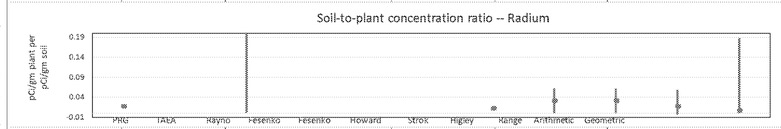
Parameter	Definition	Suburban residential scenario default value	Resident farmer scenario default value	Rodrigues *et al* 2012 (Western Europe)	Suggested value for alternate pathway evaluations	Units	Comments
Particulate Emission Factor (PEF) Residential Exposure							
Q/C	inverse of the ratio of the geometric mean air concentration to the emission flux at center of a square source	93.77	93.77		93.77	g/m^2-s per kg/m^3	
V	fraction of vegetative cover	0.5	0.5		0.5	unitless	
U_m	mean annual wind speed	4.69	4.69		4.69	m/s	
U_t	equivalent threshold value of wind speed at 7 m	11.32	11.32		11.32	m/s	
F(χ)	function dependent on U_m/U_t derived using Cowherd *et al* . (1985)	0.194	0.194		0.194	unitless	
Surface	surface	0.5	0.5		0.5	acres	
Ingestion, External, Inhalation and Produce Exposure							
TR	target risk	1.00E-06	1.00E-06		1.00E-06	unitless	
t_r	time of exposure	30	40		Variable	yr	Depends on scenario
EF_r	exposure frequency	350	350		350	d/yr	
ET_{ro}	exposure time fraction, outdoor	0.073	0.507		0.476	unitless	80 hrs/wk or varies with scenario
ET_{ri}	exposure time fraction, indoor	0.684	0.417		0.476	unitless	80 hrs/wk or varies with scenario
ET_r	exposure time, daily	24	24		24	hr/d	
DF_i	indoor dilution factor	0.4	0.4		0.4	unitless	
ACF	area correction factor	0.923	0.926		0.926	unitless	
GSF	gamma shielding factor	0.4	0.4		0.4 - 1.0	unitless	
CPF_f	contaminated plant fraction	0.25	1.0		1.00	unitless	
ED_r	exposure duration	30	40		Variable	yr	Depends on scenario
ED_{cr}	exposure duration, child	6	6		6	yr	
ED_{ar}	exposure duration, adult	24	34		Variable	yr	Depends on scenario
IR_c	soil intake rate, child	200	200		Variable	mg/day	Depends on scenario
IR_a	soil intake rate, adult	100	100		Variable	mg/day	Depends on scenario
IRA_c	inhalation rate, child	10	10		Variable	m^3/day	Depends on level of exertion
IRA_a	inhalation rate, adult	20	20		Variable	m^3/day	Depends on level of exertion
CR_{fc}	fruit consumption rate, child	5.4	5.4		0.0	kg/yr	No gardens or orchards on NN reservation
CR_{fa}	fruit consumption rate, adult	20.5	20.5		0.0	kg/yr	No gardens or orchards on NN reservation
CR_{vc}	vegetable consumption rate, child	3.8	3.8		0.0	kg/yr	No gardens or orchards on NN reservation
CR_{va}	vegetable consumption rate, adult	10.4	10.4		0.0	kg/yr	No gardens or orchards on NN reservation
IRW_c	tap water intake rate, child	1	N/A		TBD	L/day	Depends on scenario
IRW_a	tap water intake rate, adult	2	N/A		TBD	L/day	Depends on scenario
$t_{c\text{-}event}$	bathing event duration, child	0.54	N/A		TBD	hr/day	Depends on scenario
$t_{a\text{-}event}$	bathing event duration, adult	0.71	N/A		TBD	hr/day	Depends on scenario
FI_{po}	ingestion rate of fodder, poultry	N/A	0.2		0.0	kg/day	No poultry or egg production on NN reservation
$FI_{po\text{-}s}$	ingestion rate of soil, poultry	N/A	0.022		0.000	kg/day	No poultry or egg production on NN reservation
$IRE_{f\text{-}c}$	ingestion rate of eggs, farmer-child	N/A	2.3		0.0	kg/yr	No poultry or egg production on NN reservation
$IRE_{f\text{-}a}$	ingestion rate of eggs, farmer-adult	N/A	14.9		0	kg/yr	No poultry or egg production on NN reservation
