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November 28, 2007

Nuclear Regulatory Commission
Decommissioning Branch
US Nuclear Regulatory Commission, Region III
2443 Warrenville Road, Suite 210
Lisle, IL 60532-4352

ATTN: George M. McCann

RE: License Amendment Request – License No. 24-13365-01, Amendment 34, Decommissioning Plan for Sanitary Lagoon and Drainfield

Mr. McCann;

Analytical Bio-Chemistry Laboratories is submitting the Decommissioning Plan for the Sanitary Lagoon and Drainfield. Enclosed is the Characterization Data and proposed Remediation Plan. Attachment (1) is the Derived Concentration Guidelines Values.

If you have any questions or need further information, please feel free to contact Sheila C. Hecht at 573-443-9070.

Sincerely,

G. Scott Ward

G. S Ward
Senior Vice President, Chief Administrative Officer

RECEIVED NOV 3 0 2007

NRC FORM 313 (10-2005) 10 CFR 30, 32, 33, 34, 35, 36, 39, and 40

U.S. NUCLEAR REGULATORY COMMISSION

APPLICATION FOR MATERIAL LICENSE

INSTRUCTIONS: SEE THE APPROPRIATE LICENSE APPLICATION GUIDE FOR DETAILED INSTRUCTIONS FOR COMPLETING APPLICATION. SEND TWO COPIES OF THE ENTIRE COMPLETED APPLICATION TO THE NRC OFFICE SPECIFIED BELOW.

APPLICATION FOR DISTRIBUTION OF EXEMPT PRODUCTS FILE APPLICATIONS WITH:

DIVISION OF INDUSTRIAL AND MEDICAL NUCLEAR SAFETY
OFFICE OF NUCLEAR MATERIALS SAFETY AND SAFEGUARDS
U.S. NUCLEAR REGULATORY COMMISSION
WASHINGTON, DC 20555-0001

ALL OTHER PERSONS FILE APPLICATIONS AS FOLLOWS:

IF YOU ARE LOCATED IN:

ALABAMA, CONNECTICUT, DELAWARE, DISTRICT OF COLUMBIA, FLORIDA, GEORGIA, KENTUCKY, MAINE, MARYLAND, MASSACHUSETTS, MISSISSIPPI, NEW HAMPSHIRE, NEW JERSEY, NEW YORK, NORTH CAROLINA, PENNSYLVANIA, PUERTO RICO, RHODE ISLAND, SOUTH CAROLINA, TENNESSEE, VERMONT, VIRGINIA, VIRGIN ISLANDS, OR WEST VIRGINIA, SEND APPLICATIONS TO:

LICENSING ASSISTANCE TEAM
DIVISION OF NUCLEAR MATERIALS SAFETY
U.S. NUCLEAR REGULATORY COMMISSION, REGION I
475 ALLENDALE ROAD
KING OF PRUSSIA, PA 19406-1415

IF YOU ARE LOCATED IN:

ILLINOIS, INDIANA, IOWA, MICHIGAN, MINNESOTA, MISSOURI, OHIO, OR WISCONSIN, SEND APPLICATIONS TO:

MATERIALS LICENSING BRANCH
U.S. NUCLEAR REGULATORY COMMISSION, REGION III
2443 WARRENVILLE ROAD, SUITE 210
LISLE, IL 60532-4352

ALASKA, ARIZONA, ARKANSAS, CALIFORNIA, COLORADO, HAWAII, IDAHO, KANSAS, LOUISIANA, MONTANA, NEBRASKA, NEVADA, NEW MEXICO, NORTH DAKOTA, OKLAHOMA, OREGON, PACIFIC TRUST TERRITORIES, SOUTH DAKOTA, TEXAS, UTAH, WASHINGTON, OR WYOMING, SEND APPLICATIONS TO:

NUCLEAR MATERIALS LICENSING BRANCH
U.S. NUCLEAR REGULATORY COMMISSION, REGION IV
611 RYAN PLAZA DRIVE, SUITE 400
ARLINGTON, TX 76011-4005

PERSONS LOCATED IN AGREEMENT STATES SEND APPLICATIONS TO THE U.S. NUCLEAR REGULATORY COMMISSION ONLY IF THEY WISH TO POSSESS AND USE LICENSED MATERIAL IN STATES SUBJECT TO U.S.NUCLEAR REGULATORY COMMISSION JURISDICTIONS.

1. THIS IS AN APPLICATION FOR *(Check appropriate item)*

- [ ] A. NEW LICENSE
- [x] B. AMENDMENT TO LICENSE NUMBER 24-13365-01
- [ ] C. RENEWAL OF LICENSE NUMBER

2. NAME AND MAILING ADDRESS OF APPLICANT *(Include ZIP code)*

Analytical Bio-Chemistry Laboratories, Inc.
7200 E. ABC Lane
Columbia MO 65202

3. ADDRESS WHERE LICENSED MATERIAL WILL BE USED OR POSSESSED

Analytical Bio-Chemistry Laboratories, Inc.
7200 E. ABC Lane
Columbia MO 65202

4. NAME OF PERSON TO BE CONTACTED ABOUT THIS APPLICATION

Sheila C. Hecht

TELEPHONE NUMBER

(573) 443-9070

SUBMIT ITEMS 5 THROUGH 11 ON 8-1/2 X 11" PAPER. THE TYPE AND SCOPE OF INFORMATION TO BE PROVIDED IS DESCRIBED IN THE LICENSE APPLICATION GUIDE.

5. RADIOACTIVE MATERIAL
a. Element and mass number; b. chemical and/or physical form; and c. maximum amount which will be possessed at any one time.

6. PURPOSE(S) FOR WHICH LICENSED MATERIAL WILL BE USED.

7. INDIVIDUAL(S) RESPONSIBLE FOR RADIATION SAFETY PROGRAM AND THEIR TRAINING EXPERIENCE.

8. TRAINING FOR INDIVIDUALS WORKING IN OR FREQUENTING RESTRICTED AREAS.

9. FACILITIES AND EQUIPMENT.

10. RADIATION SAFETY PROGRAM.

11. WASTE MANAGEMENT.

12. LICENSE FEES *(See 10 CFR 170 and Section 170.31)*

FEE CATEGORY	AMOUNT ENCLOSED $

13. CERTIFICATION. *(Must be completed by applicant)* THE APPLICANT UNDERSTANDS THAT ALL STATEMENTS AND REPRESENTATIONS MADE IN THIS APPLICATION ARE BINDING UPON THE APPLICANT.

THE APPLICANT AND ANY OFFICIAL EXECUTING THIS CERTIFICATION ON BEHALF OF THE APPLICANT, NAMED IN ITEM 2, CERTIFY THAT THIS APPLICATION IS PREPARED IN CONFORMITY WITH TITLE 10, CODE OF FEDERAL REGULATIONS, PARTS 30, 32, 33, 34, 35, 36, 39, AND 40, AND THAT ALL INFORMATION CONTANED HEREIN IS TRUE AND CORRECT TO THE BEST OF THEIR KNOWLEDGE AND BELIEF.

WARNING: 18 U.S.C. SECTION 1001 ACT OF JUNE 25, 1948 62 STAT. 749 MAKES IT A CRIMINAL OFFENSE TO MAKE A WILLFULLY FALSE STATEMENT OR REPRESENTATION TO ANY DEPARTMENT OR AGENCY OF THE UNITED STATES AS TO ANY MATTER WITHIN ITS JURISDICTION.

CERTIFYING OFFICER – TYPED/PRINTED NAME AND TITLE	SIGNATURE	DATE
G. Scott Ward. Sr. VP Chief Administrative Officer	G. Scott Ward	11/28/2007

FOR NRC USE ONLY

TYPE OF FEE	FEE LOG	FEE CATEGORY	AMOUNT RECEIVED	CHECK NUMBER	COMMENTS
			$		
APPROVED BY				DATE	

ABC Laboratories, Inc.

