

APPENDIX E

INTAKE AND CHEMICAL RISK ASSESSMENT SUMMARY REPORT FOR OFFSITE SUBSISTENCE FARMER

Appendix E is an electronic appendix found on CD.

Table E-1
Toxicity Assessment: Carcinogenic & Noncarcinogenic Toxicity Factors

Noncarcinogenic

Chemical	Oral RfD mg/kg-day	Inhalation RfC mg/m³	Inhalation RfD mg/kg-day	Oral Absorption Factor (%)	Dermal RfD mg/kg-day
URANIUM	3.00E-03	NA	8.6E-05	85	2.55E-03

Table E-2
Physical Properties for Chemicals

Chemical	Soil to Plant		BAF	Dermal Absorption
	SP_v	SP_r		
URANIUM	1.70E-03	8.00E-04	2.5E-03	0.001

Table E-3
Radiological Dose and Risk Assessment for Off-site Subsistence Farmer

Table E-3-1. Results of Radiological Dose Assessment from Output Dose Summary Report

RESRAD-OFFSITE Version 2.0 T« Limit = 30 days 04/04/2008 12:42 Page 36

Parent Dose Report

Title : Radiological Dose and Risk Assessment for Offsite Subsistence Farmer

File : Subsistence Farmer.ROF

Contaminated Zone Dimensions

Initial Soil Concentrations pCi/g

Area:	10000	square	meters	U-234	1.06E+01
Thickness:	2	meters		U-235	6.00E-01
Cover Depth:	0	meters		U-238	5.66E+01

Total Dose TDOSE(t) mrem/yr

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

t (years):	0.00E+00	1.00E+00	3.00E+00	6.00E+00	1.20E+01	3.00E+01	7.50E+01	1.75E+02	4.20E+02	9.70E+02
TDOSE(t):	1.81E-04	1.80E-04	1.79E-04	1.77E-04	1.74E-04	1.64E-04	1.41E-04	1.01E-04	4.52E-05	1.68E-05

0Maximum TDOSE(t): 1.805E-04 mrem/yr at t = 0 years

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

in mrem/yr and as a Percentage of Total Dose at t = 0 years

Directly from primary contamination and from release to atmosphere (Inhalation excludes radon)

Nuclide	Ground	Inhalation	Plant	Soil	All Pathways
	Dose (mrem/yr)				
U-234	8.54E-13	3.07E-05	1.68E-07	3.29E-11	3.09E-05
U-235	8.77E-11	1.62E-06	9.04E-09	1.77E-12	1.63E-06
U-238	1.93E-09	1.47E-04	8.57E-07	1.68E-10	1.48E-04
Total	2.02E-09	1.79E-04	1.03E-06	2.02E-10	1.80E-04

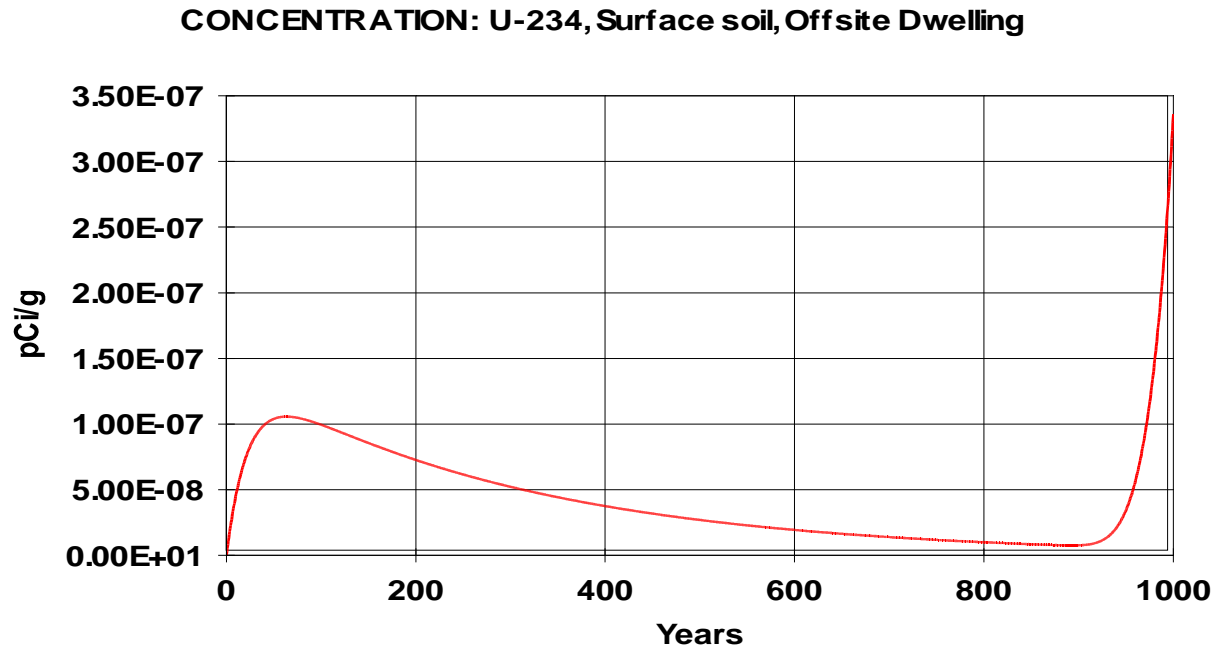
Table E-3-2. Results of Radiological Risk Assessment from Output Risk Summary Report

