



DEPARTMENT OF THE AIR FORCE
HEADQUARTERS UNITED STATES AIR FORCE
WASHINGTON DC

JUN 29 2004

23 June 2004

MEMORANDUM FOR NRC REGION IV
ATTENTION: Ms. BROWDER

FROM: AFMSA/SGPR
110 Luke Avenue, Room 405
Bolling AFB, DC 20032-7050

SUBJECT: NRC Approval for Burial of Four Tanks Containing Unimportant Quantities of NRC Licensed Radioactive Materials (Depleted Uranium rounds) at the US Ecology Hazardous Waste Treatment and Disposal Facility in Idaho

During our teleconference on April 8, 2004, we discussed the subject of transporting four M-47 tanks from the 98th Range Wing at Nellis Air Force Base Nevada to US Ecology's Hazardous Waste Treatment and Disposal Facility in Idaho, for the purpose of disposal by burial at US Ecology's non-NRC licensed facility. In summary, your office requested the Air Force submit a waiver package requesting licensed material disposal in a non-licensed NRC facility, and to provide worker dose estimates for the over-the-road truck driver transporting the tanks from Nevada to Idaho, and for the maximally exposed worker at the disposal facility.

The Air Force Institute for Operational Health (AFIOH) Radiation Surveillance Division (SDR) researched these issues and submitted a technical report (Attachment), which shows the maximally exposed workers receive negligible dose estimates. A truck driver, assuming the same driver transported all four tanks from Las Vegas Nevada to Grand View Idaho, would receive a theoretical maximum dose of 0.24 mrem. A disposal facility worker, assuming the lone worker loads, unloads and buries the four tanks at the disposal site, would receive a theoretical maximum dose of 0.89 mrem.

Please review the AFIOH/SDRH Memo with attached RESRAD computations, and approve the tank disposal waiver request allowing burial of the four tanks at the US Ecology Hazardous Waste Treatment and Disposal (RCRA) Facility in Idaho. We would appreciate it if you provide approval by 1 August 2004, as we would like to obligate the 2004 funding by 30 September 2004.

If you have any questions or need further input, please contact me at 202-767-4306 or e-mail at ramachandra.bhat@pentagon.af.mil. Our telefax is 202-404-8089.

RKB

Ramachandra K. Bhat Ph.D., CHP
Health Physicist
Radiation Protection Division and
USAF Radioisotope Committee Secretariat
Air Force Medical Operations Agency
Office of the Surgeon General

Attachment:

AFIOH/SDRH Consultative Letter, 24 May 04

cc:

99 AMDS/SGPB (Maj Smyser)
98 OG Det 2/CD (Anderson Spence)
AFIA/SGO (Lt Col Rademacher)
AFIERA/SDR (Lt Col Nichelson)
NRC REGION IV (Dr. Spitzberg)
NRC REGION IV (Mr. Gaines)



DEPARTMENT OF THE AIR FORCE
AIR FORCE INSTITUTE FOR OPERATIONAL HEALTH (AFMC)
BROOKS CITY-BASE, TEXAS

23 June 2004

MEMORANDUM FOR AFMSA/SGPR (Dr. Bhat)

FROM: AFIOH/SDRH
2350 Gillingham Drive
Brooks City-Base TX 78235-5103

SUBJECT: Consultative Letter, IOH-SD-BR-CL-2004-0054, Radiological Assessment for
Burial of Four Tanks Containing Unimportant Quantities of Radioactive Materials at
the US Ecology Hazardous Waste Treatment and Disposal Facility in Idaho

1. Introduction: At the request of the 98th Range Wing, Nellis Air Force Base (AFB), NV, the Air Force Institute for Operational Health (AFIOH) performed radiological assessments for the burial of four US Army tanks (M-47) containing less than 40 GAU-8 30mm Depleted Uranium (DU) rounds per tank. These assessments also included calculating potential radiological doses to the vehicle driver transporting the tanks and the worker placing the tanks in the burial site. These objects were contaminated with DU from A-10 aircraft target practice. The DU is the metal form with a minor contribution as an oxide. The dose assessment for the burial of the tanks was performed using an industry accepted computer code¹. Dose models performed for the workers and driver are based on empirical measurements obtained from an actual GAU-8 30mm DU round. Based on this evaluation, the dose to the driver is 0.24 mrem and the dose from burial of the tanks to the maximum exposed individual is 0.89 mrem².
2. Background: The four tanks were stored in the "Library" area in Range 63, Target Area 10, and were previously used for target practice on this Range. These particular tanks are no longer useful as targets at the range. An evaluation was recently performed at Nellis AFB to determine if costs to decontaminate the tanks would be comparable to or less than burial costs. For these tanks, the cost for disposal by burial was determined to be less than attempting to decontaminate them. As part of the effort to reduce costs to the Air Force, various solutions were evaluated to dispose of the tanks. These tanks were selected to go to the US Ecology Hazardous Waste Treatment & Disposal Facility Site in Idaho. Selection factors included number of penetrations

¹ RESRAD Version 6.1, Environmental Assessment Division, Argonne National Laboratory, U.S. Department of Energy

² For the purposes of this report, dose conversions from μR to μrem are interchangeable since gamma radiation has a quality factor of 1. The instrument indication is in units of $\mu\text{R}/\text{hr}$ and deep dose equivalent values are expressed in units of μrem .

or rounds remaining in the tank (< 40 per tank), residual contamination, condition of the tank, and other potential contaminants. These tanks contain < 0.05% by mass of U-238 when averaged over the mass of the tank. The US Ecology facility is a Subtitle C, Resource Conservation and Recovery Act (RCRA) hazardous waste disposal facility licensed by the State of Idaho.

