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Meeting Minutes Transmittal/Approval
Unit Manager's Meeting: 100 Aggregate Area/100 Area Operable Units
100-BC ERA Excavation Site, Hanford Area
July 20, 1995

FROM/APPROVAL: Nancy Werdel Date 8/23/95
Nancy Werdel, 100 Area Unit Manager, RL (H4-83)

APPROVAL: Keith K. Holliday for Date 8-23-95
Phil Staats, 100 Aggregate Area Unit Manager, WA Dept of Ecology (B5-18)

APPROVAL: Dennis Faulk Date 8-23-95
Dennis Faulk, 100 Aggregate Area Unit Manager, EPA (B5-01)

Meeting Minutes are attached. Minutes are comprised of the following:

Attachment #1	-	Meeting Summary
Attachment #2	-	Attendance Record
Attachment #3	-	Agenda
Attachment #4	-	July Unit Manager's Meeting 100 Area Status Package Source Units
Attachment #5	-	July Unit Manager's Meeting 100 Area Status Package Groundwater Units
Attachment #6	-	Summary of 100-BC FRA Excavation Demonstration (7/20/95)
Attachment #7	-	Remedial Action Requirements

SEP 1995
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Prepared by: Alan Krug Date: 8/22/95
Alan Krug, Tamen Lundquist, ERC (H4-91)

Concurrence by: Greg Eidam Date: 8/23/95
Greg Eidam, BHI 100 Area Manager (H4-91)

Attachment #1
Meeting and Summary of Commitments and Agreements

Unit Manager's Meeting: 100 aggregate Area/100 Area Operable Units
July 20, 1995

1. **SIGNING OF THE JUNE 100 AREA UNIT MANAGER'S MEETING MINUTES** - The review and approval of the minutes were deferred until the August meeting.

2. **ACTION ITEM UPDATE**: The Action Item Update was deferred until the August Meeting.

3. **NEW ACTION ITEMS**:

   None.

4. **100 AREA ACTIVITIES**:

   - ROD Strategy Discussion: Dennis Faulk (EPA) indicated that the EPA had not yet developed a ROD Strategy for the remaining 100 Area Source Operable Units. He expressed a desire to have this completed within 30 days, to coincide with EPA's review of the 100-BC-2 Focused Feasibility Study and Proposed plan. His preference is to prepare one 100 B Area ROD which would include the low priority sites.

     A joint EPA/Ecology/DOE/ERC ROD Strategy Meeting was proposed for Monday, July 31, 10:00 a.m.

   - FY96 Budget Planning: Greg Eidam (ERC) noted that DOE guidance on the FY 96 budget was expected on July 24, 1996. A $173 million budget is expected.

   - Remedial Action Requirements: Greg Eidam (ERC) passed out a handout (Attachment 7) on Remedial Action Requirements which was prepared at the regulators request.

     A joint EPA/Ecology/DOE/ERC meeting was proposed for August 2, 1995, 8:00 a.m. to discuss this.

   - Public Meeting Update: It was noted that the Next Public Meeting will be on July 25, 1995.

   - Relocation of Investigation Derived Waste (IDW) in D Reactor : Joan Woolard (ERC) noted that the location of IDW for the D and H Areas needed to be changed, due to possible impacts by nearby D&D activity. Keith Holliday (Ecology) agreed to visit the proposed site and discuss it with Joan Woolard.

   - Handout Status Package: Alan Krug (ERC) and Dick Biggerstaff (ERC) passed out the July

- Handout Status Package: Alan Krug (ERC) and Dick Biggerstaff (ERC) passed out the July UMM Status Packages (attachments 4 & 5).

- Tour of 100-BC-1 Demonstration: John April (ERC) made a brief presentation of the status of the demonstration and passed out a descriptive handout (attachment 6). A tour of the site was held.

- 116 Data Quality Objectives (DQO) Meetings: John April (ERC) noted that the 116-C-1 DQO meeting is scheduled for Monday, July 24, 1995, 2:00 - 4:00 pm. Attendance will include EPA, Ecology, Nancy Werdel, John Ludowise, John Lowe, and Roy Bauer. John April stated that ERC hoped to reduce the number of attendees in order to expedite the meeting. The facilitator will be Steve Weil. Dennis Faulk requested that he received a copy of ERC's background packet prior to the meeting.

5. **NEXT MEETINGS**: The next meeting are scheduled for:
   August 23, 1995
   September 21, 1995

100 Aggregate Area Unit Manager's Meeting
Official Attendance Record
July 20,, 1995

Please print clearly and use black ink

PRINTED NAME	ORGANIZATION	O.U. ROLE	TELEPHONE
Stephanie Johansen	Dames & Moore	Support to RL	946-3693
Arlene Tortoso	DOE	Project Mgr. EK,D&H	373-9631
Pamela Innis	EPA	UM	376-4919
Richard Buggerstaff	ERC	GW Task Lead	3729572
Alan D. Kirby	ERC	100 K/F	372-9567
MJ GALBRAITH	ERC	FLD SMPLNG	531-0685
J G. APRIL	ERC	TC BC Demo	372-9592
Dennis Faulk	EPA	OU [illegible]	376-8631
JOAN WOOLARD	ERC	100-D	376-2539
Keith Holliday	Ecology	Unit Manager	736-3036
Alvin Langstaff	ERC	100 B/C, D, H, PF	372-9515

Attachment #3
Agenda

Unit Managers Meeting: 100 Aggregate Area/100 Area Operable Units
July 20, 1995

12:45 Depart from 2440 Stevens Center Parking Lot

1:30 - 3:30

1. Tour of 100-BC-1 Demonstration - John April
2. ROD Strategy Discussion - Kevin Oates/Phil Staats
3. FY65 Budget Planning - Greg Eidam
4. Remedial Action Requirements - Greg Eidam
5. Public Meeting Update - Joan Woolard
6. Relocation of Investigation Derived Waste in D Reactor Area - Joan Woolard
7. Handout Status Package - Alan Krug

Attachment #4

STATUS PACKAGE

JULY UNIT MANAGERS MEETING

100-BC, 100-K, 100-D, 100-H, 100-F

Focused Feasibility Studies and Proposed plans

100-BC-1 Issued final (revision 0) version of the FFS. Proposed Plan (PP) issued for public review. Public comments are due August 9, 1995.

100-BC-2 The 100-BC-2 OU FFS and PP were transmitted to DOE/RL meeting the June 30, 1995 TPA Interim Milestones M-15-16E and M-15-16F. Agency Comments are due August 15, 1995.

100-IU-1 Proposed Plan Based on Agency comments; 100-IU-1, 100-IU-3, 100-IU-4, and 100-IU-5 were combined into one proposed plan. The PP was submitted for public review in concert with 100-BC-1 PP.

100-HR-1 Rev. 0 of the 100 Area Source Operable Unit FFS including the Appendix E for the 100-HR-1 FFS) and Rev. 1 of the 100-HR-1 PP were submitted to Ecology and EPA on June 16, 1995. The 100-HR-1 PP was used as a template for revising the 100-BC-1 and 100-DR-1 PPs. A 45-day public comment period on the 100-HR-1 (and 100-BC-1 and 100-DR-1) Proposed Plan was initiated on June 26, 1995. A public meeting on the Proposed Plans is scheduled for July 25, 1995.

100-HR-2 The 100-HR-2 FFS and PP were submitted to the EPA and Ecology on January 30, 1995. Comments from the regulators were due to DOE on March 14, 1995. In the future, the 100-HR-2 FFS and PP could either (1) remain in its current stand-alone format; (2) be modified to become an appendix to the 100 Area Source Operable Unit FFS (DOE/RL-94-61); or (3) be re-presented as part of a 100-H Reactor Area FFS.

100-IU-4 and 100-IU-5 Rev. 0 of the Proposed Plan for 100-IU-4 and 100-IU-5 (that are combined with 100-IU-1 and 100-IU-3) were submitted to the regulators on June 16, 1995. A 45-day public comment period on the Proposed Plan was initiated on June 26, 1995. No public meeting is planned.

100-DR-1. The Focused Feasibility Study Report (Process Document, Sensitivity Analysis, 100-BC-1, 100-HR-1 and 100-DR-1) and Proposed Plans (100-BC-1, 100-HR-1, and 100-DR-1) were finalized and issued. The public comment period on the Proposed Plans was initiated on June 26, 1995. A public meeting on the Proposed Plans is scheduled for July 25, 1995.

100-DR-2. The 100-DR-2 Focused Feasibility Study and Proposed Plan was submitted to the regulatory agencies on June 30, 1995 to meet TPA milestone M-15-20A and M-15-20B.

100-KR-1 Regulator comments on the 100-KR-1 IRM Proposed Plan were received on May 22, 1995. Comment responses were submitted to the regulators.

The 100-KR-1 Focused Feasibility Study is being updated to conform with the latest guidance used in preparing the 10-BC-1/100-HR-1/100-DR-1 FFSs. Comment dispositions were submitted to the regulators.

100-KR-2 Work continued on the 100-KR-2 combined LFI/QRA/FFS.

100-FR-1 The 100-FR-1 PP was submitted to the Regulators on May 31, 1995. Regulator comments are expected in mid-July.

The 100-FR-1 FFS was submitted to the Regulators on May 31, 1995. Regulator comments are expected in mid-July.

100-FR-2 Work continued on the 100-FR-2 combined LFI/QRA/FFS.

Treatability Studies

Soil Washing Treatability Study During this reporting period, the Soil Washing Treatability Study Report was submitted to EPA and Ecology for review. Comments are due on August 7. A comment response meeting will be scheduled shortly thereafter.

100-HR-3 Pump & Treat Study During this reporting period the 100-HR-3 Pump and Treat system was operated continuously.

118-B-1 Excavation Treatability Study The regulators have reviewed the report and have issued a letter stating that they have no comments. The final report (Revision 0) will be issued in early July.

BC Demonstration Project

100-BC-1 ERA Verbal comments have been received on the remedial design/remedial action strategy document that was initially submitted on April 7, 1995. The Design Basis Report was completed and submitted to the Senior Review Team for ERC Review.

During this reporting period the BC Demonstration Project mobilized and initiated field work at the 116-B-5 Crib. On June 26 overburden removal began and was completed on June 29. A sonic drill rig was set up at the crib on Tuesday, June 27 and drilled and sampled nine borings 10 to 15 feet outside the southern portion of the crib to determine lateral extent of contamination. On June 30 surface samples were obtained in each of the twelve crib cells. Results from both intrusive efforts showed no radiological contamination and mercury at the effluent pipe outlet at 8 to 12 ppm's.

D Area

100-D Ponds. The Data Evaluation Report for Phase II soil sampling was submitted to the regulators.

H Area

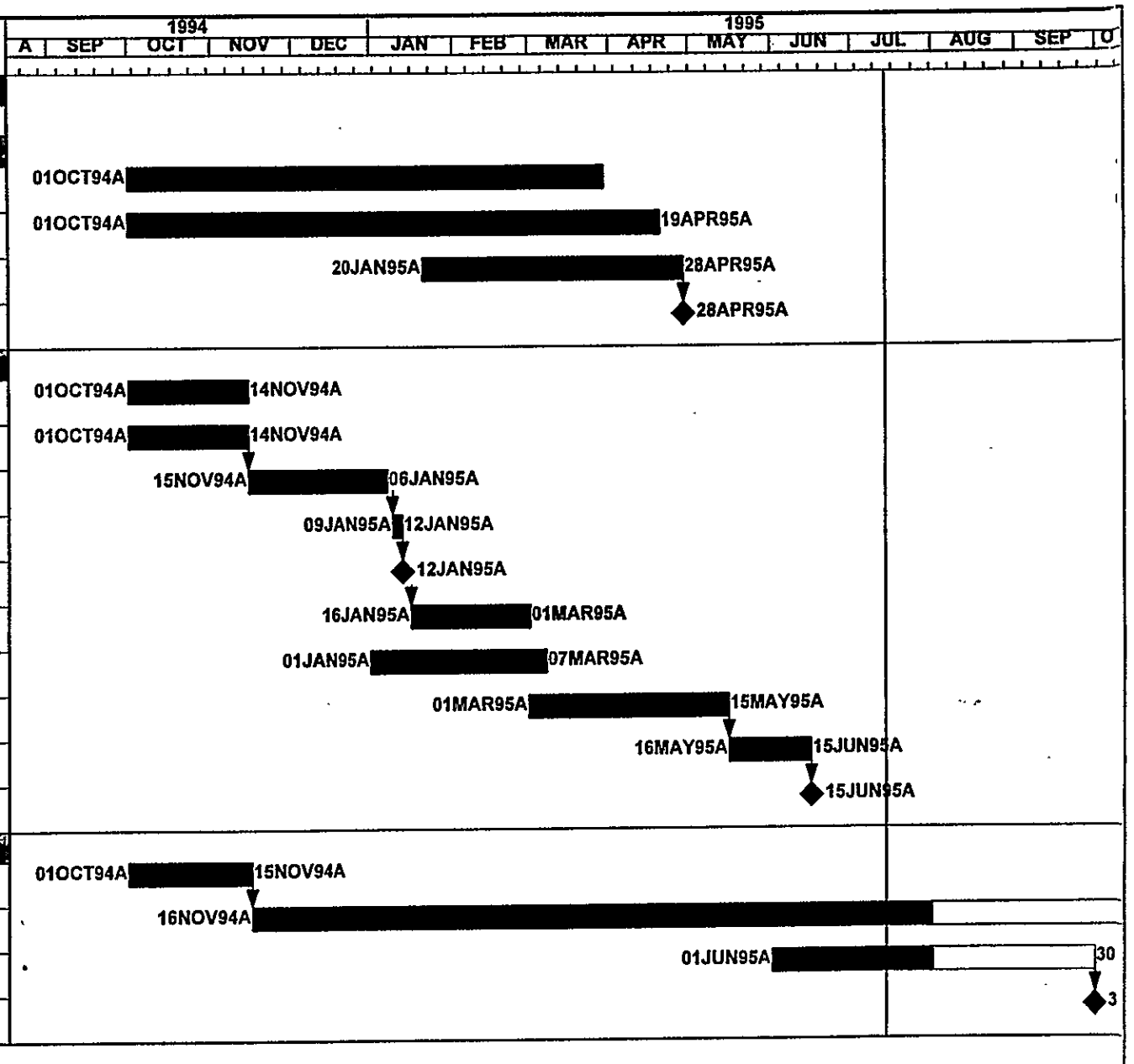
100-HR-1 Remedial design activities continued during April in conjunction with the 100-BC and 100-DR Areas. The first 100-HR Area waste site to be addressed in remedial design is the 116-H-1 process effluent disposal trench.

100-HR-2 A redline version of Rev. 0 of the 100-HR-2 LFI was submitted to the regulatory agencies for concurrence review. The redline Rev. 0 version includes text revisions made in response to comments received from the regulators on the Draft A version.

K AREA

See Focused Feasibility Studies and Proposed Plans

Activity description	Percent complete
[illegible]	
Project Lead - John April	
[illegible] Excavation Treatability Test	
CONDUCT EXCAVATION	100
SAMPLING AND ANALYSIS	100
PREPARE REPORT	100
M-15-16C SUBMIT 100-B BURIAL GROUND WORK RPT	100
100-DR-1 Soil Washing Test	
EQUIPMENT PROCUREMENT / INSTALLATION	100
PLANS / PROCEDURES / PERMITS	100
INITIATE SHAKE DOWN TEST	100
CONDUCT TREATABILITY TEST	100
M-15-07B COMPLETE TREATABILITY TEST	100
SECURE FACILITY	100
LABORATORY ANALYSIS	100
REPORT PREPARATION	100
REVIEW AND REVISION	100
SUBMIT REPORT TO EPA/ECOLOGY	100
100-HR-3 Pump & Treat Treatability	
PHASE 1 TESTING / WINTERIZATION	100
PHASE 2 TESTING	63
PREPARE REPORT	50
SUBMIT REPORT TO EPA/ECOLOGY	0



Project Start	01OCT94
Project Finish	30DEC95
Data Date	14JUL95
Plot Date	15JUL95

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Early Bar
Progress Bar

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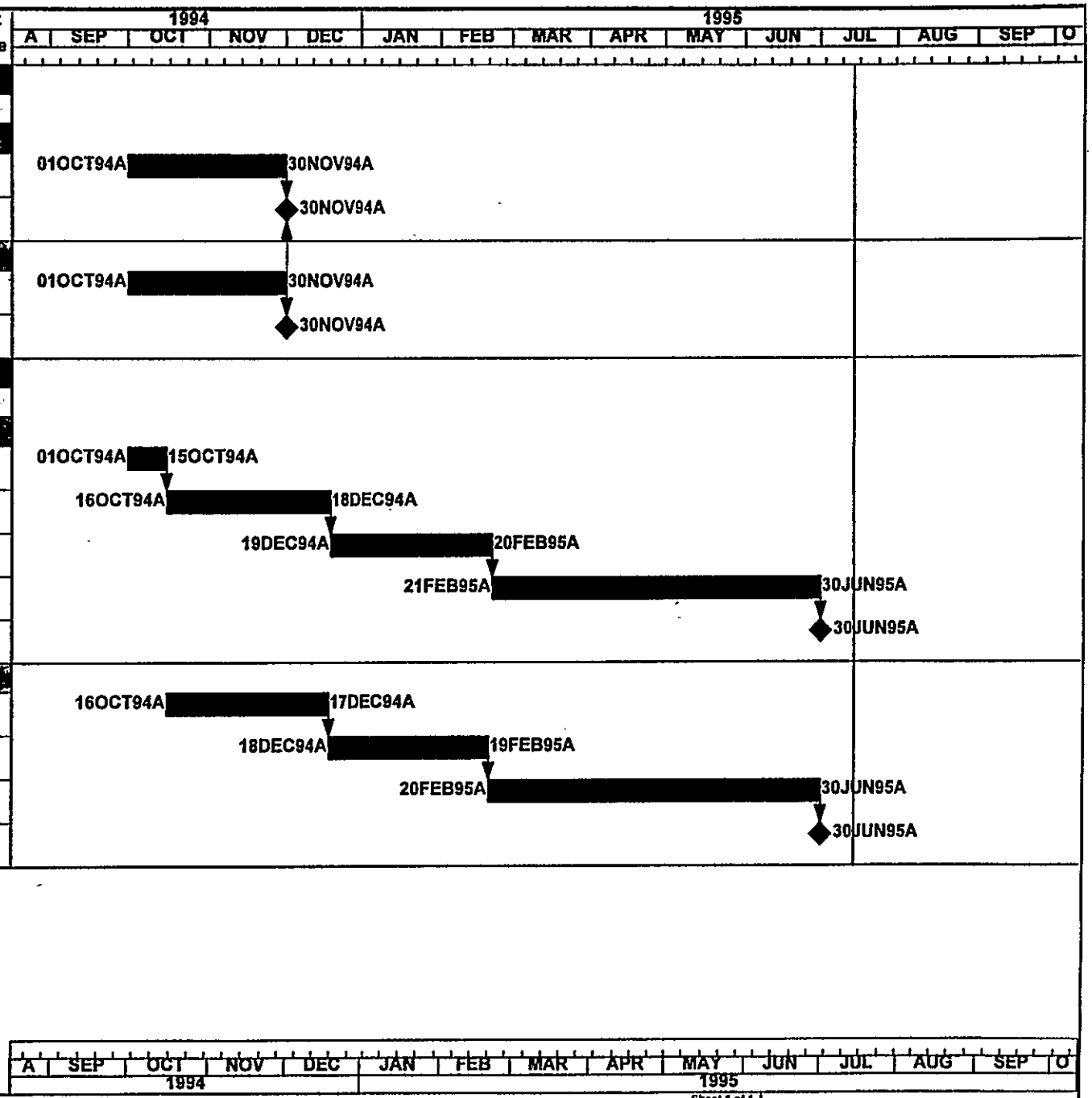
Sheet 1 of 1

Bechtal Hanford Inc.
FY 1995 Unit Managers Meeting
July 1995

Date	Revision	Checked	Approved

Activity description	Percent complete	Start	Finish
Project Lead - Roberta Day			
Proposed Feasibility Study			
DOE REVIEW / COMMENT / BHI INCORPORATION	100	01OCT94A	30NOV94A
M-15-08D SUBMIT FFS REPORT TO EPA/ECOLOGY	100	30NOV94A	30NOV94A
IRM Proposed Plan			
DOE REVIEW / COMMENT / BHI INCORPORATION	100	01OCT94A	30NOV94A
SUBMIT IRM PROPOSED PLAN WITH FFS REPORT	100	30NOV94A	30NOV94A
Project Lead - Roberta Day			
Focused Feasibility Study			
CONDUCT FOCUSED FEASIBILITY STUDY	100	01OCT94A	15OCT94A
PREPARE FOCUSED FEASIBILITY STUDY REPORT	100	16OCT94A	18DEC94A
BHI REVIEW AND INCORPORATION	100	19DEC94A	20FEB95A
DOE REVIEW / BHI INCORPORATION	100	21FEB95A	30JUN95A
M-15-16D SUBMIT FFS REPORT TO EPA/ECOLOGY	100	30JUN95A	30JUN95A
IRM Proposed Plan			
PREPARE IRM PROPOSED PLAN	100	16OCT94A	17DEC94A
BHI REVIEW AND INCORPORATION	100	18DEC94A	19FEB95A
DOE REVIEW / BHI INCORPORATION	100	20FEB95A	30JUN95A
M-15-16F SUBMIT IRM PROPOSED PLAN TO EPA/ECO	100	30JUN95A	30JUN95A



Project Start 01OCT94
Project Finish 30DEC95
Data Date 14JUL95
Plot Date 15JUL95

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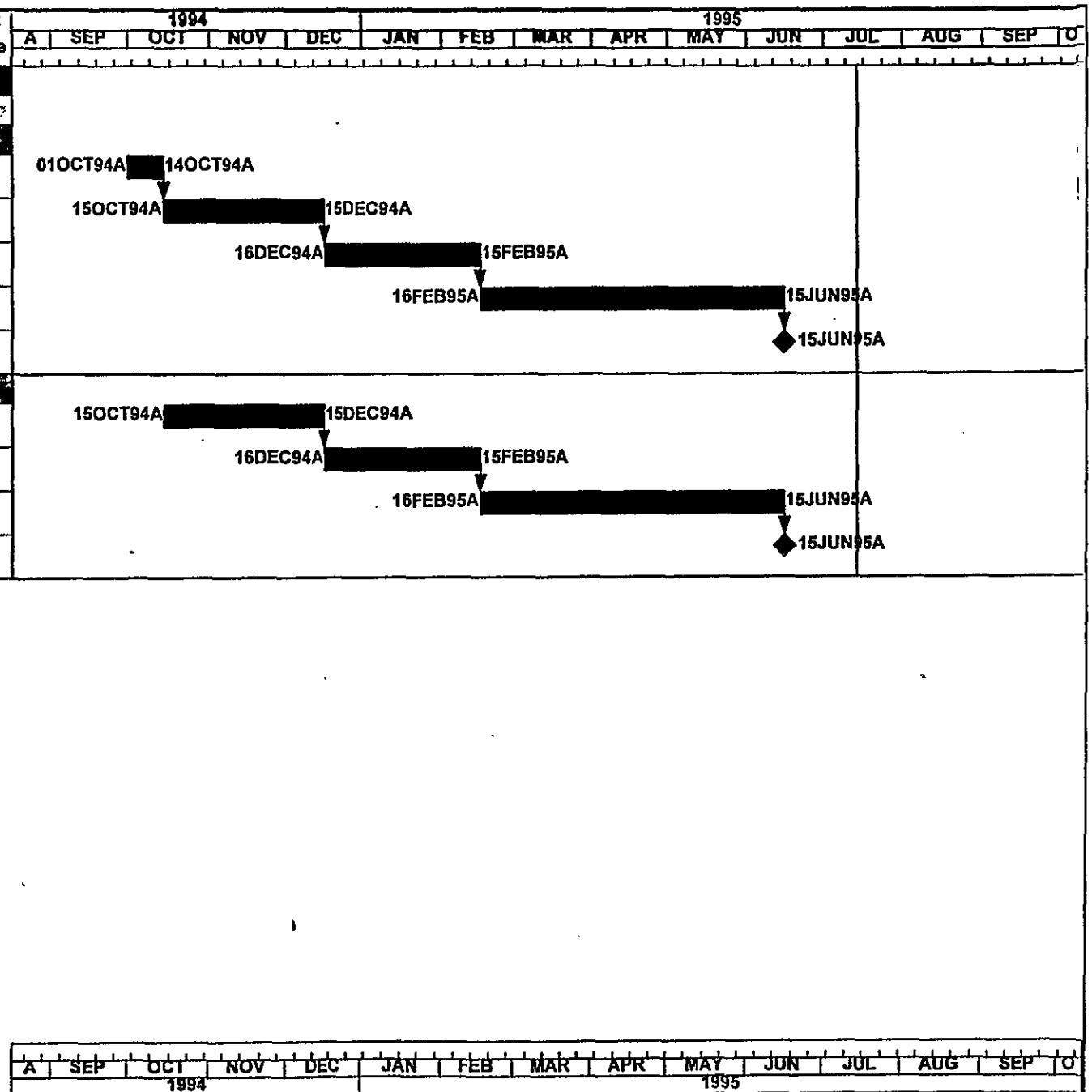
Sheet 1 of 1

Bechtal Hanford Inc.
FY 1995 Unit Managers Meeting
July 1995

Date	Revision	Checked	Approved

Activity description	Percent complete
[illegible]	
Project Lead - Joan Woolard	
Focused Feasibility Study	
FOCUSED FS	100
FOCUSED FS REPORT PREPARATION	100
BHI REVIEW / INCORPORATION	100
DOE REVIEW / INCORPORATION	100
SUBMIT FFS REPORT TO EPA/ECOLOGY	100
IRM Proposed Plan	
IRM PROPOSED PLAN PREPARATION	100
BHI REVIEW / INCORPORATION	100
DOE REVIEW / BHI INCORPORATION	100
SUBMIT IRM PROPOSED PLAN TO EPA/ECOLOGY	100



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Project Start	01OCT94
Project Finish	30DEC96
Data Date	14JUL95
Plot Date	15JUL95

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Sheet 1 of 1

Bechtal Hanford Inc.
FY 1995 Unit Managers Meeting
July 1995

Date	Revision	Checked	Approved

Activity description	Percent complete	1994	1995
[redacted]			
Project Lead Chuck Hedel			
[redacted]			
DOE REVIEW / BHI INCORPORATION	100	01OCT94A [redacted] 31JAN95A	
M-15-18B SUBMIT FFS REPORT TO EPA/ECOLOGY	100	31JAN95A	
[redacted]			
DOE REVIEW / BHI INCORPORATION	100	01OCT94A [redacted] 31JAN95A	
M-15-18C SUBMIT IRM PROPOSED PLAN TO EPA/ECOLOGY	100	31JAN95A	