$IRP_{f\text{-}c}$	ingestion rate of poultry, farmer-child	N/A	5.0		0.0	kg/yr	No poultry or egg production on NN reservation
$IRP_{f\text{-}a}$	ingestion rate of poultry, farmer-adult	N/A	35.8		0	kg/yr	No poultry or egg production on NN reservation
$IRFI_{f\text{-}c}$	ingestion rate of fish, farmer-child	N/A	6.4		0.0	kg/yr	No fishing sites on NN reservation
$IRFI_{f\text{-}a}$	ingestion rate of fish, farmer-adult	N/A	45.8		0	kg/yr	No fishing sites on NN reservation
FI_{beef}	ingestion rate of fodder, beef	N/A	11.77	16.90	TBD	kg/day	Use beef module for sheep/value to be prorated based on average sheep mass vs average beef cattle mass/grazing and feedlot values taken to be equal
$FI_{beef\text{-}s}$	ingestion rate of soil, beef	N/A	0.39	0.41	TBD	kg/day	Use beef module for sheep/arbitrarily set to 5 x beef cattle value
	ingestion rate of soil, sheep			0.10	TBD	kg/day	Use beef module for sheep/arbitrarily set to 5 x beef cattle value
$FI_{beef\text{-}w}$	ingestion rate of water, beef	N/A	53		TBD	L/day	Use beef module for sheep/value to be prorated based on average sheep mass vs average beef cattle mass or site-specific considerations regarding water
$IRB_{f\text{-}c}$	ingestion rate of beef, farmer-child	N/A	4.7		39.7	kg/yr	Use beef module for sheep/assume 4 oz./day x 350 days/yr average over lifetime
$IRB_{f\text{-}a}$	ingestion rate of beef, farmer-adult	N/A	50.2		39.7	kg/yr	Use beef module for sheep/assume 4 oz./day x 350 days/yr average over lifetime
FI_{dairy}	ingestion rate of fodder, dairy	N/A	16.9		0.0	kg/day	No dairy production on NN reservation
$FI_{dairy\text{-}s}$	ingestion rate of soil, dairy	N/A	0.41		0.00	kg/day	No dairy production on NN reservation
$FI_{dairy\text{-}w}$	ingestion rate of water, dairy	N/A	92		0	L/day	No dairy production on NN reservation
$IRD_{f\text{-}c}$	ingestion rate of dairy, farmer-child	N/A	96.9		0.0	kg/yr	No dairy production on NN reservation
$IRD_{f\text{-}a}$	ingestion rate of dairy, farmer-adult	N/A	224.4		0.0	kg/yr	No dairy production on NN reservation
FI_{swine}	ingestion rate of fodder, swine	N/A	4.7		0.0	kg/day	No swine production on NN reservation
$FI_{swine\text{-}s}$	ingestion rate of soil, swine	N/A	0.37		0.00	kg/day	No swine production on NN reservation
$FI_{swine\text{-}w}$	ingestion rate of water, swine	N/A	11.4		0.0	kg/day	No swine production on NN reservation
$IRSW_{f\text{-}c}$	ingestion rate of swine, farmer-child	N/A	4.5		0.0	kg/yr	No swine production on NN reservation
$IRSW_{f\text{-}a}$	ingestion rate of swine, farmer-adult	N/A	27.7		0.0	kg/yr	No swine production on NN reservation
Notes							
1. SF_s	soil ingestion slope factor	radionuclide-specific	7.30E-10		TBD	Risk/pCi	
SF_w	water ingestion slope factor	radionuclide-specific	3.86E-10		TBD	Risk/pCi	
K	volatilization factor (Andelman)	0.5			0.5	m^3/day	
2. SF_i	inhalation slope factor	radionuclide-specific	1.16E-08		TBD	Risk/pCi	
3. SF_e	external exposure slope factor (soil)	radionuclide-specific	8.49E-06		TBD	Risk/yr per pCi/g	
	external exposure slope factor (air)	radionuclide-specific	7.87E-09		TBD	Risk/yr per pCi/m^3	
4. SF_p	food ingestion slope factor	radionuclide-specific	5.15E-10		TBD	Risk/pCi	