The site has been receiving certain radioactive materials that are exempt from the Nuclear Regulatory Commission (NRC) licensing requirements.

3. Dose Assessments:

a. The mass of each GAU-8 30 mm is 300 grams of DU and the mass of each tank is 60 tons (54.54 metric tons). Assuming the maximum number of rounds in each tank is 40; then the mass of DU per tank is 12 kg. When averaged over the mass of the tank, the uranium content is 0.022%. As such, the materials constitute an unimportant quantity of source material, exempt from the regulations, pursuant to 10 CFR Part 40, "DOMESTIC LICENSING OF SOURCE MATERIAL."

b. The dose to the driver was calculated by using empirical values for a single GAU-8 DU projectile as measured with a Victoreen 450P Pressurized Ion Chamber. This value is $19 \mu\text{R}/\text{hr}^2$ at 30 centimeters. The dose to the driver assumes that 20 of the 40 rounds were in the front of the tank towards the driver for a potential dose of $380 \mu\text{R}/\text{hr}$ at 30 cm. The minimum distance between the driver and the front of the tank is estimated to be three meters which would yield a dose to the driver of $3.8 \mu\text{R}/\text{hr}$. The driving distance between Las Vegas, Nevada and Grand View, Idaho is approximately 800 miles per a variety of web-based mapping programs. Driving time would be approximately 16 hours (assume average speed of 50 mph). The maximum dose to the driver would be $60.8 \mu\text{rem}$ per trip or 0.24 mrem if the same driver transported all four tanks.

c. Dose to the staff that loads, unloads, and buries the tanks is minimal. Existing documentation does not show any removable contamination on the tanks and the equipment will be sealed from the environment. Dose modeling to workers also assumes that at most 20 of the 40 DU rounds will be facing any one worker at a time. The calculations assume the gamma radiation level would be $380 \mu\text{R}/\text{hr}$ at 30 centimeters or $3.8 \mu\text{R}/\text{hr}$ at three meters. Assuming that two workers were tasked with unloading each tank and the time required to process each tank is two hours, then the maximum expected exposure would be $15.2 \mu\text{rem}$ per tank. Total dose for unloading and burying all four tanks would be $60.8 \mu\text{rem}$.

d. The dose to the maximally exposed individual would be 0.89 mrem per year from the burial of the tanks. The dose model for the disposal of the tanks was unique in that the existing models assume that the contamination is in a soil matrix. To prevent the need to perform multiple calculations and various approvals, a conservative model was chosen to perform the dose assessment. Specifically, the activity in the DU penetrators was assumed to be evenly distributed in the soil displaced by the tanks. For this assessment, the International Atomic Energy Agency (IAEA) distribution of U-238, U-235, and U-234 was used to calculate the various contributions to the soil activity (http://www.iaea.org/NewsCenter/Features/DU/du_qaa.shtml). Conversion from the mass of the

penetrators to activity is referenced in Atch 1, DU Activity Calculations. The dimensions of each tank are 13.9 meters long by 6.25 meters wide by 3 meters deep or a volume of 258 m³ (2.58 E8 cm³). The total volume displaced by all four tanks is 1E9 cm³. Assuming a soil density of 1.5 grams/cm³, then the mass of the displaced soil would be 1.55 E9 grams. The activity per gram of soil for U-238 is 10.4 pCi/g, U-235 is 0.13 pCi/g, and U-234 is 1.94 pCi/g.

e. RESRAD version 6.1 was used to calculate the dose with the following variations from the default model: Milk ingestion turned off, meat ingestion turned off, plant ingestion turned off, aquatic food ingestion turned off, drinking water ingestion turned off, radon inhalation turned on, area of contaminated zone is 347.5 m², depth of contaminated zone is 3 meters, and the site specific precipitation value of 0.184 meters per year was used. Atch 2, RESRAD Run, contains a copy of the actual report.

4. Findings/Recommendations: Source material calculations support the conclusion that the uranium in each tank is an unimportant quantity of radioactive materials, less than 0.05% by weight of uranium. Dose modeling supports a proposed disposal of the tanks in a RCRA facility as authorized by 10 CFR 20.2002. The potential dose consequence is significantly less than 1 mrem per year. The US Ecology Site in Idaho is currently being used similarly by existing NRC licensees to dispose of unimportant quantities of radioactive materials.

5. If you have any comments or questions concerning this letter, please contact Jerry Hensley, CHP, at DSN 240-4970.



DALE D. THOMAS III, GS-13, DAF
Acting Chief, Radiation Surveillance Division

Attachments:

1. DU Activity Calculations
2. RESRAD Run

cc:

99 AMDS/SGPB

Attachment 1, DU Activity Calculations

1. Mass of each GAU-8 30mm Depleted Uranium (DU) penetrator is 300 grams. Mass of 160 penetrators (4 tanks * 40 penetrators) is 48,000 grams (48 kg). Mass of penetrator can be found in Air Force T.O. 60D-2-2-46.
2. Mass of tanks is 240 tons (54.54 tons per tank * 4 tanks) or 218,160 kg.
3. Percent weight of DU is 0.022% (48 kg / 218,160 kg)
4. Mass of soil
 - Tank dimensions are 13.9 meters long by 6.25 meters wide by 3 meters deep or 258 m^3
 - Total volume occupied by four tanks is 1032 m^3 ($1.03 \times 10^9 \text{ cm}^3$)
 - Area displaced by tanks is 347.5 m^2 (13.9 meters * 6.25 meters * 4 tanks)
 - Density of soil is assumed to be 1.5 g/cm^3
 - Total mass of soil is $1.55 \times 10^9 \text{ grams}$ ($1.5 \text{ g/cm}^3 \times 1.03 \times 10^9 \text{ cm}^3$)
5. Percent mass per IAEA of DU for U-238, U-235, and U-234 are as follows
 - U-238 99.8%
 - U-235 0.2%
 - U-234 .001%
6. Specific Activity Values for U-238, U-235, and U-234
 - U-238 $0.336 \mu\text{Ci/g}$ ($3.36 \times 10^5 \text{ pCi/g}$)
 - U-235 $2.16 \mu\text{Ci/g}$ ($2.16 \times 10^6 \text{ pCi/g}$)
 - U-234 $6,260 \mu\text{Ci/g}$ ($6.26 \times 10^9 \text{ pCi/g}$)
7. Total activity by radionuclide
 - U-238 $1.61 \times 10^{10} \text{ pCi}$ ($48,000 \text{ grams} \times 99.8\% \times 3.36 \times 10^5 \text{ pCi/g}$)
 - U-235 $2.07 \times 10^8 \text{ pCi}$ ($48,000 \text{ grams} \times 0.2\% \times 2.16 \times 10^6 \text{ pCi/g}$)
 - U-234 $3.0 \times 10^9 \text{ pCi}$ ($48,000 \text{ grams} \times 0.001\% \times 6.26 \times 10^9 \text{ pCi/g}$)
8. Total Soil Contamination Values by Radionuclide
 - U-238 10.4 pCi/g ($1.61 \times 10^{10} \text{ pCi} / 1.55 \times 10^9 \text{ grams}$)
 - U-235 0.13 pCi/g ($2.07 \times 10^8 \text{ pCi} / 1.55 \times 10^9 \text{ grams}$)
 - U-234 1.94 pCi/g ($3.0 \times 10^9 \text{ pCi} / 1.55 \times 10^9 \text{ grams}$)

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ATTACHMENT 2

RESRAD, Version 6.1 $T_{\frac{1}{2}}$ Limit = 0.5 year 06/15/2004 09:37 Page 2
 Summary : Burial of 4 DU contaminated tanks at US Ecology RCRA site in Idaho
 File : tank burial.RAD

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

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

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

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

RESRAD, Version 6.1 $T_{1/2}$ Limit = 0.5 year 06/15/2004 09:37 Page 4
 Summary : Burial of 4 DU contaminated tanks at US Ecology RCRA site in Idaho
 File : tank burial.RAD

Site-Specific Parameter Summary

Menu	Parameter	User Input	Default	Used b (If different)
R011	Area of contaminated zone (m^{**2})	3.475E+02	1.000E+04	-
R011	Thickness of contaminated zone (m)	3.000E+00	2.000E+00	-
R011	Length parallel to aquifer flow (m)	1.000E+02	1.000E+02	-
R011	Basic radiation dose limit (mrem/yr)	2.500E+01	2.500E+01	-
R011	Time since placement of material (yr)	0.000E+00	0.000E+00	-
R011	Times for calculations (yr)	1.000E+00	1.000E+00	-
R011	Times for calculations (yr)	3.000E+00	3.000E+00	-
R011	Times for calculations (yr)	1.000E+01	1.000E+01	-
R011	Times for calculations (yr)	3.000E+01	3.000E+01	-
R011	Times for calculations (yr)	1.000E+02	1.000E+02	-
R011	Times for calculations (yr)	3.000E+02	3.000E+02	-
R011	Times for calculations (yr)	1.000E+03	1.000E+03	-
R011	Times for calculations (yr)	not used	0.000E+00	-
R011	Times for calculations (yr)	not used	0.000E+00	-
R012	Initial principal radionuclide (pCi/g): U-234	1.940E+00	0.000E+00	-
R012	Initial principal radionuclide (pCi/g): U-235	1.300E-01	0.000E+00	-
R012	Initial principal radionuclide (pCi/g): U-238	1.040E+01	0.000E+00	-
R012	Concentration in groundwater (pCi/L): U-234	not used	0.000E+00	-
R012	Concentration in groundwater (pCi/L): U-235	not used	0.000E+00	-
R012	Concentration in groundwater (pCi/L): U-238	not used	0.000E+00	-
R013	Cover depth (m)	0.000E+00	0.000E+00	-
R013	Density of cover material (g/cm**3)	not used	1.500E+00	-
R013	Cover depth erosion rate (m/yr)	not used	1.000E-03	-
R013	Density of contaminated zone (g/cm**3)	1.500E+00	1.500E+00	-
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	-
R013	Contaminated zone total porosity	4.000E-01	4.000E-01	-
R013	Contaminated zone field capacity	2.000E-01	2.000E-01	-
R013	Contaminated zone hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	-
R013	Contaminated zone b parameter	5.300E+00	5.300E+00	-
R013	Average annual wind speed (m/sec)	2.000E+00	2.000E+00	-
R013	Humidity in air (g/m**3)	not used	8.000E+00	-
R013	Evapotranspiration coefficient	5.000E-01	5.000E-01	-
R013	Precipitation (mm/yr)	1.840E-01	1.000E+00	-
R013	Irrigation (mm/yr)	2.000E-01	2.000E-01	-
R013	Irrigation mode	overhead	overhead	-
R013	Runoff coefficient	2.000E-01	2.000E-01	-
R013	Watershed area for nearby stream or pond (m^{**2})	1.000E+06	1.000E+06	-
R013	Accuracy for water/soil computations	1.000E-03	1.000E-03	-
R014	Density of saturated zone (g/cm**3)	1.500E+00	1.500E+00	-
R014	Saturated zone total porosity	4.000E-01	4.000E-01	-
R014	Saturated zone effective porosity	2.000E-01	2.000E-01	-
R014	Saturated zone field capacity	2.000E-01	2.000E-01	-
R014	Saturated zone hydraulic conductivity (m/yr)	1.000E+02	1.000E+02	-
R014	Saturated zone hydraulic gradient	2.000E-02	2.000E-02	-
R014	Saturated zone b parameter	5.300E+00	5.300E+00	-
R014	Water table drop rate (m/yr)	1.000E-03	1.000E-03	-
R014	Well pump intake depth (m below water table)	1.000E+01	1.000E+01	-