A | SEP | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | O

1994 1995

Project Start	01OCT94
Project Finish	30DEC95
Data Date	14JUL95
Plot Date	15JUL95

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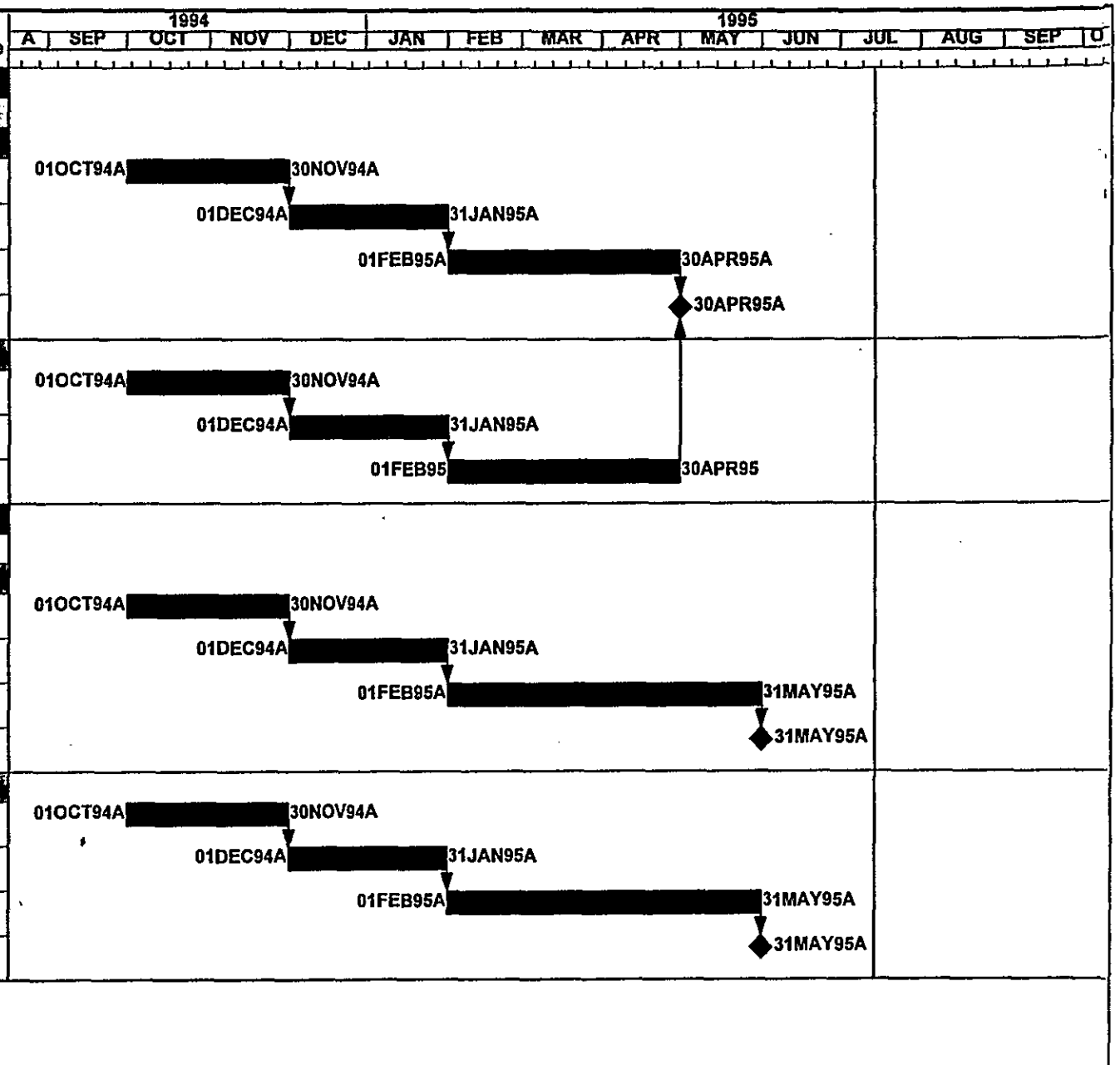
Sheet 1 of 1

Bechtal Hanford Inc.
FY 1995 Unit Managers Meeting
July 1995

Date	Revision	Checked	Approved

Activity description	Percent complete
Project Lead - Alan Krug	
Focused Feasibility Study	
FOCUSED FEASIBILITY STUDY REPORT PREPARATION	100
BHI REVIEW AND INCORPORATION	100
DOE REVIEW / BHI INCORPORATION	100
M-15-10C SUBMIT 100-KR-1 FFS & IRM PROPOSED PLAN	100
IRM Proposed Plan	
PREPARE IRM PROPOSED PLAN	100
BHI REVIEW AND INCORPORATION	100
DOE REVIEW / BHI INCORPORATION	100
Project Lead - Alan Krug	
Focused Feasibility Study	
BHI PREPARE FFS REPORT	100
BHI REVIEW / INCORPORATION	100
DOE REVIEW /BHI INCORPORATION	100
M-15-13C SUBMIT FFS REPORT TO EPA/ECOLOGY	100
IRM Proposed Plan	
BHI PREPARE IRM PROPOSED PLAN	100
BHI REVIEW / INCORPORATION	100
DOE REVIEW / BHI INCORPORATION	100
M-15-13D SUBMIT IRM PROPOSED PLAN TO EPA/ECO	100



Project Start	01OCT94
Project Finish	30DEC95
Data Date	14JUL95
Plot Date	15JUL95

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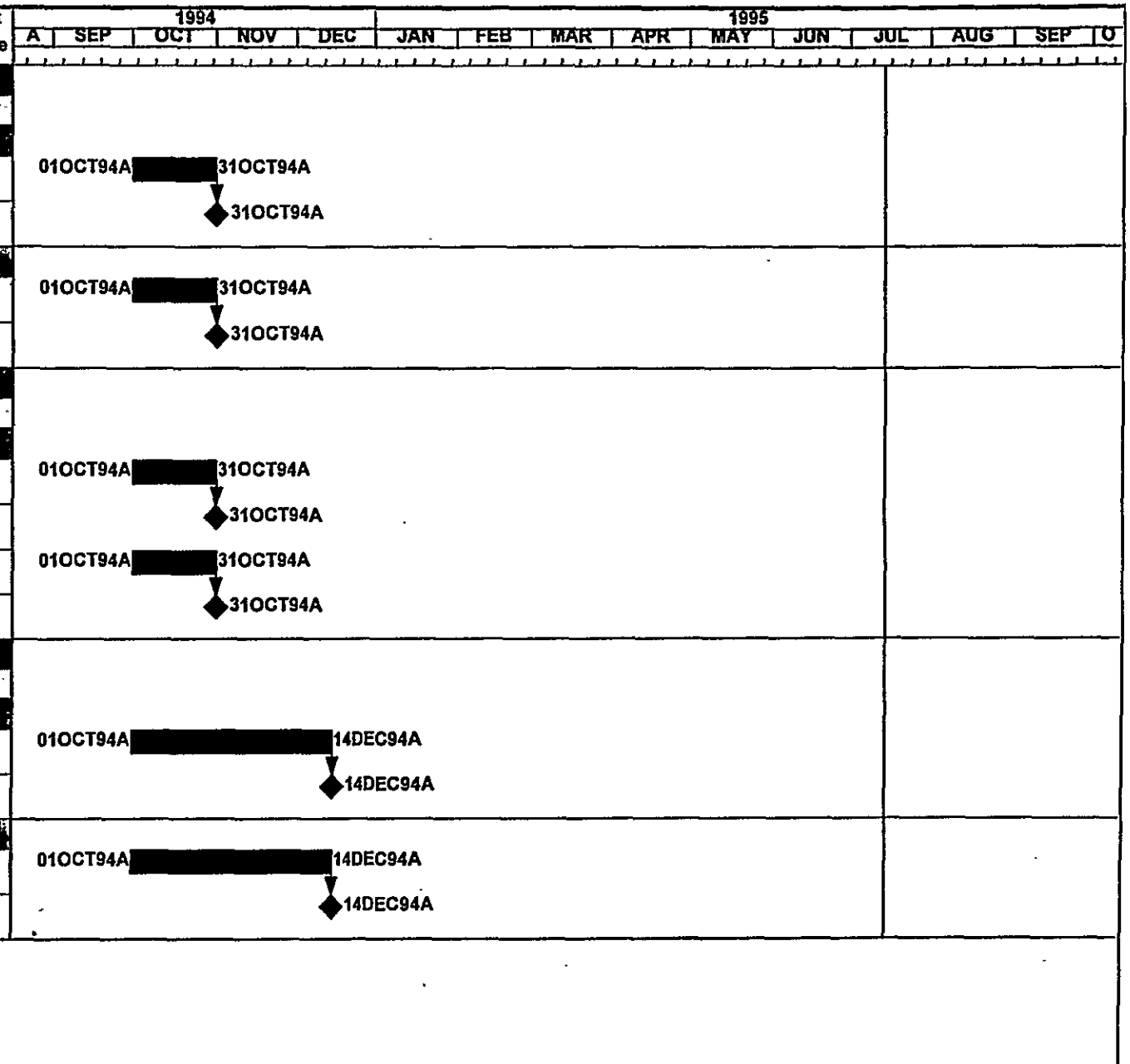
Sheet 1 of 1

Bechtal Hanford Inc.
FY 1995 Unit Managers Meeting
July 1995

Date	Revision	Checked	Approved

Activity description	Percent complete	Start	Finish
[redacted]			
Project Lead - Richard Biggerstaff			
[redacted]			
DOE REVIEW / BHI INCORPORATION	100	01OCT94A	31OCT94A
M-15-09C SUBMIT FFS REPORT TO EPA/ECOLOGY	100	31OCT94A	31OCT94A
[redacted]			
DOE REVIEW / BHI INCORPORATION	100	01OCT94A	31OCT94A
M-15-09D SUBMIT IRM PROPOSED PLAN TO EPA/ECO	100	31OCT94A	31OCT94A
[redacted]			
Project Lead - Richard Biggerstaff			
[redacted]			
DOE REVIEW / BHI INCORPORATE	100	01OCT94A	31OCT94A
M-15-11C SUBMIT FFS REPORT TO EPA/ECO	100	31OCT94A	31OCT94A
DOE REVIEW / BHI INCORPORATION	100	01OCT94A	31OCT94A
M-15-11D SUBMIT IRM PROPOSED PLAN TO EPA/ECO	100	31OCT94A	31OCT94A
[redacted]			
Project Lead - Richard Biggerstaff			
[redacted]			
DOE REVIEW / BHI INCORPORATION	100	01OCT94A	14DEC94A
M-15-13G SUBMIT FFS REPORT TO EPA/ECOLOGY	100	14DEC94A	14DEC94A
[redacted]			
DOE REVIEW / BHI INCORPORATION	100	01OCT94A	14DEC94A
M-15-13H SUBMIT IRM PROPOSED PLAN TO EPA/ECOLOGY	100	14DEC94A	14DEC94A



Project Start 01OCT94
Project Finish 30DEC95
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Bechtal Hanford Inc.
FY 1995 Unit Managers Meeting
July 1995

Sheet 1 of 1

Date	Revision	Checked	Approved

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Attachment #5

STATUS PACKAGE

JULY UNIT MANAGERS MEETING

100-BC-5, 100-KR-4, 100-HR-3 & 100-FR-3

GROUNDWATER OPERABLE UNITS

Groundwater

100-BC-5 Comments were received from the regulators on the 100-BC-5 Focused Feasibility Study (FFS) and IRM Proposed Plan. Responses to regulatory comments were provided and are currently in review.

100-HR-3/100-KR-4

A proposed groundwater strategy document was prepared for RL submittal which states that RL agrees with the EPA and Ecology preference for groundwater pumping and treatment as the preferred alternative for interim action towards protection of the Columbia River. The strategy confirms that the Tri-Parties will continue to follow the Hanford Past Practice Strategy IRM pathway, and that the IRM will be focused on protection of ecological receptors.

Responses to regulator comments on the FFSs and Proposed plans were prepared consistent with the proposed strategy as well as the additional discussions with the regulators, and were transmitted to the regulators on June 9, 1995 for their review. Review comments on the FFSs and Proposed plans were received from the regulators, the comments incorporated, and the revised responses to comments were transmitted to the regulators on July 7, 1995.

FY 1995 expenditures for 100-HR-3, 100-KR-4 and 100-BC-5 were prepared and summarized as per the regulator request and were also submitted on June 9, 1995 as requested.

Comment responses were incorporated in the 100-HR-3 FFS and Proposed plan documents, and submitted for concurrent RL/ERC/regulator review on July 17, 1995.

Comment responses are currently being incorporated in the 100-KR-4 FFS and Proposed plan for transmittal on August 18 for a similar concurrent review cycle.

100-FR-3 The soil gas investigation for TCE has been completed and a status meeting was held with RL, ERC and the regulators on July 13, 1995. The investigation showed that low levels of TCE (generally less than 50 ppb) were found through out a large area with no apparent source or sources. Agreement was reached that the installation of monitoring wells was not warranted for IRM purposes. The data will be reported in a supplementary report to the current 100-FR-3 LFI. Work will then focus on completion of the FFS and Proposed Plan to meet the December 31, 1995 milestone.

SALMON SPAWNING HABITAT INVESTIGATION A summary report was prepared and submitted June 9, 1995 for concurrent RL and regulator review. Preparations for initiating additional salmon spawning habitat investigations in the 100-HR-3 and 100-KR-4 OUs in September/October are in progress.

SUMMARY OF 100-BC ERA EXCAVATION DEMONSTRATION (7/20/95)

116-B5 Crib was excavated and sampled from 6/27/95 through 7/12/95.

Initially, samples were collected by drilling nine bore holes (labeled A through H on sketch). Samples were collected at 10 feet, 12.5 feet and 15 feet. Bore hole C (southwest corner near Cell A) could not be drilled past 7 feet. Operations then moved to Bore hole D (see sketch).

After clearing away overburden and removing cell lids, samples were collected from each cell. Final sampling to 6 feet below Cells C, B, A, D, E and Cell F was performed. Significant levels of reactor isotopes were not detected (see gamma-ray energy screenings of cell samples). Sample key is as follows:

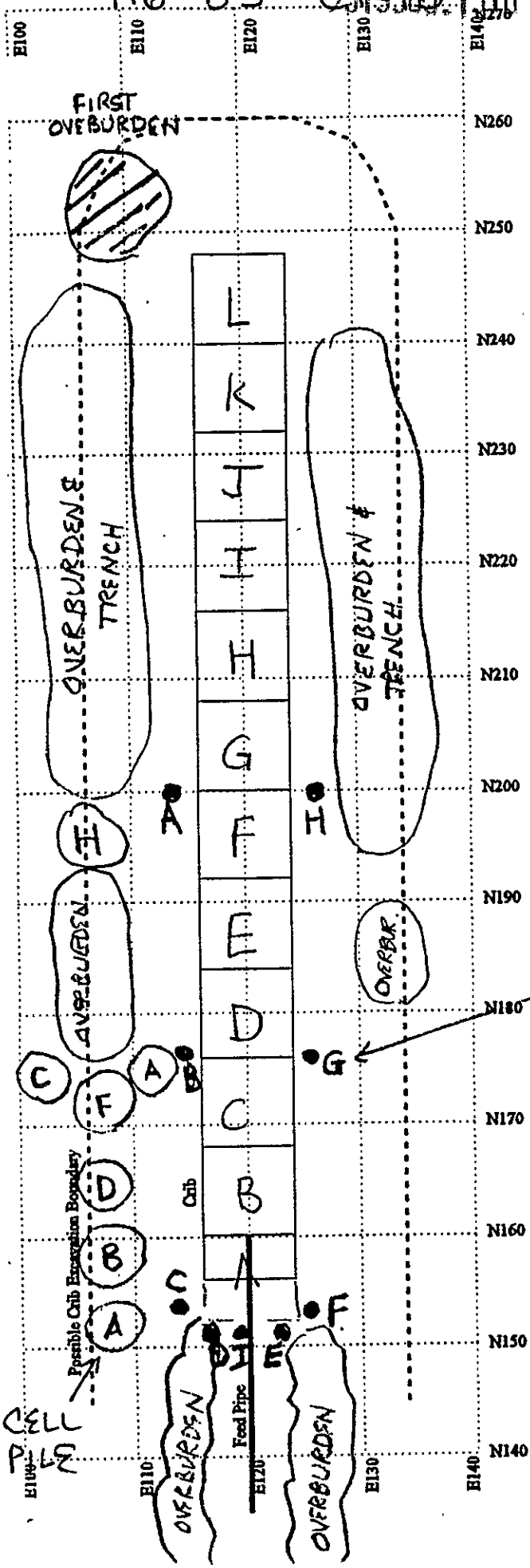
Sample Number	Location in 116-B5 Crib
BOG7C5	West Side Overburden Soil
BOG7C7	East Side Overburden Soil
BOG7C9	Crib Sand and Gravel Cell L
BOG7D1	Cell K
BOG7D3	Cell J
BOG7D5	Cell I
BOG7D7	Cell H
BOG7D9	Cell G
BOG7F1	Cell F
BOG7F3	Cell E
BOG7F5	Cell D
BOG7F7	Cell C
BOG7F9	Cell C (Duplicate)
BOG7G1	Cell B
BOG7G3	Cell A

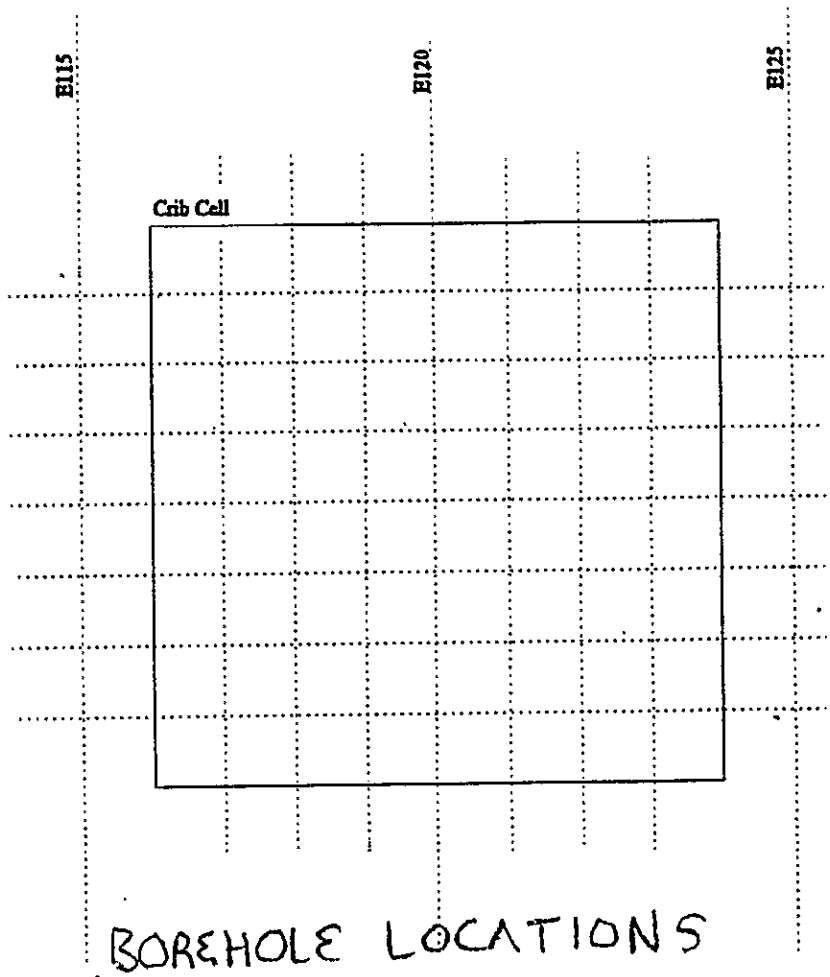
The chemical screening results of soil samples indicated potentially designating (Washington State Dangerous Waste) levels of mercury. Extraction by the Toxicity Characteristic Leaching Procedure (TCLP) and mercury analyses on four of the high samples were all <1 ug/L. Hence, none of the soil designates for mercury. At present, sampling operations have moved to 116-B4 French Drain. When all data is returned from laboratory and compiled (including off site split samples), the 116-B5 crib can be back filled.

116-B4 French Drain is currently being excavated and sampled.

As of 7/19/95, overburden has been cleared away. No structure has been found down to 6 feet deep. Samples were collected 4 feet deep just below 3 inch perforated steel drain pipe. Samples of 1-2 inch diameter drain rocks were collected for screening analyses. Radioactivity near drain pipe ranges from background to 70,000 dpm (see gamma-ray energy screenings of two samples). Plan is to excavate and sample entire drain contents down to 16 feet. Since no containment structure has been found, maximum excavation/sampling distance out from center will be 7 feet.

116-B5 CRIB SOIL PILES & BOREHOLE LOCATIONS





BOREHOLE LOCATIONS ALL DRILLED TO 15 FT EXCEPT C WHICH STOPPED AT 7 FT. SAMPLES WERE COLLECTED AT 10 ft, 12.5 ft & 15 FT.

Environmental Restoration Contractor **ERC Team**

Interoffice Memorandum

Job No. 22192
Written Response Required? NO
Closes CCN: N/A
OU: N/A
TSD: N/A
ERA: N/A
Subject Code: 8600

TO: John Ludowise, H4-90
Matt Galbreath, H6-04

DATE: July 6, 1995

COPIES: BHI Document Control H4-79, w/a
Conan Wade T7-05, w/a
Dennis R. Jordan X2-10, w/a

FROM: Albert I. Davis
Analytical Services
X2-10/373-3039

SUBJECT: **ANALYSIS OF SOILS FROM 116-B-5 CRIB**

Fifteen soil samples from the 116-B-5 Crib were gamma scanned. All had less than the 50 pCi/gram limit for reactor produced isotopes.

Only in one soil sample, B0G7G3, the analytical program flagged 129-I as read. It was not, when Europium are present there is and interfering x-ray which causes the miss-identification.

The samples B0G7-F5, F7, F9, G1, and G3 had some reactor produced isotopes; 60 Co, 137 Cs, 152 Eu, and 154 Eu.

Data is recorded in an excell spreadsheet and was transmitted via CC:mail to John Ludowise. If this is a preferred method, this can become routine followed by a cover letter.

If there are questions please call.

AID:ksb

Attachment: results

GAMMA-RAY ENERGY ANALYSIS SOIL SCREENING REPORT

Radiometric Laboratory
Environmental Analytical Laboratory
IT Hanford Co.

Customer ID Number: B0G7C5
EAL ID Number: EAL00518

Isotope		Activity, pCi/g on 30 June, 1995		
Be7	<	6.6e-01		
K40		6.5e+00	+/-	1.4e+00
Co57	<	7.2e-01		
Co60	<	9.5e-02		
RuRh106	<	8.1e-01		
Sb125	<	2.5e-01		
I129	<	4.5e+01		
Cs134	<	1.3e-01		
Cs137	<	1.2e-01		
Ce144	<	7.0e-01		
Eu152	<	7.8e-01		
Eu154	<	3.8e-01		
Eu155	<	4.3e-01		
Ra226	<	0.0e+00		
Th32dau		7.7e-01	+/-	2.6e-01
U235	<	9.6e-01		
U238	<	1.0e+01		
U238dau		8.6e-01	+/-	2.5e-01
Np237	<	1.9e-01		
Pu239	<	1.3e+03		
Pu240	<	2.0e+04		
Am241	<	6.8e-01		

Definitions:

All errors reported at 2 standard deviations

The analysis of U238 is based on the activity of Pa234m

The analysis of Np237 is based on the activity of Pa233

U238dau is the activity of Pb214 and Bi214, short lived daughter products products of U238. Equillibrium between parent and daughter products probably does not exist

Th32dau is the activity of Ac228, Pb212, and Tl208, short lived daughter products products of Th232. Equillibrium between parent and daughter products may not exist

Albert I. Davis 6-30-95
Albert I. Davis
Rad Ctg Mgr

Dennis R. Jordan 6/30
Dennis R. Jordan
EAL Manager
Date

GAMMA-RAY ENERGY ANALYSIS SOIL SCREENING REPORT

Radiometric Laboratory
Environmental Analytical Laboratory
IT Hanford Co.

Customer ID Number: B0G7C7
EAL ID Number: EAL00519

Isotope		Activity, pCi/g on 30 June, 1995		
Be7	<	7.2e-01		
K40		1.1e+01	+/-	1.7e+00
Co57	<	7.7e-01		
Co60	<	1.3e-01		
RuRh106	<	8.9e-01		
Sb125	<	2.4e-01		
I129	<	4.0e+01		
Cs134	<	1.2e-01		
Cs137	<	1.2e-01		
Ce144	<	7.4e-01		
Eu152	<	6.4e-01		
Eu154	<	3.1e-01		
Eu155	<	4.8e-01		
Th32dau		9.0e-01	+/-	2.4e-01
U235	<	7.9e-01		
U238	<	1.2e+01		
U238dau		9.8e-01	+/-	2.4e-01
Np237	<	2.0e-01		
Pu239	<	1.3e+03		
Pu240	<	1.9e+04		
Am241	<	6.4e-01		

Definitions:

All errors reported at 2 standard deviations

The analysis of U238 is based on the activity of Pa234m

The analysis of Np237 is based on the activity of Pa233

U238dau is the activity of Pb214 and Bi214, short lived daughter products products of U238. Equillibrium between parent and daughter products probably does not exist

Th32dau is the activity of Ac228, Pb212, and Tl208, short lived daughter products products of Th232. Equillibrium between parent and daughter products may not exist

Albert I. Davis 6-30-95
Rad Ctg Mgr

Dennis R. Jordan 6/30
EAL Manager
Date

GAMMA-RAY ENERGY ANALYSIS SOIL SCREENING REPORT

Radiometric Laboratory
Environmental Analytical Laboratory
IT Hanford Co.

Customer ID Number: BOG7C9
EAL ID Number: EAL00520

Isotope		Activity, pCi/g on 30 June, 1995		
Be7	<	5.2e-01		
K40		1.4e+01	+/-	1.9e+00
Co57	<	6.3e-01		
Co60	<	1.2e-01		
Co60	<	9.0e-02		
RuRh106	<	7.3e-01		
Sb125	<	2.2e-01		
I129	<	3.4e+01		
Cs134	<	1.3e-01		
Cs137	<	1.2e-01		
Ce144	<	6.1e-01		
Eu152	<	5.2e-01		
Eu154	<	3.6e-01		
Eu155	<	3.5e-01		
Th32dau		5.3e-01	+/-	2.1e-01
U235	<	6.3e-01		
U238	<	1.3e+01		
U238dau		4.0e-01	+/-	1.8e-01
Np237	<	1.7e-01		
Pu239	<	1.1e+03		
Pu240	<	1.8e+04		
Am241	<	5.8e-01		

Definitions:

All errors reported at 2 standard deviations

The analysis of U238 is based on the activity of Pa234m

The analysis of Np237 is based on the activity of Pa233

U238dau is the activity of Pb214 and Bi214, short lived daughter products products of U238. Equillibrium between parent and daughter products probably does not exist

Th32dau is the activity of Ac228, Pb212, and Tl208, short lived daughter products products of Th232. Equillibrium between parent and daughter products may not exist

Albert I. Davis 6-30-95
Albert I. Davis
Rad Ctg Mgr

Dennis R. Jordan 6/30
Dennis R. Jordan
EAL Manager
Date

GAMMA-RAY ENERGY ANALYSIS SOIL SCREENING REPORT

Radiometric Laboratory
Environmental Analytical Laboratory
IT Hanford Co.

Customer ID Number: B0G7D1
EAL ID Number: EAL00521

Isotope		Activity, pCi/g on 30 June, 1995		
Be7	<	6.0e-01		
K40		1.6e+01	+/-	1.8e+00
Co57	<	5.4e-01		
Co60	<	8.8e-02		
RuRh106	<	5.9e-01		
Sb125	<	1.9e-01		
I129	<	2.8e+01		
Cs134	<	9.1e-02		
Cs137	<	8.1e-02		
Ce144	<	5.3e-01		
Eu152	<	5.5e-01		
Eu154	<	2.2e-01		
Eu155	<	2.9e-01		
Th32dau		5.3e-01	+/-	1.6e-01
U235	<	5.4e-01		
U238	<	9.6e+00		
U238dau		2.8e-01	+/-	1.2e-01
Np237	<	1.3e-01		
Pu239	<	9.7e+02		
Pu240	<	1.3e+04		
Am241	<	4.7e-01		

Definitions:

All errors reported at 2 standard deviations

The analysis of U238 is based on the activity of Pa234m

The analysis of Np237 is based on the activity of Pa233

U238dau is the activity of Pb214 and Bi214, short lived daughter products products of U238. Equilibrium between parent and daughter products probably does not exist

Th32dau is the activity of Ac228, Pb212, and Tl208, short lived daughter products products of Th232. Equilibrium between parent and daughter products may not exist

6-30-95

Albert I. Davis
Rad Ctg Mgr

6/30

Dennis R. Jordan
EAL Manager

Date

GAMMA-RAY ENERGY ANALYSIS SOIL SCREENING REPORT

Radiometric Laboratory
Environmental Analytical Laboratory
IT Hanford Co.

Customer ID Number: B0G7D3
EAL ID Number: EAL00522

Isotope		Activity, pCi/g on 30 June, 1995		
Be7	<	5.6e-01		
K40		1.4e+01	+/-	1.7e+00
Co57	<	5.6e-01		
Co60	<	8.6e-02		
RuRh106	<	7.2e-01		
Sb125	<	1.8e-01		
I129	<	2.7e+01		
Cs134	<	9.6e-02		
Cs137	<	8.0e-02		
Ce144	<	5.4e-01		
Eu152	<	4.5e-01		
Eu154	<	2.9e-01		
Eu155	<	2.9e-01		
Th32dau		5.5e-01	+/-	1.5e-01
U235	<	5.9e-01		
U238	<	1.0e+01		
U238dau		3.5e-01	+/-	1.2e-01
Np237	<	1.4e-01		
Pu239	<	9.5e+02		
Pu240	<	1.4e+04		
Am241	<	4.3e-01		

Definitions:

All errors reported at 2 standard deviations

The analysis of U238 is based on the activity of Pa234m

The analysis of Np237 is based on the activity of Pa233

U238dau is the activity of Pb214 and Bi214, short lived daughter products products of U238. Equillibrium between parent and daughter products probably does not exist

Th32dau is the activity of Ac228, Pb212, and Tl208, short lived daughter products products of Th232. Equillibrium between parent and daughter products may not exist

Albert I. Davis 6-30-95
Rad Ctg Mgr

Dennis R. Jordan 6/30
EAL Manager
Date

GAMMA-RAY ENERGY ANALYSIS SOIL SCREENING REPORT

Radiometric Laboratory
Environmental Analytical Laboratory
IT Hanford Co.