SHIPPING REQUEST FORM

All information must be properly filled out to insure no delays in shipping. All shipping request forms with packages must be in the Shipping area before 1:00 pm on the day of the shipment.

Material Description: NRC Permit Amendment	Amount (weight or volume):	Study #:

Complete Shipping Address *(P.O. Box Numbers NOT ACCEPTABLE)*

Company:NRC, Decommissioning Branch, NRC Region III		Attn: George McCann	
Address: 2443 Warrenville Road, Suite 210,		City: Lisle	
State:IL	Zip: 60532-4352	Country:US	Recipient Phone Number: (630) 829-9856

Materials Management (Use Only)

Tracking Number:	Date:

Type of Service Requested *(Check One)*

X Fed Ex Priority Overnight ☐ Fed Ex Standard Overnight ☐ Fed Ex Two Day

☐ Fed Ex Express Saver ☐ Standard US Mail

Type of Material

Yes	No			
☐	x	**DEA Controlled Substance**	Recipient's DEA License Number: (must have a current copy)	
☐	x	**Radioactive Material**	Isotope:	Total Activity:
☐	x	Recipient licensed to receive Radioactive Material	Recipient's NRC License Number:	
☐	x	**Flammable Liquid**	Identity of Material:	Amount
☐	x	**Corrosive Material**	Identity of Material:	Amount
☐	x	**Reactive Material**	Identity of Material:	Amount
☐	x	**Toxic or Infectious Material**	Identity of Material:	Amount
☐	x	**Other Hazards**	Identity of Material:	Amount

Approval

Requestor:Sheila Hecht	Date:29 Nov 2007

Radiation Safety Officer Approval (for radioactive material only): Date:

EH&S Manager Approval (for DEA controlled substances):

Packaging

xNone	☐ Dry Ice	☐ Wet Ice

Dry Ice Shipment

Weight of Each Box Shipped:	1.	2.	3.	4.	5.	6.	7.	8.
Dry Ice Weight per box:	1.	2.	3.	4.	5.	6.	7.	8.

Form FC-SR 1.003

Site Characterization and Remediation Plan in Support of Decommissioning for Analytical Bio-Chemistry Laboratories Sanitary Lagoon(s) and Drain-Field(s)

Authored By: Paul Nipper Date: 11/26/07
Paul Nipper, QA Manager, Bionomics, Inc.

Reviewed By: Sheila Hecht Date: 11/28/07
Sheila Hecht, Director Safety and Occupational Health, ABC Laboratories, Inc.

Approved By: Scott Ward Date: 11/28/07
Scott Ward, Senior Vice President, ABC Laboratories, Inc.

TABLE OF CONTENTS

1.0 INTRODUCTION

Analytical Bio-Chemistry Laboratories, Inc. requests that the NRC categorize this decommissioning as a Group 4 decommissioning "Unrestricted Release with Site-Specific Dose Analysis and No Ground Water Contamination; Decommissioning Plan Required." under NUREG 1757 "Consolidated NMSS Decommissioning Guidance" because subsurface (>15 cm depth) contamination is present in excess of the C-14 default screening value. From NUREG 1757: "Group 4 facilities have residual radiological contamination present in building surfaces and soils, but the licensee cannot meet, or chooses not to use, screening criteria, and the ground water is demonstrably not contaminated. The licensees are able to demonstrate that residual radioactive material may remain at their site but within the levels specified in NRC criteria for unrestricted use (10 CFR 20.1402, "Radiological Criteria for Unrestricted Use") by applying site-specific criteria in a comprehensive dose analysis.

This plan was developed using the guidance provided in NUREG 1757, "Consolidated NMSS Decommissioning Guidance" and NUREG 1575, "Multi Agency Radiation Survey and Site Investigation Manual" (MARSSIM). It will provide the approach, methods, and techniques for the radiological decommissioning of impacted areas of the facility. Final status surveys will be designed to implement the protocols and guidance provided in MARSSIM to demonstrate compliance with the project release criteria.

The site has been characterized and areas have been identified which require remediation in order to achieve unrestricted release. This plan identifies those areas with proposed remedial action. In brief, areas requiring remediation will be excavated down to a level which meets criteria for unrestricted use. Please note that additional geotechnical data may be required to support this scenario.

Excavated material will be disposed of at a commercial licensed facility. At this time it is anticipated that the material will be categorized as exempt material with final disposition at the US Ecology disposal site in Idaho. Please note an exemption request will be submitted to the NRC if the material meets the US Ecology site acceptance criteria. In the event the material does not meet the US Ecology acceptance criteria the proposed site would be the Energy Solutions disposal site in Utah.

The Analytical Bio-Chemistry (ABC) Laboratory facility is located at 7200 East ABC Lane in Columbia, Missouri adjacent to Interstate 70 approximately 3 miles northeast of the city of Columbia. The site is approximately 56 acres in size. As part of their contract testing services, the facility uses some radioactive materials, primarily 14C (Carbon-14) under the U.S. Nuclear Regulatory Commission (NRC) broad-scope license number 24-13365-01.

As part of the facility, a sanitary surface lagoon and drain-field as shown was built in 1986, as permitted by the Missouri Department of Natural Resources, to serve the facilities sanitary needs. In March of 2004, the facilities sewerage discharge was diverted to the Boone County Regional Sewer District and the use of the sanitary lagoon was discontinued. Through site operations, a small amount of 14C had been periodically discharged to the sanitary lagoon under the provisions as specified in the radioactive materials license. This material was very dilute and no other discharge of radioactive materials were authorized or allowed.

2.0 AREAS REQUIRING REMEDIATION

Based upon sample results and dose modeling, the primary area requiring remediation has been identified. This primary area is:

Sanitary Lagoon and Embankment Area (Berm)

Sample results indicate the removal of the sediment layer covering the clay liner to achieve release criteria. The sediment layer depth is from 0" to six inches deep. The clay liner also may require limited remediation. Anticipated excavation will be to a maximum depth of six inches. The estimated disposal volume is **21,345** cubic feet.

3.0 AREAS WITH ELAVATED LEVELS

The following areas have elevated levels of C-14 but are below the average DCGL of 89 picocuries per gram **(See Attachment One).** ***Selected areas*** within these areas will be subject to limited remediation as part of ABC Laboratories proactive approach thus assuring that ALARA objectives are achieved.

