	
Total Uranium		No		X	
Strontium-90		No		X	
Americium-241		No		X	

[2] If tritium is not expected, attach a statement signed by the FPL stating that, based on a review of the available information and professional judgment, it is not necessary to sample for tritium at this site.

WASTE CHARACTERIZATION STRATEGY FORM

OU Number/FU	PRS/SWMU Number	Title
1100/FU2	53-008	Boneyard (surface storage area)
Specific Waste Type: PPE and waste handling equipment		

Preliminary RCRA Determination

Based on available information, indicate the waste and whether it could potentially be any of the wastes as defined in 40 CFR 261. List the F-, D-, K-, P-, or U- category and number.

During Phase I sampling, radionuclides were detected in the soil samples. Soil wastes will be sampled for SVOCs, VOAs, pesticides, PCBs, TCLP metals, tritium and by a gamma scan. A final RCRA determination for the visibly contaminated PPE/waste handling equipment will be based on an evaluation of the soil sample results. Visibly uncontaminated PPE/waste handling equipment with no elevated radiation will be managed as non-hazardous waste until disposal.

Preliminary RCRA Status

__X__ Non-RCRA: (No 90-Day Storage Requirement)

Describe how waste will be stored/handled:

Visibly uncontaminated PPE/waste handling equipment will be stored on site in sealed containers until it is disposed.

__X__ RCRA: (90-Day Storage Requirement)

Waste will be stored/handled in accordance with 20 NMAC Generator Requirements

Visibly contaminated PPE/waste sampling equipment will be placed in labeled and sealed plastic bags and stored onsite in a 55-gal drum until the soil analyses are evaluated and a final waste determination is made.

Preliminary Determination for Radioactivity

Based on available information, indicate the amount and type of radiation contamination expected in the waste.

The soil at this PRS is contaminated with radionuclides, so the visibly contaminated waste may also be contaminated. This waste will be stored onsite and evaluated as described above.

Preliminary Radioactivity Status

__X__ Material is not radioactive

Describe how waste will be stored/handled

Visibly uncontaminated waste with no above background radiation will be managed as non-radioactive waste until it is disposed.

__X__ Material is radioactive

Describe the controlled area, labeling, and protection against inadvertent contamination

Visibly contaminated waste will be stored onsite in a container labeled as a storage area for radioactive materials until a final determination is made about its radioactive status.

WASTE CHARACTERIZATION STRATEGY FORM

OU Number/FU	PRS/SWMU Number	Title
1100/FU2	53-008	Boneyard (surface storage area)
Specific Waste Type: Decontamination liquids		

Waste Description

Description of Waste Type, Potential Contaminants, Volume Estimate, and Waste Packaging:

Waste Type Description: Decontamination liquids consist of Liquinox® detergent, tap water and distilled water.
Potential Regulatory Status: Low-level radioactive liquid waste.
Volume Estimate: A total volume of less than 30 gallons.
Waste Packaging: The liquid will be placed inside a 55-gallon drum.

Characterization Strategy

Description of Strategy:

The decontamination liquids will be characterized for RCRA based on the results of an analysis of a grab liquid sample. The decontamination liquids from this PRS will placed in a separate drum and labeled with the PRS number. Further analyses may be required to meet the waste acceptance criteria of a TSD after the hazard and radioactive determination is made for the decon. liquids. Disposal sites could be the TA-46 SWSC sewer plant, if the liquids are non-hazardous and non-radioactive. If they are either hazardous or radioactive, disposal may be at the TA-50 TSD or at another approved TSD.

Waste Sampling*: (If sampling will be used, indicate how many grab or composite samples will be collected per container or volume of waste and whether the waste is considered homogeneous or heterogeneous.)

One grab sample of the decontamination liquids will be analyzed for TAL metals, SVOCs, and by a gamma scan. A grab sample was selected because the waste is expected to be homogeneous. One sample per waste stream was considered sufficient because of the small volume of the waste stream (less than 30 gallons).

- Grab sampling is appropriate for wastes that are fairly homogeneous, such as liquid wastes.
- Composite sampling is appropriate for wastes that are heterogeneous, such as soil, sediment, and debris.

Analytical Strategy

Analyte Category	Analytical Method	May be Present (yes, no, unknown)	Direct Sampling of Containerized Waste	Acceptable Knowledge Existing Information	Acceptable Knowledge Data from Proposed Site Characterization
Volatile Organic Con.		Unk			X
Semivolatile Constituents	SW 846 8270	Unk	X		
Organic Pesticides		Unk			X
Organic Herbicides		No		X	
Pesticides and PCBs		No		X	
PCBs		No		X	

WASTE CHARACTERIZATION STRATEGY FORM

OU Number/FU	PRS/SWMU Number	Title
1100/FU2	53-008	Boneyard (surface storage area)
Specific Waste Type: Decontamination liquids		

Analytical Strategy (Continued)

Analyte Category	Analytical Method	May be Present (yes, no, unknown)	Direct Sampling of Containerized Waste	Acceptable Knowledge Existing Information	Acceptable Knowledge Data from Proposed Site Characterization
Total Metals	SW 846 6010	Yes	X		
Total Cyanide		No		X	
Other Inorganic Constit. (specify)		No		X	
High Explosive Con.		No		X	
Asbestos		No		X	
TPH		No		X	
TCLP Metals		Yes			X
TCLP Organics		No		X	
TCLP Pest. & Herb.		No		X	
Gross Alpha	Field	Unk			X
Gross Beta	Screen	Unk			X
Gross Gamma	"	Unk			X
Tritium[3]		Unk			X
Gamma Spectroscopy	HASL300	Unk	X		
Isotopic Plutonium		No		X	
Total Plutonium		No		X	
Isotopic Uranium		No		X	
Total Uranium		No		X	
Strontium-90		No		X	
Americium-241		No		X	

[3] If tritium is not expected, attach a statement signed by the FPL stating that, based on a review of the available information and professional judgment, it is not necessary to sample for tritium at this site.