Customer ID Number: B0G7D5
EAL ID Number: EAL00523

Isotope		Activity, pCi/g on 30 June, 1995		
Be7	<	5.1e-01		
K40		1.4e+01	+/-	1.7e+00
Co57	<	5.4e-01		
Co60	<	7.5e-02		
RuRh106	<	8.8e-01		
Sb125	<	2.0e-01		
I129	<	2.9e+01		
Cs134	<	7.5e-02		
Cs137	<	8.2e-02		
Ce144	<	5.3e-01		
Eu152	<	3.4e-01		
Eu154	<	2.6e-01		
Eu155	<	3.4e-01		
Th32dau		4.9e-01	+/-	1.5e-01
U235	<	5.4e-01		
U238		8.6e+00	+/-	5.0e+00
U238dau		3.3e-01	+/-	1.0e-01
Np237	<	1.4e-01		
Pu239	<	9.6e+02		
Pu240	<	1.3e+04		
Am241	<	5.3e-01		

Definitions:

All errors reported at 2 standard deviations

The analysis of U238 is based on the activity of Pa234m

The analysis of Np237 is based on the activity of Pa233

U238dau is the activity of Pb214 and Bi214, short lived daughter products products of U238. Equillibrium between parent and daughter products probably does not exist

Th32dau is the activity of Ac228, Pb212, and Tl208, short lived daughter products products of Th232. Equillibrium between parent and daughter products may not exist

Albert I. Davis 6-30-95
Albert I. Davis
Rad Ctg Mgr

Dennis R. Jordan 6/30
Dennis R. Jordan Date
EAL Manager

GAMMA-RAY ENERGY ANALYSIS SOIL SCREENING REPORT

Radiometric Laboratory
Environmental Analytical Laboratory
IT Hanford Co.

Customer ID Number: B0G7D7
EAL ID Number: EAL00524

Isotope		Activity, pCi/g on 30 June, 1995		
Be7	<	4.9e-01		
K40		1.4e+01	+/-	1.7e+00
Co57	<	5.6e-01		
Co60	<	7.7e-02		
RuRh106	<	7.1e-01		
Sb125	<	2.0e-01		
I129	<	2.6e+01		
Cs134	<	8.2e-02		
Cs137	<	7.2e-02		
Ce144	<	5.4e-01		
Eu152	<	4.0e-01		
Eu154	<	2.7e-01		
Eu155	<	2.6e-01		
Th32dau		5.7e-01	+/-	1.5e-01
U235	<	6.0e-01		
U238	<	9.9e+00		
U238dau		3.1e-01	+/-	1.4e-01
Np237	<	1.3e-01		
Pu239	<	9.5e+02		
Pu240	<	1.2e+04		
Am241	<	4.8e-01		

Definitions:

All errors reported at 2 standard deviations

The analysis of U238 is based on the activity of Pa234m

The analysis of Np237 is based on the activity of Pa233

U238dau is the activity of Pb214 and Bi214, short lived daughter products products of U238. Equillibrium between parent and daughter products probably does not exist

Th32dau is the activity of Ac228, Pb212, and Tl208, short lived daughter products products of Th232. Equillibrium between parent and daughter products may not exist

Albert I. Davis 6-30-95
Rad Ctg Mgr

Dennis R. Jordan 6/30
EAL Manager
Date

GAMMA-RAY ENERGY ANALYSIS SOIL SCREENING REPORT

Radiometric Laboratory
Environmental Analytical Laboratory
IT Hanford Co.

Customer ID Number: B0G7D9
EAL ID Number: EAL00525

Isotope		Activity, pCi/g on 30 June, 1995		
Be7	<	3.9e-01		
K40		1.4e+01	+/-	1.6e+00
Co57	<	5.2e-01		
Co60	<	6.2e-02		
RuRh106	<	5.0e-01		
Sb125	<	1.6e-01		
I129	<	2.7e+01		
Cs134	<	8.2e-02		
Cs137	<	5.7e-02		
Ce144	<	5.1e-01		
Eu152	<	3.5e-01		
Eu154	<	2.8e-01		
Eu155	<	2.8e-01		
Th32dau		5.9e-01	+/-	1.6e-01
U235	<	5.2e-01		
U238	<	7.4e+00		
U238dau		4.0e-01	+/-	1.0e-01
Np237	<	1.2e-01		
Pu239	<	9.3e+02		
Pu240	<	1.1e+04		
Am241	<	4.8e-01		

Definitions:

All errors reported at 2 standard deviations

The analysis of U238 is based on the activity of Pa234m

The analysis of Np237 is based on the activity of Pa233

U238dau is the activity of Pb214 and Bi214, short lived daughter products products of U238. Equillibrium between parent and daughter products probably does not exist

Th32dau is the activity of Ac228, Pb212, and Tl208, short lived daughter products products of Th232. Equillibrium between parent and daughter products may not exist

Albert I. Davis
Rad Ctg Mgr

6-30-95

Dennis R. Jordan
EAL Manager

6/30
Date

GAMMA-RAY ENERGY ANALYSIS SOIL SCREENING REPORT

Radiometric Laboratory
Environmental Analytical Laboratory
IT Hanford Co.

Customer ID Number: B0G7F1
EAL ID Number: EAL00532

Isotope		Activity, pCi/g on 5 July, 1995		
Be7	<	6.4e-01		
K40		1.5e+01	+/-	1.8e+00
Co57	<	5.8e-01		
Co60	<	8.4e-02		
RuRh106	<	7.4e-01		
Sb125	<	1.6e-01		
I129	<	3.0e+01		
Cs134	<	1.0e-01		
Cs137	<	8.5e-02		
Ce144	<	5.6e-01		
Eu152	<	5.6e-01		
Eu154	<	3.0e-01		
Eu155	<	3.4e-01		
Th32dau		4.7e-01	+/-	1.8e-01
U235	<	5.7e-01		
U238	<	1.2e+01		
U238dau		3.5e-01	+/-	1.2e-01
Np237	<	1.6e-01		
Pu239	<	1.0e+03		
Pu240	<	1.3e+04		
Am241	<	5.2e-01		

Definitions:

All errors reported at 2 standard deviations

The analysis of U238 is based on the activity of Pa234m

The analysis of Np237 is based on the activity of Pa233

U238dau is the activity of Pb214 and Bi214, short lived daughter products products of U238. Equilibrium between parent and daughter products probably does not exist

Th32dau is the activity of Ac228, Pb212, and Tl208, short lived daughter products products of Th232. Equilibrium between parent and daughter products may not exist

Albert I. Davis
Rad Ctg Mgr

7-5-95

Dennis R. Jordan
EAL Manager

7/5/95
Date

GAMMA-RAY ENERGY ANALYSIS SOIL SCREENING REPORT

Radiometric Laboratory
Environmental Analytical Laboratory
IT Hanford Co.

Customer ID Number: B0G7F3
EAL ID Number: EAL00526

Isotope		Activity, pCi/g on 5 July, 1995		
Be7	<	6.1e-01		
K40		1.6e+01	+/-	1.9e+00
Co57	<	6.1e-01		
Co60	<	1.1e-01		
RuRh106	<	6.1e-01		
Sb125	<	1.8e-01		
I129	<	2.9e+01		
Cs134	<	1.0e-01		
Cs137	<	7.2e-02		
Ce144	<	5.9e-01		
Eu152	<	8.9e-01		
Eu154	<	3.2e-01		
Eu155	<	3.5e-01		
Th32dau		5.2e-01	+/-	1.8e-01
U235	<	6.3e-01		
U238	<	1.2e+01		
U238dau		4.4e-01	+/-	1.4e-01
Np237	<	1.7e-01		
Pu239	<	1.1e+03		
Pu240	<	1.5e+04		
Am241	<	5.4e-01		

Definitions:

All errors reported at 2 standard deviations

The analysis of U238 is based on the activity of Pa234m

The analysis of Np237 is based on the activity of Pa233

U238dau is the activity of Pb214 and Bi214, short lived daughter products products of U238. Equillibrium between parent and daughter products probably does not exist

Th32dau is the activity of Ac228, Pb212, and Tl208, short lived daughter products products of Th232. Equillibrium between parent and daughter products may not exist

7-5-95

Albert I. Davis
Rad Ctg Mgr

Dennis R. Jordan
EAL Manager

7/5/95
Date

GAMMA-RAY ENERGY ANALYSIS SOIL SCREENING REPORT

Radiometric Laboratory
Environmental Analytical Laboratory
IT Hanford Co.

Customer ID Number: B0G7F5
EAL ID Number: EAL00527

Isotope		Activity, pCi/g on 5 July, 1995		
Be7	<	7.6e-01		
K40		1.6e+01	+/-	1.8e+00
Co57	<	7.3e-01		
Co60		1.5e-01	+/-	7.5e-02
RuRh106	<	8.3e-01		
Sb125	<	2.6e-01		
I129	<	3.8e+01		
Cs134	<	1.1e-01		
Cs137		3.1e-01	+/-	8.7e-02
Ce144	<	7.1e-01		
Eu152		2.3e+00	+/-	7.2e-01
Eu154	<	3.6e-01		
Eu155	<	4.4e-01		
Th32dau		5.4e-01	+/-	1.7e-01
U235	<	7.1e-01		
U238	<	1.3e+01		
U238dau		4.3e-01	+/-	1.8e-01
Np237	<	1.9e-01		
Pu239	<	1.3e+03		
Pu240	<	1.6e+04		
Am241	<	6.0e-01		

Definitions:

All errors reported at 2 standard deviations

The analysis of U238 is based on the activity of Pa234m

The analysis of Np237 is based on the activity of Pa233

U238dau is the activity of Pb214 and Bi214, short lived daughter products products of U238. Equilibrium between parent and daughter products probably does not exist

Th32dau is the activity of Ac228, Pb212, and Tl208, short lived daughter products products of Th232. Equilibrium between parent and daughter products may not exist

Albert I. Davis 7-5-95
Rad Ctg Mgr

Dennis R. Jordan 7/5/95
EAL Manager
Date

GAMMA-RAY ENERGY ANALYSIS SOIL SCREENING REPORT

Radiometric Laboratory
Environmental Analytical Laboratory
IT Hanford Co.

Customer ID Number: B0G7F7
EAL ID Number: EAL00528

Isotope		Activity, pCi/g on 5 July, 1995		
Be7	<	1.1e+00		
K40		1.1e+01	+/-	1.9e+00
Co57	<	9.6e-01		
Co60		2.0e-01	+/-	1.0e-01
RuRh106	<	1.3e+00		
Sb125	<	3.3e-01		
I129	<	5.6e+01		
Cs134	<	1.5e-01		
Cs137		1.9e-01	+/-	9.2e-02
Ce144	<	9.5e-01		
Eu152		2.6e+00	+/-	8.1e-01
Eu154	<	4.9e-01		
Eu155	<	5.7e-01		
Ra226	<	0.0e+00		
Th32dau		7.1e-01	+/-	2.8e-01
U235	<	9.0e-01		
U238	<	1.8e+01		
U238dau		7.3e-01	+/-	2.4e-01
Np237	<	2.4e-01		
Pu239	<	1.8e+03		
Pu240	<	2.6e+04		
Am241	<	8.4e-01		

Definitions:

All errors reported at 2 standard deviations

The analysis of U238 is based on the activity of Pa234m

The analysis of Np237 is based on the activity of Pa233

U238dau is the activity of Pb214 and Bi214, short lived daughter products products of U238. Equilibrium between parent and daughter products probably does not exist

Th32dau is the activity of Ac228, Pb212, and Tl208, short lived daughter products products of Th232. Equilibrium between parent and daughter products may not exist

7-5-95

Albert I. Davis
Rad Ctg Mgr

7/5/95

Dennis R. Jordan
EAL Manager

Date

GAMMA-RAY ENERGY ANALYSIS SOIL SCREENING REPORT

Radiometric Laboratory
Environmental Analytical Laboratory
IT Hanford Co.

Customer ID Number: B0G7F9
EAL ID Number: EAL00529

Isotope		Activity, pCi/g on 5 July, 1995		
Be7	<	1.1e+00		
K40		8.6e+00	+/-	1.7e+00
Co57	<	1.1e+00		
Co60	<	1.5e-01		
RuRh106	<	1.2e+00		
Sb125	<	3.4e-01		
I129	<	5.6e+01		
Cs134	<	1.7e-01		
Cs137		1.7e-01	+/-	1.1e-01
Ce144	<	1.1e+00		
Eu152		2.7e+00	+/-	7.8e-01
Eu154	<	4.5e-01		
Eu155	<	5.8e-01		
Th32dau		9.7e-01	+/-	2.8e-01
U235	<	1.0e+00		
U238	<	2.0e+01		
U238dau		8.3e-01	+/-	2.8e-01
Np237	<	2.9e-01		
Pu239	<	2.0e+03		
Pu240	<	2.5e+04		
Am241	<	8.7e-01		

Definitions:

All errors reported at 2 standard deviations

The analysis of U238 is based on the activity of Pa234m

The analysis of Np237 is based on the activity of Pa233

U238dau is the activity of Pb214 and Bi214, short lived daughter products products of U238. Equillibrium between parent and daughter products probably does not exist

Th32dau is the activity of Ac228, Pb212, and Tl208, short lived daughter products products of Th232. Equillibrium between parent and daughter products may not exist

7-5-95
Albert I. Davis
Rad Ctg Mgr

7/5/95
Dennis R. Jordan
EAL Manager
Date

GAMMA-RAY ENERGY ANALYSIS SOIL SCREENING REPORT

Radiometric Laboratory
Environmental Analytical Laboratory
IT Hanford Co.

Customer ID Number: BOG7G1
EAL ID Number: EAL00530

Isotope		Activity, pCi/g on 5 July, 1995		
Be7	<	9.3e-01		
K40		9.5e+00	+/-	1.8e+00
Co57	<	8.3e-01		
Co60	<	1.1e-01		
RuRh106	<	1.2e+00		
Sb125	<	3.1e-01		
I129	<	5.3e+01		
Cs134	<	1.5e-01		
Cs137	<	1.3e-01		
Ce144	<	8.1e-01		
Eu152		8.5e-01	+/-	4.8e-01
Eu154	<	4.3e-01		
Eu155	<	4.8e-01		
Th32dau		1.0e+00	+/-	2.8e-01
U235	<	8.2e-01		
U238	<	1.6e+01		
U238dau		9.9e-01	+/-	2.8e-01
Np237	<	2.7e-01		
Pu239	<	1.5e+03		
Pu240	<	2.3e+04		
Am241	<	7.7e-01		

Definitions:

All errors reported at 2 standard deviations

The analysis of U238 is based on the activity of Pa234m

The analysis of Np237 is based on the activity of Pa233

U238dau is the activity of Pb214 and Bi214, short lived daughter products products of U238. Equillibrium between parent and daughter products probably does not exist

Th32dau is the activity of Ac228, Pb212, and Tl208, short lived daughter products products of Th232. Equillibrium between parent and daughter products may not exist

7-5-95
Albert I. Davis
Rad Ctg Mgr

Dennis R. Jordan
EAL Manager

7/5/95
Date

GAMMA-RAY ENERGY ANALYSIS SOIL SCREENING REPORT

Radiometric Laboratory
Environmental Analytical Laboratory
IT Hanford Co.

Customer ID Number: B0G7G3
EAL ID Number: EAL00531

Isotope		Activity, pCi/g on 5 July, 1995		
Be7	<	1.1e+00		
K40		1.4e+01	+/-	1.9e+00
Co57	<	1.1e+00		
Co60		7.0e-01	+/-	1.5e-01
RuRh106	<	1.2e+00		
Sb125	<	3.1e-01		
I129	<	4.7e+01	~~+/-~~	~~2.3e+01~~
Cs134	<	1.7e-01		
Cs137	<	1.5e-01		
Ce144	<	1.0e+00		
Eu152		6.5e+00	+/-	1.0e+00
Eu154		6.7e-01	+/-	2.7e-01
Eu155	<	6.1e-01		
Th32dau		6.2e-01	+/-	2.2e-01
U235	<	1.1e+00		
U238	<	2.1e+01		
U238dau		4.6e-01	+/-	1.6e-01
Np237	<	2.7e-01		
Pu239	<	1.9e+03		
Pu240	<	2.4e+04		
Am241	<	7.7e-01		

[illegible] ^{129}I [illegible]

Definitions:

All errors reported at 2 standard deviations

The analysis of U238 is based on the activity of Pa234m

The analysis of Np237 is based on the activity of Pa233

U238dau is the activity of Pb214 and Bi214, short lived daughter products products of U238. Equilibrium between parent and daughter products probably does not exist

Th32dau is the activity of Ac228, Pb212, and Tl208, short lived daughter products products of Th232. Equilibrium between parent and daughter products may not exist

7-5-95
Albert I. Davis
Rad Ctg Mgr

Dennis R. Jordan
EAL Manager
Date 7/5/95

9513383.1327

Environmental Restoration Contractor **ERC Team**

Interoffice Memorandum

Job No. 22192
Written Response Required? N0
Closes CCN: N/A
OU: N/A
TSD: N/A
ERA: N/A
Subject Code: 8600

TO: Matt Galbraith, H6-04

DATE: July 12, 1995

COPIES: Bill Whitten, N3-05
John Ludowise, H4-90
Conan Wade, T7-05
BHI Document Control H4-79, w/a

FROM: Albert I. Davis
Analytical Services
X2-10/373-9731

SUBJECT: **SAMPLE ANALYSIS**

Samples from the French drain 116-B-4, B0G8H8, T0, were completed and data results transmitted. The samples had low amounts of activity, but nothing greater than 50 pCi/g for the reactor preduced isotopes. The natural component activity averages about 11 pCi/g for these samples.

If there are any questions please call. Thank you.

AID:ksb

Attachment: results

GAMMA-RAY ENERGY ANALYSIS SOIL SCREENING REPORT

Radiometric Laboratory
Environmental Analytical Laboratory
IT Hanford Co.

Customer ID Number: B0G8H8
EAL ID Number: EAL00558

Isotope		Activity, pCi/g on 12 July, 1995		
Be7	<	5.2e-01		
K40		9.9e+00	+/-	1.4e+00
Co57	<	5.3e-01		
Co60	<	7.6e-02		
RuRh106	<	6.3e-01		
Sb125	<	1.8e-01		
I129	<	2.6e+01		
Cs134	<	5.9e-02		
Cs137		1.8e-01	+/-	6.6e-02
Ce144	<	5.1e-01		
Eu152	<	4.3e-01		
Eu154	<	2.3e-01		
Eu155	<	3.0e-01		
Ra226	<	0.0e+00		
Th32dau		4.4e-01	+/-	1.5e-01
U235	<	5.3e-01		
U238	<	9.6e+00		
U238dau	<	3.0e-01		
U238dau		4.7e-01	+/-	1.3e-01
Np237	<	1.4e-01		
Pu239	<	9.3e+02		
Pu240	<	1.3e+04		
Am241	<	4.4e-01		

Definitions:

All errors reported at 2 standard deviations

The analysis of U238 is based on the activity of Pa234m

The analysis of Np237 is based on the activity of Pa233

U238dau is the activity of Pb214 and Bi214, short lived daughter products products of U238. Equilibrium between parent and daughter products probably does not exist

Th32dau is the activity of Ac228, Pb212, and Tl208, short lived daughter products products of Th232. Equilibrium between parent and daughter products may not exist

7-12-95
Albert I. Davis
Rad Ctg Mgr

7/12/95
Dennis R. Jordan
EAL Manager
Date

GAMMA-RAY ENERGY ANALYSIS SOIL SCREENING REPORT

Radiometric Laboratory
Environmental Analytical Laboratory
IT Hanford Co.

Customer ID Number: B0G8J0
EAL ID Number: EAL00559

Isotope		Activity, pCi/g on 12 July, 1995		
Be7	<	5.7e-01		
K40		9.8e+00	+/-	1.5e+00
Co57	<	7.1e-01		
Co60		2.1e-01	+/-	8.0e-02
RuRh106	<	7.9e-01		
Sb125	<	1.9e-01		
I129	<	3.6e+01		
Cs134	<	9.1e-02		
Cs137	<	8.2e-02		
Ce144	<	6.9e-01		
Eu152		8.4e-01	+/-	3.2e-01
Eu154	<	3.3e-01		
Eu155	<	3.7e-01		
Ra226	<	0.0e+00		
Th32dau		5.4e-01	+/-	1.7e-01
U235	<	7.0e-01		
U238	<	1.1e+01		
U238dau		4.6e-01	+/-	1.6e-01
Np237	<	1.7e-01		
Pu239	<	1.3e+03		
Pu240	<	1.7e+04		
Am241	<	6.0e-01		

Definitions:

All errors reported at 2 standard deviations

The analysis of U238 is based on the activity of Pa234m

The analysis of Np237 is based on the activity of Pa233

U238dau is the activity of Pb214 and Bi214, short lived daughter products products of U238. Equillibrium between parent and daughter products probably does not exist

Th32dau is the activity of Ac228, Pb212, and Tl208, short lived daughter products products of Th232. Equillibrium between parent and daughter products may not exist

7-12-95
Albert I. Davis
Rad Ctg Mgr

7/12/95
Dennis R. Jordan
EAL Manager
Date

FAST Sample Data Summary
All Results in mg/kg as-received basis

FAST Sample ID	Field Sample ID	HEIS Number	Date Sampled	Time Sampled	Acetone	Trichloroethylene	Carbon Tetrachloride	Methyl Ethyl Ketone	Chromium	Soil pH	Silver	Cadmium	Barium	Mercury	TCLP Mercury	Comments
FT5047-01	116-B5F-10		6/28/95	0721					<10	9.4	<10	<1	<300	<0.1		
FT5047-02	116-B5F-12.5		6/28/95	0721					<10	9.5	<10	<1	<300	<0.1		
FT5047-03	116-B5F-15		6/28/95	0721					<10	9.4	<10	<1	<300	<0.1		
FT5047-04	116-B5E-10		6/28/95	0816					<10	9.3		<1	300	<0.1		7/5 split to WSCF
FT5047-05	116-B5E-12.5		6/28/95	0816						9.6	<10	<1	<300	<0.1		Digest loss. Rerun.
FT5047-06	116-B5E-15		6/28/95	0816					<10	9.7	<10	<1	<300	<0.1		
FT5047-07	116-B5I-10		6/28/95	0852					<10	9.6	<10	<1	<300	<0.1		7/5 split to WSCF
FT5047-08	116-B5I-12.5		6/28/95	0852					10	9.4	<10	<1	<300	<0.1		
FT5047-09	116-B5I-15		6/28/95	0852					<10	9.6	<10	1	<300	<0.1		
FT5047-10	116-B5I-D		6/27/95	0852					<10	9.5	<10	1	<300			
FT5047-11	116-B5A-10		6/27/95	1347					10	9.4	<10	<1	300	<0.1		
FT5047-12	116-B5A-12.5		6/27/95	1347					<10	9.2	<10	<1	<300	<0.1		
FT5047-13	116-B5A-14.5		6/27/95	1347					10	8.8	<10	<1	<300	<0.1		
FT5047-14	116-B5B-10		6/27/95	1436					<10	9.1	<10	<1	<1000	<0.1		
FT5047-15	116-B5B-12.5		6/27/95	1436					<10	9.2	<10	<1	<1000	<0.1		
FT5047-16	116-B5B-14.5		6/27/95	1436					<10	9.2	<10	<10	<1000	<0.1		
FT5047-17	116-B5C-6		6/27/95	1510					<10	9.2	<10	<1	<300	<0.1		
FT5047-18	116-B5D-10		6/27/95	1553					<10	9.3	<10	1	<300	<0.1		
FT5047-19	116-B5D-12.5		6/27/95	1553					<10	9.1	<10	1	<300	<0.1		
FT5047-20	116-B5D-15		6/27/95	1553					10	9.0	<10	1	<300	<0.1		
FT5047-21	116-B5H-10		6/27/95	1631					10	9.6	<10	<1	<300	<0.1		
FT5047-22	116-B5H-12.5		6/27/95	1631					<10	9.7	<10	1	<300	<0.1		
FT5047-23	116-B5H-15		6/27/95	1637					<10	9.1	<10	1	<1000	<0.1		
FT5047-24	116-B5G-10		6/27/95	1649					<10	9.3	<10	<10	<1000	<0.1		
FT5047-25	116-B5G-12.5		6/27/95	1649					<10	9.3	<10	1	<1000	<0.1		
FT5047-26	116-B5G-15		6/27/95	1649					<10	9.4	<10	<10	<1000	<0.1		
FT5047-27		BOG-7C2	6/28/95	1216					<10	8.4	<10	<100		<0.1		
FT5047-28		BOG-7C4	6/29/95	1351					<10	8.4	<10	<100		<0.1		
FT5047-29	east side pile	BOG-7C6	6/29/95	1403					<10	8.4	<10	<10		<0.1		
FT5047-30	cell J	BOG-7D2	6/30/95	1053					<10	9.4	<10	<10		<0.1		7/5 Split to WSCF
FT5047-31	cell L	BOG-7C8	6/30/95	1041					<10		<10	<1		<0.1		

9513383.1330

FAST Sample Data Summary
All Results in mg/kg as-received basis

FAST Sample ID	Field Sample ID	HEIS Number	Date Sampled	Time Sampled	Acetone	Trichloroethylene	Carbon Tetrachloride	Methyl Ethyl Ketone	Chromium	Soil pH	Silver	Cadmium	Barium	Mercury	TCLP Mercury	Comments
FT5047-32	cell K	BOG-7D0	6/30/95	1047					<10			<1		<0.1		
FT5047-33	cell I	BOG-7D4	6/30/95	1100					<10			<1		<0.1		
FT5047-34	cell H	BOG-7D6	6/30/95	1110					<10			<1		<0.1		
FT5047-35	cell G	BOG-7D8	6/30/95	1117					<10			<1		<0.1		
FT5047-36	cell F	BOG-7F0	6/30/95	1259					<10			<1		<0.1		
FT5047-37	cell E	BOG-7F2	6/30/95	1304					10			<1		<0.1		
FT5047-38	cell D	BOG-7F4	6/30/95	1312					<10			<1		<0.1		
FT5047-39	cell C	BOG-7F6	6/30/95	1322					<10		<10	<10	<1000	1.2		
FT5047-40	cell C	BOG-7F8	6/30/95	1322					<10		<10	<10		2.4		
FT5047-41	cell B	BOG-7G0	6/30/95	1351					10		<10	<10	<1000	0.2		
FT5047-42	cell A	BOG-7G2	6/30/95	1402					10			<10	<1000	12.1	<1 ug/L	7/6 WSCF for TCLP
FT5047-43	at 4' S	BOG-7G6	7/6/95	1050					<10			<20		0.4		
FT5047-44	at 14' S	BOG-7G8	7/6/95	1058					<10			<10		<0.1		
FT5047-45	at 24' S	BOG-7H0	7/6/95	1115					<10			<10		<0.1		
FT5047-46	at 34' S	BOG-7H2	7/6/95	1140					<10			<10		<0.1		
FT5047-47	at 47' S	BOG-7H4	7/6/95	1220					<10			<10		<0.1		
FT5047-48	at 54' S	BOG-7H6	7/6/95	1233					<10			<1		<0.1		
FT5047-49	at 61' S	BOG-7H8	7/6/95	1250					<10			<10		<0.1		
FT5047-50	cell H 2'	BOG-7J0	7/7/95	1005					10	9.3		<10		<0.1		
FT5047-51	cell H 4'	BOG-7J2	7/7/95	1032					<10	9.5		<10		0.5		
FT5047-52	cell F 2'	BOG-7J4	7/7/95	1114					<10	8.9		1		0.6		
FT5047-53	cell D 2'	BOG-7J6	7/7/95	1153					<10	8.6		<10		7.4		
FT5047-54	cell B 2'	BOG-7J8	7/7/95	1231					<10	8.2		<10		9.4		
FT5047-55	cell C 2'	BOG-7K0	7/7/95	1243					<10	8.3		<10		16	<1 ug/L	
FT5047-56	cell B 6'	BOG-7K2	7/7/95	1328					<10	8.3		<10		2.8	<1 ug/L	
FT5047-57	cell A -2'	BOG-7K4	7/7/95	1347					<10			<10		4	<1 ig/L	
FT5047-58	cell A -2'	BOG-7K6	7/7/95	1347					<1			<1		4.8		
FT5047-59	French d	BOG-8H1	7/10/95	1450					<1			<1		<.1		
FT5047-60	French d	BOG-8H3	7/10/95	1503										<.1		
FT5047-61	French d	BOG-8H5	7/10/95	1510										0.9		
FT5047-62	FD N 4'	BOG-8H7	7/11/95	1411										<.1		

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FAST Sample Data Summary
All Results in mg/kg as-received basis

FAST Sample ID	Field Sample ID	HEIS Number	Date Sampled	Time Sampled	Acetone	Trichloroethylene	Carbon Tetrachloride	Methyl Ethyl Ketone	Chromium	Soil pH	Silver	Cadmium	Barium	Mercury	TCLP Mercury	Comments
FT5047-63	FD S 4'	BOG-8H9	7/11/95	1106										<.1		
FT5047-64	cell C -4'	BOG-7K8	7/12/95	1347										2.4		
FT5047-65	cell C -6'	BOG-7L0	7/12/95	1408										1.6		
FT5047-66	cell A -4'	BOG-7L2	7/12/95	1441										2.7		
FT5047-67	cell A -6'	BOG-7L4	7/12/95	1512										2.8		
FT5047-68	cell E -2'	BOG-7L6	7/17/95	1400										<.1		
FT5047-69	cell E -4'	BOG-7L8	7/17/95	1418										<.1		
FT5047-70	cell E -4'	BOG-7M0	7/17/95	1418										<.1		
FT5047-71	cell E -6'	BOG-7M2	7/17/95	1439										1.4		
FT5047-72	cell E -6'	BOG-7M4	7/17/95	1439										1.4		

9513383.1332

Attachment #7

Attached are the following items for your information:

1) Meeting Minutes, Summary of Agreements on Remedial Action Goals, 100 Area RD/RA

2) Calc Brief: MTCA Method B

3) Calc Brief: 15 mrem/yr above background

4) Calc Brief: Protection of Groundwater or River

These items are in support of the existing and future remedial action within the 100 Area Source Operable Units.