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used b (If different)
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	-
R014	Well pumping rate (m**3/yr)	2.500E+02	2.500E+02	-
R015	Number of unsaturated zone strata	not used	1	-
R015	Unsat. zone 1, thickness (m)	4.000E+00	4.000E+00	-
R015	Unsat. zone 1, soil density (g/cm**3)	1.500E+00	1.500E+00	-
R015	Unsat. zone 1, total porosity	4.000E-01	4.000E-01	-
R015	Unsat. zone 1, effective porosity	2.000E-01	2.000E-01	-
R015	Unsat. zone 1, field capacity	2.000E-01	2.000E-01	-
R015	Unsat. zone 1, soil-specific b parameter	5.300E+00	5.300E+00	-
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	-
R016	Distribution coefficients for U-234			
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	-
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	-
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	-
R016	Leach rate (/yr)	0.000E+00	0.000E+00	7.68
R016	Solubility constant	0.000E+00	0.000E+00	not
R016	Distribution coefficients for U-235			
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	-
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	-
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	-
R016	Leach rate (/yr)	0.000E+00	0.000E+00	7.68
R016	Solubility constant	0.000E+00	0.000E+00	not
R016	Distribution coefficients for U-238			
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	-
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	-
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	-
R016	Leach rate (/yr)	0.000E+00	0.000E+00	7.68
R016	Solubility constant	0.000E+00	0.000E+00	not
R016	Distribution coefficients for daughter Ac-227			
R016	Contaminated zone (cm**3/g)	2.000E+01	2.000E+01	-
R016	Unsaturated zone 1 (cm**3/g)	2.000E+01	2.000E+01	-
R016	Saturated zone (cm**3/g)	2.000E+01	2.000E+01	-
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.91
R016	Solubility constant	0.000E+00	0.000E+00	not
R016	Distribution coefficients for daughter Pa-231			
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	-
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	-
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	-
R016	Leach rate (/yr)	0.000E+00	0.000E+00	7.68
R016	Solubility constant	0.000E+00	0.000E+00	not

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used b (If different)
R016	Distribution coefficients for daughter Pb-210			
R016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02	-
R016	Unsaturated zone 1 (cm**3/g)	1.000E+02	1.000E+02	-
R016	Saturated zone (cm**3/g)	1.000E+02	1.000E+02	-
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.85
R016	Solubility constant	0.000E+00	0.000E+00	not
R016	Distribution coefficients for daughter Ra-226			
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	-
R016	Unsaturated zone 1 (cm**3/g)	7.000E+01	7.000E+01	-
R016	Saturated zone (cm**3/g)	7.000E+01	7.000E+01	-
R016	Leach rate (/yr)	0.000E+00	0.000E+00	5.49
R016	Solubility constant	0.000E+00	0.000E+00	not
R016	Distribution coefficients for daughter Th-230			
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	-
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	-
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	-
R016	Leach rate (/yr)	0.000E+00	0.000E+00	6.43
R016	Solubility constant	0.000E+00	0.000E+00	not
R017	Inhalation rate (m**3/yr)	8.400E+03	8.400E+03	-
R017	Mass loading for inhalation (g/m**3)	1.000E-04	1.000E-04	-
R017	Exposure duration	3.000E+01	3.000E+01	-
R017	Shielding factor, inhalation	4.000E-01	4.000E-01	-
R017	Shielding factor, external gamma	7.000E-01	7.000E-01	-
R017	Fraction of time spent indoors	5.000E-01	5.000E-01	-
R017	Fraction of time spent outdoors (on site)	2.500E-01	2.500E-01	-
R017	Shape factor flag, external gamma	1.000E+00	1.000E+00	>0 shows ci
R017	Radius of shape factor array (used if FS = -1):			
R017	Outer annular radius (m), ring 1:	not used	5.000E+01	-
R017	Outer annular radius (m), ring 2:	not used	7.071E+01	-
R017	Outer annular radius (m), ring 3:	not used	0.000E+00	-
R017	Outer annular radius (m), ring 4:	not used	0.000E+00	-
R017	Outer annular radius (m), ring 5:	not used	0.000E+00	-
R017	Outer annular radius (m), ring 6:	not used	0.000E+00	-
R017	Outer annular radius (m), ring 7:	not used	0.000E+00	-
R017	Outer annular radius (m), ring 8:	not used	0.000E+00	-
R017	Outer annular radius (m), ring 9:	not used	0.000E+00	-
R017	Outer annular radius (m), ring 10:	not used	0.000E+00	-
R017	Outer annular radius (m), ring 11:	not used	0.000E+00	-
R017	Outer annular radius (m), ring 12:	not used	0.000E+00	-