Total Excess Cancer Risk CNRSI(i,p,t)** for Initially Existent Radionuclides (i) and Pathways (p)					
and Fraction of Total Risk at t = 0 years					
Directly from primary contamination and from release to atmosphere (Inhalation excludes radon)					
Nuclide	Ground	Inhalation	Plant	Soil	All Pathways
	Risk (no Unit)				
U-234	3.36E-16	1.85E-10	1.72E-12	6.60E-15	1.87E-10
U-235	3.73E-14	9.46E-12	9.97E-14	3.84E-16	9.59E-12
U-238	8.55E-13	8.42E-10	1.16E-11	4.47E-14	8.55E-10
Total	8.93E-13	1.04E-09	1.34E-11	5.17E-14	1.05E-09

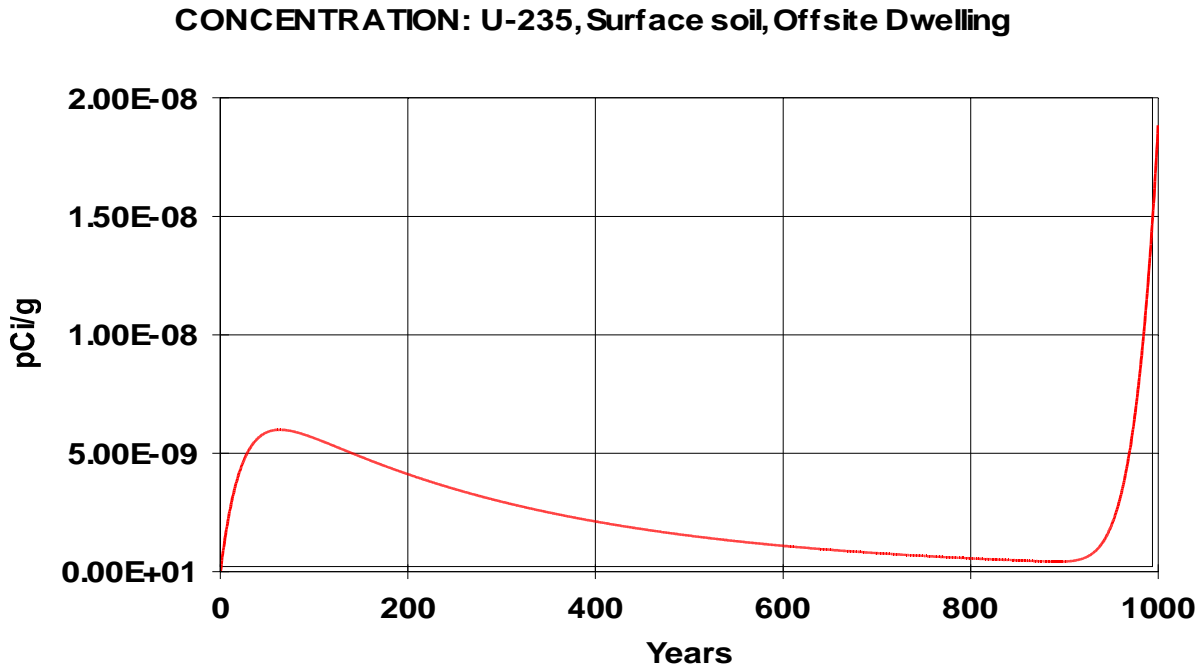
is contribution from progeny radionuclide:

s and from primary contamination via all pathways

Figure E-1. Graphical Output of RESRAD-OFFSITE model for Subsistence Farmer

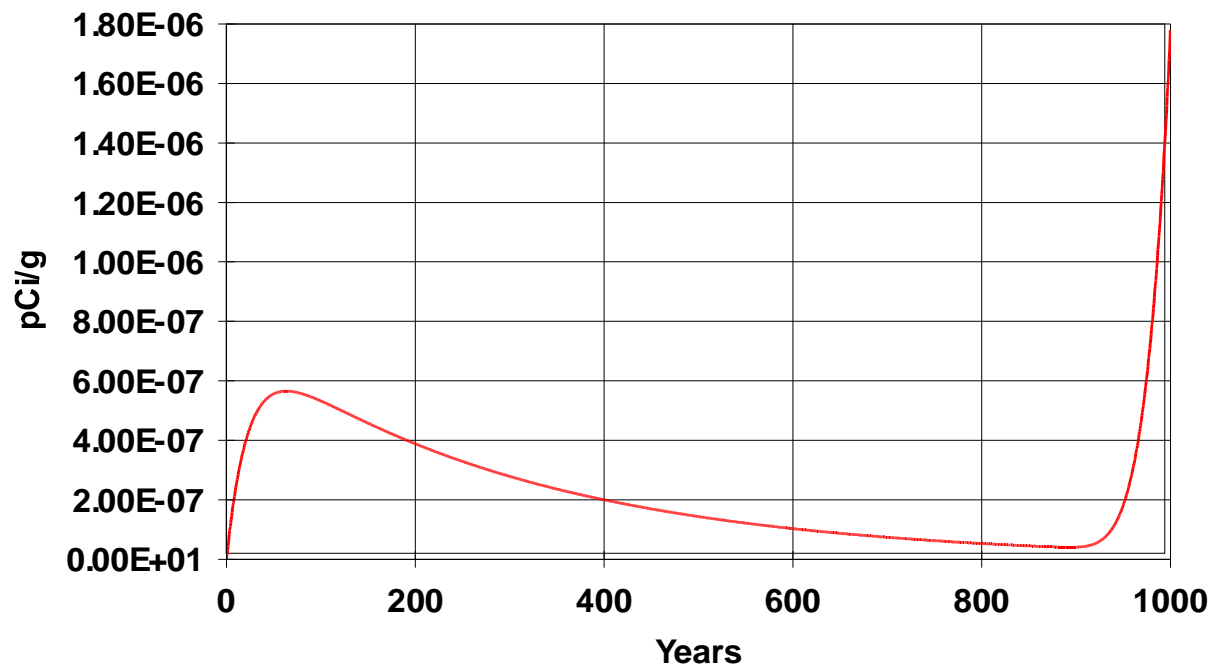


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FFSITE RECEPTOR.ROF 04/03/2008 17:20 GRAPHICS.ASC

CONCENTRATION: U-238, Surface soil, Offsite Dwelling



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Table E-4.
Determination of Total Uranium Concentration

Radionuclides	U-234	U-235	U-238
Offsite Soil Conc (pCi/g)	3.20E-07	1.80E-08	1.70E-06
Specific Activity (pCi/ug)	6250	2.16	0.336
Ratio (Conc/Sp. Activity)	5.12E-11	8.33E-09	5.06E-06
U-total (mg/kg)	5.1E-06		

$$U_{Total} = \left(\frac{{}^{234}\text{U}}{6,250 \text{ pCi} / \mu\text{g}} \right) + \left(\frac{{}^{235}\text{U}}{2.16 \text{ pCi} / \mu\text{g}} \right) + \left(\frac{{}^{238}\text{U}}{0.336 \text{ pCi} / \mu\text{g}} \right)$$

Table E-5
Daily Intake Calculations: Residential Receptor

Table E-5-1
Ingestion of Chemicals in Soil of All Depth

Equation	$DI_{\text{ingestion}} = \left[\frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT} \right]$																				
Units	mg/kg-day		mg/kg	x	mg soil/day	x	unitless	x	kg/mg	x	days/year	x	years		/		kg	x	days		
CARCINOGENIC EFFECTS																					
URANIUM	4.79E-12	=	[5.1E-06	x	115	x	1	x	1.00E-06	x	365	x	40]	/	[70	x	25550]
NONCARCINOGENIC EFFECTS																					
URANIUM	8.38E-12	=	[5.1E-06	x	115	x	1	x	1.00E-06	x	365	x	40]	/	[70	x	14600]

DI _{ingestion} = daily chemical intake via soil ingestion	FI = fraction of intake	ED = exposure duration
CS = chemical concentration in soil	CF = conversion factor	BW = body weight
IR = soil ingestion rate	EF = exposure frequency	AT = averaging time

Table E-5-2
Inhalation of Chemicals in Soil of All Depth

Equation	$DI_{\text{inhalation}} = [\text{CS} \times \text{IR} \times \text{EF} \times \text{ET} \times \text{ED}] / [\text{PEF} \times \text{BW} \times \text{AT}]$																				
Units	mg/kg-day		mg/kg		m³/hour		days/year		hours/day		years			m³/kg		kg		days			
CARCINOGENIC EFFECTS																					
URANIUM	6.28E-16	=	[5.1E-06	x	0.830	x	365	x	24.0	x	40]	/	[1.32E+09	x	70	x	25,550]
NONCARCINOGENIC EFFECTS																					
URANIUM	1.10E-15	=	[5.1E-06	x	0.830	x	365	x	24.0	x	40]	/	[1.32E+09	x	70	x	14600]