Action: Schedule Meeting to discuss calculation briefs for the afternoon of Thursday, July 27, 1995 or Friday, July 28, 1995.

July 20, 1995
Unit Managers Meeting

Meeting Minutes
Summary of Agreements on Remedial Action Goals
100 Area RD/RA
July 20, 1995

These minutes summarize the results of meetings held May 9th, May 23rd, May 31st, and June 14th between ERC, RL, EPA and Ecology to obtain agreements on the decision rules for implementing remedial action goals for 100 Area Remedial Design/Remedial Action (RD/RA). These decision rules address the remedial action goals as defined in the Proposed Plans for the 100-BC-1, 100-DR-1 and 100-HR-1 Operable Units. This documents the agreements for each remedial action goal that were reached during these meetings.

The remedial goals as stated in the proposed plans are: (e.g.; DOE/RL-94-99, Rev. 0, June ' 95)

- State of Washington *Model Toxics Control Act* (WAC 173-340) for organic and inorganic chemical constituents in soil to support unrestricted (residential) use.

- Draft EPA and Nuclear Regulatory Commission (NRC) proposed standards of 15 mrem/year in soil above background for radionuclides for human health.

- Protection of groundwater such that contaminants remaining in the soil after remediation do not result in an impact to groundwater that could exceed Maximum Contaminant Levels (MCLs) under the *Safe Drinking Water Act* (40 CFR 141). This applies to waste sites where groundwater has not been impacted.

- Protection of the Columbia River such that contaminants remaining in soil after remediation do not result in an impact to groundwater and, therefore, the Columbia River that could exceed the Ambient Water Quality Criteria under the *Clean Water Act* for protection of fish. This applies to sites where groundwater has already been impacted.

Agreements for MTCA Remedial Action Goal

Criteria	Agreement Reached with Regulatory Agencies?	Current Resolution
Land Use	Yes	Potential exposure to an individual resident will be assumed.
Exposure scenario and pathways	Yes	Scenario and pathways consistent with MTCA Method B cleanup level (WAC-173-340-740(3)); soil ingestion for a child receptor.
Exposure point	Yes	The exposure point for soil cleanup levels based on human health exposure shall be established from ground surfact to 15 ft below ground surface. (WAC 173-340-740(6)(c)
Definition of the cleanup standard	Yes	Method B formula values presented in *Model Toxics Control Act (MTCA) Cleanup Level and Risk Calculation (CLARC II) Update, January, 1995*
Cleanup standards should be above background concentrations in soil	Yes	Contaminant-specific cleanup standards will be significantly greater than Hanford site background concentrations, based on hypothesis testing (WAC 173-340-708(11)).
Cleanup standards should be above quantitation limits	Yes	Where cleanup levels are below practical quantitation limits, the cleanup level will be the practical quantitation limit (WAC 173-340-707(2)).

9513383.1335

Agreements for 15 mrem/year above Background Remedial Action Goal

Criteria	Agreement Reached with Regulatory Agencies?	Current Resolution
Land Use	Yes	Potential exposure to an individual resident will be assumed
Exposure point	Yes	The exposure point for soil cleanup levels based on human health exposure shall be established from ground surface to 15 ft below ground surface. (WAC 173-340-740(6)(c)
Compliance date for radionuclide decay	Yes	2018
Exposure scenario	Yes	Exposure scenario will be similar to that described for MTCA Method B with the following inclusions due to the influence of radionuclides. -External exposure - Crop ingestion - Meat ingestion - Milk ingestion - Soil ingestion
Background soils data	Yes	Hanford site background data.
Cleanup standards should be above quantitation limits	Yes	Where cleanup levels are below practical quantitation limits, the cleanup level will be the practical quantitation limit; these will be considered the CRQL/CRDL specified in previous plans.

9513383.1336

Agreements for MCLs in Groundwater Remedial Action Goal

Criteria	Agreement Reached with Regulatory Agencies?	Current Resolution
Definition of the "Waste Site"	Yes	Individual waste disposal unit, i.e., french drain, crib, etc.
What is the period of assessment to evaluate "Remaining in the Soil"?	Yes	100 years
What portion of "Groundwater" is meant by groundwater?	Yes	The average unconfined aquifer is 30 to 90 ft. For purposes of this activity a 15 ft mixing zone will be used.
How is a "Previous impact to groundwater" to be determined?	Yes	Determined by the presence of any contaminant above MCLs and/or State Water Quality Standards under the disposal unit as monitored by the current well network.
Calculation of soil concentrations	Yes	Screening of COPC followed by a calculation of soil concentrations based on the Summers method.
Cleanup standards should be above background concentrations in soil	Yes	Contaminant-specific cleanup standards will be significantly greater than Hanford Site background concentrations, based on hypothesis testing (WAC 173-340-708(11).
Cleanup standards should be above quantitation limits	Yes	Where cleanup levels are below practical quantitation limits, the cleanup level will be the practical quantitation limit (WAC 173-340-707(2).

9513383.1337

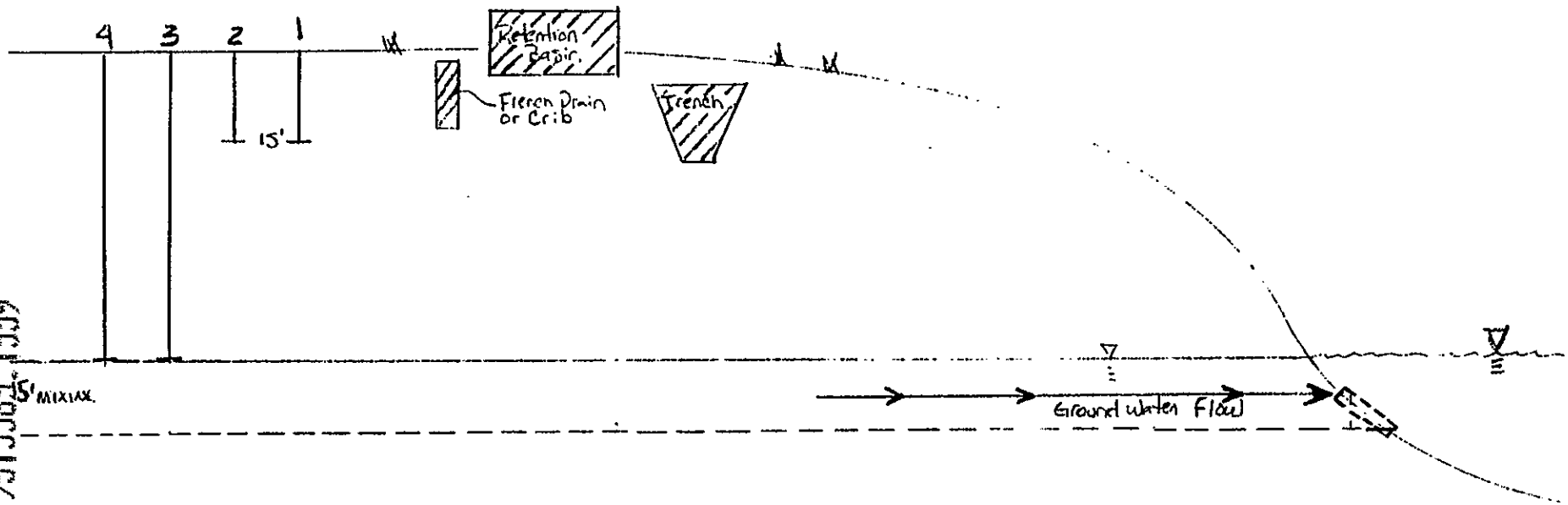
Agreements for AWQC at the River Remedial Action Goal

Criteria	Agreement Reached with Regulatory Agencies?	Current Resolution
Definition of when this remedial action goal is applied.	Yes	Applies to sites where groundwater is contaminated above MCLs (counterpart to the fourth criterion in the previous remedial action goal.)
Definition of the "Waste Site"	Yes	Individual waste disposal unit, i.e., french drain, crib, etc.
What is the period of assessment to evaluate "Remaining in the Soil"?	Yes	100 years
What portion of "Groundwater" is meant by groundwater?	Yes	The average unconfined aquifer is 30 to 90 ft. For purposes of this activity, a 15 foot mixing zone will be used.
Radionuclide criterion consistent with AWQC?	Yes	Use AWQC available for chemical constituents for protection of fish. Use 1 rad/day for radionuclides.
What is the dilution factor from groundwater to surface water?	Yes	A 10 to 1 dilution factor has been assumed until quantifiable data is available. POE is the river.
Calculation of soil concentrations	Yes	Calculation of soil concentrations based on the Summers method.

9513383.1338

Remedial Action Goal #1 : MTCA
#2 : 15 mrem/yr above background
#3 : Protection of River, or
#4 : Protection of Groundwater

—Not To Scale—



Legend:

- DASHED LINE TO SHOW MODEL AREA ASSOCIATED WITH GOAL
- SOLID LINE TO SHOW AREA IN WHICH SPECIFIC GOAL MUST BE APPLIED
- VARIOUS WASTE SITES AND POTENTIAL DEPTHS
- 4 NUMBER ASSOCIATED WITH REMEDIAL ACTION GOAL AS LISTED ABOVE

CH2M HILL

SUBJECT 100 Area Remedial Action Goals

BY

SHEET NO. ___ of ___

DATE

PROJECT NO.

9513383.1339

Calculation Cover Sheet

Originator: John Lowe Date: June 19, 1995
Project: 100-BC-1 Demonstration Project
100 Area Remedial Design

Calc Title: Documentation of MTCA Method B Cleanup Levels

Objective: Document MTCA Method B cleanup levels.

Methodology:

Cleanup levels for nonradioactive (chemical) contaminants are tabulated directly from *Model Toxic Control Act Cleanup Act (MCTA) Level and Risk Calculation (CLARC II) Update, August 31, 1994, and January 1995 Update.*

Assumptions:

1) MTCA Method B values for soil are used. This calculation sheet does not include the 100 times groundwater cleanup level values for soil, also specified in MTCA Method B. Values presented in this calculation sheet are applied only to contaminants detected within the top 15 feet of soil.

2) Value for cadmium is based on non-carcinogenic effects (cadmium is not a carcinogen by ingestion exposure). EPA and Washington Department of Ecology do not provide an oral cancer slope factor for estimating ingestion cancer risks from cadmium. EPA judges ingestion carcinogenicity data to be inadequate at this time (EPA, 1994).

3) Value for lead is based on MTCA Method A (Table 2) value, WAC-173-340-740 - no method B value for lead in CLARC.

4) Method B value for arsenic (1.43 mg/kg) is less than Hanford Site Background (9 mg/kg). Site background is used as the cleanup standard.

Contaminant	MTCA B Cleanup Level (mg/kg in soil)
Antimony	32
Arsenic	9*
Barium	5600
Cadmium	80
Chromium VI	400
Lead	250
Manganese	11200
Mercury	24
Zinc	24000
PCBs	0.13
Benzo(a)pyrene	0.137
Chrysene	0.137

Pentachlorophenol	8.33

[a]Hanford site background - UCL of 95th percentile value (DOE/RL-92-42)

Attachments:

Tabulated values from CLARC II table are attached (pages 3-11).

Table 2 from MTCA (lead value), page 12

Hanford Site Background for arsenic, page 13

References:

Washington Department of Ecology. 1994. *Model Toxic Control Act Cleanup Act (MCTA) Level and Risk Calculation (CLARC II) Update, August 31, 1994, and January 1995 Update.* Publication #94-145.

Environmental Protection Agency. 1994. *Integrated Risk Information System.* Toxicology Data Network, National Library of Medicine, Bethesda MD.

Hanford Site Background Part 1: Soil Background for Nonradioactive Analytes. DOE/RL-92-24.

Checked by: _____ Date: 6/21/95

Note for checker: Mark each item checked with a highlighter. Resolve any discrepencies with originator. Have originator initial any changes required. Sign and date in ink.

9513383.1342

D.K. Tyler

WASHINGTON STATE
DEPARTMENT OF
ECOLOGY

Model Toxics Control Act Cleanup Levels and Risk Calculation (CLARC II) Update

August 31, 1994

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WASHINGTON STATE
DEPARTMENT OF
ECOLOGY

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Model Toxics Control Act (MTCA) Cleanup Levels and Risk Calculation (CLARC II) Update
January 1995

This document is an update to the Toxic Cleanup Program's August 31, 1994 Cleanup Levels and Risk Calculations (CLARC II) tables. A complete report will not be generated at this time. The following updates should be added directly to the August 31, 1994, CLARC II.

Excessively High-Risk Based Cleanup Levels

The use of CLARC II data can result in the calculation of excessively large cleanup levels for approximately 100-125 contaminants. This occurs primarily in the Method C Industrial Soil Category for non-carcinogens. Percent level concentrations of contaminants such as chromium (III), 1,1-dichloroethane, xylenes, etc. have been calculated. Users of CLARC II should be aware that these calculated cleanup levels may not be acceptable for a site when considering other factors, such as the potential for cross-media contamination and the need to protect natural resources (groundwater, sediments, harvestable shellfish beds) and populations that may be at a disproportionate risk.

Rounded Values

The CLARC II database includes reference doses. For printing purposes, the presentation of reference doses in this report are rounded "to four decimal places". That is, if they are less than "1" they will look like ".XXXX", where "X" is a whole number. This number may be rounded to four decimal places. Since reference doses become more important as they get smaller (the cleanup level will also get smaller) then it might be important to know the full value of the reference dose. If necessary, please contact Barb Huether at the number shown below for the non-rounded values.

Those numbers that are rounded "down" such as 0.00002 are shown as "0.0000". A number such as "0.00008" will be rounded "up" to "0.0001". Since this will make a difference in the calculation of hazard quotients, you should be aware of this when you see either ".0000" or ".000X".

Note that "0.0000" is <u>not</u> the same as no value being listed. When no value is listed there is no established reference dose, and a non-carcinogen cleanup value cannot be calculated.

Cancer potency factors also use "four decimal places." However, the effect is not as critical since smaller values become less consequential because they result in higher, not smaller cleanup values.

Method B and Method C "Formula Values" listed in CLARC II are computed using the entire (not rounded) reference dose in the formula calculation, and are not effected by rounding.

If you have questions regarding CLARC II, please contact either Barb Huether at (360) 407-7183 or Dick Boose at (360) 407-7190. Questions related to development of site-specific cleanup standards using CLARC II should be directed to regional offices. If you have special accommodation needs, please contact the Toxics Cleanup Program at (360) 407-7183 (voice) or (360) 407-6006 (TCDD).

As a final note, CLARC II is not mandated by law, but rather is provided as a service to staff and clients. While CLARC II is extensive, it is not exhaustive and the user may need to seek additional sources for compounds not shown. Furthermore, there is no assurance that CLARC II is free from errors, substantive or procedural, enforceable by any party in litigation with the State of Washington.

CLARC II Modification History

Date	Chemical	CAS #	Changed from:	Changed to:	Type:
12/12/94	arochlor 1254	11097-69-1	empty	ocularloxicity; immunotoxicity	CE
12/12/94	arochlor 1254	11097-69-1	new record	0.00002 mg/kg/day	ORFD
12/12/94	arochlor 1254	11097-69-1	new record	pcbs; polychlorinated biphenyls	SYN
12/12/94	cadmium in soil	7440-43-9a	6.1 mg/kg/day	empty	OCPF
12/12/94	cadmium in soil	7440-43-9a	empty	6.1 mg/kg/day	RCPF
12/12/94	danitol	39515-41-8	withdrawn	0.025 mg/kg/day	ORFD
12/12/94	danitol	39515-41-8	empty	fenpropathrin	SYN
12/12/94	difluoroethane;1,1-	75-37-6	new record	11.42857143 mg/kg/day	IRFD
12/12/94	difluoroethane;1,1-	75-37-6	empty	freon 152a	SYN
12/12/94	endosulfan	115-29-7	withdrawn	0.006 mg/kg/day	ORFD
12/12/94	hexamethylene diisocyanate;1,6-	822-06-0	new record	2.86E-06	IRFD
12/12/94	hydrogen cyanide	74-90-8	empty	.000857143 mg/kg/day	IRFD
12/12/94	hydrogen cyanide	74-90-8	empty	.2 mg/l	Proposed MCL
12/12/94	naphthalene	91-20-3	0.004	0.04	ORFD
12/12/94	nitric oxide	10102-43-9	.1 mg/kg/day	empty	ORFD
12/12/94	nitrogen dioxide	10102-44-0	1 mg/kg/day	empty	ORFD

*Type	Definitions				
ORFD	Oral reference dose		CAS	Chemical Abstract Service number	
CLASS	EPA Classification		BCF	Bioconcentration factor	
CE	Critical effect		MCL	Maximum contaminant level	
OCPF	Oral cancer potency factor		MCLG	Maximum contaminant level goal	
IRFD	Inhalation reference dose		SYN	Synonym for chemical name	
NAME	Chemical name				

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Model Toxics Control Act
Method B Formula Values
Data updated: 8/31/94

Chemical Name	CAS Number	Ground Water (ug/L) Carcinogen	Ground Water (ug/L) Non-Carcinogen	Surface Water (ug/L) Carcinogen	Surface Water (ug/L) Non-Carcinogen	Soil(mg/kg) Carcinogen	Soil(mg/kg) Non-Carcinogen	Air(mg/m3) Carcinogen	Air(mg/m3) Non-Carcinogen
antimony	7440-36-0		6.40e+000		1.04e+003		3.20e+001		
antimony pentoxide	1314-60-9		8.00e+000				4.00e+001		
antimony potassium tartrate	28300-74-5		1.44e+001				7.20e+001		
antimony tetroxide	1332-81-6		6.40e+000				3.20e+001		
antimony trioxide	1309-64-4		6.40e+000				3.20e+001		
apollo	74115-24-5		2.08e+002				1.04e+003		
aramite	140-57-8	3.50e+000	8.00e+002			4.00e+001	4.00e+003	3.00e-004	
aroclor 1016	12674-11-2		1.12e+000				5.60e+000		
arsenic, inorganic	7440-38-2	5.00e-002	4.80e+000	8.42e-002	1.77e+001	1.43e+000	6.00e+001	1.50e-007	
arsine	7784-42-1								2.27e-005
asbestos	1332-21-4								
assure	76578-14-8		1.44e+002				7.20e+002		
asulam	3337-71-1		8.00e+002				4.00e+003		
atrazine	1912-24-9	3.98e-001	5.60e+002			4.55e+000	2.80e+003		
avermectin B1	65195-55-3		6.40e+000				3.20e+001		
azobenzene	103-33-3	7.95e-001				9.09e+000		6.82e-005	
barium	7440-39-3		1.12e+003				5.60e+003		1.60e-004
barium cyanide	542-62-1		1.60e+003				8.00e+003		
baygon	114-26-1		6.40e+001				3.20e+002		
bayleton	43121-43-3								
baythroid	68359-37-5		4.00e+002				2.00e+003		
benefin	1861-40-1		4.80e+003				2.40e+004		
benomyl	17804-35-2		8.00e+002				4.00e+003		
bentazon	25057-89-0		4.00e+001				2.00e+002		
benzaldehyde	100-52-7		1.60e+003				8.00e+003		
benzene	71-43-2	1.51e+000		4.30e+001		3.45e+001		2.59e-004	
benzidine	92-87-5	3.80e-004	4.80e+001	3.22e-004	8.89e+001	4.35e-003	2.40e+002	3.26e-008	
benzo[a]anthracene	56-55-3	1.20e-002		2.96e-002		1.37e-001			
benzo[a]pyrene	50-32-8	1.20e-002		2.96e-002		1.37e-001		1.23e-006	
benzo[b]fluoranthene	205-99-2	1.20e-002		2.96e-002		1.37e-001			
benzo[k]fluoranthene	207-08-9	1.20e-002		2.96e-002		1.37e-001			
benzoic acid	65-85-0		6.40e+004				3.20e+005		

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Method B Formula Values
Data updated: 8/31/94

Chemical Name	CAS Number	Ground Water (ug/L) Carcinogen	Ground Water (ug/L) Non-Carcinogen	Surface Water (ug/L) Carcinogen	Surface Water (ug/L) Non-Carcinogen	Soil(mg/kg) Carcinogen	Soil(mg/kg) Non-Carcinogen	Air(mg/m3) Carcinogen	Air(mg/m3) Non-Carcinogen
benzotrichloride	98-07-7	6.73e-003				7.69e-002			
benzyl alcohol	100-51-6								
benzyl chloride	100-44-7	2.57e-001				5.88e+000			
beryllium	7440-41-7	2.03e-002	8.00e+001	7.93e-002	6.82e+002	2.33e-001	4.00e+002	8.93e-007	
beta-chloronaphthalene	91-58-7		1.28e+003				6.40e+003		
bidrin	141-66-2		1.60e+000				8.00e+000		
biphenthrin	82657-04-3		2.40e+002				1.20e+003		
biphenyl;1,1'-	92-52-4		8.00e+002				4.00e+003		
bis(2-chloro-1-methyl-ethyl)ether	108-60-1	1.25e+000				1.43e+001		1.07e-004	
bis(2-chloroethyl)ether	111-44-4	3.98e-002		8.54e-001		9.09e-001		6.82e-006	
bis(2-chloroisopropyl) ether	39638-32-9		3.20e+002		4.20e+004		3.20e+003		
bis(2-ethylhexyl) phthalate	117-81-7	6.25e+000	3.20e+002	3.56e+000	3.99e+002	7.14e+001	1.60e+003		
bis(chloromethyl)ether	542-88-1	1.99e-004				4.55e-003		3.41e-008	
bisphenol a	80-05-7		8.00e+002				4.00e+003		
boron	7440-42-8		1.44e+003				7.20e+003		
bromodichloromethane	75-27-4	7.06e-001	1.60e+002	2.79e+001	1.38e+004	1.61e+001	1.60e+003		
bromoethene	593-60-2							6.82e-005	1.37e-003
bromoform	75-25-2	5.54e+000	1.60e+002	2.19e+002	1.38e+004	1.27e+002	1.60e+003	1.92e-003	
bromomethane	74-83-9		1.12e+001		9.68e+002		1.12e+002		2.29e-003
bromophos	2104-96-3		8.00e+001				4.00e+002		
bromoxynil	1689-84-5		3.20e+002				1.60e+003		
bromoxynil octanoate	1689-99-2		3.20e+002				1.60e+003		
butadiene;1,3-	106-99-0							4.17e-006	
butanol;n-	71-36-3		1.60e+003				8.00e+003		
butyl benzyl phthalate	85-68-7		3.20e+003		1.25e+003		1.60e+004		
butylate	2008-41-5		8.00e+002				4.00e+003		
butylphthalyl butylglycolate	85-70-1		1.60e+004				8.00e+004		
butyric acid;4-(2-methyl-4-chlorophenoxy)-	94-81-5		1.60e+002				8.00e+002		
cacodylic acid	75-60-5		4.80e+001				2.40e+002		
cadmium in soil (ignore water values for Methods B and C)	7440-43-9a	1.43e-002	1.60e+001	1.66e-002	4.05e+001	1.64e-001	8.00e+001		

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Model Toxics Control Act
Method B Formula Values
Date updated: 8/31/94

Chemical Name	CAS Number	Ground Water (ug/L) Carcinogen	Ground Water (ug/L) Non-Carcinogen	Surface Water (ug/L) Carcinogen	Surface Water (ug/L) Non-Carcinogen	Soil(mg/kg) Carcinogen	Soil(mg/kg) Non-Carcinogen	Air(mg/m3) Carcinogen	Air(mg/m3) Non-Carcinogen
chlorobenzotrifluoride;4-	98-56-6		3.20e+002				1.60e+003		
chlorobutane;1-	106-69-3		6.40e+003				3.20e+004		
chloroform	67-66-3	7.17e+000	8.00e+001	2.83e+002	6.91e+003	1.64e+002	8.00e+002	9.26e-005	
chloromethane	74-87-3	3.37e+000		1.33e+002		7.69e+001		1.19e-003	
chloromethyl methyl ether	107-30-2								
chloronitrobenzene;o-	88-73-3	3.50e+000				4.00e+001			
chloronitrobenzene;p-	100-00-5	4.86e+000				5.56e+001			
chlorophenol;2-	95-57-8		8.00e+001		9.67e+001		4.00e+002		
chlorophenyl methyl sulfide;p-	123-09-1								
chlorophenyl methyl sulfone;p-	98-57-1								
chlorophenyl methyl sulfoxide;p-	934-73-6								
chloropropane;2-	75-29-6								4.64e-002
chlorothalonil	1897-45-6	7.95e+000	2.40e+002			9.09e+001	1.20e+003		
chlorotoluene;o-	95-49-8		1.60e+002				1.60e+003		
chlorpropham	101-21-3		3.20e+003				1.60e+004		
chlorpyrifos	2921-88-2		4.80e+001				2.40e+002		
chlorpyrifos-methyl	5598-13-0		1.60e+002				8.00e+002		
chlorthiophos	60238-56-4		1.28e+001				6.40e+001		
chromium (total)	7440-47-3								
chromium(III)	16065-83-1		1.60e+004		1.62e+005		8.00e+004		
chromium(VI)	18540-29-9		8.00e+001		8.10e+002		4.00e+002	1.83e-007	
chrysene	218-01-9	1.20e-002		2.96e-002		1.37e-001			
copper	7440-50-8		5.92e+002		2.66e+003		2.96e+003		
copper cyanide	544-92-3		8.00e+001				4.00e+002		
creosote	8001-58-9								
cresol;m-	108-39-4		8.00e+002				4.00e+003		
cresol;o-	95-48-7		8.00e+002				4.00e+003		
cresol;p-	106-44-5		8.00e+001				4.00e+002		
crotonaldehyde	123-73-9	4.61e-002				5.26e-001		3.95e-006	
cumene	98-82-8		6.40e+002				3.20e+003		4.16e-003
cyanazine	21725-46-2		3.20e+001				1.60e+002		
cyanide	57-12-5		3.20e+002		5.19e+004		1.60e+003		

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Model Toxics Control Act
Method B Formula Values
Data updated: 8/31/94