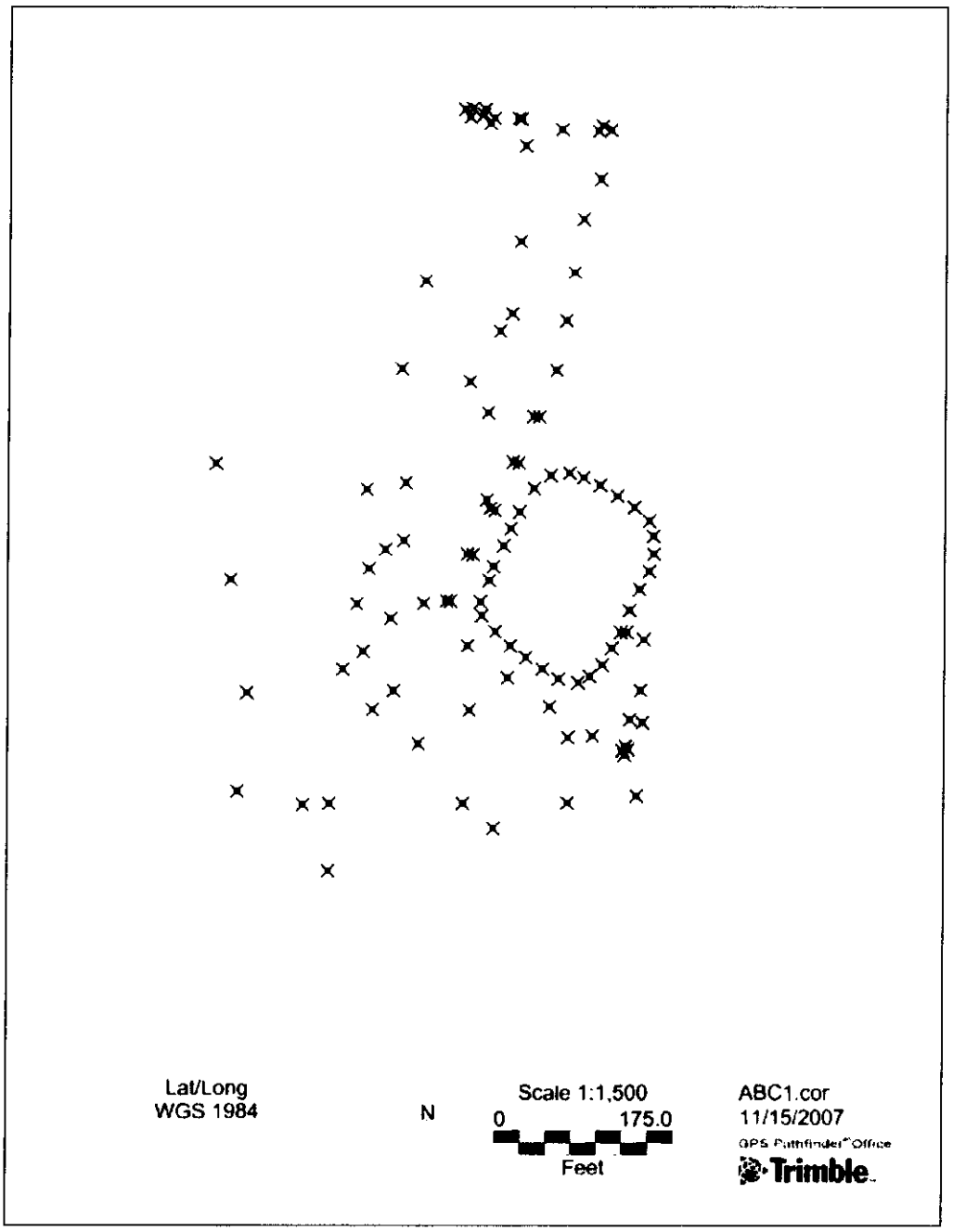
Field Application Area (Red Arrows) down-gradient of the Sanitary Lagoon.

Sample results indicate the removal of the topsoil in selected areas to achieve release criteria. The topsoil depth is from 0" to six inches deep. Anticipated excavation will be to a depth of six inches. The estimated disposal volume is **<2500** cubic feet.

Sanitary Lagoon Leach-field and soil surrounding System Piping

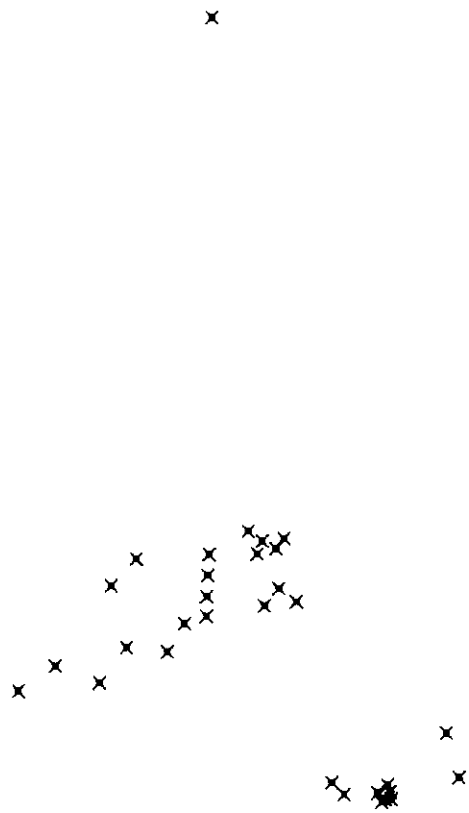
Areas to be remediated include discharge areas (4) of piping system as well as selected areas around and down gradient from the piping. It is estimated an area from the discharge ends of the piping will require removal to a depth of six inches and ten feet out from the pipe discharge outlets. The estimated disposal volume is **<1500** cubic feet.

4.0 GPS SAMPLE LOCATIONS



Note: Lagoon GPS locations were not obtained in the lagoon since this area will not require cross referencing for remediation purposes. Berm sample locations bound the perimeter of the lagoon.

Historical Ponds



Lat/Long
WGS 1984

N

Scale 1:1,700
0 200.0
Feet

ABC1.cor
11/15/2007
GPS Pathfinder® Office
Trimble.

5.0 CHARATERIZATION DATA SUMMARY

5.1 Background

Number of samples – 10
Results = <MDA

5.2 Sanitary Lagoon and Embankment Area (Berm)

5.2.1 Lagoon
5.2.1.1 Number of samples – 38
5.2.1.2 Results

High - 3750 pCi/g
Low – 13 pCi/g
Mean – 950 pCi/g

5.2.1 Top of Embankment
5.2.1.1 Number of samples – 30
5.2.1.2 Results

High – 2.8 pCi/g
Low - <MDA
Mean - <MDA

5.3 Field Application Area

5.3.1 Number of samples - 37
5.3.2 Results

High – 153 pCi/g
Low – <MDA
Mean – 40 pCi/g

5.4 Sanitary Lagoon Leach-field and surrounding System Piping

5.4.1 Number of samples - 32
5.4.2 Results

High – 247 pCi/g
Low - <MDA
Mean – 37 pCi/g

5.5 Historical sanitary Ponds Area

5.5.1 Number of samples - 20
5.5.2 Results

High – 5.1 pCi/g
Low - <MDA
Mean – <MDA pCi/g

5.6 Well Samples

5.6.1 Number of samples - 4
5.6.2 Results
5.6.2.1 Old Well – 197 pCi/L
5.6.2.2 Well #1 – 0 pCi/L
5.6.2.3 Well #2 – 525 pCi/L
5.6.2.4 Deep Well – 0 pCi/L

6.0 REMEDIATION PLAN

This plan will be implemented to achieve unrestricted release of the impacted areas. It is the intent of ABC Laboratories to conduct all remediation activities in a safe and compliant manner in order to safeguard the public, environment and remediation workers during the excavation, packaging and disposal phases. Remediation work will be performed by ABC employees and/or trained contractors. Contractor activities shall be performed under the terms and conditions of NRC License number 24-13365-01 as well as any site operating procedures developed pertaining to this plan. Specific operating procedures will be developed for implementing the remediation plan. All personnel involved directly or indirectly will be trained in their areas of responsibilities.
Areas to be addressed are listed below.

6.1 Health & Safety
The primary radiological hazard associated with this project will be from the generation of possible airborne contamination during excavation and packaging operations. During these activities air sampling will be employed. Measures such as misting of soil prior to removal may be required to mitigate these concerns.

6.2 Excavation and Packaging
The primary hazards associated with this project will be from working on and around mechanical equipment. Standard safeguards will be taken and addressed in the field operating procedures.

6.3 Additional Sampling Requirements
Additional sampling will be required during the remediation phase to assure removal of material has been accomplished as well as providing additional data for use in the FSS. These samples must be handled in accordance with approved procedures so that data is verifiable.

6.4 Disposal Shipments
At a minimum all shipments and packaging will meet DOT requirements for the material being shipped for disposal. Disposal site waste acceptance criteria will also apply. It is anticipated this material will not be classified as a Class 7 radioactive material.

7.0 FINAL STATUS SURVEYS

Final status surveys will be performed to demonstrate that residual radioactivity in each survey unit satisfies the predetermined criteria for release for unrestricted use. The final status survey will be conducted using the Data Quality Objective (DQO) process. Characterization and remedial action survey data will be used as final status survey data to the maximum extent possible in order to minimize overall project costs.