5. IR_s	age-adjusted soil ingestion rate	120.00	120.00	50	TBD	mg/day	
6. IR_i	age-adjusted inhalation rate	18	18		Variable	m^3/day	Depends on level of exertion
7. CR_f	age-adjusted fruit consumption rate	17.48	17.48		0.00	kg/yr	No gardens or orchards on NN reservation
8. CR_v	age-adjusted vegetable consumption rate	9.08	9.08	54.74	0.00	kg/yr	No gardens or orchards on NN reservation
	beef consumption rate			13.23		kg/yr	
	sheep consumption rate			2.38		kg/yr	
	beef kidney & liver consumption rate			5.74		kg/yr	
9. PEF	particulate emission factor	1359292542	1359292542		1359292542	m^3/kg	
10. TF_p	soil-to-plant transfer factor	radionuclide-specific	4.00E-02		4.00E-02	pCi/gm plant per pCi/gm soil	
	plant-to-beef transfer factor	radionuclide-specific	1.00E-03		1.00E-03	pCi/gm beef per pCi/gm plant	
11. λ	decay constant (0.693/half-life or ln2/half-life)	radionuclide-specific	1600		1600	yr^{-1}	
12. Ci	The curie (Ci), the customary unit of radioactivity, is equal to 3.7×10^{10} nuclear transformations per second. 1 picocurie (pCi) = 10^{-12} Ci. The International System (SI) unit of radioactivity is the becquerel (1 Bq = 1 nuclear transformation per second).					Ci, pCi, Bq	

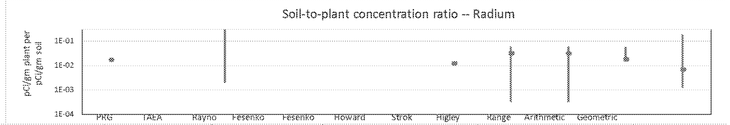
ref: http://epa-prgs.ornl.gov/cgi-bin/radionuclides/rprg_search

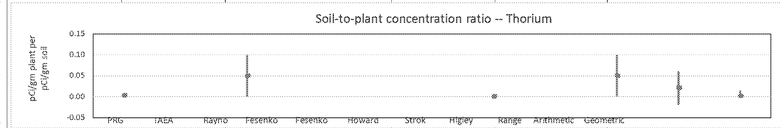
Parameter	Definition	Element	Resident farmer scenario default value	IAEA 2010 (from Strok & Smodis 2012)		Rayno 1983 Southwest US		Fesenko *et al* 2007a&b Mostly Europe		Fesenko *et al* 2009 Mostly Europe		Howard *et al* 2009 Mostly Europe		Strok & Smodis 2012 Slovenia		Higley & Bilwerk 2007 Oregon		Range		Arithmetic mean	Arithmetic standard deviation	Geometric mean	Geometric standard deviation	Units
TF_{p-d}	soil-to-plant transfer factor (dry)	Radium	1.70E-02	-----	-----	2.0E-03	6.5E+00	-----	-----	-----	-----	-----	-----	9.74E-03	1.41E-02	3.10E-04	6.20E-02	3.10E-04	6.50E+00	8.26E-01	2.45E+00	1.79E-02	1.78E+01	pCi/gm plant per pCi/gm soil
		Thorium	2.10E-03	-----	-----	1.0E-04	1.0E-01	-----	-----	-----	-----	-----	-----	4.44E-04	6.52E-04	-----	-----	1.00E-04	1.00E-01	2.07E-02	4.44E-02	1.43E-03	1.03E+01	pCi/gm plant per pCi/gm soil
		Uranium	6.20E-03	-----	-----	1.0E-05	2.0E-01	-----	-----	-----	-----	-----	-----	3.32E-03	4.28E-03	2.90E-04	2.50E-03	1.00E-05	2.00E-01	2.71E-02	7.46E-02	2.00E-03	1.66E+01	pCi/gm plant per pCi/gm soil
TF_{beef}	feed-and-soil-to-beef transfer factor	Radium	1.70E-03	-----	-----	5.1E-04	4.0E-03	-----	-----	-----	-----	-----	1.7E-03	-----	-----	-----	9.00E-04	5.10E-04	4.00E-03	1.78E-03	1.56E-03	1.40E-03	2.00E+00	pCi/kg beef per pCi/day ingested
		Thorium	2.30E-04	-----	-----	-----	2.0E-04	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2.00E-04	2.30E-04	2.15E-04	-----	2.14E-04	-----	pCi/kg beef per pCi/day ingested
		Uranium	3.90E-04	-----	-----	-----	3.4E-04	8.1E-03	1.6E-02	-----	-----	2.5E-04	6.3E-04	-----	-----	-----	3.00E-04	2.50E-04	1.59E-02	3.70E-03	6.11E-03	3.09E-03	4.89E+00	pCi/kg beef per pCi/day ingested
TF_{dairy}	feed-and-soil-to-cow-milk transfer factor	Radium	3.80E-04	9.0E-05	1.4E-03	4.0E-04	5.9E-04	-----	-----	-----	-----	9.0E-05	1.4E-03	6.84E-04	1.04E-03	-----	-----	9.00E-05	1.40E-03	6.74E-04	5.05E-04	4.65E-04	2.68E+00	pCi/kg milk per pCi/day ingested