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used b (If different)
R017	Fractions of annular areas within AREA:			
R017	Ring 1	not used	1.000E+00	-
R017	Ring 2	not used	2.732E-01	-
R017	Ring 3	not used	0.000E+00	-
R017	Ring 4	not used	0.000E+00	-
R017	Ring 5	not used	0.000E+00	-
R017	Ring 6	not used	0.000E+00	-
R017	Ring 7	not used	0.000E+00	-
R017	Ring 8	not used	0.000E+00	-
R017	Ring 9	not used	0.000E+00	-
R017	Ring 10	not used	0.000E+00	-
R017	Ring 11	not used	0.000E+00	-
R017	Ring 12	not used	0.000E+00	-
R018	Fruits, vegetables and grain consumption (kg/yr)	not used	1.600E+02	-
R018	Leafy vegetable consumption (kg/yr)	not used	1.400E+01	-
R018	Milk consumption (L/yr)	not used	9.200E+01	-
R018	Meat and poultry consumption (kg/yr)	not used	6.300E+01	-
R018	Fish consumption (kg/yr)	not used	5.400E+00	-
R018	Other seafood consumption (kg/yr)	not used	9.000E-01	-
R018	Soil ingestion rate (g/yr)	3.650E+01	3.650E+01	-
R018	Drinking water intake (L/yr)	not used	5.100E+02	-
R018	Contamination fraction of drinking water	not used	1.000E+00	-
R018	Contamination fraction of household water	1.000E+00	1.000E+00	-
R018	Contamination fraction of livestock water	not used	1.000E+00	-
R018	Contamination fraction of irrigation water	not used	1.000E+00	-
R018	Contamination fraction of aquatic food	not used	5.000E-01	-
R018	Contamination fraction of plant food	not used	-1	-
R018	Contamination fraction of meat	not used	-1	-
R018	Contamination fraction of milk	not used	-1	-
R019	Livestock fodder intake for meat (kg/day)	not used	6.800E+01	-
R019	Livestock fodder intake for milk (kg/day)	not used	5.500E+01	-
R019	Livestock water intake for meat (L/day)	not used	5.000E+01	-
R019	Livestock water intake for milk (L/day)	not used	1.600E+02	-
R019	Livestock soil intake (kg/day)	not used	5.000E-01	-
R019	Mass loading for foliar deposition (g/m**3)	not used	1.000E-04	-
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	-
R019	Depth of roots (m)	not used	9.000E-01	-
R019	Drinking water fraction from ground water	not used	1.000E+00	-
R019	Household water fraction from ground water	1.000E+00	1.000E+00	-
R019	Livestock water fraction from ground water	not used	1.000E+00	-
R019	Irrigation fraction from ground water	not used	1.000E+00	-
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	not used	7.000E-01	-
R19B	Wet weight crop yield for Leafy (kg/m**2)	not used	1.500E+00	-
R19B	Wet weight crop yield for Fodder (kg/m**2)	not used	1.100E+00	-
R19B	Growing Season for Non-Leafy (years)	not used	1.700E-01	-
R19B	Growing Season for Leafy (years)	not used	2.500E-01	-
R19B	Growing Season for Fodder (years)	not used	8.000E-02	-

RESRAD, Version 6.1
Summary : Burial of 4 DU contaminated tanks at US Ecology RCRA site in Idaho
File : tank burial.RAD

T_{1/2} Limit = 0.5 year

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Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used b (If different)
R19B	Translocation Factor for Non-Leafy	not used	1.000E-01	-
R19B	Translocation Factor for Leafy	not used	1.000E+00	-
R19B	Translocation Factor for Fodder	not used	1.000E+00	-
R19B	Dry Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	-
R19B	Dry Foliar Interception Fraction for Leafy	not used	2.500E-01	-
R19B	Dry Foliar Interception Fraction for Fodder	not used	2.500E-01	-
R19B	Wet Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	-
R19B	Wet Foliar Interception Fraction for Leafy	not used	2.500E-01	-
R19B	Wet Foliar Interception Fraction for Fodder	not used	2.500E-01	-
R19B	Weathering Removal Constant for Vegetation	not used	2.000E+01	-
C14	C-12 concentration in water (g/cm**3)	not used	2.000E-05	-
C14	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	-
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	-
C14	Fraction of vegetation carbon from air	not used	9.800E-01	-
C14	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	-
C14	C-14 evasion flux rate from soil (1/sec)	not used	7.000E-07	-
C14	C-12 evasion flux rate from soil (1/sec)	not used	1.000E-10	-
C14	Fraction of grain in beef cattle feed	not used	8.000E-01	-
C14	Fraction of grain in milk cow feed	not used	2.000E-01	-
C14	DCF correction factor for gaseous forms of C14	not used	8.894E+01	-
STOR	Storage times of contaminated foodstuffs (days):			
STOR	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	-
STOR	Leafy vegetables	1.000E+00	1.000E+00	-
STOR	Milk	1.000E+00	1.000E+00	-
STOR	Meat and poultry	2.000E+01	2.000E+01	-
STOR	Fish	7.000E+00	7.000E+00	-
STOR	Crustacea and mollusks	7.000E+00	7.000E+00	-
STOR	Well water	1.000E+00	1.000E+00	-
STOR	Surface water	1.000E+00	1.000E+00	-
STOR	Livestock fodder	4.500E+01	4.500E+01	-
R021	Thickness of building foundation (m)	1.500E-01	1.500E-01	-
R021	Bulk density of building foundation (g/cm**3)	2.400E+00	2.400E+00	-
R021	Total porosity of the cover material	not used	4.000E-01	-
R021	Total porosity of the building foundation	1.000E-01	1.000E-01	-
R021	Volumetric water content of the cover material	not used	5.000E-02	-
R021	Volumetric water content of the foundation	3.000E-02	3.000E-02	-
R021	Diffusion coefficient for radon gas (m/sec):			
R021	in cover material	not used	2.000E-06	-
R021	in foundation material	3.000E-07	3.000E-07	-
R021	in contaminated zone soil	2.000E-06	2.000E-06	-
R021	Radon vertical dimension of mixing (m)	2.000E+00	2.000E+00	-
R021	Average building air exchange rate (1/hr)	5.000E-01	5.000E-01	-
R021	Height of the building (room) (m)	2.500E+00	2.500E+00	-
R021	Building interior area factor	0.000E+00	0.000E+00	code computed
R021	Building depth below ground surface (m)	-1.000E+00	-1.000E+00	code computed
R021	Emanating power of Rn-222 gas	2.500E-01	2.500E-01	-
R021	Emanating power of Rn-220 gas	not used	1.500E-01	-