DI _{inhalation} = daily chemical intake via inhalation	EF = exposure frequency	BW = body weight
CS = chemical concentration in soil	ET = exposure time	AT = averaging time
IR = inhalation rate	ED = exposure duration	

Table E-5-3
Dermal Contact with Chemicals in Soil of All Depth

Equation	AD_{dermal}	=	[	CS	x	CF	x	SA	x	AF	x	ABS	x	SCT	x	EF	x	ED	]	/	[	BW	x	AT]
Units	mg/kg-day			mg/kg		kg/mg		cm²		mg/cm²		unitless		unitless		days/year		years				kg		days	
CARCINOGENIC EFFECTS																									
URANIUM	1.90E-14	=	[	5.1E-06	x	1.00E-06	x	5,700	x	0.08	x	0.001	x	1	x	365	x	40	]	/	[	70	x	25,550]

NONCARCINOGENIC EFFECTS

URANIUM	3.32E-14	=	[5.1E-06	x	1.00E-06	x	5,700	x	0.08	x	0.001	x	1	x	365	x	40]	/	[70	x	14600]
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AD_{dermal} = daily absorbed chemical dose

CS = chemical concentration in soil

CF = conversion factor

SA = skin surface area available for contact

AF = soil to skin adherence factor

ABS = absorption factor

SCT = skin contact time

EF = exposure frequency

ED = exposure duration

BW = body weight

AT = averaging time

Table E-5-4
Ingestion of Chemicals through Fruit, Vegetable, and Grain Consumption

Equation	DI_{ingestion}	=	[	CS	x	BCF	x	IR	x	FI	x	CF	x	EF	x	ED	]	/	[	BW	x	AT]
Units	mg/kg-day			mg/kg		unitless		mg/day		unitless		kg/mg		days/year		years				kg		days	
CARCINOGENIC EFFECTS																							
URANIUM	1.38E-12	=	[	5.1E-06	x	0.0006	x	1.38E+06	x	0.038	x	1.00E-06	x	365	x	40	]	/	[	70	x	25,550]

NONCARCINOGENIC EFFECTS

URANIUM	2.41E-12	=	[5.1E-06	x	0.00063	x	1.38E+06	x	0.038	x	1.00E-06	x	365	x	40]	/	[70	x	14,600]
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DI_{ingestion} = daily chemical intake via soil ingestion

CS = chemical concentration in soil

IR = Fruit, vegetable and grain ingestion rate

BCF = Bio-concentration factor from soil to plant

FI = fraction of intake

CF = conversion factor

EF = exposure frequency

ED = exposure duration

BW = body weight

AT = averaging time

Table E-6
Risk Characterization for Schofield Barrack Site
Residential Receptor

Equation Units	Carcinogenic Effects					Noncarcinogenic Effects					
	DI mg/kg-day	x	SF (mg/kg-day)-1	=	CR unitless	DI mg/kg-day	/	RfD mg/kg-day	=	HQ unitless	
Ingestion of Chemicals in Soil											
URANIUM	4.79E-12	x	NA	=	NA	8.38E-12	/	3.00E-03	=	2.79E-09	
			Pathway total =		0.00E+00				Pathway total = 2.8E-09		
Inhalation of Chemicals in Soil											
URANIUM	6.28E-16	x	NA	=	NA	1.10E-15	/	8.60E-05	=	1.28E-11	
			Pathway total =		0.00E+00				Pathway total = 1.28E-11		
Dermal Contact with Chemicals in Soil											
URANIUM	1.90E-14	x	NA	=	NA	3.32E-14	/	2.55E-03	=	1.30E-11	
			Pathway total =		0.00E+00				Pathway total = 1.30E-11		
Ingestion of Chemicals through Fruit, Vegetable, and Grain Consumption											
URANIUM	1.38E-12	x	NA	=	NA	2.41E-12	/	3.00E-03	=	8.02E-10	
			Pathway total =		0.0E+00				Pathway total = 8.02E-10		
Chemical Totals											
URANIUM	Sum of all pathways			=	NA	Sum of all pathways			=	3.6E-09	
	Total Carcinogenic Risk					Total Noncarcinogenic Risk					
	All Pathways and Chemicals				=	All Pathways and Chemicals				=	3.6E-09

DI = Chemical Daily Intake;
SF = Cancer Slope Factor;

RfD = Noncancer Reference Dose;
HQ = Hazard Quotient

ND = no data
NA = not applicable

CR = Cancer Risk