Chemical Name	CAS Number	Ground Water (ug/L) Carcinogen	Ground Water (ug/L) Non-Carcinogen	Surface Water (ug/L) Carcinogen	Surface Water (ug/L) Non-Carcinogen	Soil(mg/kg) Carcinogen	Soil(mg/kg) Non-Carcinogen	Air(mg/m3) Carcinogen	Air(mg/m3) Non-Carcinogen
hexachlorophene	70-30-4		4.80e+000				2.40e+001		
hexane;n-	110-54-3		4.80e+002				4.80e+003		9.14e-002
hexazinone	51235-04-2		5.28e+002				2.64e+003		
hydrazine/hydrazine sulfate	302-01-2	2.92e-002				3.33e-001		4.41e-007	
hydrogen chloride	7647-01-0								3.20e-003
hydrogen cyanide	74-90-8		3.20e+002				1.60e+003		
hydrogen sulfide	7783-06-4		2.40e+001				2.40e+002		4.16e-004
hydroquinone;p-	123-31-9		6.40e+002				3.20e+003		
imazalil	35554-44-0		2.08e+003				1.04e+004		
imazaquin	81335-37-7		4.00e+003				2.00e+004		
indeno(1,2,3-cd)pyrene	193-39-5	1.20e-002		2.96e-002		1.37e-001			
iprodione	36734-19-7		6.40e+002				3.20e+003		
isobutyl alcohol	78-83-1		4.80e+003				2.40e+004		
isophorone	78-59-1	9.21e+001	3.20e+003	1.56e+003	1.18e+005	1.05e+003	1.60e+004		
isopropalin	33820-53-0		2.40e+002				1.20e+003		
isopropyl methyl phosphonic acid	1832-54-8		1.60e+003				8.00e+003		
isoxaben	82558-50-7		8.00e+002				4.00e+003		
lactofen	77501-63-4		3.20e+001				1.60e+002		
lead	7439-92-1								
lead alkyls	unavailable02		1.60e-003				8.00e-003		
lindane	58-89-9	6.73e-002	4.80e+000	3.84e-002	5.98e+000	7.69e-001	2.40e+001		
linuron	330-55-2		3.20e+001				1.60e+002		
londax	83055-99-6		3.20e+003				1.60e+004		
malathion	121-75-5		3.20e+002				1.60e+003		
maleic anhydride	108-31-6		1.60e+003				8.00e+003		
maleic hydrazide	123-33-1		8.00e+003				4.00e+004		
malononitrile	109-77-3		3.20e-001				1.60e+000		
mancozeb	8018-01-7		4.80e+002				2.40e+003		
maneb	12427-38-2		8.00e+001				4.00e+002		
manganese in soil	7439-96-5a		2.24e+003				1.12e+004		2.29e-005
manganese in water	7439-96-5		8.00e+001				4.00e+002		2.29e-005
mephosfolan	950-10-7		1.44e+000				7.20e+000		

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Method B Formula Values
Data updated: 8/31/94

Chemical Name	CAS Number	Ground Water (ug/L) Carcinogen	Ground Water (ug/L) Non-Carcinogen	Surface Water (ug/L) Carcinogen	Surface Water (ug/L) Non-Carcinogen	Soil(mg/kg) Carcinogen	Soil(mg/kg) Non-Carcinogen	Air(mg/m3) Carcinogen	Air(mg/m3) Non-Carcinogen
mepiquat chloride	24307-26-4		4.80e+002				2.40e+003		
mercury	7439-97-6		4.80e+000				2.40e+001		1.37e-004
merphos	150-50-5								
merphos oxide	78-48-8		4.80e-001				2.40e+000		
metalaxyl	57837-19-1		9.60e+002				4.80e+003		
methacrylonitrile	126-98-7		1.60e+000				8.00e+000		3.20e-004
methamidosphos	10265-92-6		8.00e-001				4.00e+000		
methanol	67-56-1		4.00e+003				4.00e+004		
methidathion	950-37-8		1.60e+001				8.00e+001		
methomyl	16752-77-5		4.00e+002				2.00e+003		
methoxy-5-nitroaniline;2-	99-59-2	1.90e+000				2.17e+001			
methoxychlor	72-43-5		8.00e+001		8.36e+000		4.00e+002		
methoxyethanol acetate;2-	110-49-6		3.20e+001				1.60e+002		
methoxyethanol;2-	109-86-4		6.40e+001				3.20e+002		9.14e-003
methyl acetate	79-20-9		8.00e+003				8.00e+004		
methyl acrylate	96-33-3		4.80e+002				2.40e+003		
methyl ethyl ketone	78-93-3		4.80e+003				4.80e+004		4.57e-001
methyl isobutyl ketone	108-10-1		4.00e+002				4.00e+003		3.20e-002
methyl mercury	22967-92-6		4.80e+000				2.40e+001		
methyl methacrylate	80-62-6		6.40e+002				6.40e+003		
methyl parathion	298-00-0		4.00e+000				2.00e+001		
methyl styrene	25013-15-4		9.60e+001				4.80e+002		1.60e-002
methyl styrene, alpha	98-83-9		1.12e+003				5.60e+003		
methyl tert-butyl ether	1634-04-4								1.37e+000
methyl-4-chlorophenoxy-acetic acid;2-	94-74-6		8.00e+000				4.00e+001		
methyl-5-nitroaniline;2-	99-55-8	2.65e+000				3.03e+001			
methylaniline hydrochloride;2-	636-21-5	4.86e-001				5.56e+000			
methylaniline;2-	95-53-4	3.65e-001				4.17e+000			
methylene bis(2-chloroaniline);4,4'-	101-14-4	6.73e-001	1.12e+001			7.69e+000	5.60e+001	5.77e-005	
methylene bis(n,n'-dimethyl)aniline;4,4'-	101-61-1	1.90e+000				2.17e+001			

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Method B Formula Values
Data updated: 8/31/94

Chemical Name	CAS Number	Ground Water (ug/L) Carcinogen	Ground Water (ug/L) Non-Carcinogen	Surface Water (ug/L) Carcinogen	Surface Water (ug/L) Non-Carcinogen	Soil(mg/kg) Carcinogen	Soil(mg/kg) Non-Carcinogen	Air(mg/m3) Carcinogen	Air(mg/m3) Non-Carcinogen
nitrosodiphenylamine;N-	86-30-6	1.79e+001		9.73e+000		2.04e+002			
nitrosopyrrolidine;N-	930-55-2	4.17e-002				4.76e-001		3.57e-006	
nitrotoluenes;o-,m-,p-	1321-12-6		1.60e+002				8.00e+002		
norflurazon	27314-13-2		6.40e+002				3.20e+003		
nustar	85509-19-9		1.12e+001				5.60e+001		
octabromodiphenyl ether	32536-52-0		4.80e+001				2.40e+002		
octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine	2691-41-0		8.00e+002				4.00e+003		
octamethylpyrophosphoramide	152-16-9		3.20e+001				1.60e+002		
oryzalin	19044-88-3		8.00e+002				4.00e+003		
oxadiazon	19666-30-9		8.00e+001				4.00e+002		
oxamyl	23135-22-0		4.00e+002				2.00e+003		
oxyfluorfen	42874-03-3		4.80e+001				2.40e+002		
paclobutrazol	76738-62-0		2.08e+002				1.04e+003		
pah	unavailable05	1.20e-002				1.37e-001			
paraquat	1910-42-5		7.20e+001				3.60e+002		
parathion	56-38-2		9.60e+001				4.80e+002		
pebulate	1114-71-2		8.00e+002				4.00e+003		
pendimethalin	40487-42-1		6.40e+002				3.20e+003		
pentabromo-6-chloro-cyclohexane;1,2,3,4,5-	87-84-3	3.80e+000				4.35e+001			
pentabromodiphenyl ether	32534-81-9		3.20e+001				1.60e+002		
pentachlorobenzene	608-93-5		1.28e+001				6.40e+001		
pentachloronitrobenzene	82-68-8	3.37e-001	4.80e+001			3.85e+000	2.40e+002		
pentachlorophenol	87-86-5	7.29e-001	4.80e+002	4.91e+000	7.07e+003	8.33e+000	2.40e+003		
permethrin	52645-53-1		8.00e+002				4.00e+003		
perthane	72-56-0	2.65e+002	4.80e+001			3.03e+003	2.40e+002		
phenmedipham	13684-63-4		4.00e+003				2.00e+004		
phenol	108-95-2		9.60e+003		1.11e+006		4.80e+004		
phenylenediamine;m-	108-45-2		9.60e+001				4.80e+002		
phenylenediamine;o-	95-54-5	1.86e+000				2.13e+001			
phenylmercuric acetate	62-38-4		1.28e+000				6.40e+000		

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Model Toxics Control Act
Method B Formula Values
Data updated: 8/31/94

Chemical Name	CAS Number	Ground Water (ug/L) Carcinogen	Ground Water (ug/L) Non-Carcinogen	Surface Water (ug/L) Carcinogen	Surface Water (ug/L) Non-Carcinogen	Soil(mg/kg) Carcinogen	Soil(mg/kg) Non-Carcinogen	Air(mg/m3) Carcinogen	Air(mg/m3) Non-Carcinogen
phenylphenol;2-	90-43-7	4.61e+001				5.26e+002			
phosmet	732-11-6		3.20e+002				1.60e+003		
phosphine	7803-51-2		4.80e+000				2.40e+001		
phthalic acid;p-	100-21-0		1.60e+004				8.00e+004		
phthalic anhydride	85-44-9		3.20e+004				1.60e+005		
picloram	1918-02-1		1.12e+003				5.60e+003		
pirimiphos-methyl	29232-93-7		1.60e+001				8.00e+001		
polybrominated biphenyls	unavailable06	9.83e-003	1.12e-001			1.12e-001	5.60e-001		
polychlorinated biphenyls	1336-36-3	1.14e-002		2.70e-005		1.30e-001			
potassium cyanide	151-50-8		8.00e+002				4.00e+003		
potassium silver cyanide	506-61-6		3.20e+003				1.60e+004		
prochloraz	67747-09-5	5.83e-001	1.44e+002			6.67e+000	7.20e+002		
profluralin	26399-36-0		9.60e+001				4.80e+002		
prometon	1610-18-0		2.40e+002				1.20e+003		
prometryn	7287-19-6		6.40e+001				3.20e+002		
pronamide	23950-58-5		1.20e+003				6.00e+003		
propachlor	1918-16-7		2.08e+002				1.04e+003		
propanil	709-98-8		8.00e+001				4.00e+002		
propargite	2312-35-8		3.20e+002				1.60e+003		
propargyl alcohol	107-19-7		3.20e+001				1.60e+002		
propazine	139-40-2		3.20e+002				1.60e+003		
propham	122-42-9		3.20e+002				1.60e+003		
propiconazole	60207-90-1		2.08e+002				1.04e+003		
propionic acid;(2-methyl-4-chlorophenoxy)2-	93-65-2		1.60e+001				8.00e+001		
propylene glycol	57-55-6		3.20e+005				1.60e+006		3.20e+000
propylene glycol dinitrate;1,2-	6423-43-4								
propylene glycol monoethyl ether	52125-53-8		1.12e+004				5.60e+004		
propylene glycol monomethyl ether	107-98-2		1.12e+004				5.60e+004		9.14e-001
propylene oxide	75-56-9	1.82e-001				4.17e+000		5.77e-004	1.37e-002
pursuit	81335-77-5		4.00e+003				2.00e+004		
pydrin	51630-58-1		4.00e+002				2.00e+003		

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Model Toxics Control Act
Method B Formula Values
Data updated: 8/31/94

Chemical Name	CAS Number	Ground Water (ug/L) Carcinogen	Ground Water (ug/L) Non-Carcinogen	Surface Water (ug/L) Carcinogen	Surface Water (ug/L) Non-Carcinogen	Soil(mg/kg) Carcinogen	Soil(mg/kg) Non-Carcinogen	Air(mg/m3) Carcinogen	Air(mg/m3) Non-Carcinogen
vanadium pentoxide	1314-62-1		1.44e+002				7.20e+002		
vanadyl sulfate	27774-13-6		3.20e+002				1.60e+003		
vernam	1929-77-7		1.60e+001				8.00e+001		
vinclozolin	50471-44-8		4.00e+002				2.00e+003		
vinyl acetate	108-05-4		8.00e+003				8.00e+004		9.14e-002
vinyl chloride	75-01-4	2.30e-002		2.92e+000		5.26e-001		2.50e-005	
warfarin	81-81-2		4.80e+000				2.40e+001		
white phosphorus	7723-14-0		3.20e-001				1.60e+000		
xylene	1330-20-7		1.60e+004				1.60e+005		
xylene;m-	108-38-3		1.60e+004				1.60e+005		3.20e-001
xylene;o-	95-47-6		1.60e+004				1.60e+005		3.20e-001
zinc	7440-66-6		4.80e+003		1.65e+004		2.40e+004		
zinc cyanide	557-21-1		8.00e+002				4.00e+003		
zinc phosphide	1314-84-7		4.80e+000				2.40e+001		
zineb	12122-67-7		8.00e+002				4.00e+003		

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Table 2
Method A Cleanup Levels – Soil[a]

Hazardous Substance	CAS Number	Cleanup Level
Arsenic	7440-38-2	20.0 mg/kg[b]
Benzene	71-43-2	0.5 mg/kg[c]
Cadmium	7440-43-9	2.0 mg/kg[d]
Chromium	7440-47-3	100.0 mg/kg[e]
DDT	50-29-3	1.0 mg/kg[f]
Ethylbenzene	100-41-4	20.0 mg/kg[g]
Ethylene dibromide	106-93-4	0.001 mg/kg[h]
Lead	7439-92-1	250.0 mg/kg[i]
Lindane	58-89-9	1.0 mg/kg[j]
Methylene chloride	75-09-2	0.5 mg/kg[k]
Mercury (inorganic)	7439-97-6	1.0 mg/kg[l]
PAHs (carcinogenic)		1.0 mg/kg[m]
PCB Mixtures		1.0 mg/kg[n]
Tetrachloroethylene	127-18-4	0.5 mg/kg[o]
Toluene	108-88-3	40.0 mg/kg[p]
TPH (gasoline)		100.0 mg/kg[q]
TPH (diesel)		200.0 mg/kg[r]
TPH (other)		200.0 mg/kg[s]
1,1,1 Trichloroethane	71-55-6	20.0 mg/kg[t]
Trichloroethylene	79-01-5	0.5 mg/kg[u]
Xylenes	1330-20-7	20.0 mg/kg[v]

[a] Caution on misusing method A tables. Method A tables have been developed for specific purposes. They are intended to provide conservative cleanup levels for sites undergoing routine cleanup actions or those sites with relatively few hazardous substances. The tables may not be appropriate for defining cleanup levels at other sites. For these reasons, the values in these tables should not automatically be used to define cleanup levels that must be met for financial, real estate, insurance coverage or placement, or similar transactions or purposes. Exceedances of the values in these tables do not necessarily trigger requirements for cleanup action under this chapter.

[b] Arsenic. Cleanup level based on background concentrations in the state of Washington.

[c] Benzene. Cleanup level based on protection of ground water.

[d] Cadmium. Cleanup level based on plant protection.

[e] Chromium. Cleanup level based on health risks associated with inhalation of resuspended dust.

[f] DDT. Cleanup level based on concentrations derived using the procedures in subsection (3)(a)(iii)(B) of this section.

[g] Ethylbenzene. Cleanup level based on protection of ground water.

[h] Ethylene dibromide. Cleanup level based on protection of ground water.

[i] Lead. Cleanup level based on preventing unacceptable blood lead levels.

Table 6-9.a. Sitewide Soil Background Threshold Levels Calculated from the Systematic Random Data Set for Using Weibull Distribution Results. Concentrations for the Percentiles of the Distribution (on the Regression Line) Are Listed Under the Respective Percentile Headings (e.g., 80%). Concentrations Corresponding to the Upper Confidence Limit (UCL) for the Estimated Percentiles are Listed Under the Percentile UCL Heading (e.g., 80% UCL).

WEIBULL DISTRIBUTION RESULTS

ANALYTE	80%	80% UCL (1)	90%	90% UCL	95%	95% UCL
ALUMINUM	10464	11276	12134	13216	13621	15082
ANTIMONY	-	-	-	-	-	-
ARSENIC	5.1	5.7	6.4	7.3	7.6	9.0
BARIUM	118	127	138	151	156	175
BERYLLIUM	1.3	1.3	1.4	1.5	1.6	1.8
CADMIUM	-	-	-	-	-	-
CALCIUM	14032	15712	17572	20052	21012	24642
CHROMIUM	16	18	20	23	24	28
COBALT	15	15	16	17	18	19
COPPER	19	20	22	25	26	30
IRON	29906	31476	33076	35026	35746	38246
LEAD	8.3	9.3	10.5	12.0	12.6	14.9
MAGNESIUM	6246	6710	7224	7905	8169	9160
MANGANESE	464	487	510	538	548	583
MERCURY	0.1	0.2	0.3	0.5	0.6	1.3
NICKEL	17	18	20	21	22	25
POTASSIUM	1854	2058	2277	2568	2676	3090
SELENIUM	-	-	-	-	-	-
SILVER	1.4	1.4	1.4	1.4	1.5	2.1
SODIUM (1)	496	560	631	728	764	909
SODIUM (2)	481	604	712	940	969	1393
THALLIUM	-	-	-	-	-	-
VANADIUM	75	81	87	94	97	107
ZINC	65	67	70	73	75	79
MOLYBDENUM	-	-	-	-	-	-
TITANIUM	2175	2395	2575	2865	2925	3307
ZIRCONIUM	32	36	39	44	45	53
LITHIUM	28	33	33	35	35	37
	0.0	0.0	0.0	0.0	0.0	0.0
NH3	3.7	5.7	8.5	13.6	16.0	27.4
ALKALINITY	4165	5925	7985	11685	12985	20085
SILICON (1)	36	45	54	68	73	96
SILICON (2)	27	36	51	91	107	239
FLUORINE	1.8	2.0	2.6	4.2	5.3	13.0
CHLORINE	32	63	121	255	331	783
NO2	-	-	-	-	-	-
NO3	16	28	46	84	104	208
O-PO4	1.7	1.8	1.8	2.4	3.0	12.7
SO4	91	151	243	417	503	931

(1) UPPER CONFIDENCE LIMITS BASED ON 95% COVERAGE

Calculation Cover Sheet

Originator: John Lowe Date: June 20, 1995
Project: 100-BC-1 Demonstration Project
100 Area Remedial Design

Calc Title: Use of RESRAD for verifying 15 mrem/year above background remedial action goal and calculating 15 mrem/year radionuclide soil concentrations

Objective: Document the assumptions, parameters and calculations used in RESRAD to verify achievement of 15 mrem/year above background remedial action goal.

Methodology:

Introduction

Cleanup of radionuclides in soils at selected 100 Area liquid waste disposal sites is intended to achieve a cumulative 15 mrem/year above background dose rate. Determining when remedial action has achieved this cleanup level involves converting radionuclide concentrations (in pCi/g) in soil into dose rates (in mrem/year) using a dose assessment model. Use of a model requires an exposure scenario that specifies a hypothetical receptor (i.e. a resident, worker or recreational user of a site), pathways of exposure from radionuclides in soil to the receptor and assumptions and parameters for estimating exposures and doses to the receptor from radionuclides in soil. This document describes the model to be selected for performing dose assessments for 100 Area Remedial Design/Remedial Action (RD/RA), describes the exposure scenario and presents the parameters and assumptions to be used in the model.

Model Selection

The model selected for 100 Area Remedial Design/Remedial Action (RD/RA) and Demonstration Project is the RESRAD (RESidual RADioactivity) model (ANL, 1993a). RESRAD was developed by Argonne National Laboratory (ANL) for implementing Department of Energy (DOE) guidelines for residual radioactive material in soil (ANL, 1993a). RESRAD has been evaluated by the U.S. Environmental Protection Agency (EPA) for use in performing dose assessments in support of the EPA's proposed radionuclide soil cleanup standard of 15 mrem/year above background (40 CFR 196) (EPA, 1994a). ~~RESRAD Version~~ Version 5.6 of RESRAD will be used for 100 Area projects.

Exposure Scenario

The regulatory agencies (EPA and Ecology) have expressed the intent that interim remedial measures for 100 Area sites did not restrict future uses of those sites. This general goal must be specified in terms of an exposure scenario and exposure pathways in order to use RESRAD to

convert radionuclide concentrations in soil into doses.

For purposes of using RESRAD, unrestricted future use of the sites is assumed to be represented by an individual resident, in a rural-residential setting. This resident is assumed to consume crops raised in a backyard garden, and consume animal products, such meat and milk from locally-raised livestock or meat from game animals. Groundwater use is not included in the exposure scenario; cleanup levels evaluated using RESRAD address contaminants only within the top 15 feet of soil. Cleanups of contaminants in soil for protection of groundwater is addressed separately from cleanups for protection of human health from contact with soil contaminants.

The selected exposure pathways are consistent with the recommendations provided by the RESRAD user's manual (ANL, 1993a), except for exclusion of the drinking water exposure pathway and ingestion of fish from surface water. As discussed previously, protection of groundwater is intended to achieve MCLs (4 mrem/year), which is consistent with the EPA's proposed radionuclide soil cleanup standard (EPA, 1994b). For fish ingestion at 100 Area sites, there is little likelihood that surface runoff to the point of exposure (the Columbia River) would contribute significantly to total exposure. For most of the contaminants of potential concern in the 100 Area, external exposure would be the dominant exposure pathway (ingestion and inhalation exposure pathways contribute little to total exposure). However, for Sr-90, ingestion pathways are the dominant exposure pathways, and should be included to properly address cleanup of Sr-90 in soil.

Exposure Pathways

Exposure pathways to be used for converting radionuclide concentrations in soil to doses are:

- External exposure
- Inhalation of suspended dust
- Inhalation of radon
- Crop ingestion
- Meat ingestion
- Milk ingestion
- Soil ingestion

Assumptions:

1. The parameters and assumptions to be used in RESRAD are summarized below in Table 1. Most of the parameters values are the defaults supplied with RESRAD (ANL, 1993b).

Attachments:

1. Table 1 with summary of assumptions and parameters.

2. Summary output file from RESRAD 5.6.

References:

ANL. 1993a. *Manual. for Implementing Residual Radioactive Materials Guidelines Using RESRAD, Version 5.0.* Environmental Assessment Division, Argonne National Laboratory. ANL/EAD/LD-2.

ANL. 1993b. *Data Collection Handbook to Support Modeling the Impacts of Radioactive Material in Soil.* Environmental Assessment and Information Sciences Division, Argonne National Laboratory. ANL/EAIS-8.

EPA. 1994a. *Technical Summary Report Supporting the Development of Standards for the Cleanup of Radioactively Contaminated Sites.* U.S. Environmental Protection Agency, Office of Radiation and Indoor Air, Washington, D.C. Draft, April 1994.

EPA. 1994b. Notice of Proposed Rulemaking for *Radiation Site Cleanup Regulations*, Draft 40 CFR part 196, May 11, 1994.

Checked by: _____ Date: 6/28/95

Note for checker: Mark each item checked with a highlighter. Resolve any discrepencies with originator. Have originator initial any changes required. Sign and date in ink.

See attached memo

Table 1. RESRAD parameters for unrestricted land use at selected 100 Area sites					
Parameter	Selected Value	Default	Units	Citation	Rationale
Soil Density	2	1.5	g/cm3	WHC-SD-EN-TI-294, Hydrogeology of the 100-K Area	
Total Porosity	0.4	0.4			Default
Effective Porosity	0.2	0.2			Default
Hydraulic conductivity	10	10	m/yr		Default
Volumetric water content	0.094	0.05		DOE-RL 94-16, 100 Area Excavation Treatability Study	Based on mean 4.7 percent moisture content by weight.
Effective radon diffusion coefficient	3.00E-07	3.00E-07	m2/s		Default
Radon emanation coefficient - Ra-222	0.25	0.25			Default
Ra-220	0.15	0.15			Default
Precipitation rate	0.16	1	m/yr	DOE/RL-90-07, Rev 0., 100-BC-1 Work Plan	Based on 6.3" per year annual rainfall
Runoff coefficient	Not used	0.2			
Irrigation rate	0.76	2	m/yr	Information from Franklin Irrigation District	Based on 30" of irrigation/year
Evapotranpiration coefficient	0.83	0.5		DOE/RL-90-07, Rev 0., 100-BC-1 Work Plan	Calculated from evapotranspiration rate of 29", precipitation rate of 6.3" and irrigation rate of 30"
Soil-specific exponential b parameter	5.3	5.3			Default
Erosion rate	0.001	0.001	m/yr.		Default
Hydraulic gradient in groundwater	Not used	0.02			
Length of contaminated zone parallel to aquifer flow	Not used	100	m		
Watershed area for nearby stream or pond	Not used	1.00E+06	m2		
Water table drop rate	Not used	0.001	m/yr		
Radon vertical mixing dimension	2	2	m		Default
Annual average windspeed	3.3	2	m/s	DOE/RL-90-07, Rev 0., 100-BC-1 Work Plan	Based on 12 km/h. Monthly average windspeeds range from 10 to 16 km/h
Average building air exchange rate	0.5	0.5	h-1		Default
Building room height	2.5	2.5	m		Default
Building indoor area factor	1	1			Default
Thickness of uncontaminated unsaturated zone	12	12		DOE/RL-90-07, Rev 0., 100-BC-1 Work Plan	Assumes depth to groundwater is 40 ft
Building foundation thickness	0.15	0.15	m		Default
Foundation depth below ground surface	1	1	m		Default
Fraction of time spent indoors on-site	0.5	0.5			Default
Fraction of time spent outdoors on site	0.25	0.25			Default

resradqc.wpd

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Table 1. RESRAD parameters for unrestricted land use at selected 100 Area sites					
Parameter	Selected Value	Default	Units	Citation	Rationale
Area of contaminated zone	10,000	10,000	m2		Default
Cover depth	0	0	m		Default; assumes contaminated soil spread on the surface.
Distribution coefficients	Contaminant-specific				Default
Mass loading for inhalation	2.00E-04	2.00E-04	g/m3		Defalt
Shielding factor for inhalation	0.4	0.4			Default
Depth of roots	0.9	0.9	m		Default
Soil ingestion rate	42	42	g/yr		Default
Thickness of contaminated zone	0.305	2	m		Assumes contaminated is spread on the soil to a depth of 1 ft
Seafood consumption rate	Not used				
Fruit, vegetable and grain consumption rate	160	160	kg/yr		Default
Inhalation rate	8400	8400	m3/yr		Default
Leafy vegetable consumption rate	14	14	kg/yr		Default
Livestock water ingestion rate for beef cattle	50	50	L/d		Default
Livestock water ingestion rate for milk cows	160	160	L/d		Default
Meat and poultry consumption rate63	63	63	kg/yr		Default
Milk consumption rate	92	92	L/yr		Default
Shielding facator for external gamma radiation	0.7	0.7			Default
Elapsed time of waste placement	0	0	yr		Default
Shape factor (external gamma)	1	1			Default
Drinking water intake rate	Not used	510	L/yr		

Notes:
*Source for default parameteers: *Data Collection Handbook to Support Modeling the Impacts of Radioactive Materials in Soil.* ANL/EAIS-8.