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	(If different)	Used b
TITL	Number of graphical time points	32	---		-
TITL	Maximum number of integration points for dose	17	---		-
TITL	Maximum number of integration points for risk	257	---		-

Summary of Pathway Selections

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

RESRAD, Version 6.1 $T_{1/2}$ Limit = 0.5 year 06/15/2004 09:37 Page 10
Summary : Burial of 4 DU contaminated tanks at US Ecology RCRA site in Idaho
File : tank burial.RAD

Contaminated Zone Dimensions		Initial Soil Concentrations, pCi/g	
Area:	347.50 square meters	U-234	1.940E+00
Thickness:	3.00 meters	U-235	1.300E-01
Cover Depth:	0.00 meters	U-238	1.040E+01

Total Dose TDOSE(t), mrem/yr

Basic Radiation Dose Limit = 2.500E+01 mrem/yr

Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.00
TDOSE(t):	8.918E-01	8.911E-01	8.898E-01	8.850E-01	8.718E-01	8.284E-01	7.268E-01	5.47
M(t):	3.567E-02	3.565E-02	3.559E-02	3.540E-02	3.487E-02	3.314E-02	2.907E-02	2.18

Maximum TDOSE(t): 8.918E-01 mrem/yr at t = 0.000E+00 years

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

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	4.231E-04	0.0005	1.154E-02	0.0129	6.943E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	5.251E-02	0.0589	7.208E-04	0.0008	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	7.391E-01	0.8288	5.531E-02	0.0620	2.638E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	7.921E-01	0.8882	6.758E-02	0.0758	6.943E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

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

Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat	
	mrem/yr	fract.								
U-234	0.000E+00	0.0000								
U-235	0.000E+00	0.0000								
U-238	0.000E+00	0.0000								
Total	0.000E+00	0.0000								

*Sum of all water independent and dependent pathways.

RESRAD, Version 6.1 $T_{\frac{1}{2}}$ Limit = 0.5 year 06/15/2004 09:37 Page 12

Summary : Burial of 4 DU contaminated tanks at US Ecology RCRA site in Idaho

File : tank burial.RAD

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

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	4.228E-04	0.0005	1.153E-02	0.0129	4.858E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	5.247E-02	0.0589	7.204E-04	0.0008	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	7.386E-01	0.8288	5.527E-02	0.0620	3.955E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	7.915E-01	0.8882	6.753E-02	0.0758	4.858E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

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

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat	
	mrem/yr	fract.								
U-234	0.000E+00	0.0000								
U-235	0.000E+00	0.0000								
U-238	0.000E+00	0.0000								
Total	0.000E+00	0.0000								

*Sum of all water independent and dependent pathways.

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

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	4.224E-04	0.0005	1.152E-02	0.0129	2.565E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	5.239E-02	0.0589	7.198E-04	0.0008	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	7.374E-01	0.8288	5.519E-02	0.0620	4.608E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	7.903E-01	0.8882	6.742E-02	0.0758	2.565E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

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

Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat	
	mrem/yr	fract.								
U-234	0.000E+00	0.0000								
U-235	0.000E+00	0.0000								
U-238	0.000E+00	0.0000								
Total	0.000E+00	0.0000								

*Sum of all water independent and dependent pathways.

RESRAD, Version 6.1 $T_{1/2}$ Limit = 0.5 year 06/15/2004 09:37 Page 14
Summary : Burial of 4 DU contaminated tanks at US Ecology RCRA site in Idaho
File : tank burial.RAD

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

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	4.223E-04	0.0005	1.146E-02	0.0129	2.285E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	5.212E-02	0.0589	7.182E-04	0.0008	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	7.335E-01	0.8288	5.489E-02	0.0620	1.217E-09	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	7.860E-01	0.8881	6.707E-02	0.0758	2.285E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

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

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat	
Nuclide	mrem/yr	fract.								
U-234	0.000E+00	0.0000								
U-235	0.000E+00	0.0000								
U-238	0.000E+00	0.0000								
Total	0.000E+00	0.0000								

*Sum of all water independent and dependent pathways.

Summary : Burial of 4 DU contaminated tanks at US Ecology RCRA site in Idaho

File : tank burial.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) 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	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	4.338E-04	0.0005	1.129E-02	0.0129	1.904E-04	0.0002	0.000E+00	0.0000	0.000E+00	0.0000
U-235	5.135E-02	0.0589	7.179E-04	0.0008	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	7.223E-01	0.8285	5.406E-02	0.0620	2.939E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	7.741E-01	0.8879	6.606E-02	0.0758	1.904E-04	0.0002	0.000E+00	0.0000	0.000E+00	0.0000

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

Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat	
	mrem/yr	fract.								
U-234	0.000E+00	0.0000								
U-235	0.000E+00	0.0000								
U-238	0.000E+00	0.0000								
Total	0.000E+00	0.0000								

*Sum of all water independent and dependent pathways.