Final status surveys will be conducted by performing soil sampling at locations determined by MARSSIM protocols and areas of remediation. Since scanning is not suitable for C-14, alternate means must be employed to ensure the area bounded by sample locations is sufficient to ensure small areas of elevated activity concentrations do not exist above the site specific DCGL.

Final Report

A final status report will be developed describing project activities and the radiological status of the site. The guidance provided in NUREG 1757 will be used to determine the appropriate content and format of the final report.

ATTACHMENT ONE

Derived Concentration Guideline Values for Analytical Bio-Chemistry Laboratories

Resident Farmer Exposure Scenario/Critical Group

Analytical Bio-Chemistry Laboratories
7200 East ABC Lane
Columbia, MO

Prepared by Safety and Ecology Corporation

November 26, 2007

Table of Contents

1 Introduction

This document has been prepared by Safety and Ecology Corporation (SEC) on behalf of Bionomics, to document the derivation of Derived Concentration Guideline Values (DCGLs) for the unrestricted release of the Analytical Bio-Chemistry (ABC) Laboratories Sanitary Lagoon(s) and Drain-Field(s) (SLDF) in Columbia, Missouri, post remediation.

A dose model was used to derive DCGLs that would result in a dose (total effective dose equivalent or TEDE) to the critical group below the selected standard. The DCGL values are used to plan remediation activities and to demonstrate compliance with the selected standard at the completion of remediation. The cleanup standards and methodology found in 10 Code of Federal Regulations (CFR) 20.1402 "Radiological Criteria for Unrestricted Use". The DCGLs, were developed in accordance with 10 CFR 20.1402, which states:

> "A site will be considered acceptable for unrestricted use if the residual radioactivity that is distinguishable from background radiation results in a TEDE to an average member of the critical group that does not exceed 25 mrem (0.25 mSv) per year, including that from groundwater sources of drinking water, and the residual radioactivity has been reduced to levels that are as low as reasonably achievable (ALARA)."

The scenario, the critical group, and the exposure pathways define a dose model. The Resident Farmer Scenario was selected to model exposure from the SLDF area for the next 1000 years. The Resident Farmer Scenario includes exposure from the following exposure pathways:

- Direct exposure to external radiation from the contaminated soil material;
- Internal dose from inhalation of airborne radionuclides, excluding radon progeny; and
- Internal dose from ingestion of
  - Plant foods grown in the contaminated soil and irrigated with contaminated water,
  - Meat and milk from livestock fed with contaminated fodder and water,
  - Drinking water from a contaminated well or pond,
  - Fish from a contaminated pond, and
  - Contaminated soil.

The RESidual RADadioactivity (RESRAD) code was selected for modeling the resident farmer scenario. The deterministic mode of RESRAD Version 6.3 was used for the calculation of TEDEs and DCGLs for the urban resident.

Site specific input parameter values were used where available. For the majority of additional inputs for which no site specific value was available, the default (conservative) value was used.

The remainder of this report is structured as follows: Chapter 2 provides the details of the assumptions and the non-default RESRAD input parameter values used, Chapter 3 provides a summary table of all of the RESRAD input parameters, Chapter 4 presents a summary of the dose assessment results, Chapter 5 presents supporting documentation including RESRAD output files and graphs and Chapter 6 references.

2 Assumptions and Input Parameter Values

2.1 Dose Assessment

The RESRAD code with the resident farmer scenario was selected with all environmental and exposure pathways active, except radon. Figure 1 illustrates the exposure pathways. Figure 2 is an illustration of the RESRAD model cover, contaminated zone, unsaturated zone, and saturated zone strata post remediation.

Figure 1 – RESRAD Environmental and Exposure Pathways – SLDF excludes Radon

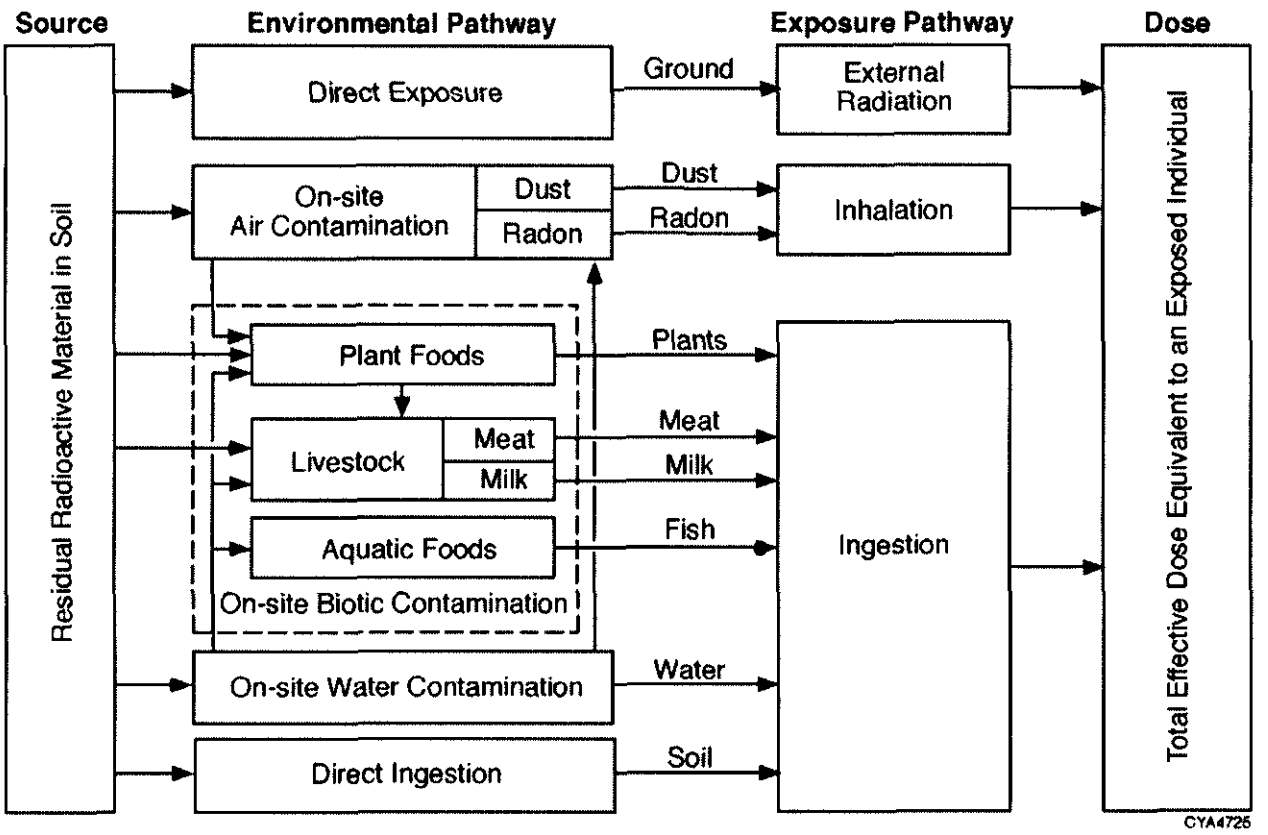
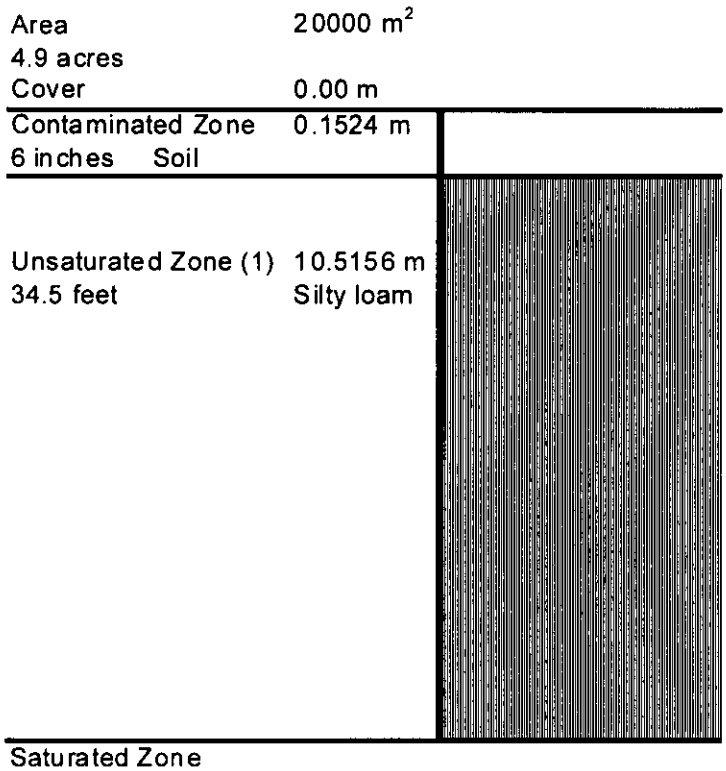


Figure 2 – Dose Assessment As-Left Strata



Note:
The figure is not to scale.