WASTE CHARACTERIZATION STRATEGY FORM

OU Number/FU	PRS/SWMU Number	Title
1100/FU2	53-008	Boneyard (surface storage area)
Specific Waste Type: Decontamination liquids		

Preliminary RCRA Determination

Based on available information, indicate the waste and whether it could potentially be any of the wastes as defined in 40 CFR 261. List the F-, D-, K-, P-, or U- category and number.

During Phase I sampling, several radionuclides were detected by gamma spectroscopy. However, all TAL metals were below their TC screening levels. The decon. liquids are expected to be non-hazardous and non-radioactive. A final RCRA determination will be made after the liquid sample results are evaluated.

Preliminary RCRA Status

__X__ Non-RCRA: (No 90-Day Storage Requirement)
Describe how waste will be stored/handled:
Wastes will be stored onsite in a sealed container until the results of the liquid samples are evaluated.

_____ RCRA: (90-Day Storage Requirement)
Waste will be stored/handled in accordance with 20 NMAC Generator Requirements

Preliminary Determination for Radioactivity

Based on available information, indicate the amount and type of radiation contamination expected in the waste.
The soil at this PRS contains low-levels of several radionuclides (See page 1). However, the decon. liquids used to clean the PPE/waste handling equipment are not expected to contain sufficient radionuclides to make them radioactive. A final determination as to their radioactive status will be made after the liquid sample results are evaluated.

Preliminary Radioactivity Status

__X__ Material is not radioactive
Describe how waste will be stored/handled
The wastes will be stored onsite in a sealed container until the sample results are evaluated.

_____ Material is radioactive
Describe the controlled area, labeling, and protection against inadvertent contamination

WASTE CHARACTERIZATION STRATEGY FORM

OU Number/FU	PRS/SWMU Number	Title
1100/FU2	53-008	Boneyard (surface storage area)
Waste Types or Wastestreams: Soil, PPE and waste handling equipment, and decontamination liquids		

Signatures:

Field Team Leader _____

Field Team Waste Management Coordinator _____

Waste Management Representative _____

ANNEX 7.8

VCA CHECKLIST AND FIELD WORK AUTHORIZATION FORM

Voluntary Corrective Action (VCA)
Checklist and Fieldwork Authorization Form

PRS No. 53-008 HSWA or AOC

X_____ COPC(s) defined.

X_____ Nature and extent defined or field screening method available to guide where not defined.

X_____ Remedy is obvious.

X_____ Time for removal is less than 6 months.

X_____ Remedy is final.

X_____ Land use assumptions straightforward.

X_____ Treatment, Storage, Disposal Facilities are available for waste type and volume.

X_____ Cleanup cost is reasonable for the planned action, and meets accelerated decision logic criterion for decision to proceed with VCA.

Explain criteria not checked above._____

_____

_____

Through reviewing the above criteria associated with this site, I believe that a VCA is the appropriate Accelerated Cleanup approach.

FPL _____ Date _____

FPC _____ Date _____

The undersigned have reviewed the final plan and believe that it fully satisfies the appropriate Accelerated Cleanup approach.

FPL _____ Date _____

FPC _____ Date _____

Through reviewing the VCA Plan, for site(s) **53-008** and believing that the above criteria have been met, I authorize the fieldwork to proceed.

DOE ER Program Manager_____ Date_____

ANNEX 7.9

COST ESTIMATE

Table 7.9.1 is a cost estimate for PRS 53-008.

TABLE 7.9-1

COST ESTIMATE FOR PRS 53-008

Plan Development	$ 1,500
Mobilization	$ 2,000
Cleanup	$15,000
Verification Sampling	$10,000
Waste Disposal	$25,000
Field Screening	$ 2,000
Demobilization/Restore Site	$ 1,000
Reporting	$ 1,500
Total Cost	$58,000

8.0 REFERENCES

EPA (US Environmental Protection Agency), August 1987. "RCRA Facility Assessment (RFA)—Preliminary Review/Visual Site Inspection (PR/VSI) Report of the Los Alamos National Laboratory, Los Alamos, NM, ID#NM 890010515," prepared for the EPA, Region VI, by A. T. Kearny and K. W. Brown & Assoc., Inc. (EPA 1987, 0816)

EPA (U.S. Environmental Protection Agency), February 1994. "USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review," EPA540/R-94/013, Washington, D.C. (EPA 1994, 1206)

Fribush, H.M., September 29, 1989. "J-Qualified CLP Data and Recommendations for Its Use," US Environmental Protection Agency memorandum, ER ID No. 56023, Washington, D.C. (Fribush 1989, ER ID No. 56023)

LANL (Los Alamos National Laboratory), May 1994. "RFI Work Plan for Operable Unit 1100," Los Alamos National Laboratory Report LA-UR-94-1097, Los Alamos, New Mexico. (LANL 1994, 1157)

Perona, R., April 12, 1996. "Derivation and Use of Radionuclide Soil Cleanup Guidelines," Los Alamos National Laboratory Report LA-UR-96-1985, Los Alamos, New Mexico. (Perona 1996, 1330)