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

0 Menu	Parameter	Current Value	Default	Parameter Name
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	Ac-227+D	6.720E+00	6.720E+00	DCF2(1)
B-1	Am-241	4.440E-01	4.440E-01	DCF2(2)
B-1	Co-60	2.190E-04	2.190E-04	DCF2(3)
B-1	Cs-137+D	3.190E-05	3.190E-05	DCF2(4)
B-1	Eu-152	2.210E-04	2.210E-04	DCF2(5)
B-1	Eu-154	2.860E-04	2.860E-04	DCF2(7)
B-1	Eu-155	4.140E-05	4.140E-05	DCF2(8)
B-1	Gd-152	2.430E-01	2.430E-01	DCF2(9)
B-1	Ni-63	6.290E-06	6.290E-06	DCF2(10)
B-1	Np-237+D	5.400E-01	5.400E-01	DCF2(11)
B-1	Pa-231	1.280E+00	1.280E+00	DCF2(12)
B-1	Pb-210+D	2.320E-02	2.320E-02	DCF2(13)
B-1	Pu-238	3.920E-01	3.920E-01	DCF2(14)

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B-1	Pu-239	4.290E-01	4.290E-01	DCF2(15)
B-1	Ra-226+D	8.600E-03	8.600E-03	DCF2(16)
B-1	Ra-228+D	5.080E-03	5.080E-03	DCF2(17)
B-1	Sr-90+D	1.310E-03	1.310E-03	DCF2(18)
B-1	Th-228+D	3.450E-01	3.450E-01	DCF2(19)
B-1	Th-229+D	2.160E+00	2.160E+00	DCF2(20)
B-1	Th-230	3.260E-01	3.260E-01	DCF2(21)
B-1	Th-232	1.640E+00	1.640E+00	DCF2(22)
B-1	U-233	1.350E-01	1.350E-01	DCF2(23)
B-1	U-234	1.320E-01	1.320E-01	DCF2(24)
B-1	U-235+D	1.230E-01	1.230E-01	DCF2(25)
B-1	U-238+D	1.180E-01	1.180E-01	DCF2(26)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	Ac-227+D	1.480E-02	1.480E-02	DCF3(1)
D-1	Am-241	3.640E-03	3.640E-03	DCF3(2)
D-1	Co-60	2.690E-05	2.690E-05	DCF3(3)
D-1	Cs-137+D	5.000E-05	5.000E-05	DCF3(4)
D-1	Eu-152	6.480E-06	6.480E-06	DCF3(5)
D-1	Eu-154	9.550E-06	9.550E-06	DCF3(7)
D-1	Eu-155	1.530E-06	1.530E-06	DCF3(8)
D-1	Gd-152	1.610E-04	1.610E-04	DCF3(9)
D-1	Ni-63	5.770E-07	5.770E-07	DCF3(10)
D-1	Np-237+D	4.440E-03	4.440E-03	DCF3(11)
D-1	Pa-231	1.060E-02	1.060E-02	DCF3(12)
D-1	Pb-210+D	7.270E-03	7.270E-03	DCF3(13)
D-1	Pu-238	3.200E-03	3.200E-03	DCF3(14)
D-1	Pu-239	3.540E-03	3.540E-03	DCF3(15)
D-1	Ra-226+D	1.330E-03	1.330E-03	DCF3(16)
D-1	Ra-228+D	1.440E-03	1.440E-03	DCF3(17)
D-1	Sr-90+D	1.530E-04	1.530E-04	DCF3(18)
D-1	Th-228+D	8.080E-04	8.080E-04	DCF3(19)
D-1	Th-229+D	4.030E-03	4.030E-03	DCF3(20)
D-1	Th-230	5.480E-04	5.480E-04	DCF3(21)
D-1	Th-232	2.730E-03	2.730E-03	DCF3(22)
D-1	U-233	2.890E-04	2.890E-04	DCF3(23)
D-1	U-234	2.830E-04	2.830E-04	DCF3(24)

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

0 Menu	Parameter	Current Value	Default	Parameter Name
D-1	U-235+D	2.670E-04	2.670E-04	DCF3(25)
D-1	U-238+D	2.690E-04	2.690E-04	DCF3(26)

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D-34	Food transfer factors:			
D-34	Ac-227+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(1,1)
D-34	Ac-227+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,2)
D-34	Ac-227+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,3)
D-34				
D-34	Am-241 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(2,1)
D-34	Am-241 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-05	5.000E-05	RTF(2,2)
D-34	Am-241 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-06	2.000E-06	RTF(2,3)
D-34				
D-34	Co-60 , plant/soil concentration ratio, dimensionless	8.000E-02	8.000E-02	RTF(3,1)
D-34	Co-60 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-02	2.000E-02	RTF(3,2)
D-34	Co-60 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-03	2.000E-03	RTF(3,3)
D-34				
D-34	Cs-137+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(4,1)
D-34	Cs-137+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.000E-02	3.000E-02	RTF(4,2)
D-34	Cs-137+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	8.000E-03	8.000E-03	RTF(4,3)
D-34				
D-34	Eu-152 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(5,1)
D-34	Eu-152 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-03	2.000E-03	RTF(5,2)
D-34	Eu-152 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(5,3)
D-34				
D-34	Eu-154 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(7,1)
D-34	Eu-154 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-03	2.000E-03	RTF(7,2)
D-34	Eu-154 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(7,3)
D-34				
D-34	Eu-155 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(8,1)
D-34	Eu-155 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-03	2.000E-03	RTF(8,2)
D-34	Eu-155 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(8,3)
D-34				
D-34	Gd-152 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(9,1)
D-34	Gd-152 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-03	2.000E-03	RTF(9,2)
D-34	Gd-152 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(9,3)
D-34				
D-34	Ni-63 , plant/soil concentration ratio, dimensionless	5.000E-02	5.000E-02	RTF(10,1)
D-34	Ni-63 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(10,2)
D-34	Ni-63 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-02	2.000E-02	RTF(10,3)
D-34				
D-34	Np-237+D , plant/soil concentration ratio, dimensionless	2.000E-02	2.000E-02	RTF(11,1)
D-34	Np-237+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(11,2)
D-34	Np-237+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(11,3)
D-34				
D-34	Pa-231 , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(12,1)
D-34	Pa-231 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(12,2)
D-34	Pa-231 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(12,3)
D-34				
D-34	Pb-210+D , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(13,1)
D-34	Pb-210+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-04	8.000E-04	RTF(13,2)
D-34	Pb-210+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RTF(13,3)

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Dose Conversion Factor (and Related) Parameter Summary (continued)
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0 Menu	Parameter	Current Value	Default	Parameter Name
D-34	Pu-238 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(14,1)
D-34	Pu-238 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(14,2)
D-34	Pu-238 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-06	1.000E-06	RTF(14,3)
D-34				
D-34	Pu-239 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(15,1)
D-34	Pu-239 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(15,2)
D-34	Pu-239 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-06	1.000E-06	RTF(15,3)
D-34				
D-34	Ra-226+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(16,1)
D-34	Ra-226+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(16,2)
D-34	Ra-226+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(16,3)
D-34				
D-34	Ra-228+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(17,1)
D-34	Ra-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(17,2)
D-34	Ra-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(17,3)
D-34				
D-34	Sr-90+D , plant/soil concentration ratio, dimensionless	3.000E-01	3.000E-01	RTF(18,1)
D-34	Sr-90+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-03	8.000E-03	RTF(18,2)
D-34	Sr-90+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-03	2.000E-03	RTF(18,3)
D-34				
D-34	Th-228+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(19,1)
D-34	Th-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(19,2)
D-34	Th-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(19,3)
D-34				
D-34	Th-229+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(20,1)
D-34	Th-229+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(20,2)
D-34	Th-229+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(20,3)
D-34				
D-34	Th-230 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(21,1)
D-34	Th-230 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(21,2)
D-34	Th-230 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(21,3)
D-34				
D-34	Th-232 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(22,1)
D-34	Th-232 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(22,2)
D-34	Th-232 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(22,3)
D-34				
D-34	U-233 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(23,1)
D-34	U-233 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(23,2)
D-34	U-233 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(23,3)
D-34				

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D-34	U-234 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(24,1)
D-34	U-234 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(24,2)
D-34	U-234 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(24,3)
D-34				
D-34	U-235+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(25,1)
D-34	U-235+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(25,2)
D-34	U-235+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(25,3)
D-34				
D-34	U-238+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(26,1)
D-34	U-238+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(26,2)
D-34	U-238+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(26,3)

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

D Menu	Parameter	Current Value	Default	Parameter Name
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-5	Ac-227+D , fish	1.500E+01	1.500E+01	BIOFAC(1,1)
D-5	Ac-227+D , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(1,2)
D-5				
D-5	Am-241 , fish	3.000E+01	3.000E+01	BIOFAC(2,1)
D-5	Am-241 , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(2,2)
D-5				
D-5	Co-60 , fish	3.000E+02	3.000E+02	BIOFAC(3,1)
D-5	Co-60 , crustacea and mollusks	2.000E+02	2.000E+02	BIOFAC(3,2)
D-5				
D-5	Cs-137+D , fish	2.000E+03	2.000E+03	BIOFAC(4,1)
D-5	Cs-137+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(4,2)
D-5				
D-5	Eu-152 , fish	5.000E+01	5.000E+01	BIOFAC(5,1)
D-5	Eu-152 , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(5,2)
D-5				
D-5	Eu-154 , fish	5.000E+01	5.000E+01	BIOFAC(7,1)
D-5	Eu-154 , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(7,2)
D-5				
D-5	Eu-155 , fish	5.000E+01	5.000E+01	BIOFAC(8,1)
D-5	Eu-155 , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(8,2)
D-5				
D-5	Gd-152 , fish	2.500E+01	2.500E+01	BIOFAC(9,1)
D-5	Gd-152 , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(9,2)
D-5				
D-5	Ni-63 , fish	1.000E+02	1.000E+02	BIOFAC(10,1)
D-5	Ni-63 , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(10,2)
D-5				
D-5	Np-237+D , fish	3.000E+01	3.000E+01	BIOFAC(11,1)

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D-5	Np-237+D , crustacea and mollusks	4.000E+02	4.000E+02	BIOFAC(11,2)
D-5				
D-5	Pa-231 , fish	1.000E+01	1.000E+01	BIOFAC(12,1)
D-5	Pa-231 , crustacea and mollusks	1.100E+02	1.100E+02	BIOFAC(12,2)
D-5				
D-5	Pb-210+D , fish	3.000E+02	3.000E+02	BIOFAC(13,1)
D-5	Pb-210+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(13,2)
D-5				
D-5	Pu-238 , fish	3.000E+01	3.000E+01	BIOFAC(14,1)
D-5	Pu-238 , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(14,2)
D-5				
D-5	Pu-239 , fish	3.000E+01	3.000E+01	BIOFAC(15,1)
D-5	Pu-239 , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(15,2)
D-5				
D-5	Ra-226+D , fish	5.000E+01	5.000E+01	BIOFAC(16,1)
D-5	Ra-226+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(16,2)
D-5				
D-5	Ra-228+D , fish	5.000E+01	5.000E+01	BIOFAC(17,1)
D-5	Ra-228+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(17,2)
D-5				
D-5	Sr-90+D , fish	6.000E+01	6.000E+01	BIOFAC(18,1)
D-5	Sr-90+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(18,2)

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

0 Menu	Parameter	Current Value	Default	Parameter Name
D-5	Th-228+D , fish	1.000E+02	1.000E+02	BIOFAC(19,1)
D-5	Th-228+D , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(19,2)
D-5				
D-5	Th-229+D , fish	1.000E+02	1.000E+02	BIOFAC(20,1)
D-5	Th-229+D , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(20,2)
D-5				
D-5	Th-230 , fish	1.000E+02	1.000E+02	BIOFAC(21,1)
D-5	Th-230 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(21,2)
D-5				
D-5	Th-232 , fish	1.000E+02	1.000E+02	BIOFAC(22,1)
D-5	Th-232 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(22,2)
D-5				
D-5	U-233 , fish	1.000E+01	1.000E+01	BIOFAC(23,1)
D-5	U-233 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(23,2)
D-5				
D-5	U-234 , fish	1.000E+01	1.000E+01	BIOFAC(24,1)
D-5	U-234 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(24,2)
D-5				

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D-5	U-235+D , fish	1.000E+01	1.000E+01	BIOFAC(25,1)
D-5	U-235+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(25,2)
D-5				
D-5	U-238+D , fish	1.000E+01	1.000E+01	BIOFAC(26,1)
D-5	U-238+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(26,2)

Site-Specific Parameter Summary

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R011	Area of contaminated zone (m**2)	1.000E+04	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	3.050E-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)	2.200E+01	3.000E+01	---	T(5)
R011	Times for calculations (yr)	3.000E+01	1.000E+02	---	T(6)
R011	Times for calculations (yr)	1.000E+02	3.000E+02	---	T(7)
R011	Times for calculations (yr)	3.000E+02	1.000E+03	---	T(8)
R011	Times for calculations (yr)	1.000E+03	0.000E+00	---	T(9)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g): Am-241	1.000E+00	0.000E+00	---	S1(2)
R012	Initial principal radionuclide (pCi/g): Co-60	1.000E+00	0.000E+00	---	S1(3)
R012	Initial principal radionuclide (pCi/g): Cs-137	1.000E+00	0.000E+00	---	S1(4)
R012	Initial principal radionuclide (pCi/g): Eu-152	1.000E+00	0.000E+00	---	S1(5)
R012	Initial principal radionuclide (pCi/g): Eu-154	1.000E+00	0.000E+00	---	S1(7)
R012	Initial principal radionuclide (pCi/g): Eu-155	1.000E+00	0.000E+00	---	S1(8)
R012	Initial principal radionuclide (pCi/g): Ni-63	1.000E+00	0.000E+00	---	S1(10)
R012	Initial principal radionuclide (pCi/g): Pu-238	1.000E+00	0.000E+00	---	S1(14)
R012	Initial principal radionuclide (pCi/g): Pu-239	1.000E+00	0.000E+00	---	S1(15)
R012	Initial principal radionuclide (pCi/g): Sr-90	1.000E+00	0.000E+00	---	S1(18)
R012	Initial principal radionuclide (pCi/g): Th-228	1.000E+00	0.000E+00	---	S1(19)
R012	Initial principal radionuclide (pCi/g): Th-232	1.000E+00	0.000E+00	---	S1(22)
R012	Initial principal radionuclide (pCi/g): U-234	1.000E+00	0.000E+00	---	S1(24)
R012	Initial principal radionuclide (pCi/g): U-238	1.000E+00	0.000E+00	---	S1(26)
R012	Concentration in groundwater (pCi/L): Am-241	not used	0.000E+00	---	W1(2)
R012	Concentration in groundwater (pCi/L): Co-60	not used	0.000E+00	---	W1(3)
R012	Concentration in groundwater (pCi/L): Cs-137	not used	0.000E+00	---	W1(4)
R012	Concentration in groundwater (pCi/L): Eu-152	not used	0.000E+00	---	W1(5)
R012	Concentration in groundwater (pCi/L): Eu-154	not used	0.000E+00	---	W1(7)
R012	Concentration in groundwater (pCi/L): Eu-155	not used	0.000E+00	---	W1(8)

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R012	Concentration in groundwater (pCi/L): Ni-63	not used	0.000E+00	---	W1(10)
R012	Concentration in groundwater (pCi/L): Pu-238	not used	0.000E+00	---	W1(14)
R012	Concentration in groundwater (pCi/L): Pu-239	not used	0.000E+00	---	W1(15)
R012	Concentration in groundwater (pCi/L): Sr-90	not used	0.000E+00	---	W1(18)
R012	Concentration in groundwater (pCi/L): Th-228	not used	0.000E+00	---	W1(19)
R012	Concentration in groundwater (pCi/L): Th-232	not used	0.000E+00	---	W1(22)
R012	Concentration in groundwater (pCi/L): U-234	not used	0.000E+00	---	W1(24)
R012	Concentration in groundwater (pCi/L): U-238	not used	0.000E+00	---	W1(26)
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)	2.000E+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

Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
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	Humidity in air (g/cm**3)	not used	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	8.300E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	1.600E-01	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	7.600E-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)	2.000E+00	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	4.000E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	2.000E-01	2.000E-01	---	EPSZ
R014	Saturated zone hydraulic conductivity (m/yr)	1.000E+02	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	2.000E-02	2.000E-02	---	HGWT
R014	Saturated zone b parameter	5.300E+00	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	1.000E-03	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	1.000E+01	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	2.500E+02	2.500E+02	---	UW
R015	Number of unsaturated zone strata	1	1	---	NS
R015	Unsat. zone 1, thickness (m)	1.200E+01	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	1.500E+00	1.500E+00	---	DENSUZ(1)

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R015	Unsat. zone 1, total porosity	4.000E-01	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	2.000E-01	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	5.300E+00	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCUZ(1)
R016	Distribution coefficients for Am-241				
R016	Contaminated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCC(2)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCU(2,1)
R016	Saturated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.228E-02	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)
R016	Distribution coefficients for Co-60				
R016	Contaminated zone (cm**3/g)	1.000E+03	1.000E+03	---	DCNUCC(3)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+03	1.000E+03	---	DCNUCU(3,1)
R016	Saturated zone (cm**3/g)	1.000E+03	1.000E+03	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.474E-04	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)
R016	Distribution coefficients for Cs-137				
R016	Contaminated zone (cm**3/g)	1.000E+03	1.000E+03	---	DCNUCC(4)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+03	1.000E+03	---	DCNUCU(4,1)
R016	Saturated zone (cm**3/g)	1.000E+03	1.000E+03	---	DCNUCS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.474E-04	ALEACH(4)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(4)

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Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for Eu-152				
R016	Contaminated zone (cm**3/g)	-1.000E+00	-1.000E+00	5.758E+02	DCNUCC(5)
R016	Unsaturated zone 1 (cm**3/g)	-1.000E+00	-1.000E+00	5.758E+02	DCNUCU(5,1)
R016	Saturated zone (cm**3/g)	-1.000E+00	-1.000E+00	5.758E+02	DCNUCS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.297E-04	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(5)
R016	Distribution coefficients for Eu-154				
R016	Contaminated zone (cm**3/g)	-1.000E+00	-1.000E+00	5.758E+02	DCNUCC(7)
R016	Unsaturated zone 1 (cm**3/g)	-1.000E+00	-1.000E+00	5.758E+02	DCNUCU(7,1)
R016	Saturated zone (cm**3/g)	-1.000E+00	-1.000E+00	5.758E+02	DCNUCS(7)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.297E-04	ALEACH(7)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(7)
R016	Distribution coefficients for Eu-155				
R016	Contaminated zone (cm**3/g)	-1.000E+00	-1.000E+00	5.758E+02	DCNUCC(8)

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R016	Unsaturated zone 1 (cm**3/g)	-1.000E+00	-1.000E+00	5.758E+02	DCNUCU(8,1)
R016	Saturated zone (cm**3/g)	-1.000E+00	-1.000E+00	5.758E+02	DCNUCS(8)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.297E-04	ALEACH(8)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(8)
R016	Distribution coefficients for Ni-63				
R016	Contaminated zone (cm**3/g)	1.000E+03	1.000E+03	---	DCNUCC(10)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+03	1.000E+03	---	DCNUCU(10,1)
R016	Saturated zone (cm**3/g)	1.000E+03	1.000E+03	---	DCNUCS(10)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.474E-04	ALEACH(10)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(10)
R016	Distribution coefficients for Pu-238				
R016	Contaminated zone (cm**3/g)	2.000E+03	2.000E+03	---	DCNUCC(14)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+03	2.000E+03	---	DCNUCU(14,1)
R016	Saturated zone (cm**3/g)	2.000E+03	2.000E+03	---	DCNUCS(14)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.237E-04	ALEACH(14)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(14)
R016	Distribution coefficients for Pu-239				
R016	Contaminated zone (cm**3/g)	2.000E+03	2.000E+03	---	DCNUCC(15)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+03	2.000E+03	---	DCNUCU(15,1)
R016	Saturated zone (cm**3/g)	2.000E+03	2.000E+03	---	DCNUCS(15)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.237E-04	ALEACH(15)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(15)
R016	Distribution coefficients for Sr-90				
R016	Contaminated zone (cm**3/g)	3.000E+01	3.000E+01	---	DCNUCC(18)
R016	Unsaturated zone 1 (cm**3/g)	3.000E+01	3.000E+01	---	DCNUCU(18,1)
R016	Saturated zone (cm**3/g)	3.000E+01	3.000E+01	---	DCNUCS(18)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	8.209E-03	ALEACH(18)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(18)

Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for Th-228				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(19)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(19,1)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS(19)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.125E-06	ALEACH(19)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(19)
R016	Distribution coefficients for Th-232				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(22)

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R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(22,1)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS(22)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.125E-06	ALEACH(22)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(22)
R016	Distribution coefficients for U-234				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(24)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(24,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(24)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.935E-03	ALEACH(24)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(24)
R016	Distribution coefficients for U-238				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(26)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(26,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(26)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.935E-03	ALEACH(26)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(26)
R016	Distribution coefficients for daughter Ac-227				
R016	Contaminated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCC(1)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCU(1,1)
R016	Saturated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.228E-02	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for daughter Gd-152				
R016	Contaminated zone (cm**3/g)	-1.000E+00	-1.000E+00	5.758E+02	DCNUCC(9)
R016	Unsaturated zone 1 (cm**3/g)	-1.000E+00	-1.000E+00	5.758E+02	DCNUCU(9,1)
R016	Saturated zone (cm**3/g)	-1.000E+00	-1.000E+00	5.758E+02	DCNUCS(9)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.297E-04	ALEACH(9)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(9)
R016	Distribution coefficients for daughter Np-237				
R016	Contaminated zone (cm**3/g)	-1.000E+00	-1.000E+00	2.036E+02	DCNUCC(11)
R016	Unsaturated zone 1 (cm**3/g)	-1.000E+00	-1.000E+00	2.036E+02	DCNUCU(11,1)
R016	Saturated zone (cm**3/g)	-1.000E+00	-1.000E+00	2.036E+02	DCNUCS(11)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.215E-03	ALEACH(11)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(11)

Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for daughter Pa-231				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(12)

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R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(12,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(12)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.935E-03	ALEACH(12)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(12)
R016	Distribution coefficients for daughter Pb-210				
R016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCC(13)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCU(13,1)
R016	Saturated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCS(13)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.471E-03	ALEACH(13)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(13)
R016	Distribution coefficients for daughter Ra-226				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(16)
R016	Unsaturated zone 1 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(16,1)
R016	Saturated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCS(16)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.528E-03	ALEACH(16)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(16)
R016	Distribution coefficients for daughter Ra-228				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(17)
R016	Unsaturated zone 1 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(17,1)
R016	Saturated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCS(17)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.528E-03	ALEACH(17)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(17)
R016	Distribution coefficients for daughter Th-229				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(20)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(20,1)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS(20)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.125E-06	ALEACH(20)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(20)
R016	Distribution coefficients for daughter Th-230				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(21)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(21,1)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS(21)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.125E-06	ALEACH(21)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(21)
R016	Distribution coefficients for daughter U-233				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(23)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(23,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(23)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.935E-03	ALEACH(23)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(23)

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Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (if different from user input)	Parameter Name
R016	Distribution coefficients for daughter U-235				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(25)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(25,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(25)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.935E-03	ALEACH(25)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(25)
R017	Inhalation rate (m**3/yr)	8.400E+03	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	2.000E-04	2.000E-04	---	MLINH
R017	Dilution length for airborne dust, inhalation (m)	3.000E+00	3.000E+00	---	LM
R017	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)

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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)	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

Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R018	Drinking water intake (L/yr)	not used	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	not used	1.000E+00	---	FDW
R018	Contamination fraction of household water	1.000E+00	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	not used	5.000E-01	---	FR9
R018	Contamination fraction of plant food	-1	-1	0.500E+00	FPLANT
R018	Contamination fraction of meat	-1	-1	0.500E+00	FMEAT
R018	Contamination fraction of milk	-1	-1	0.500E+00	FMILK
R019	Livestock fodder intake for meat (kg/day)	6.800E+01	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	5.500E+01	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	5.000E+01	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	1.600E+02	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	5.000E-01	5.000E-01	---	LSI
R019	Mass loading for foliar deposition (g/m**3)	1.000E-04	1.000E-04	---	MLFD
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
R019	Depth of roots (m)	9.000E-01	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	1.000E+00	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	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
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
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):				

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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	not used	7.000E+00	---	STOR_T(5)
STOR	Crustacea and mollusks	not used	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)	1.500E-01	1.500E-01	---	FLOOR
R021	Bulk density of building foundation (g/cm**3)	2.400E+00	2.400E+00	---	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV
R021	Total porosity of the building foundation	1.000E-01	1.000E-01	---	TPFL
R021	Volumetric water content of the cover material	not used	5.000E-02	---	PH2OCV
R021	Volumetric water content of the foundation	3.000E-02	3.000E-02	---	PH2OFL

Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	not used	2.000E-06	---	DIFCV
R021	in foundation material	3.000E-07	3.000E-07	---	DIFFL
R021	in contaminated zone soil	2.000E-06	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	2.000E+00	2.000E+00	---	HMIX
R021	Average annual wind speed (m/sec)	2.000E+00	2.000E+00	---	WIND
R021	Average building air exchange rate (1/hr)	5.000E-01	5.000E-01	---	REXG
R021	Height of the building (room) (m)	2.500E+00	2.500E+00	---	HRM
R021	Building interior area factor	0.000E+00	0.000E+00	code computed (time dependent)	FAI
R021	Building depth below ground surface (m)	-1.000E+00	-1.000E+00	code computed (time dependent)	DMFL
R021	Emanating power of Rn-222 gas	2.500E-01	2.500E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	1.500E-01	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

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6 -- aquatic foods	suppressed
7 -- drinking water	suppressed
8 -- soil ingestion	active
9 -- radon	active

Contaminated Zone Dimensions

Area: 10000.00 square meters
Thickness: 0.31 meters
Cover Depth: 0.00 meters

Initial Soil Concentrations, pCi/g

Am-241	1.000E+00
Co-60	1.000E+00
Cs-137	1.000E+00
Eu-152	1.000E+00
Eu-154	1.000E+00
Eu-155	1.000E+00
Ni-63	1.000E+00
Pu-238	1.000E+00
Pu-239	1.000E+00
Sr-90	1.000E+00
Th-228	1.000E+00
Th-232	1.000E+00
U-234	1.000E+00
U-238	1.000E+00

0

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	2.200E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
TDOSE(t):	3.153E+01	2.842E+01	2.460E+01	2.027E+01	1.792E+01	1.685E+01	1.337E+01	1.292E+00	0.000E+00
M(t):	2.102E+00	1.895E+00	1.640E+00	1.352E+00	1.195E+00	1.123E+00	8.914E-01	8.610E-02	0.000E+00

0Maximum TDOSE(t): 3.153E+01 mrem/yr at t = 0.000E+00 years

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

0
0

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.
Am-241	2.544E-02	0.0008	3.259E-01	0.0103	0.000E+00	0.0000	1.095E-01	0.0035	3.009E-03	0.0001	1.742E-04	0.0000	9.965E-02	0.0032
Co-60	9.269E+00	0.2940	1.607E-04	0.0000	0.000E+00	0.0000	6.317E-02	0.0020	3.896E-02	0.0012	4.870E-03	0.0002	7.364E-04	0.0000
Cs-137	1.955E+00	0.0620	2.341E-05	0.0000	0.000E+00	0.0000	5.895E-02	0.0019	6.706E-02	0.0021	2.291E-02	0.0007	1.369E-03	0.0000
Eu-152	4.017E+00	0.1274	1.622E-04	0.0000	0.000E+00	0.0000	4.806E-04	0.0000	2.276E-04	0.0000	3.265E-06	0.0000	1.774E-04	0.0000
Eu-154	4.403E+00	0.1396	2.099E-04	0.0000	0.000E+00	0.0000	7.076E-04	0.0000	3.348E-04	0.0000	4.811E-06	0.0000	2.614E-04	0.0000

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Eu-155	1.054E-01	0.0033	3.039E-05	0.0000	0.000E+00	0.0000	1.131E-04	0.0000	5.342E-05	0.0000	7.701E-07	0.0000	4.188E-05	0.0000
Ni-63	0.000E+00	0.0000	4.617E-06	0.0000	0.000E+00	0.0000	8.507E-04	0.0000	1.502E-04	0.0000	7.605E-04	0.0000	1.580E-05	0.0000
Pu-238	8.972E-05	0.0000	2.877E-01	0.0091	0.000E+00	0.0000	9.624E-02	0.0031	5.289E-03	0.0002	7.656E-05	0.0000	8.760E-02	0.0028
Pu-239	1.718E-04	0.0000	3.149E-01	0.0100	0.000E+00	0.0000	1.065E-01	0.0034	5.854E-03	0.0002	8.470E-05	0.0000	9.691E-02	0.0031
Sr-90	1.475E-02	0.0005	9.615E-04	0.0000	0.000E+00	0.0000	1.352E+00	0.0429	2.847E-01	0.0090	8.553E-02	0.0027	4.188E-03	0.0001
Th-228	5.831E+00	0.1849	2.532E-01	0.0080	3.835E-01	0.0122	2.400E-02	0.0008	1.307E-03	0.0000	9.641E-05	0.0000	2.212E-02	0.0007
Th-232	3.023E-04	0.0000	1.204E+00	0.0382	0.000E+00	0.0000	8.213E-02	0.0026	4.514E-03	0.0001	3.266E-04	0.0000	7.473E-02	0.0024
U-234	2.339E-04	0.0000	9.689E-02	0.0031	0.000E+00	0.0000	2.103E-02	0.0007	1.696E-03	0.0001	4.281E-03	0.0001	7.747E-03	0.0002
U-238	7.878E-02	0.0025	8.661E-02	0.0027	0.000E+00	0.0000	1.999E-02	0.0006	1.612E-03	0.0001	4.070E-03	0.0001	7.364E-03	0.0002
Total	2.570E+01	0.8151	2.570E+00	0.0815	3.835E-01	0.0122	1.936E+00	0.0614	4.148E-01	0.0132	1.232E-01	0.0039	4.029E-01	0.0128

0

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

0
0

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.637E-01	0.0179
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	9.377E+00	0.2974
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.105E+00	0.0668
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.018E+00	0.1274
Eu-154	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.404E+00	0.1397
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.057E-01	0.0034
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.782E-03	0.0001
Pu-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.770E-01	0.0151
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.244E-01	0.0166
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.742E+00	0.0553
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.515E+00	0.2066
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.366E+00	0.0433
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.319E-01	0.0042
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.984E-01	0.0063
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	3.153E+01	1.0000

0*Sum of all water independent and dependent pathways.