2.2 DCGL Derivation Dose Assessment

The DCGL values are derived from the dose based standard of the USNRC (10CFR20.1402), mainly the radiological criteria for unrestricted use as follows:

"A site will be considered acceptable for unrestricted use if the residual radioactivity that is distinguishable from background radiation results in a TEDE to an average member of the critical group that does not exceed 25 mrem (0.25 mSv) per year."

Therefore, the dose resulting from projected as-left condition of the site post remediation were derived and the results were then used to determine limiting DCGLs values as appropriate.

As-Left Sanitary Lagoon(s) and Drain Field(s) – SLDF

The as-left condition of the site (SLDF), i.e., the condition of the site post remediation, is defined by the following:

- Contaminated zone area = 20,000 m^2 (for areas modeled greater than 10,000 m^2 there is not increase in dose).
- Contaminated zone depth = 0.152 m (6-inch surface layer based on the characterization data for the site).
- Cover depth = 0.000 m (i.e., there is no cover. The contaminated zone is on the surface).
- The unsaturated zone (the depth of soil between the contaminated zone and the saturated (groundwater bearing zone) zone = 10.5 m (based on the approximate 35 feet to groundwater from the surface of the site)

DCGLs based on the projected as-left condition of the site are presented in Section 4.

2.3 Site Specific Non-Default Input Parameter Values

Table 1 Site Specific Non-Default Parameters for As-Left

Parameter Name[1]	Unit	Default Value	Site Specific	Remarks
Area of contaminated zone	m^2	10000	20000	Application Field area
Thickness of contaminated zone	m	2	0.1524	Average contaminated zone thickness 6 inches
Initial principal radionuclides	pCi/g	-	C-14 20	Application Field average
Unsaturated zone thickness	m	4.00	10.5156	Unsaturated zone – 34.5 feet
Unsaturated zone soil density	g/cm^3	1.5	1.28	Dry density for silt loam DCH – Table 2.1
Unsaturated zone total porosity	-	0.4	0.45	Representative Porosity Value for silt DCH – Table 3.2
Unsaturated zone Hydraulic conductivity	m/yr	10	227	Representative Value of Saturated Hydraulic Conductivity for Silty loam DCH – Table 5.2

DCH – Data Collection Handbook to Support Modeling Impacts of Radioactive Material in Soil
Environmental Assessment and Information Sciences Division
Argonne National Laboratory, April 1993

3 Input Parameter Assignments Summary

Table 2 – Input Parameters

RESRAD Input Parameter Assignments				
Screen	Name	Value	Units	Description
R016	**ALEACH(i)**	0	L/yr	Default Leach Rate for N(i)
R011	**AREA**	Refer to Table 1	m^2	Area of Contaminated Zone
R013	**BCZ**	5.30	--	Default Contaminated Zone Exponential *b* Parameter
R011	**BRDL**	25	mrem/ yr	Radiation Dose Limit
R014	**BSZ**	5.30	--	Saturated Zone Exponential *b* Parameter
R015	**BUZ(1)**	5.30	--	Uncontaminated Unsaturated Zone *1* – Exponential *b* Parameter
R013	**COVER0**	0	m	Cover Depth
R016	**DCNUCC(i)**	0	cm^3/g	Default Distribution Coefficient for C-14 in Contaminated Zone
R016	**DENSAQ**	0	cm^3/g	Distribution Coefficient for C-14 in Saturated Zone
R016	**DENSCV**	0	cm^3/g	Distribution Coefficient for C-14 in Unsaturated Zone
R021	**DENSFL**	1.50	g/cm^3	Density of Saturated Zone
R015	**DENSUZ(1)**	Not Used	g/cm^3	Default Density of Cover Material
R018	**DIET(1)**	1.50	g/cm^3	Density of Contaminated Zone
R018	**DIET(2)**	Not Used	g/cm^3	Bulk Density of Building Foundation
R018	**DIET(3)**	Refer to Table 1	g/cm^3	Uncontaminated Unsaturated Zone *1* – Soil Density
R018	**DIET(4)**	160	kg/yr	Fruit, Vegetable, and Grain Consumption
R018	**DIET(5)**	14	kg/yr	Leafy Vegetable Consumption
R018	**DIET(6)**	92	L/yr	Milk Consumption
R021	**DIFCV**	63	kg/yr	Meat and Poultry Consumption
R021	**DIFCZ**	5.4	kg/yr	Fish Consumption
R021	**DIFFL**	0.90	kg/yr	Other Seafood Consumption
R019	**DM**	Not Used	m^2/s	Diffusion Coefficient for Radon Gas in Cover Material
R021	**DMFL**	Not Used	m^2/s	Diffusion Coefficient for Radon Gas in Contaminated Zone Soil
R019	**DROOT**	Not Used	m^2/s	Diffusion Coefficient for Radon Gas in Foundation Material
R019	**DWI**	0.15	m	Default Depth of Soil Mixing Layer
R014	**DWIBWT**	Not Used	m	Building Foundation Depth Below Ground Surface
R019	**ED**	0.90	m	Depth of Roots
R018	**EMANA(1)**	510	L/yr	Drinking Water Intake
R014	**EMANA(2)**	10	m	Well Pump Intake Depth
R013	**EPS**	30	yr	Defalut Exposure Duration