RESRAD, Version 6.1 T_{1/2} Limit = 0.5 year 06/15/2004 09:37 Page 16
Summary : Burial of 4 DU contaminated tanks at US Ecology RCRA site in Idaho
File : tank burial.RAD

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

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	6.017E-04	0.0007	1.071E-02	0.0129	1.984E-03	0.0024	0.000E+00	0.0000	0.000E+00	0.0000
U-235	4.884E-02	0.0590	7.352E-04	0.0009	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	6.845E-01	0.8262	5.124E-02	0.0619	1.005E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	7.339E-01	0.8859	6.268E-02	0.0757	1.985E-03	0.0024	0.000E+00	0.0000	0.000E+00	0.0000

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

Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat	
	mrem/yr	fract.								
U-234	0.000E+00	0.0000								
U-235	0.000E+00	0.0000								
U-238	0.000E+00	0.0000								
Total	0.000E+00	0.0000								

*Sum of all water independent and dependent pathways.

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

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	2.003E-03	0.0028	9.227E-03	0.0127	1.579E-02	0.0217	0.000E+00	0.0000	0.000E+00	0.0000
U-235	4.237E-02	0.0583	7.821E-04	0.0011	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	5.870E-01	0.8075	4.397E-02	0.0605	2.369E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	6.313E-01	0.8686	5.398E-02	0.0743	1.581E-02	0.0218	0.000E+00	0.0000	0.000E+00	0.0000

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

Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat	
	mrem/yr	fract.								
U-234	0.000E+00	0.0000								
U-235	0.000E+00	0.0000								
U-238	0.000E+00	0.0000								
Total	0.000E+00	0.0000								

*Sum of all water independent and dependent pathways.

RESRAD, Version 6.1 $T_{1/2}$ Limit = 0.5 year 06/15/2004 09:37 Page 18
Summary : Burial of 4 DU contaminated tanks at US Ecology RCRA site in Idaho
File : tank burial.RAD

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

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	1.268E-02	0.0232	5.518E-03	0.0101	1.177E-01	0.2153	0.000E+00	0.0000	0.000E+00	0.0000
U-235	2.573E-02	0.0470	7.652E-04	0.0014	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	3.428E-01	0.6267	2.573E-02	0.0470	5.658E-04	0.0010	0.000E+00	0.0000	0.000E+00	0.0000
Total	3.812E-01	0.6969	3.201E-02	0.0585	1.183E-01	0.2163	0.000E+00	0.0000	0.000E+00	0.0000

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

Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat	
	mrem/yr	fract.								
U-234	0.000E+00	0.0000								
U-235	0.000E+00	0.0000								
U-238	0.000E+00	0.0000								
Total	0.000E+00	0.0000								

*Sum of all water independent and dependent pathways.

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

Parent	Product	Branch	DSR(i,t) (mrem/yr)/(pCi/g)						
(i)	(j)	Fraction*	t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+
U-234	U-234	1.000E+00	8.859E-03	8.852E-03	8.838E-03	8.791E-03	8.656E-03	8.201E-03	7.029E-
U-234	Th-230	1.000E+00	9.254E-08	2.775E-07	6.470E-07	1.936E-06	5.580E-06	1.789E-05	4.958E-
U-234	Ra-226	1.000E+00	3.957E-08	2.768E-07	1.462E-06	1.302E-05	1.085E-04	1.130E-03	8.997E-
U-234	Pb-210	1.000E+00	3.687E-13	5.491E-12	6.306E-11	1.581E-09	3.322E-08	7.606E-07	8.830E-
U-234	Σ DSR(j)		8.859E-03	8.853E-03	8.840E-03	8.806E-03	8.770E-03	9.350E-03	1.608E-
U-235	U-235	1.000E+00	4.120E-01	4.117E-01	4.111E-01	4.089E-01	4.026E-01	3.815E-01	3.272E-
U-235	Pa-231	1.000E+00	2.748E-06	8.239E-06	1.919E-05	5.727E-05	1.638E-04	5.110E-04	1.308E-
U-235	Ac-227	1.000E+00	1.669E-07	1.157E-06	5.978E-06	4.941E-05	3.372E-04	2.020E-03	6.552E-
U-235	Σ DSR(j)		4.120E-01	4.117E-01	4.111E-01	4.090E-01	4.031E-01	3.841E-01	3.350E-
U-238	U-238	1.000E+00	7.895E-02	7.889E-02	7.877E-02	7.834E-02	7.715E-02	7.311E-02	6.269E-
U-238	U-234	1.000E+00	1.256E-08	3.764E-08	8.770E-08	2.617E-07	7.485E-07	2.337E-06	5.990E-
U-238	Th-230	1.000E+00	8.744E-14	6.118E-13	3.230E-12	2.880E-11	2.403E-10	2.517E-09	2.032E-
U-238	Ra-226	1.000E+00	2.804E-14	4.204E-13	4.898E-12	1.293E-10	3.124E-09	1.069E-07	2.519E-
U-238	Pb-210	1.000E+00	2.093E-19	6.449E-18	1.604E-16	1.198E-14	7.486E-13	6.035E-11	2.264E-
U-238	Σ DSR(j)		7.895E-02	7.889E-02	7.877E-02	7.834E-02	7.715E-02	7.311E-02	6.270E-

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

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
 Basic Radiation Dose Limit = 2.500E+01 mrem/yr

Nuclide	G(i,t) in pCi/g						
(i)	t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02
U-234	2.822E+03	2.824E+03	2.828E+03	2.839E+03	2.851E+03	2.674E+03	1.554E+03
U-235	6.068E+01	6.072E+01	6.081E+01	6.113E+01	6.201E+01	6.509E+01	7.462E+01
U-238	3.167E+02	3.169E+02	3.174E+02	3.191E+02	3.240E+02	3.419E+02	3.987E+02