		Thorium	5.00E-06	-----	-----	-----	5.0E-06	-----	-----	-----	-----	-----	-----	2.51E-03	3.69E-03	-----	-----	5.00E-06	3.69E-03	1.55E-03	1.85E-03	1.23E-04	2.47E+01	pCi/kg milk per pCi/day ingested
		Uranium	1.80E-03	5.0E-04	6.1E-03	1.4E-04	6.1E-04	-----	-----	-----	-----	5.0E-04	6.1E-03	1.92E-03	4.38E-02	-----	-----	1.40E-04	4.38E-02	6.83E-03	1.40E-02	1.70E-03	5.14E+00	pCi/kg milk per pCi/day ingested
$TF_{dairy(goat)}$	feed-and-soil-to-goat-milk transfer factor	Radium	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	pCi/L milk per pCi/day ingested
		Thorium	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	pCi/L milk per pCi/day ingested
		Uranium	-----	-----	-----	-----	-----	8.1E-04	2.0E-03	-----	-----	-----	-----	-----	-----	-----	-----	8.12E-04	1.99E-03	1.40E-03	8.32E-04	1.27E-03	1.56E+00	pCi/L milk per pCi/day ingested
TF_{po}	feed-and-soil-to-poultry transfer factor	Radium	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	pCi/kg poultry per pCi/day ingested
		Thorium	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	pCi/kg poultry per pCi/day ingested
		Uranium	7.50E-01	-----	-----	-----	-----	1.1E-02	1.9E-02	-----	-----	3.00E-01	1.20E+00	-----	-----	-----	-----	1.11E-02	1.20E+00	4.56E-01	5.13E-01	1.41E-01	6.83E+00	pCi/kg poultry per pCi/day ingested
TF_{e}	feed-and-soil-to-egg transfer factor	Radium	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	pCi/kg egg per pCi/day ingested
		Thorium	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	pCi/kg egg per pCi/day ingested
		Uranium	1.10E+00	-----	-----	-----	-----	-----	-----	-----	1.25E+00	9.20E-01	1.20E+00	-----	-----	-----	-----	9.20E-01	1.25E+00	1.12E+00	1.46E-01	1.11E+00	1.13E+00	pCi/kg egg per pCi/day ingested
TF_{swine}	feed-and-soil-to-swine transfer factor	Radium	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	pCi/kg swine per pCi/day ingested
		Thorium	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	pCi/kg swine per pCi/day ingested
		Uranium	4.40E-02	-----	-----	-----	-----	4.2E-03	2.0E-02	2.6E-02	6.2E-02	2.6E-02	6.2E-02	-----	-----	-----	-----	4.16E-03	6.20E-02	3.49E-02	2.19E-02	2.66E-02	2.37E+00	pCi/kg swine per pCi/day ingested

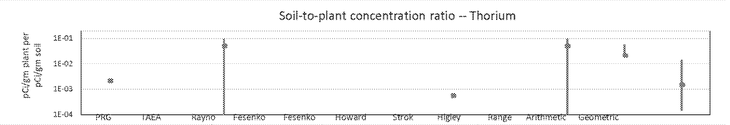
ref: http://epa-prgs.ornl.gov/cgi-bin/radionuclides/rprg_search

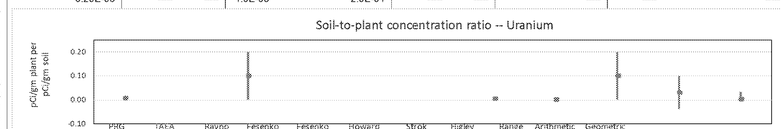
Parameter	Parameter / Reference / Statistic	Element	High	Low	Mean / Median / Midpoint	Resident farmer scenario default value	IAEA 2010 (from Strok & Smodis 2012)	Rayno 1983 Southwest US	Fesenko *et al* 2007a&b Mostly Europe	Fesenko *et al* 2009 Mostly Europe	Howard *et al* 2009 Mostly Europe	Strok & Smodis 2012 Slovenia	Higley & Bitwerk 2007 Oregon	Range	Arithmetic mean	Arithmetic standard deviation	Geometric mean	Geometric standard deviation	Units
$TF_{p\text{-}d}$	soil-to-plant concentration ratio (dry)	Radium				1.70E-02	----- -----	2.0E-03 6.5E+00	----- -----	-----	----- -----	9.74E-03 1.41E-02	3.10E-04 6.20E-02	3.10E-04 6.20E-02	1.75E-02	2.08E-02	6.69E-03	5.49E+00	pCi/gm plant per pCi/gm soil
	Resident farmer scenario default value		1.70E-02	1.70E-02	1.70E-02														