RESRAD Input Parameter Assignments				
Screen	Name	Value	Units	Description
R014	**EPSZ**	Not Used	d.d.f.[a]	Emanating Power of ^{222}Rn Gas
R015	**EPUZ(1)**	Not Used	d.d.f.	Emanating Power of ^{220}Rn Gas
R013	**EVAPTR**	0.001	--	Accuracy for Water/Soil Computations
R021	**FAI**	0.20	d.d.f.	Saturated Zone Effective Porosity
R018	**FDW**	0.2	d.d.f.	Uncontaminated Unsaturated Zone *1* – Effective Porosity
R019	**FGWDW**	0.5	--	Defalut Evapotranspiration Coefficient
R021	**FGWIR**	Not Used	d.d.f.	Building Interior Area Factor
R019	**FIND**	1.0	d.d.f.	Drinking Water Fraction from Groundwater
R021	**FLOOR**	1.0	d.d.f.	Irrigation Fraction from Groundwater
R017	**FOTD**	1.0	d.d.f.	Livestock Water Fraction from Groundwater
R017	**FR9**	0.50	d.d.f.	Fraction of Time Spent Indoors Onsite
R021	**FRACA(1)**	Not Used	m	Thickness of Building Foundation
R017	**FS1**	0.25	d.d.f.	Fraction of Time Spent Outdoors Onsite
R015	**H(1)**	0.5	d.d.f.	Fraction of Aquatic Food from Site
R013	**HCCZ**	Not Used	d.d.f.	Fraction of Annular Area 1 Within AREA
R014	**HCSZ**	1 -Circular	--	Shape Factor for External Gamma Radiation
R015	**HCUZ(1)**	Refer to Table 1	m	Uncontaminated Unsaturated Zone *1* – Thickness
R014	**HGWT**	10.0	m/yr	Contaminated Zone Hydraulic Conductivity
R021	**HMIX**	100	m/yr	Saturated Zone Hydraulic Conductivity
R021	**HRM**	Refer to Table 1	m/yr	Uncontaminated Unsaturated Zone *1* – Hydraulic Conductivity
R013	**IDITCH**	0.02	d.d.f.	Saturated Zone Hydraulic Gradient
R017	**INHALR**	Not Used	m	Radon Vertical Dimension of Mixing
R011	**LCZPAQ**	Not Used	m	Building/Room Height
R019	**LFI5**	Overhead	--	Default Irrigation Mode
R019	**LFI6**	8400	m^3/yr	Default Inhalation Rate
R019	**LWI5**	100	m	Length of Contaminated Zone Parallel to Aquifer Flow
R019	**LWI6**	68	kg/d	Livestock Fodder Intake for Meat
R019	**MLFD**	55	kg/d	Livestock Fodder Intake for Milk
R019	**MLINH**	50	L/day	Livestock Water Intake for Meat
R019	**MODEL**	160	L/day	Livestock Water Intake for Milk
R019	**NS ≤ 5**	0.0001	g/m^3	Mass Loading for Foliar Deposition
R021	**PH2OCV**	0.0001	g/m^3	Default Mass Loading for Inhalation
R021	**PH2OFL**	Not Used	--	Model: Nondispersion (ND) or Mass-Balance (MB)
R013	**PRECIP**	1	--	Number of Uncontaminated Unsaturated Zone Strata
R021	**REXG**	Not Used	d.d.f.	Volumetric Water Content of Cover Material
R013	**RI**	Not Used	d.d.f.	Volumetric Water Content of Building Foundation

RESRAD Input Parameter Assignments				
Screen	Name	Value	Units	Description
R013	**RUNOFF**	1.0	m/yr	Precipitation
R012	**S(i)**	Not Used	1/h	Average Building Air Exchange Rate
R012	**S(i)**	0.2	m/yr	Irrigation
R012	**S(i)**	0.2	--	Defalut Runoff Coefficient
R012	**S(i)**	20.0	pCi/g	Initial Concentrations of C-14
R012	**S(i)**	0.7	d.d.f.	Shielding Factor – External Gamma Radiation
R012	**S(i)**	0.4	ddf	Defalut Shielding Factor – Inhalation
R012	**S(i)**	36.5	g/yr	Defalut Soil Ingestion Rate
R012	**S(i)**	1,3,10,30, 100,300, 1000	yr	Default Calculation Times
R012	**S(i)**	Refer to Table 1	m	Thickness of Contaminated Zone
R017	**SHF1**	0	yr	Defalut Elapsed Time of Waste Placement
R017	**SHF3**	Not Used	d.d.f.	Total Porosity of Cover Material
R018	**SOIL**	0.4	d.d.f.	Contaminated Zone Total Porosity
R011	**T(2)**	Not Used	d.d.f.	Total Porosity of Building Foundation
R011	**T(3)**	0.4	d.d.f.	Saturated Zone Total Porosity
R011	**T(4)**	Refer to Table 1	d.d.f.	Uncontaminated Unsaturated Zone *1* – Total Porosity
R011	**T(5)**	Not Used	d.d.f.	Individual's Use of Groundwater
R011	**T(6)**	Not Used	m/yr	Cover Depth Erosion Rate
R011	**T(7)**	0.001	m/yr	Contaminated Zone Erosion Rate
R011	**T(8)**	0.001	m/yr	Water Table Drop Rate
R011	**T(9)**	0	pCi/g	Groundwater Concentration of N(i)
R011	**T(10)**	1000000	m^2	Watershed Area for Nearby Stream or Pond
R011	**THICK(0)**	2.0	m/s	Default Average Annual Wind Speed
R011	**TI**	0	L/yr	Default Leach Rate for N(i)
R021	**TPCV**	Refer to Table 1	m^2	Area of Contaminated Zone
R013	**TPCZ**	5.30	--	Default Contaminated Zone Exponential *b* Parameter
R021	**TPFL**	25	mrem/ yr	Radiation Dose Limit
R014	**TPSZ**	5.30	--	Saturated Zone Exponential *b* Parameter
R015	**TPUZ(1)**	5.30	--	Uncontaminated Unsaturated Zone *1* – Exponential *b* Parameter
R014	**UW**	0	m	Cover Depth
R013	**VCV**	0	cm^3/g	Default Distribution Coefficient for C-14 in

RESRAD Input Parameter Assignments				
Screen	Name	Value	Units	Description
				Contaminated Zone
R014	**VWT**	0	cm^3/g	Distribution Coefficient for C-14 in Saturated Zone
R013	**WAREA**	0	cm^3/g	Distribution Coefficient for C-14 in Unsaturated Zone
C14	**C12WTR**	2.0E-5	g/cm^3	C12 Concentration in water
C14	**C12CZ**	0.03	g	C12 Concentration in contaminate soil
C14	**CSOIL**	0.02	d.d.f.	Fraction of vegetation carbon from soil
C14	**CAIR**	0.98	d.d.f.	Fraction of vegetation carbon from air
C14	**DMC**	0.30	m	C14 Evasion layer thickness in soil
C14	**EVSN**	7.0E-07	1/sec	C14 Evasion flux rate from soil
C14	**REVSN**	1.0E-10	1/sec	C12 Evasion flux rate from soil
C14	**AVFG4**	0.80	d.d.f.	Fraction of grain in beef cattle feed
C14	**AVFG5**	0.20	d.d.f.	Fraction of grain in milk cow feed
C14	**CO2F**	123.4	d.d.f.	DCF correction factor for gaseous forms of C14
a - d.d.f. = dimensionless decimal fraction				

4 Dose Assessment/DCGL Determination Summary

4.1 10CFR20.1402 DCGLs

Summary results of the C-14 dose assessment are presented in the following table.

Table 3 – Dose Assessment Summary

Assessment	Max TDOSE(t) (mrem/yr)	t_{max} (years)	Soil Guideline DCGL (pCi/g)
ABC Labs Application Field	5.573	3.700	89.72

5 Attachments

5.1 RESRAD Output File and Graphs (refer to table)

RESRAD File Name	RESRAD File Description
ABC Labs FA	ABC Labs DCGL Derivation

6 References

1. 10CFR20.1402
2. RESRAD Computer Code 6.3 – Environmental Assessment Division of Argonne National Laboratory, August 25, 2005
3. User's Manual for RESRAD Version 6 – Environmental Assessment Division of Argonne National Laboratory, July 2001
4. Data Collection Handbook to Support Modeling Impacts of Radioactive Material in Soil – Environmental Assessment and Information Sciences Division of Argonne National Laboratory, April 1993

Table of Contents

Part I: Mixture Sums and Single Radionuclide Guidelines

Dose Conversion Factor (and Related) Parameter Summary
File: FGR 13 MORBIDITY

Menu	Parameter	Current Value	Base Case*	Parameter Name
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	C-14	2.090E-06	2.090E-06	DCF2(1)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	C-14	2.090E-06	2.090E-06	DCF3(1)
D-34	Food transfer factors:			
D-34	C-14 , plant/soil concentration ratio, dimensionless	5.500E+00	5.500E+00	RTF(1,1)
D-34	C-14 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.100E-02	3.100E-02	RTF(1,2)
D-34	C-14 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.200E-02	1.200E-02	RTF(1,3)
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-5	C-14 , fish	5.000E+04	5.000E+04	BIOFAC(1,1)
D-5	C-14 , crustacea and mollusks	9.100E+03	9.100E+03	BIOFAC(1,2)

*Base Case means Default.Lib w/o Associate Nuclide contributions.