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

Nuclide	Initial (pCi/g)	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
U-234	1.940E+00	1.000E+03	7.144E-02	3.499E+02	8.859E-03	2.822E+03
U-235	1.300E-01	0.000E+00	4.120E-01	6.068E+01	4.120E-01	6.068E+01
U-238	1.040E+01	0.000E+00	7.895E-02	3.167E+02	7.895E-02	3.167E+02

RESRAD, Version 6.1 T½ Limit = 0.5 year 06/15/2004 09:37 Page 20
Summary : Burial of 4 DU contaminated tanks at US Ecology RCRA site in Idaho
File : tank burial.RAD

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

Nuclide	Parent	BRF(i)	DOSE(j,t), mrem/yr					
(j)	(i)	t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+
U-234	U-234	1.000E+00	1.719E-02	1.717E-02	1.715E-02	1.705E-02	1.679E-02	1.591E-02
U-234	U-238	1.000E+00	1.306E-07	3.915E-07	9.120E-07	2.721E-06	7.784E-06	2.430E-05
U-234	ΣDOSE(j)		1.719E-02	1.717E-02	1.715E-02	1.706E-02	1.680E-02	1.593E-02
Th-230	U-234	1.000E+00	1.795E-07	5.384E-07	1.255E-06	3.756E-06	1.082E-05	3.471E-05
Th-230	U-238	1.000E+00	9.093E-13	6.362E-12	3.360E-11	2.995E-10	2.499E-09	2.617E-08
Th-230	ΣDOSE(j)		1.795E-07	5.384E-07	1.255E-06	3.756E-06	1.083E-05	3.474E-05
Ra-226	U-234	1.000E+00	7.676E-08	5.370E-07	2.835E-06	2.526E-05	2.105E-04	2.193E-03
Ra-226	U-238	1.000E+00	2.916E-13	4.372E-12	5.094E-11	1.345E-09	3.249E-08	1.111E-06
Ra-226	ΣDOSE(j)		7.676E-08	5.370E-07	2.835E-06	2.526E-05	2.105E-04	2.194E-03
Pb-210	U-234	1.000E+00	7.152E-13	1.065E-11	1.223E-10	3.068E-09	6.444E-08	1.476E-06
Pb-210	U-238	1.000E+00	2.176E-18	6.707E-17	1.668E-15	1.245E-13	7.785E-12	6.277E-10
Pb-210	ΣDOSE(j)		7.152E-13	1.065E-11	1.223E-10	3.068E-09	6.445E-08	1.476E-06
U-235	U-235	1.000E+00	5.356E-02	5.352E-02	5.344E-02	5.315E-02	5.234E-02	4.960E-02
Pa-231	U-235	1.000E+00	3.573E-07	1.071E-06	2.495E-06	7.445E-06	2.129E-05	6.644E-05
Ac-227	U-235	1.000E+00	2.170E-08	1.504E-07	7.772E-07	6.424E-06	4.383E-05	2.626E-04
U-238	U-238	1.000E+00	8.211E-01	8.204E-01	8.192E-01	8.148E-01	8.023E-01	7.603E-01

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

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

Nuclide	Parent	BRF(i)	S(j,t), pCi/g						
(j)	(i)		t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+
U-234	U-234	1.000E+00	1.940E+00	1.939E+00	1.936E+00	1.925E+00	1.896E+00	1.796E+00	1.539E+
U-234	U-238	1.000E+00	0.000E+00	2.946E-05	8.825E-05	2.926E-04	8.643E-04	2.730E-03	7.021E-
U-234	$\Sigma S(j)$:		1.940E+00	1.939E+00	1.936E+00	1.925E+00	1.896E+00	1.799E+00	1.546E+
Th-230	U-234	1.000E+00	0.000E+00	1.746E-05	5.233E-05	1.740E-04	5.178E-04	1.680E-03	4.670E-
Th-230	U-238	1.000E+00	0.000E+00	1.326E-10	1.192E-09	1.320E-08	1.176E-07	1.260E-06	1.024E-
Th-230	$\Sigma S(j)$:		0.000E+00	1.746E-05	5.233E-05	1.740E-04	5.179E-04	1.681E-03	4.680E-
Ra-226	U-234	1.000E+00	0.000E+00	3.781E-09	3.399E-08	3.761E-07	3.345E-06	3.568E-05	2.860E-
Ra-226	U-238	1.000E+00	0.000E+00	1.915E-14	5.164E-13	1.904E-11	5.077E-10	1.799E-08	4.284E-
Ra-226	$\Sigma S(j)$:		0.000E+00	3.781E-09	3.399E-08	3.761E-07	3.346E-06	3.569E-05	2.864E-
Pb-210	U-234	1.000E+00	0.000E+00	3.887E-11	1.032E-09	3.613E-08	8.375E-07	1.984E-05	2.323E-
Pb-210	U-238	1.000E+00	0.000E+00	1.479E-16	1.182E-14	1.393E-12	9.943E-11	8.393E-09	3.188E-
Pb-210	$\Sigma S(j)$:		0.000E+00	3.887E-11	1.032E-09	3.613E-08	8.376E-07	1.985E-05	2.327E-
U-235	U-235	1.000E+00	1.300E-01	1.299E-01	1.297E-01	1.290E-01	1.270E-01	1.204E-01	1.032E-
Pa-231	U-235	1.000E+00	0.000E+00	2.748E-06	8.232E-06	2.729E-05	8.061E-05	2.544E-04	6.532E-
Ac-227	U-235	1.000E+00	0.000E+00	4.327E-08	3.805E-07	3.904E-06	2.841E-05	1.739E-04	5.670E-
U-238	U-238	1.000E+00	1.040E+01	1.039E+01	1.038E+01	1.032E+01	1.016E+01	9.631E+00	8.259E+

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

RESCALC.EXE execution time = 1.07 seconds