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Summary : RESRAD default data File: 15MREM.DAT

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)

0
0

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.
Am-241	2.509E-02	0.0009	3.214E-01	0.0113	0.000E+00	0.0000	1.076E-01	0.0038	2.967E-03	0.0001	1.718E-04	0.0000	9.827E-02	0.0035
Co-60	8.124E+00	0.2859	1.409E-04	0.0000	0.000E+00	0.0000	5.519E-02	0.0019	3.407E-02	0.0012	4.259E-03	0.0001	6.455E-04	0.0000

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Cs-137	1.910E+00	0.0672	2.288E-05	0.0000	0.000E+00	0.0000	5.741E-02	0.0020	6.538E-02	0.0023	2.234E-02	0.0008	1.337E-03	0.0000
Eu-152	3.807E+00	0.1339	1.537E-04	0.0000	0.000E+00	0.0000	4.540E-04	0.0000	2.156E-04	0.0000	3.094E-06	0.0000	1.681E-04	0.0000
Eu-154	4.056E+00	0.1427	1.934E-04	0.0000	0.000E+00	0.0000	6.498E-04	0.0000	3.083E-04	0.0000	4.431E-06	0.0000	2.409E-04	0.0000
Eu-155	9.165E-02	0.0032	2.641E-05	0.0000	0.000E+00	0.0000	9.802E-05	0.0000	4.642E-05	0.0000	6.692E-07	0.0000	3.641E-05	0.0000
Ni-63	0.000E+00	0.0000	4.584E-06	0.0000	0.000E+00	0.0000	8.419E-04	0.0000	1.488E-04	0.0000	7.535E-04	0.0000	1.568E-05	0.0000
Pu-238	8.901E-05	0.0000	2.854E-01	0.0100	9.198E-14	0.0000	9.517E-02	0.0033	5.246E-03	0.0002	7.596E-05	0.0000	8.690E-02	0.0031
Pu-239	1.717E-04	0.0000	3.148E-01	0.0111	0.000E+00	0.0000	1.061E-01	0.0037	5.852E-03	0.0002	8.468E-05	0.0000	9.689E-02	0.0034
Sr-90	1.428E-02	0.0005	9.310E-04	0.0000	0.000E+00	0.0000	1.305E+00	0.0459	2.749E-01	0.0097	8.256E-02	0.0029	4.055E-03	0.0001
Th-228	4.058E+00	0.1428	1.763E-01	0.0062	2.669E-01	0.0094	1.665E-02	0.0006	9.097E-04	0.0000	6.710E-05	0.0000	1.540E-02	0.0005
Th-232	4.974E-01	0.0175	1.209E+00	0.0425	7.129E-03	0.0003	2.747E-01	0.0097	1.182E-02	0.0004	9.582E-03	0.0003	7.961E-02	0.0028
U-234	2.328E-04	0.0000	9.641E-02	0.0034	9.766E-08	0.0000	2.086E-02	0.0007	1.687E-03	0.0001	4.259E-03	0.0001	7.709E-03	0.0003
U-238	7.840E-02	0.0028	8.618E-02	0.0030	9.206E-14	0.0000	1.983E-02	0.0007	1.603E-03	0.0001	4.048E-03	0.0001	7.328E-03	0.0003
Total	2.266E+01	0.7974	2.491E+00	0.0876	2.740E-01	0.0096	2.061E+00	0.0725	4.051E-01	0.0143	1.282E-01	0.0045	3.986E-01	0.0140

0

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

0
0

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.555E-01	0.0195
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	8.219E+00	0.2892
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.057E+00	0.0724
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.808E+00	0.1340
Eu-154	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.058E+00	0.1428
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.186E-02	0.0032
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.764E-03	0.0001
Pu-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.729E-01	0.0166
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.240E-01	0.0184
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.682E+00	0.0592
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.535E+00	0.1595
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.089E+00	0.0735
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.312E-01	0.0046
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.974E-01	0.0069
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	2.842E+01	1.0000

0*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)

0
0

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.

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Am-241	2.441E-02	0.0010	3.126E-01	0.0127	0.000E+00	0.0000	1.040E-01	0.0042	2.885E-03	0.0001	1.670E-04	0.0000	9.558E-02	0.0039
Co-60	6.242E+00	0.2537	1.083E-04	0.0000	0.000E+00	0.0000	4.213E-02	0.0017	2.604E-02	0.0011	3.256E-03	0.0001	4.960E-04	0.0000
Cs-137	1.824E+00	0.0741	2.184E-05	0.0000	0.000E+00	0.0000	5.444E-02	0.0022	6.215E-02	0.0025	2.124E-02	0.0009	1.277E-03	0.0001
Eu-152	3.419E+00	0.1390	1.381E-04	0.0000	0.000E+00	0.0000	4.051E-04	0.0000	1.935E-04	0.0000	2.777E-06	0.0000	1.510E-04	0.0000
Eu-154	3.443E+00	0.1400	1.642E-04	0.0000	0.000E+00	0.0000	5.479E-04	0.0000	2.615E-04	0.0000	3.759E-06	0.0000	2.044E-04	0.0000
Eu-155	6.924E-02	0.0028	1.995E-05	0.0000	0.000E+00	0.0000	7.357E-05	0.0000	3.505E-05	0.0000	5.053E-07	0.0000	2.750E-05	0.0000
Ni-63	0.000E+00	0.0000	4.518E-06	0.0000	0.000E+00	0.0000	8.244E-04	0.0000	1.460E-04	0.0000	7.395E-04	0.0000	1.546E-05	0.0000
Pu-238	8.759E-05	0.0000	2.809E-01	0.0114	2.456E-12	0.0000	9.305E-02	0.0038	5.161E-03	0.0002	7.475E-05	0.0000	8.552E-02	0.0035
Pu-239	1.717E-04	0.0000	3.147E-01	0.0128	0.000E+00	0.0000	1.054E-01	0.0043	5.848E-03	0.0002	8.464E-05	0.0000	9.686E-02	0.0039
Sr-90	1.339E-02	0.0005	8.728E-04	0.0000	0.000E+00	0.0000	1.215E+00	0.0494	2.561E-01	0.0104	7.694E-02	0.0031	3.802E-03	0.0002
Th-228	1.966E+00	0.0799	8.540E-02	0.0035	1.293E-01	0.0053	8.016E-03	0.0003	4.406E-04	0.0000	3.250E-05	0.0000	7.459E-03	0.0003
Th-232	1.757E+00	0.0714	1.236E+00	0.0502	4.743E-02	0.0019	5.936E-01	0.0241	2.400E-02	0.0010	2.490E-02	0.0010	8.935E-02	0.0036
U-234	2.306E-04	0.0000	9.547E-02	0.0039	8.712E-07	0.0000	2.052E-02	0.0008	1.669E-03	0.0001	4.215E-03	0.0002	7.634E-03	0.0003
U-238	7.763E-02	0.0032	8.534E-02	0.0035	2.461E-12	0.0000	1.950E-02	0.0008	1.587E-03	0.0001	4.006E-03	0.0002	7.256E-03	0.0003
Total	1.884E+01	0.7657	2.412E+00	0.0980	1.767E-01	0.0072	2.258E+00	0.0918	3.865E-01	0.0157	1.357E-01	0.0055	3.956E-01	0.0161

0

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

0
0 Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.397E-01	0.0219
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.314E+00	0.2567
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.963E+00	0.0798
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.420E+00	0.1390
Eu-154	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.444E+00	0.1400
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.940E-02	0.0028
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.730E-03	0.0001
Pu-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.648E-01	0.0189
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.231E-01	0.0213
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.566E+00	0.0637
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.197E+00	0.0893
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.772E+00	0.1533
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.297E-01	0.0053
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.953E-01	0.0079
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	2.460E+01	1.0000

0*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
0 Water Independent Pathways (Inhalation excludes radon)

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0

Radio-Nuclide	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.
Am-241	2.215E-02	0.0011	2.836E-01	0.0140	0.000E+00	0.0000	9.225E-02	0.0046	2.616E-03	0.0001	1.514E-04	0.0000	8.673E-02	0.0043
Co-60	2.482E+00	0.1224	4.305E-05	0.0000	0.000E+00	0.0000	1.636E-02	0.0008	1.017E-02	0.0005	1.272E-03	0.0001	1.972E-04	0.0000
Cs-137	1.551E+00	0.0765	1.856E-05	0.0000	0.000E+00	0.0000	4.520E-02	0.0022	5.204E-02	0.0026	1.780E-02	0.0009	1.085E-03	0.0001
Eu-152	2.347E+00	0.1158	9.477E-05	0.0000	0.000E+00	0.0000	2.717E-04	0.0000	1.325E-04	0.0000	1.902E-06	0.0000	1.036E-04	0.0000
Eu-154	1.940E+00	0.0957	9.248E-05	0.0000	0.000E+00	0.0000	3.016E-04	0.0000	1.470E-04	0.0000	2.113E-06	0.0000	1.152E-04	0.0000
Eu-155	2.596E-02	0.0013	7.480E-06	0.0000	0.000E+00	0.0000	2.694E-05	0.0000	1.311E-05	0.0000	1.890E-07	0.0000	1.031E-05	0.0000
Ni-63	0.000E+00	0.0000	4.297E-06	0.0000	0.000E+00	0.0000	7.658E-04	0.0000	1.366E-04	0.0000	6.927E-04	0.0000	1.470E-05	0.0000
Pu-238	8.281E-05	0.0000	2.655E-01	0.0131	8.739E-11	0.0000	8.597E-02	0.0042	4.874E-03	0.0002	7.069E-05	0.0000	8.085E-02	0.0040
Pu-239	1.716E-04	0.0000	3.144E-01	0.0155	0.000E+00	0.0000	1.029E-01	0.0051	5.836E-03	0.0003	8.448E-05	0.0000	9.676E-02	0.0048
Sr-90	1.068E-02	0.0005	6.963E-04	0.0000	0.000E+00	0.0000	9.471E-01	0.0467	1.999E-01	0.0099	6.007E-02	0.0030	3.033E-03	0.0001
Th-228	1.556E-01	0.0077	6.760E-03	0.0003	1.024E-02	0.0005	6.201E-04	0.0000	3.485E-05	0.0000	2.571E-06	0.0000	5.905E-04	0.0000
Th-232	5.618E+00	0.2771	1.347E+00	0.0665	2.137E-01	0.0105	1.231E+00	0.0607	4.882E-02	0.0024	5.583E-02	0.0028	1.143E-01	0.0056
U-234	2.239E-04	0.0000	9.224E-02	0.0045	9.384E-06	0.0000	1.937E-02	0.0010	1.609E-03	0.0001	4.064E-03	0.0002	7.375E-03	0.0004
U-238	7.501E-02	0.0037	8.244E-02	0.0041	8.806E-11	0.0000	1.841E-02	0.0009	1.529E-03	0.0001	3.863E-03	0.0002	7.009E-03	0.0003
Total	1.423E+01	0.7017	2.393E+00	0.1180	2.239E-01	0.0110	2.561E+00	0.1263	3.278E-01	0.0162	1.439E-01	0.0071	3.981E-01	0.0196

0

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

0

0

Radio-Nuclide	Water mrem/yr	Water fract.	Fish mrem/yr	Fish fract.	Radon mrem/yr	Radon fract.	Water Dependent Pathways: Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	All Pathways* mrem/yr	All Pathways* fract.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.875E-01	0.0240
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	2.510E+00	0.1238
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.667E+00	0.0822
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.348E+00	0.1158
Eu-154	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.940E+00	0.0957
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.601E-02	0.0013
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.614E-03	0.0001
Pu-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.374E-01	0.0216
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.202E-01	0.0257
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.221E+00	0.0602
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.738E-01	0.0086
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.629E+00	0.4256
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.249E-01	0.0062
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.883E-01	0.0093
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	2.027E+01	1.0000

0*Sum of all water independent and dependent pathways.

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25/35

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 2.200E+01 years
Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Am-241	1.875E-02	0.0010	2.401E-01	0.0134	0.000E+00	0.0000	7.499E-02	0.0042	2.211E-03	0.0001	1.280E-04	0.0000	7.342E-02	0.0041
Co-60	5.103E-01	0.0285	8.858E-06	0.0000	0.000E+00	0.0000	3.230E-03	0.0002	2.026E-03	0.0001	2.540E-04	0.0000	4.058E-05	0.0000
Cs-137	1.174E+00	0.0655	1.405E-05	0.0000	0.000E+00	0.0000	3.282E-02	0.0018	3.836E-02	0.0021	1.315E-02	0.0007	8.212E-04	0.0000
Eu-152	1.231E+00	0.0687	4.972E-05	0.0000	0.000E+00	0.0000	1.368E-04	0.0000	6.924E-05	0.0000	9.948E-07	0.0000	5.437E-05	0.0000
Eu-154	7.250E-01	0.0405	3.458E-05	0.0000	0.000E+00	0.0000	1.082E-04	0.0000	5.474E-05	0.0000	7.876E-07	0.0000	4.306E-05	0.0000
Eu-155	4.827E-03	0.0003	1.391E-06	0.0000	0.000E+00	0.0000	4.809E-06	0.0000	2.428E-06	0.0000	3.504E-08	0.0000	1.917E-06	0.0000
Ni-63	0.000E+00	0.0000	3.942E-06	0.0000	0.000E+00	0.0000	6.741E-04	0.0000	1.218E-04	0.0000	6.190E-04	0.0000	1.349E-05	0.0000
Pu-238	7.522E-05	0.0000	2.412E-01	0.0135	8.683E-10	0.0000	7.497E-02	0.0042	4.419E-03	0.0002	6.424E-05	0.0000	7.342E-02	0.0041
Pu-239	1.714E-04	0.0000	3.138E-01	0.0175	0.000E+00	0.0000	9.864E-02	0.0055	5.815E-03	0.0003	8.420E-05	0.0000	9.658E-02	0.0054
Sr-90	7.249E-03	0.0004	4.727E-04	0.0000	0.000E+00	0.0000	6.168E-01	0.0344	1.306E-01	0.0073	3.926E-02	0.0022	2.059E-03	0.0001
Th-228	2.010E-03	0.0001	8.744E-05	0.0000	1.324E-04	0.0000	7.702E-06	0.0000	4.500E-07	0.0000	3.321E-08	0.0000	7.638E-06	0.0000
Th-232	8.212E+00	0.4582	1.429E+00	0.0797	3.355E-01	0.0187	1.533E+00	0.0855	6.151E-02	0.0034	7.163E-02	0.0040	1.299E-01	0.0072
U-234	2.157E-04	0.0000	8.696E-02	0.0049	4.303E-05	0.0000	1.752E-02	0.0010	1.510E-03	0.0001	3.817E-03	0.0002	6.953E-03	0.0004
U-238	7.072E-02	0.0039	7.770E-02	0.0043	8.830E-10	0.0000	1.665E-02	0.0009	1.435E-03	0.0001	3.629E-03	0.0002	6.607E-03	0.0004
Total	1.196E+01	0.6672	2.389E+00	0.1333	3.357E-01	0.0187	2.470E+00	0.1378	2.481E-01	0.0138	1.326E-01	0.0074	3.899E-01	0.0218

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 2.200E+01 years
Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.096E-01	0.0229
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	5.159E-01	0.0288
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.260E+00	0.0703
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.232E+00	0.0687
Eu-154	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.253E-01	0.0405
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.838E-03	0.0003
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.432E-03	0.0001
Pu-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.941E-01	0.0220
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.151E-01	0.0287
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.964E-01	0.0444
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.246E-03	0.0001
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.177E+01	0.6569
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.170E-01	0.0065
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.767E-01	0.0099
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	1.792E+01	1.0000

*Sum of all water independent and dependent pathways.

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

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Am-241	1.678E-02	0.0010	2.149E-01	0.0128	0.000E+00	0.0000	6.526E-02	0.0039	1.976E-03	0.0001	1.145E-04	0.0000	6.570E-02	0.0039
Co-60	1.778E-01	0.0105	3.087E-06	0.0000	0.000E+00	0.0000	1.094E-03	0.0001	6.907E-04	0.0000	8.669E-05	0.0000	1.414E-05	0.0000
Cs-137	9.755E-01	0.0579	1.167E-05	0.0000	0.000E+00	0.0000	2.648E-02	0.0016	3.129E-02	0.0019	1.074E-02	0.0006	6.820E-04	0.0000
Eu-152	8.008E-01	0.0475	3.234E-05	0.0000	0.000E+00	0.0000	8.648E-05	0.0000	4.492E-05	0.0000	6.457E-07	0.0000	3.537E-05	0.0000
Eu-154	3.762E-01	0.0223	1.795E-05	0.0000	0.000E+00	0.0000	5.460E-05	0.0000	2.833E-05	0.0000	4.079E-07	0.0000	2.235E-05	0.0000
Eu-155	1.573E-03	0.0001	4.533E-07	0.0000	0.000E+00	0.0000	1.523E-06	0.0000	7.889E-07	0.0000	1.139E-08	0.0000	6.247E-07	0.0000
Ni-63	0.000E+00	0.0000	3.722E-06	0.0000	0.000E+00	0.0000	6.185E-04	0.0000	1.128E-04	0.0000	5.740E-04	0.0000	1.273E-05	0.0000
Pu-238	7.054E-05	0.0000	2.262E-01	0.0134	2.101E-09	0.0000	6.836E-02	0.0041	4.140E-03	0.0002	6.027E-05	0.0000	6.886E-02	0.0041
Pu-239	1.712E-04	0.0000	3.134E-01	0.0186	0.000E+00	0.0000	9.579E-02	0.0057	5.802E-03	0.0003	8.402E-05	0.0000	9.647E-02	0.0057
Sr-90	5.598E-03	0.0003	3.651E-04	0.0000	0.000E+00	0.0000	4.630E-01	0.0275	9.821E-02	0.0058	2.955E-02	0.0018	1.590E-03	0.0001
Th-228	1.107E-04	0.0000	4.818E-06	0.0000	7.296E-06	0.0000	4.126E-07	0.0000	2.477E-08	0.0000	1.828E-09	0.0000	4.209E-07	0.0000
Th-232	8.697E+00	0.5161	1.444E+00	0.0857	3.587E-01	0.0213	1.553E+00	0.0921	6.301E-02	0.0037	7.356E-02	0.0044	1.328E-01	0.0079
U-234	2.122E-04	0.0000	8.361E-02	0.0050	7.712E-05	0.0000	1.637E-02	0.0010	1.448E-03	0.0001	3.661E-03	0.0002	6.684E-03	0.0004
U-238	6.798E-02	0.0040	7.470E-02	0.0044	2.150E-09	0.0000	1.556E-02	0.0009	1.376E-03	0.0001	3.480E-03	0.0002	6.351E-03	0.0004
Total	1.112E+01	0.6599	2.357E+00	0.1399	3.588E-01	0.0213	2.305E+00	0.1368	2.081E-01	0.0124	1.219E-01	0.0072	3.792E-01	0.0225

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

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.647E-01	0.0216
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	1.796E-01	0.0107
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.045E+00	0.0620
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.010E-01	0.0475
Eu-154	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.763E-01	0.0223
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.576E-03	0.0001
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.322E-03	0.0001
Pu-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.677E-01	0.0218
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.118E-01	0.0304
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.983E-01	0.0355
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.237E-04	0.0000
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.232E+01	0.7313
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.121E-01	0.0067
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.694E-01	0.0101

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Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.685E+01	1.0000

0*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)

0
0

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Am-241	6.358E-03	0.0005	8.130E-02	0.0061	0.000E+00	0.0000	1.857E-02	0.0014	7.417E-04	0.0001	4.296E-05	0.0000	2.486E-02	0.0019
Co-60	1.725E-05	0.0000	3.050E-10	0.0000	0.000E+00	0.0000	8.058E-08	0.0000	5.495E-08	0.0000	6.983E-09	0.0000	1.397E-09	0.0000
Cs-137	1.909E-01	0.0143	2.296E-06	0.0000	0.000E+00	0.0000	3.886E-03	0.0003	5.181E-03	0.0004	1.806E-03	0.0001	1.342E-04	0.0000
Eu-152	1.836E-02	0.0014	7.513E-07	0.0000	0.000E+00	0.0000	1.502E-06	0.0000	1.019E-06	0.0000	1.470E-08	0.0000	8.216E-07	0.0000
Eu-154	1.194E-03	0.0001	5.779E-08	0.0000	0.000E+00	0.0000	1.315E-07	0.0000	8.908E-08	0.0000	1.288E-09	0.0000	7.197E-08	0.0000
Eu-155	8.613E-08	0.0000	2.482E-11	0.0000	0.000E+00	0.0000	6.237E-11	0.0000	4.219E-11	0.0000	6.119E-13	0.0000	3.422E-11	0.0000
Ni-63	0.000E+00	0.0000	2.252E-06	0.0000	0.000E+00	0.0000	2.790E-04	0.0000	5.653E-05	0.0000	2.919E-04	0.0000	7.705E-06	0.0000
Pu-238	4.026E-05	0.0000	1.290E-01	0.0096	5.030E-08	0.0000	2.928E-02	0.0022	2.337E-03	0.0002	3.454E-05	0.0000	3.927E-02	0.0029
Pu-239	1.696E-04	0.0000	3.101E-01	0.0232	0.000E+00	0.0000	7.119E-02	0.0053	5.682E-03	0.0004	8.244E-05	0.0000	9.544E-02	0.0071
Sr-90	5.814E-04	0.0000	3.812E-05	0.0000	0.000E+00	0.0000	3.604E-02	0.0027	7.840E-03	0.0006	2.371E-03	0.0002	1.661E-04	0.0000
Th-228	1.047E-15	0.0000	4.657E-17	0.0000	7.052E-17	0.0000	2.996E-18	0.0000	2.371E-19	0.0000	1.753E-20	0.0000	4.068E-18	0.0000
Th-232	8.828E+00	0.6603	1.453E+00	0.1087	3.724E-01	0.0278	1.185E+00	0.0887	5.514E-02	0.0041	6.450E-02	0.0048	1.345E-01	0.0101
U-234	2.355E-04	0.0000	5.930E-02	0.0044	6.037E-04	0.0000	8.696E-03	0.0007	1.002E-03	0.0001	2.542E-03	0.0002	4.741E-03	0.0004
U-238	4.775E-02	0.0036	5.289E-02	0.0040	5.412E-08	0.0000	8.237E-03	0.0006	9.511E-04	0.0001	2.416E-03	0.0002	4.497E-03	0.0003
Total	9.094E+00	0.6801	2.085E+00	0.1560	3.730E-01	0.0279	1.362E+00	0.1018	7.893E-02	0.0059	7.409E-02	0.0055	3.036E-01	0.0227

0

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

0
0

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.319E-01	0.0099
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	1.739E-05	0.0000
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.019E-01	0.0151
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.837E-02	0.0014
Eu-154	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.194E-03	0.0001
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.630E-08	0.0000
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.374E-04	0.0000
Pu-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.000E-01	0.0150
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.827E-01	0.0361
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.703E-02	0.0035
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.171E-15	0.0000

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Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.209E+01	0.9045
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.712E-02	0.0058
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.167E-01	0.0087
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	1.337E+01	1.0000

0*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)

0
0

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Am-241	1.543E-04	0.0001	1.689E-04	0.0001	0.000E+00	0.0000	2.919E-05	0.0000	1.581E-06	0.0000	8.891E-08	0.0000	5.164E-05	0.0000
Co-60	7.405E-18	0.0000	3.661E-23	0.0000	0.000E+00	0.0000	7.077E-21	0.0000	5.342E-21	0.0000	6.891E-22	0.0000	1.677E-22	0.0000
Cs-137	2.424E-04	0.0002	7.358E-10	0.0000	0.000E+00	0.0000	9.116E-07	0.0000	1.415E-06	0.0000	5.014E-07	0.0000	4.302E-08	0.0000
Eu-152	5.142E-08	0.0000	5.374E-13	0.0000	0.000E+00	0.0000	7.893E-13	0.0000	7.145E-13	0.0000	1.035E-14	0.0000	5.875E-13	0.0000
Eu-154	1.195E-11	0.0000	1.460E-16	0.0000	0.000E+00	0.0000	2.441E-16	0.0000	2.208E-16	0.0000	3.203E-18	0.0000	1.818E-16	0.0000
Eu-155	1.509E-20	0.0000	5.522E-25	0.0000	0.000E+00	0.0000	1.020E-24	0.0000	9.208E-25	0.0000	1.340E-26	0.0000	7.612E-25	0.0000
Ni-63	0.000E+00	0.0000	1.786E-08	0.0000	0.000E+00	0.0000	1.619E-06	0.0000	3.754E-07	0.0000	1.970E-06	0.0000	6.111E-08	0.0000
Pu-238	6.180E-06	0.0000	8.643E-04	0.0007	2.718E-08	0.0000	1.451E-04	0.0001	1.553E-05	0.0000	2.429E-07	0.0000	2.630E-04	0.0002
Pu-239	4.925E-05	0.0000	1.003E-02	0.0078	0.000E+00	0.0000	1.702E-03	0.0013	1.822E-04	0.0001	2.648E-06	0.0000	3.086E-03	0.0024
Sr-90	1.643E-07	0.0000	1.998E-09	0.0000	0.000E+00	0.0000	1.382E-06	0.0000	3.114E-07	0.0000	9.486E-08	0.0000	8.703E-09	0.0000
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	1.045E+00	0.8088	4.839E-02	0.0375	1.399E-01	0.1083	2.892E-02	0.0224	1.592E-03	0.0012	1.864E-03	0.0014	4.479E-03	0.0035
U-234	8.072E-05	0.0001	7.454E-04	0.0006	1.373E-04	0.0001	8.354E-05	0.0001	1.255E-05	0.0000	3.130E-05	0.0000	5.991E-05	0.0000
U-238	2.934E-03	0.0023	6.575E-04	0.0005	3.308E-08	0.0000	7.525E-05	0.0001	1.160E-05	0.0000	2.956E-05	0.0000	5.590E-05	0.0000
Total	1.048E+00	0.8114	6.085E-02	0.0471	1.400E-01	0.1084	3.096E-02	0.0240	1.818E-03	0.0014	1.930E-03	0.0015	7.995E-03	0.0062

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

0
0

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.057E-04	0.0003
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	7.419E-18	0.0000
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.453E-04	0.0002
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.142E-08	0.0000
Eu-154	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.195E-11	0.0000
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.510E-20	0.0000
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.044E-06	0.0000
Pu-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.294E-03	0.0010

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Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.505E-02	0.0117
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.963E-06	0.0000
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.270E+00	0.9830
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.151E-03	0.0009
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.764E-03	0.0029
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	1.292E+00	1.0000

0*Sum of all water independent and dependent pathways.

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Summary : RESRAD default data File: 15MREM.DAT

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)

0
0

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-154	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

0

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

0
0

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-154	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

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Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

0*Sum of all water independent and dependent pathways.