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)	2.000E+04	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	1.524E-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)	2.500E+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): C-14	2.000E+01	0.000E+00	---	S1(1)
R012	Concentration in groundwater (pCi/L): C-14	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)	1.500E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	4.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity	2.000E-01	2.000E-01	---	FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	5.300E+00	5.300E+00	---	BCZ
R013	Average annual wind speed (m/sec)	2.000E+00	2.000E+00	---	WIND
R013	Humidity in air (g/m**3)	not used	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	5.000E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	1.000E+00	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	2.000E-01	2.000E-01	---	RI
R013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	2.000E-01	2.000E-01	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	1.000E+06	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	1.000E-03	1.000E-03	---	EPS
R014	Density of saturated zone (g/cm**3)	1.500E+00	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	4.000E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	2.000E-01	2.000E-01	---	EPSZ
R014	Saturated zone field capacity	2.000E-01	2.000E-01	---	FCSZ
R014	Saturated zone hydraulic conductivity (m/yr)	1.000E+02	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	2.000E-02	2.000E-02	---	HGWT
R014	Saturated zone b parameter	5.300E+00	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	1.000E-03	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	1.000E+01	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	2.500E+02	2.500E+02	---	UW
R015	Number of unsaturated zone strata	1	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)	1.052E+01	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	1.280E+00	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	4.500E-01	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	2.000E-01	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, field capacity	2.000E-01	2.000E-01	---	FCUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	5.300E+00	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	2.270E+02	1.000E+01	---	HCUZ(1)
R016	Distribution coefficients for C-14				
R016	Contaminated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCNUCC(1)
R016	Unsaturated zone 1 (cm**3/g)	0.000E+00	0.000E+00	---	DCNUCU(1,1)
R016	Saturated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.022E+01	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R017	Inhalation rate (m**3/yr)	8.400E+03	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	1.000E-04	1.000E-04	---	MLINH
R017	Exposure duration	3.000E+01	3.000E+01	---	ED
R017	Shielding factor, inhalation	4.000E-01	4.000E-01	---	SHF3
R017	Shielding factor, external gamma	7.000E-01	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	5.000E-01	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	2.500E-01	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	1.000E+00	1.000E+00	>0 shows circular AREA.	FS
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	not used	5.000E+01	---	RAD_SHAPE(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)
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)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R018	Fruits, vegetables and grain consumption (kg/yr)	1.600E+02	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	1.400E+01	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	9.200E+01	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	6.300E+01	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	5.400E+00	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	9.000E-01	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	3.650E+01	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	5.100E+02	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	1.000E+00	1.000E+00	---	FDW
R018	Contamination fraction of household water	not used	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	1.000E+00	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	1.000E+00	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	5.000E-01	5.000E-01	---	FR9
R018	Contamination fraction of plant food	5.000E-01	-1	---	FPLANT
R018	Contamination fraction of meat	1.000E+00	-1	---	FMEAT
R018	Contamination fraction of milk	1.000E+00	-1	---	FMILK
R019	Livestock fodder intake for meat (kg/day)	6.800E+01	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	5.500E+01	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	5.000E+01	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	1.600E+02	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	5.000E-01	5.000E-01	---	LSI
R019	Mass loading for foliar deposition (g/m**3)	1.000E-04	1.000E-04	---	MLFD
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
R019	Depth of roots (m)	9.000E-01	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	1.000E+00	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	not used	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	1.000E+00	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	1.000E+00	1.000E+00	---	FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	7.000E-01	7.000E-01	---	YV(1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	1.500E+00	1.500E+00	---	YV(2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	1.100E+00	1.100E+00	---	YV(3)
R19B	Growing Season for Non-Leafy (years)	1.700E-01	1.700E-01	---	TE(1)
R19B	Growing Season for Leafy (years)	2.500E-01	2.500E-01	---	TE(2)
R19B	Growing Season for Fodder (years)	8.000E-02	8.000E-02	---	TE(3)
R19B	Translocation Factor for Non-Leafy	1.000E-01	1.000E-01	---	TIV(1)
R19B	Translocation Factor for Leafy	1.000E+00	1.000E+00	---	TIV(2)
R19B	Translocation Factor for Fodder	1.000E+00	1.000E+00	---	TIV(3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	2.500E-01	2.500E-01	---	RDRY(1)
R19B	Dry Foliar Interception Fraction for Leafy	2.500E-01	2.500E-01	---	RDRY(2)
R19B	Dry Foliar Interception Fraction for Fodder	2.500E-01	2.500E-01	---	RDRY(3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	2.500E-01	2.500E-01	---	RWET(1)
R19B	Wet Foliar Interception Fraction for Leafy	2.500E-01	2.500E-01	---	RWET(2)
R19B	Wet Foliar Interception Fraction for Fodder	2.500E-01	2.500E-01	---	RWET(3)
R19B	Weathering Removal Constant for Vegetation	2.000E+01	2.000E+01	---	WLAM
C14	C-12 concentration in water (g/cm**3)	2.000E-05	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	3.000E-02	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	2.000E-02	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	9.800E-01	9.800E-01	---	CAIR

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
C14	C-14 evasion layer thickness in soil (m)	3.000E-01	3.000E-01	---	DMC
C14	C-14 evasion flux rate from soil (1/sec)	7.000E-07	7.000E-07	---	EVSN
C14	C-12 evasion flux rate from soil (1/sec)	1.000E-10	1.000E-10	---	REVSN
C14	Fraction of grain in beef cattle feed	8.000E-01	8.000E-01	---	AVFG4
C14	Fraction of grain in milk cow feed	2.000E-01	2.000E-01	---	AVFG5
C14	DCF correction factor for gaseous forms of C14	1.234E+02	0.000E+00	---	CO2F
STOR	Storage times of contaminated foodstuffs (days):				
STOR	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	---	STOR_T(1)
STOR	Leafy vegetables	1.000E+00	1.000E+00	---	STOR_T(2)
STOR	Milk	1.000E+00	1.000E+00	---	STOR_T(3)
STOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(4)
STOR	Fish	7.000E+00	7.000E+00	---	STOR_T(5)
STOR	Crustacea and mollusks	7.000E+00	7.000E+00	---	STOR_T(6)
STOR	Well water	1.000E+00	1.000E+00	---	STOR_T(7)
STOR	Surface water	1.000E+00	1.000E+00	---	STOR_T(8)
STOR	Livestock fodder	4.500E+01	4.500E+01	---	STOR_T(9)
R021	Thickness of building foundation (m)	not used	1.500E-01	---	FLOOR1
R021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	---	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV
R021	Total porosity of the building foundation	not used	1.000E-01	---	TPFL
R021	Volumetric water content of the cover material	not used	5.000E-02	---	PH2OCV
R021	Volumetric water content of the foundation	not used	3.000E-02	---	PH2OFL
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	not used	2.000E-06	---	DIFCV
R021	in foundation material	not used	3.000E-07	---	DIFFL
R021	in contaminated zone soil	not used	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	not used	2.000E+00	---	HMIX
R021	Average building air exchange rate (1/hr)	not used	5.000E-01	---	REXG
R021	Height of the building (room) (m)	not used	2.500E+00	---	HRM
R021	Building interior area factor	not used	0.000E+00	---	FAI
R021	Building depth below ground surface (m)	not used	-1.000E+00	---	DMFL
R021	Emanating power of Rn-222 gas	not used	2.500E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)
TITL	Number of graphical time points	32	---	---	NPTS
TITL	Maximum number of integration points for dose	17	---	---	LYMAX
TITL	Maximum number of integration points for risk	257	---	---	KYMAX

Summary of Pathway Selections

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

Summary : ABC Labs Application Field C-14 RF File: ABC Labs FA.RAD

Contaminated Zone Dimensions		Initial Soil Concentrations, pCi/g	
Area:	20000.00 square meters	C-14	2.000E+01
Thickness:	0.15 meters		
Cover Depth:	0.00 meters		