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

0Parent (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	2.200E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Am-241	Am-241	1.000E+00	5.637E-01	5.555E-01	5.397E-01	4.875E-01	4.096E-01	3.647E-01	1.318E-01	4.028E-04	0.000E+00
Am-241	Np-237	1.000E+00	0.000E+00	1.254E-06	3.689E-06	1.149E-05	2.251E-05	2.843E-05	4.931E-05	2.889E-06	0.000E+00
Am-241	U-233	1.000E+00	0.000E+00	9.478E-14	8.408E-13	8.886E-12	3.949E-11	6.942E-11	4.797E-10	4.865E-11	0.000E+00
Am-241	Th-229	1.000E+00	0.000E+00	6.101E-17	1.630E-15	5.826E-14	5.837E-13	1.422E-12	3.758E-11	3.424E-11	0.000E+00
Am-241	ΣDSR(j)		5.637E-01	5.555E-01	5.397E-01	4.875E-01	4.096E-01	3.647E-01	1.319E-01	4.057E-04	0.000E+00
0Co-60	Co-60	1.000E+00	9.377E+00	8.219E+00	6.314E+00	2.510E+00	5.159E-01	1.796E-01	1.739E-05	7.419E-18	0.000E+00
0Cs-137	Cs-137	1.000E+00	2.105E+00	2.057E+00	1.963E+00	1.667E+00	1.260E+00	1.045E+00	2.019E-01	2.453E-04	0.000E+00
0Eu-152	Eu-152	7.208E-01	2.896E+00	2.745E+00	2.465E+00	1.692E+00	8.877E-01	5.773E-01	1.324E-02	3.707E-08	0.000E+00
0Eu-152	Eu-152	2.792E-01	1.122E+00	1.063E+00	9.548E-01	6.555E-01	3.439E-01	2.236E-01	5.129E-03	1.436E-08	0.000E+00
Eu-152	Gd-152	2.792E-01	0.000E+00	3.496E-16	9.941E-16	2.767E-15	4.588E-15	5.276E-15	6.292E-15	1.912E-16	0.000E+00
Eu-152	ΣDSR(j)		1.122E+00	1.063E+00	9.548E-01	6.555E-01	3.439E-01	2.236E-01	5.129E-03	1.436E-08	0.000E+00
0Eu-154	Eu-154	1.000E+00	4.404E+00	4.058E+00	3.444E+00	1.940E+00	7.253E-01	3.763E-01	1.194E-03	1.195E-11	0.000E+00
0Eu-155	Eu-155	1.000E+00	1.057E-01	9.186E-02	6.940E-02	2.601E-02	4.838E-03	1.576E-03	8.630E-08	1.510E-20	0.000E+00
0Ni-63	Ni-63	1.000E+00	1.782E-03	1.764E-03	1.730E-03	1.614E-03	1.432E-03	1.322E-03	6.374E-04	4.044E-06	0.000E+00
0Pu-238	Pu-238	1.000E+00	4.770E-01	4.729E-01	4.648E-01	4.374E-01	3.941E-01	3.677E-01	1.999E-01	1.294E-03	0.000E+00
Pu-238	U-234	1.000E+00	0.000E+00	3.705E-07	1.096E-06	3.478E-06	7.035E-06	9.071E-06	1.855E-05	5.186E-07	0.000E+00
Pu-238	Th-230	1.000E+00	0.000E+00	3.454E-12	3.080E-11	3.316E-10	1.521E-09	2.730E-09	2.238E-08	3.187E-09	0.000E+00
Pu-238	Ra-226	1.000E+00	0.000E+00	1.069E-13	2.855E-12	1.017E-10	1.012E-09	2.452E-09	5.945E-08	3.923E-08	0.000E+00
Pu-238	Pb-210	1.000E+00	0.000E+00	3.622E-17	2.859E-15	3.227E-13	6.494E-12	2.031E-11	1.066E-09	5.666E-10	0.000E+00
Pu-238	ΣDSR(j)		4.770E-01	4.729E-01	4.648E-01	4.374E-01	3.941E-01	3.677E-01	2.000E-01	1.294E-03	0.000E+00
0Pu-239	Pu-239	1.000E+00	5.244E-01	5.240E-01	5.231E-01	5.202E-01	5.151E-01	5.118E-01	4.827E-01	1.505E-02	0.000E+00
Pu-239	U-235	1.000E+00	0.000E+00	5.513E-10	1.645E-09	5.385E-09	1.149E-08	1.534E-08	4.288E-08	1.192E-08	0.000E+00
Pu-239	Pa-231	1.000E+00	0.000E+00	5.896E-14	5.249E-13	5.617E-12	2.548E-11	4.535E-11	3.407E-10	5.250E-11	0.000E+00
Pu-239	Ac-227	1.000E+00	0.000E+00	8.302E-16	2.180E-14	7.340E-13	6.682E-12	1.533E-11	2.663E-10	9.074E-11	0.000E+00
Pu-239	ΣDSR(j)		5.244E-01	5.240E-01	5.231E-01	5.202E-01	5.151E-01	5.118E-01	4.827E-01	1.505E-02	0.000E+00
0Sr-90	Sr-90	1.000E+00	1.742E+00	1.682E+00	1.566E+00	1.221E+00	7.964E-01	5.983E-01	4.703E-02	1.963E-06	0.000E+00
0Th-228	Th-228	1.000E+00	6.515E+00	4.535E+00	2.197E+00	1.738E-01	2.246E-03	1.237E-04	1.171E-15	0.000E+00	0.000E+00
0Th-232	Th-232	1.000E+00	1.366E+00	1.367E+00	1.369E+00	1.373E+00	1.372E+00	1.370E+00	1.348E+00	4.443E-02	0.000E+00

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Th-232	Ra-228	1.000E+00	0.000E+00	6.009E-01	1.597E+00	3.628E+00	4.709E+00	4.872E+00	4.560E+00	4.481E-01	0.000E+00
Th-232	Th-228	1.000E+00	0.000E+00	1.211E-01	8.057E-01	3.628E+00	5.690E+00	6.079E+00	6.185E+00	7.771E-01	0.000E+00
Th-232	ΣDSR(j)		1.366E+00	2.089E+00	3.772E+00	8.629E+00	1.177E+01	1.232E+01	1.209E+01	1.270E+00	0.000E+00

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

0Parent (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	2.200E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
U-234	U-234	1.000E+00	1.319E-01	1.312E-01	1.297E-01	1.249E-01	1.169E-01	1.119E-01	7.620E-02	9.369E-04	0.000E+00
U-234	Th-230	1.000E+00	0.000E+00	2.446E-06	7.299E-06	2.388E-05	5.090E-05	6.797E-05	1.896E-04	1.262E-05	0.000E+00
U-234	Ra-226	1.000E+00	0.000E+00	1.135E-07	1.013E-06	1.092E-05	5.014E-05	8.998E-05	7.135E-04	1.982E-04	0.000E+00
U-234	Pb-210	1.000E+00	0.000E+00	5.119E-11	1.346E-09	4.542E-08	4.137E-07	9.471E-07	1.501E-05	3.047E-06	0.000E+00
U-234	ΣDSR(j)		1.319E-01	1.312E-01	1.297E-01	1.249E-01	1.170E-01	1.121E-01	7.712E-02	1.151E-03	0.000E+00
0U-238	U-238	1.000E+00	1.984E-01	1.974E-01	1.953E-01	1.883E-01	1.767E-01	1.694E-01	1.167E-01	3.763E-03	0.000E+00
U-238	U-234	1.000E+00	0.000E+00	3.711E-07	1.101E-06	3.532E-06	7.277E-06	9.498E-06	2.156E-05	7.955E-07	0.000E+00
U-238	Th-230	1.000E+00	0.000E+00	3.457E-12	3.090E-11	3.350E-10	1.556E-09	2.814E-09	2.464E-08	4.083E-09	0.000E+00
U-238	Ra-226	1.000E+00	0.000E+00	1.070E-13	2.862E-12	1.025E-10	1.029E-09	2.508E-09	6.396E-08	4.774E-08	0.000E+00
U-238	Pb-210	1.000E+00	0.000E+00	3.624E-17	2.865E-15	3.247E-13	6.584E-12	2.070E-11	1.135E-09	6.804E-10	0.000E+00
U-238	ΣDSR(j)		1.984E-01	1.974E-01	1.953E-01	1.883E-01	1.767E-01	1.694E-01	1.167E-01	3.764E-03	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.
0

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

0Nuclide (i)	t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	2.200E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Am-241	2.661E+01	2.700E+01	2.780E+01	3.077E+01	3.662E+01	4.113E+01	1.137E+02	3.697E+04	*3.424E+12
Co-60	1.600E+00	1.825E+00	2.376E+00	5.977E+00	2.908E+01	8.350E+01	8.625E+05	*1.131E+15	*1.131E+15
Cs-137	7.124E+00	7.293E+00	7.641E+00	8.998E+00	1.191E+01	1.436E+01	7.430E+01	6.116E+04	*8.652E+13
Eu-152	3.733E+00	3.939E+00	4.386E+00	6.389E+00	1.218E+01	1.873E+01	8.166E+02	2.917E+08	*1.810E+14
Eu-154	3.406E+00	3.697E+00	4.355E+00	7.731E+00	2.068E+01	3.986E+01	1.256E+04	1.256E+12	*2.732E+14
Eu-155	1.419E+02	1.633E+02	2.161E+02	5.766E+02	3.101E+03	9.516E+03	1.738E+08	*4.651E+14	*4.651E+14
Ni-63	8.418E+03	8.502E+03	8.671E+03	9.293E+03	1.047E+04	1.135E+04	2.353E+04	3.709E+06	*5.679E+13
Pu-238	3.145E+01	3.172E+01	3.227E+01	3.429E+01	3.806E+01	4.080E+01	7.502E+01	1.159E+04	*1.711E+13
Pu-239	2.860E+01	2.863E+01	2.867E+01	2.884E+01	2.912E+01	2.931E+01	3.108E+01	9.968E+02	*6.203E+10
Sr-90	8.609E+00	8.920E+00	9.576E+00	1.228E+01	1.883E+01	2.507E+01	3.189E+02	7.641E+06	*1.380E+14
Th-228	2.302E+00	3.308E+00	6.828E+00	8.629E+01	6.678E+03	1.213E+05	*8.192E+14	*8.192E+14	*8.192E+14
Th-232	1.098E+01	7.180E+00	3.976E+00	1.738E+00	1.274E+00	1.217E+00	1.240E+00	1.181E+01	*1.092E+05
U-234	1.137E+02	1.144E+02	1.156E+02	1.201E+02	1.282E+02	1.339E+02	1.945E+02	1.303E+04	*6.233E+09
U-238	7.559E+01	7.599E+01	7.680E+01	7.967E+01	8.487E+01	8.852E+01	1.285E+02	3.985E+03	*3.360E+05

*At specific activity limit

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

ONuclide (i)	Initial pCi/g	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
Am-241	1.000E+00	0.000E+00	5.637E-01	2.661E+01	5.637E-01	2.661E+01
Co-60	1.000E+00	0.000E+00	9.377E+00	1.600E+00	9.377E+00	1.600E+00
Cs-137	1.000E+00	0.000E+00	2.105E+00	7.124E+00	2.105E+00	7.124E+00
Eu-152	1.000E+00	0.000E+00	4.018E+00	3.733E+00	4.018E+00	3.733E+00
Eu-154	1.000E+00	0.000E+00	4.404E+00	3.406E+00	4.404E+00	3.406E+00
Eu-155	1.000E+00	0.000E+00	1.057E-01	1.419E+02	1.057E-01	1.419E+02
Ni-63	1.000E+00	0.000E+00	1.782E-03	8.418E+03	1.782E-03	8.418E+03
Pu-238	1.000E+00	0.000E+00	4.770E-01	3.145E+01	4.770E-01	3.145E+01
Pu-239	1.000E+00	0.000E+00	5.244E-01	2.860E+01	5.244E-01	2.860E+01
Sr-90	1.000E+00	0.000E+00	1.742E+00	8.609E+00	1.742E+00	8.609E+00
Th-228	1.000E+00	0.000E+00	6.515E+00	2.302E+00	6.515E+00	2.302E+00
Th-232	1.000E+00	44.42 ± 0.04	1.252E+01	1.199E+00	1.366E+00	1.098E+01
U-234	1.000E+00	0.000E+00	1.319E-01	1.137E+02	1.319E-01	1.137E+02
U-238	1.000E+00	0.000E+00	1.984E-01	7.559E+01	1.984E-01	7.559E+01

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

ONuclide (j)	Parent (i)	BRF(i)	DOSE(j,t), mrem/yr t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	2.200E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Am-241	Am-241	1.000E+00	5.637E-01	5.555E-01	5.397E-01	4.875E-01	4.096E-01	3.647E-01	1.318E-01	4.028E-04	0.000E+00
ONp-237	Am-241	1.000E+00	0.000E+00	1.254E-06	3.689E-06	1.149E-05	2.251E-05	2.843E-05	4.931E-05	2.889E-06	0.000E+00
OU-233	Am-241	1.000E+00	0.000E+00	9.478E-14	8.408E-13	8.886E-12	3.949E-11	6.942E-11	4.797E-10	4.865E-11	0.000E+00
OTh-229	Am-241	1.000E+00	0.000E+00	6.101E-17	1.630E-15	5.826E-14	5.837E-13	1.422E-12	3.758E-11	3.424E-11	0.000E+00
OCo-60	Co-60	1.000E+00	9.377E+00	8.219E+00	6.314E+00	2.510E+00	5.159E-01	1.796E-01	1.739E-05	7.419E-18	0.000E+00
OCs-137	Cs-137	1.000E+00	2.105E+00	2.057E+00	1.963E+00	1.667E+00	1.260E+00	1.045E+00	2.019E-01	2.453E-04	0.000E+00
OEu-152	Eu-152	7.208E-01	2.896E+00	2.745E+00	2.465E+00	1.692E+00	8.877E-01	5.773E-01	1.324E-02	3.707E-08	0.000E+00
Eu-152	Eu-152	2.792E-01	1.122E+00	1.063E+00	9.548E-01	6.555E-01	3.439E-01	2.236E-01	5.129E-03	1.436E-08	0.000E+00
Eu-152	ΣDOSE(j):		4.018E+00	3.808E+00	3.420E+00	2.348E+00	1.232E+00	8.010E-01	1.837E-02	5.142E-08	0.000E+00
OGd-152	Eu-152	2.792E-01	0.000E+00	3.496E-16	9.941E-16	2.767E-15	4.588E-15	5.276E-15	6.292E-15	1.912E-16	0.000E+00
OEu-154	Eu-154	1.000E+00	4.404E+00	4.058E+00	3.444E+00	1.940E+00	7.253E-01	3.763E-01	1.194E-03	1.195E-11	0.000E+00
OEu-155	Eu-155	1.000E+00	1.057E-01	9.186E-02	6.940E-02	2.601E-02	4.838E-03	1.576E-03	8.630E-08	1.510E-20	0.000E+00
ONi-63	Ni-63	1.000E+00	1.782E-03	1.764E-03	1.730E-03	1.614E-03	1.432E-03	1.322E-03	6.374E-04	4.044E-06	0.000E+00
OPu-238	Pu-238	1.000E+00	4.770E-01	4.729E-01	4.648E-01	4.374E-01	3.941E-01	3.677E-01	1.999E-01	1.294E-03	0.000E+00
OU-234	Pu-238	1.000E+00	0.000E+00	3.705E-07	1.096E-06	3.478E-06	7.035E-06	9.071E-06	1.855E-05	5.186E-07	0.000E+00

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U-234	U-234	1.000E+00	1.319E-01	1.312E-01	1.297E-01	1.249E-01	1.169E-01	1.119E-01	7.620E-02	9.369E-04	0.000E+00
U-234	U-238	1.000E+00	0.000E+00	3.711E-07	1.101E-06	3.532E-06	7.277E-06	9.498E-06	2.156E-05	7.955E-07	0.000E+00
U-234	ΣDOSE(j):		1.319E-01	1.312E-01	1.297E-01	1.249E-01	1.169E-01	1.119E-01	7.624E-02	9.382E-04	0.000E+00
0Th-230	Pu-238	1.000E+00	0.000E+00	3.454E-12	3.080E-11	3.316E-10	1.521E-09	2.730E-09	2.238E-08	3.187E-09	0.000E+00
Th-230	U-234	1.000E+00	0.000E+00	2.446E-06	7.299E-06	2.388E-05	5.090E-05	6.797E-05	1.896E-04	1.262E-05	0.000E+00
Th-230	U-238	1.000E+00	0.000E+00	3.457E-12	3.090E-11	3.350E-10	1.556E-09	2.814E-09	2.464E-08	4.083E-09	0.000E+00
Th-230	ΣDOSE(j):		0.000E+00	2.446E-06	7.299E-06	2.388E-05	5.090E-05	6.798E-05	1.897E-04	1.263E-05	0.000E+00
0Ra-226	Pu-238	1.000E+00	0.000E+00	1.069E-13	2.855E-12	1.017E-10	1.012E-09	2.452E-09	5.945E-08	3.923E-08	0.000E+00
Ra-226	U-234	1.000E+00	0.000E+00	1.135E-07	1.013E-06	1.092E-05	5.014E-05	8.998E-05	7.135E-04	1.982E-04	0.000E+00
Ra-226	U-238	1.000E+00	0.000E+00	1.070E-13	2.862E-12	1.025E-10	1.029E-09	2.508E-09	6.396E-08	4.774E-08	0.000E+00
Ra-226	ΣDOSE(j):		0.000E+00	1.135E-07	1.013E-06	1.092E-05	5.015E-05	8.998E-05	7.136E-04	1.983E-04	0.000E+00
0Pb-210	Pu-238	1.000E+00	0.000E+00	3.622E-17	2.859E-15	3.227E-13	6.494E-12	2.031E-11	1.066E-09	5.666E-10	0.000E+00
Pb-210	U-234	1.000E+00	0.000E+00	5.119E-11	1.346E-09	4.542E-08	4.137E-07	9.471E-07	1.501E-05	3.047E-06	0.000E+00
Pb-210	U-238	1.000E+00	0.000E+00	3.624E-17	2.865E-15	3.247E-13	6.584E-12	2.070E-11	1.135E-09	6.804E-10	0.000E+00
Pb-210	ΣDOSE(j):		0.000E+00	5.119E-11	1.346E-09	4.542E-08	4.137E-07	9.472E-07	1.501E-05	3.048E-06	0.000E+00
0Pu-239	Pu-239	1.000E+00	5.244E-01	5.240E-01	5.231E-01	5.202E-01	5.151E-01	5.118E-01	4.827E-01	1.505E-02	0.000E+00
0U-235	Pu-239	1.000E+00	0.000E+00	5.513E-10	1.645E-09	5.385E-09	1.149E-08	1.534E-08	4.288E-08	1.192E-08	0.000E+00

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

0Nuclide (j)	Parent (i)	BRF(i)	DOSE(j,t), mrem/yr t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	2.200E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Pa-231	Pu-239	1.000E+00	0.000E+00	5.896E-14	5.249E-13	5.617E-12	2.548E-11	4.535E-11	3.407E-10	5.250E-11	0.000E+00
0Ac-227	Pu-239	1.000E+00	0.000E+00	8.302E-16	2.180E-14	7.340E-13	6.682E-12	1.533E-11	2.663E-10	9.074E-11	0.000E+00
0Sr-90	Sr-90	1.000E+00	1.742E+00	1.682E+00	1.566E+00	1.221E+00	7.964E-01	5.983E-01	4.703E-02	1.963E-06	0.000E+00
0Th-228	Th-228	1.000E+00	6.515E+00	4.535E+00	2.197E+00	1.738E-01	2.246E-03	1.237E-04	1.171E-15	0.000E+00	0.000E+00
Th-228	Th-232	1.000E+00	0.000E+00	1.211E-01	8.057E-01	3.628E+00	5.690E+00	6.079E+00	6.185E+00	7.771E-01	0.000E+00
Th-228	ΣDOSE(j):		6.515E+00	4.656E+00	3.002E+00	3.802E+00	5.693E+00	6.080E+00	6.185E+00	7.771E-01	0.000E+00
0Th-232	Th-232	1.000E+00	1.366E+00	1.367E+00	1.369E+00	1.373E+00	1.372E+00	1.370E+00	1.348E+00	4.443E-02	0.000E+00
0Ra-228	Th-232	1.000E+00	0.000E+00	6.009E-01	1.597E+00	3.628E+00	4.709E+00	4.872E+00	4.560E+00	4.481E-01	0.000E+00
0U-238	U-238	1.000E+00	1.984E-01	1.974E-01	1.953E-01	1.883E-01	1.767E-01	1.694E-01	1.167E-01	3.763E-03	0.000E+00

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

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

0Nuclide (j)	Parent (i)	BRF(i)	S(j,t), pCi/g t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	2.200E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Am-241	Am-241	1.000E+00	1.000E+00	9.862E-01	9.592E-01	8.704E-01	7.368E-01	6.593E-01	2.495E-01	1.553E-02	9.335E-07
0Np-237	Am-241	1.000E+00	0.000E+00	3.215E-07	9.500E-07	3.005E-06	6.055E-06	7.794E-06	1.626E-05	1.736E-05	7.585E-06
0U-233	Am-241	1.000E+00	0.000E+00	7.004E-13	6.220E-12	6.598E-11	2.951E-10	5.210E-10	3.741E-09	1.133E-08	8.564E-09
0Th-229	Am-241	1.000E+00	0.000E+00	2.221E-17	5.936E-16	2.123E-14	2.130E-13	5.195E-13	1.387E-11	1.668E-10	8.801E-10

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0Co-60	Co-60	1.000E+00	1.000E+00	8.766E-01	6.735E-01	2.678E-01	5.511E-02	1.921E-02	1.898E-06	6.832E-18	0.000E+00
0Cs-137	Cs-137	1.000E+00	1.000E+00	9.770E-01	9.327E-01	7.928E-01	6.000E-01	4.982E-01	9.806E-02	9.428E-04	8.218E-11
0Eu-152	Eu-152	7.208E-01	7.208E-01	6.831E-01	6.135E-01	4.211E-01	2.209E-01	1.437E-01	3.338E-03	7.161E-08	3.274E-24
Eu-152	Eu-152	2.792E-01	2.792E-01	2.646E-01	2.376E-01	1.631E-01	8.558E-02	5.567E-02	1.293E-03	2.774E-08	1.268E-24
Eu-152	ΣS(j):		1.000E+00	9.477E-01	8.511E-01	5.842E-01	3.065E-01	1.994E-01	4.632E-03	9.935E-08	4.542E-24
0Gd-152	Eu-152	2.792E-01	0.000E+00	1.744E-15	4.961E-15	1.383E-14	2.299E-14	2.648E-14	3.204E-14	2.954E-14	2.187E-14
0Eu-154	Eu-154	1.000E+00	1.000E+00	9.213E-01	7.820E-01	4.405E-01	1.647E-01	8.550E-02	2.753E-04	2.087E-11	2.501E-36
0Eu-155	Eu-155	1.000E+00	1.000E+00	8.692E-01	6.567E-01	2.462E-01	4.578E-02	1.492E-02	8.169E-07	5.452E-19	0.000E+00
0Ni-63	Ni-63	1.000E+00	1.000E+00	9.928E-01	9.787E-01	9.307E-01	8.539E-01	8.062E-01	4.878E-01	1.161E-01	7.625E-04
0Pu-238	Pu-238	1.000E+00	1.000E+00	9.920E-01	9.762E-01	9.229E-01	8.382E-01	7.861E-01	4.483E-01	9.007E-02	3.276E-04
0U-234	Pu-238	1.000E+00	0.000E+00	2.811E-06	8.324E-06	2.652E-05	5.398E-05	6.990E-05	1.486E-04	1.258E-04	6.273E-06
U-234	U-234	1.000E+00	1.000E+00	9.951E-01	9.853E-01	9.518E-01	8.971E-01	8.623E-01	6.103E-01	2.273E-01	7.170E-03
U-234	U-238	1.000E+00	0.000E+00	2.815E-06	8.363E-06	2.693E-05	5.584E-05	7.319E-05	1.727E-04	1.930E-04	2.031E-05
U-234	ΣS(j):		1.000E+00	9.951E-01	9.853E-01	9.519E-01	8.972E-01	8.625E-01	6.106E-01	2.276E-01	7.197E-03
0Th-230	Pu-238	1.000E+00	0.000E+00	1.268E-11	1.131E-10	1.220E-09	5.608E-09	1.008E-08	8.377E-08	3.549E-07	6.255E-07
Th-230	U-234	1.000E+00	0.000E+00	8.980E-06	2.681E-05	8.783E-05	1.876E-04	2.510E-04	7.099E-04	1.405E-03	1.791E-03
Th-230	U-238	1.000E+00	0.000E+00	1.269E-11	1.135E-10	1.232E-09	5.734E-09	1.039E-08	9.222E-08	4.547E-07	9.923E-07
Th-230	ΣS(j):		0.000E+00	8.980E-06	2.681E-05	8.783E-05	1.876E-04	2.510E-04	7.101E-04	1.406E-03	1.793E-03
0Ra-226	Pu-238	1.000E+00	0.000E+00	1.831E-15	4.902E-14	1.763E-12	1.785E-11	4.376E-11	1.214E-09	1.503E-08	6.180E-08
Ra-226	U-234	1.000E+00	0.000E+00	1.944E-09	1.739E-08	1.893E-07	8.843E-07	1.606E-06	1.457E-05	7.592E-05	1.845E-04
Ra-226	U-238	1.000E+00	0.000E+00	1.833E-15	4.914E-14	1.776E-12	1.815E-11	4.477E-11	1.306E-09	1.829E-08	9.461E-08
Ra-226	ΣS(j):		0.000E+00	1.944E-09	1.739E-08	1.893E-07	8.843E-07	1.606E-06	1.457E-05	7.595E-05	1.847E-04
0Pb-210	Pu-238	1.000E+00	0.000E+00	1.415E-17	1.123E-15	1.293E-13	2.696E-12	8.638E-12	5.772E-10	1.146E-08	5.645E-08
Pb-210	U-234	1.000E+00	0.000E+00	1.999E-11	5.285E-10	1.820E-08	1.717E-07	4.028E-07	8.130E-06	6.165E-05	1.695E-04
Pb-210	U-238	1.000E+00	0.000E+00	1.415E-17	1.125E-15	1.301E-13	2.733E-12	8.802E-12	6.151E-10	1.377E-08	8.600E-08
Pb-210	ΣS(j):		0.000E+00	1.999E-11	5.285E-10	1.820E-08	1.717E-07	4.028E-07	8.131E-06	6.167E-05	1.697E-04
0Pu-239	Pu-239	1.000E+00	1.000E+00	9.998E-01	9.995E-01	9.985E-01	9.967E-01	9.954E-01	9.849E-01	9.553E-01	8.586E-01
0U-235	Pu-239	1.000E+00	0.000E+00	9.824E-10	2.932E-09	9.602E-09	2.050E-08	2.740E-08	7.710E-08	1.499E-07	1.753E-07

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

0Nuclide (j)	Parent (i)	BRF(i)	S(j,t), pCi/g t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	2.200E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Pa-231	Pu-239	1.000E+00	0.000E+00	1.037E-14	9.272E-14	1.006E-12	4.680E-12	8.476E-12	7.494E-11	3.645E-10	7.405E-10
0Ac-227	Pu-239	1.000E+00	0.000E+00	1.091E-16	2.869E-15	9.691E-14	8.871E-13	2.043E-12	3.671E-11	2.401E-10	5.338E-10
0Sr-90	Sr-90	1.000E+00	1.000E+00	9.682E-01	9.077E-01	7.241E-01	4.916E-01	3.797E-01	3.965E-02	6.234E-05	9.604E-15
0Th-228	Th-228	1.000E+00	1.000E+00	6.961E-01	3.372E-01	2.670E-02	3.453E-04	1.903E-05	1.839E-16	0.000E+00	0.000E+00
Th-228	Th-232	1.000E+00	0.000E+00	1.859E-02	1.237E-01	5.572E-01	8.749E-01	9.355E-01	9.711E-01	9.703E-01	9.676E-01
Th-228	ΣS(j):		1.000E+00	7.147E-01	4.609E-01	5.839E-01	8.752E-01	9.355E-01	9.711E-01	9.703E-01	9.676E-01
0Th-232	Th-232	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	9.999E-01	9.999E-01	9.996E-01	9.988E-01	9.959E-01
0Ra-228	Th-232	1.000E+00	0.000E+00	1.132E-01	3.015E-01	6.900E-01	9.078E-01	9.478E-01	9.711E-01	9.703E-01	9.676E-01
0U-238	U-238	1.000E+00	1.000E+00	9.951E-01	9.853E-01	9.518E-01	8.971E-01	8.624E-01	6.105E-01	2.275E-01	7.190E-03

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

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9513383.1392

FROM THE DESK OF: **SCOTT PETERSEN**
RISK ASSESSMENT
372-9574/H4-90

TO: John Lowe **DATE:** 6/27/94

SUBJECT: Review of RESRAD calculations for 100-BC-1 Demonstration Project

I have reviewed the calculations and narrative on the assumptions and parameters for using RESRAD in the 100-BC-1 area. The parameters seem appropriate for the residential scenario described, although it seems likely that a rural/residential family would be utilizing groundwater resources.

The only major worry I have about the methodology deals with radionuclides with progeny which contribute significantly to dose. These are ^{238}U and ^{232}Th, with the latter being of greatest concern. If it is assumed that these two radionuclides are present due to contamination only, then it is valid to assume that they are not in secular equilibrium at the time of deposition. In this case, only the relatively short-lived progeny of ^{232}Th, ^{228}Ra and ^{228}Th, would need to be accounted for if more than a few years have passed since deposition. It takes about 12 years for ingrowth of ^{228}Ra and ^{228}Th to build to equilibrium activities. Since ^{232}Th may be a COPC in the 100 Areas (it was used as a target in many if not all of the reactors), and over 12 years have passed since most of those reactors were operational, it is reasonable that its daughters are in secular equilibrium. With this assumption, 1 pCi/g of ^{232}Th + Daughters will yield a dose of approximately 13 mrem/yr in the modeling scenario you propose.

Uranium-238 has no short-lived progeny of concern which would be in secular equilibrium after only a few years. The daughters of ^{238}U which could contribute significantly to dose are ^{226}Ra, ^{222}Rn, and ^{210}Pb. Radium-226 is especially important in background considerations, as it is the parent of radon. However, ingrowth of ^{226}Ra from ^{238}U would not build to significant levels for several hundreds of thousands of years after the decay chain had been broken, because ^{234}U is between these two isotopes and has a very long half life.

Some general comments on the use of equating a 15 mrem/yr dose with a specific radionuclide activity, and interpretation of laboratory data:

If ^{238}U and/or ^{232}Th are COPCs, natural background values must be considered when evaluating the 15 mrem/yr above background dose limit. In the exposure scenario you propose, background dose for ^{238}U and its progeny is 49 mrem/yr with radon, and 9 mrem/yr without radon. Background concentrations for ^{232}Th + daughters is 9 to 12 mrem/yr (approx. 1 pCi/g of ^{232}Th and each of its progeny). One can use the lab data to determine if these parent radionuclides are in equilibrium with their progeny, and then compute appropriate dose rates. This and information on other isotopic ratios may also help to determine the presence of contamination vs. natural radionuclide activity. For example, if ^{230}Th is found to be in secular equilibrium with ^{238}U, then it may be assumed that ^{226}Ra is also present in equilibrium. Assumptions about ^{222}Rn, the next member in the decay chain, are fraught with uncertainties.

In short, the only change I would make to your calculations is to add ^{228}Th to the list, and report ^{232}Th as the entire decay chain. RESRAD will do this for you if you look at the parent and ingrowths after 12 years, but ^{232}Th concentrations drop off sharply after 150 years (leaching of Th?), so look in that window.

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020241

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July 20, 1995

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