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 2.500E+01 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
TDOSE(t):	1.276E+00	7.098E-13	5.533E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
M(t):	5.105E-02	2.839E-14	2.213E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Maximum TDOSE(t): 5.573E+00 mrem/yr at t = 3.799 ± 0.008 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 = 3.799E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	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.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
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 = 3.799E+00 years

Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	7.779E-01	0.1396	4.241E+00	0.7610	0.000E+00	0.0000	2.189E-01	0.0393	1.185E-01	0.0213	2.167E-01	0.0389	5.573E+00	1.0000
Total	7.779E-01	0.1396	4.241E+00	0.7610	0.000E+00	0.0000	2.189E-01	0.0393	1.185E-01	0.0213	2.167E-01	0.0389	5.573E+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 = 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.
C-14	5.210E-06	0.0000	1.981E-04	0.0002	0.000E+00	0.0000	4.838E-01	0.3791	6.663E-01	0.5221	1.258E-01	0.0986	3.755E-05	0.0000
Total	5.210E-06	0.0000	1.981E-04	0.0002	0.000E+00	0.0000	4.838E-01	0.3791	6.663E-01	0.5221	1.258E-01	0.0986	3.755E-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.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.276E+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	1.276E+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.
C-14	4.681E-20	0.0000	1.768E-18	0.0000	0.000E+00	0.0000	3.112E-14	0.0438	6.307E-13	0.8885	4.801E-14	0.0676	3.373E-19	0.0000
Total	4.681E-20	0.0000	1.768E-18	0.0000	0.000E+00	0.0000	3.112E-14	0.0438	6.307E-13	0.8885	4.801E-14	0.0676	3.373E-19	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.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.098E-13	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	7.098E-13	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-	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.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
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+00 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
C-14	7.721E-01	0.1395	4.211E+00	0.7610	0.000E+00	0.0000	2.174E-01	0.0393	1.180E-01	0.0213	2.151E-01	0.0389	5.533E+00	1.0000
Total	7.721E-01	0.1395	4.211E+00	0.7610	0.000E+00	0.0000	2.174E-01	0.0393	1.180E-01	0.0213	2.151E-01	0.0389	5.533E+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+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.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
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+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.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
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 = 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.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
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+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.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
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+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.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
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+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.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
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 = 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.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
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.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
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.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
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.
C-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
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)	Thread Fraction	DSR(j,t) At Time in Years (mrem/yr)/(pCi/g) 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
C-14	C-14	1.000E+00	6.381E-02	3.549E-14	2.767E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

The DSR includes contributions from associated (half-life ≤ 180 days) daughters.

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 2.500E+01 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
C-14	3.918E+02	*4.455E+12	9.036E+01	*4.455E+12	*4.455E+12	*4.455E+12	*4.455E+12	*4.455E+12

*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 = 3.799 ± 0.008 years

Nuclide (i)	Initial (pCi/g)	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
C-14	2.000E+01	3.799 ± 0.008	2.787E-01	8.972E+01	2.787E-01	8.972E+01

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

Nuclide (j)	Parent (i)	THF(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
C-14	C-14	1.000E+00	1.276E+00	7.098E-13	5.533E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

THF(i) is the thread fraction of the parent nuclide.

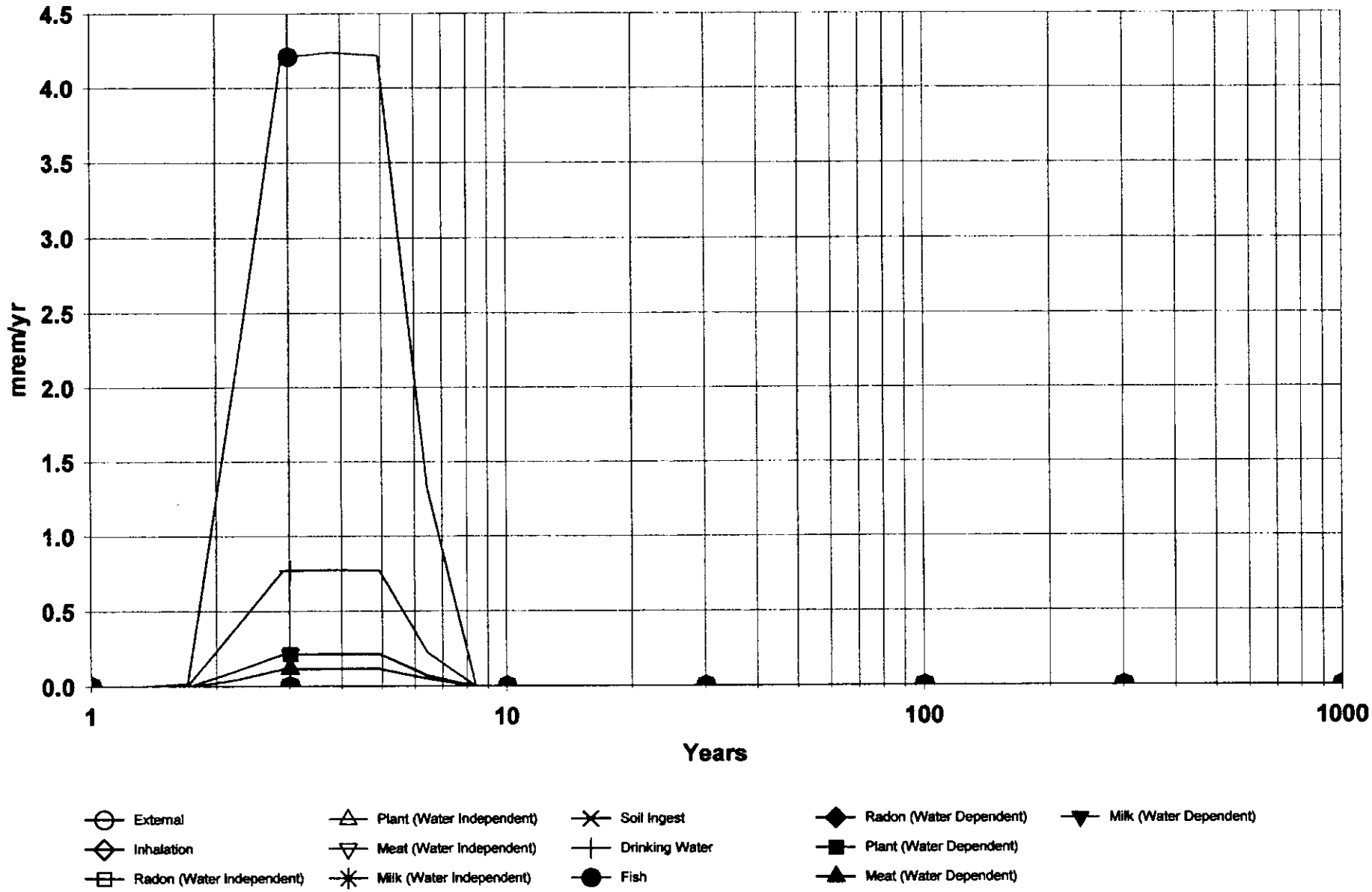
Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	THF(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
C-14	C-14	1.000E+00	2.000E+01	1.797E-13	1.449E-41	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

THF(i) is the thread fraction of the parent nuclide.

RESCALC.EXE execution time = 1.82 seconds

DOSE: C-14, Component Pathways



ABC Labs FA.RAD 11/26/2007 11:51 GRAPHICS.ASC

From: Origin ID: COUA (573)443-9000
Elsie Nickell
ABC Labs
7200 ABC Lane

Columbia, MO 65202

FedEx Express

Ship Date: 29NOV07
ActWgt: 1 LB
System#: 2261399/INET7091
Account#: S *********

Delivery Address Bar Code

Ref # Sheila Hecht
Invoice #
PO #
Dept # 700

SHIP TO: (573)443-6000 BILL SENDER
George McCann, Decommissioning Bran
Nuclear Regulatory Commission III
2443 WARRENVILLE RD STE 210

LISLE, IL 605324352

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