	IAEA 2010 (from Strok & Smodis 2012)																		
	Rayno 1980		6.50E+00	2.00E-03	3.25E+00														
	Fesenko *et al* 2007a&b																		
	Fesenko *et al* 2009																		
	Howard *et al* 2009																		
	Strok & Smodis 2012		1.41E-02	9.74E-03	1.19E-02														
	Higley & Bitwerk 2007		6.20E-02	3.10E-04	3.12E-02														
	Range & median		6.20E-02	3.10E-04	3.12E-02														
	Arithmetic mean ± σ		5.82E-02	-3.25E-03	1.75E-02														
	Geometric mean ± geometric σ		1.89E-01	1.22E-03	6.69E-03														
		Thorium				2.10E-03	----- -----	1.0E-04 1.0E-01	----- -----	-----	----- -----	4.44E-04 6.52E-04	-----	1.00E-04 1.00E-01	2.07E-02	3.97E-02	1.43E-03	1.03E+01	pCi/gm plant per pCi/gm soil
	Resident farmer scenario default value		2.10E-03	2.10E-03	2.10E-03														
	IAEA 2010 (from Strok & Smodis 2012)																		
	Rayno 1980		1.00E-01	1.00E-04	5.01E-02														
	Fesenko *et al* 2007a&b																		
	Fesenko *et al* 2009																		
	Howard *et al* 2009																		
	Strok & Smodis 2012		6.52E-04	4.44E-04	5.48E-04														
	Higley & Bitwerk 2007																		
	Range & median		1.00E-01	1.00E-04	5.01E-02														
	Arithmetic mean ± 1.96 σ		6.03E-02	-1.90E-02	2.07E-02														
	Geometric mean ± 1.96 geometric σ		1.48E-02	1.39E-04	1.43E-03														
		Uranium				6.20E-03	----- -----	1.0E-05 2.0E-01	----- -----	-----	----- -----	3.32E-03 4.28E-03	2.90E-04 2.50E-03	1.00E-05 2.00E-01	3.09E-02	6.90E-02	2.00E-03	1.66E+01	pCi/gm plant per pCi/gm soil
	Resident farmer scenario default value		6.20E-03	6.20E-03	6.20E-03														
	IAEA 2010 (from Strok & Smodis 2012)																		
	Rayno 1980		2.00E-01	1.00E-05	1.00E-01														
	Fesenko *et al* 2007a&b																		
	Fesenko *et al* 2009																		
	Howard *et al* 2009																		
	Strok & Smodis 2012		4.28E-03	3.32E-03	3.80E-03														
	Higley & Bitwerk 2007		2.50E-03	2.90E-04	1.40E-03														
	Range & median		2.00E-01	1.00E-05	1.00E-01														
	Arithmetic mean ± 1.96 σ		1.00E-01	-3.81E-02	3.09E-02														
	Geometric mean ± 1.96 geometric σ		3.31E-02	1.21E-04	2.00E-03														
TF_{beef}	feed-and-soil-to-beef transfer factor	Radium				1.70E-03	----- -----	5.1E-04 4.0E-03	----- -----	-----	----- -----	-----	----- 9.00E-04	5.10E-04 4.00E-03	1.76E-03	1.21E-03	1.40E-03	2.00E+00	pCi/kg beef per pCi/day ingested
	Resident farmer scenario default value		1.70E-03	1.70E-03	1.70E-03														
	IAEA 2010 (from Strok & Smodis 2012)																		
	Rayno 1980		4.00E-03	5.10E-04	2.26E-03														
	Fesenko *et al* 2007a&b																		
	Fesenko *et al* 2009																		
	Howard *et al* 2009		1.70E-03	1.70E-03	1.70E-03														
	Strok & Smodis 2012																		
	Higley & Bitwerk 2007		9.00E-04	9.00E-04	9.00E-04														
	Range & median		4.00E-03	5.10E-04	2.26E-03														
	Arithmetic mean ± 1.96 σ		2.97E-03	5.51E-04	1.76E-03														
	Geometric mean ± 1.96 geometric σ		2.79E-03	6.99E-04	1.40E-03														
		Thorium				2.30E-04	----- -----	----- 2.0E-04	----- -----	-----	----- -----	-----	----- -----	2.00E-04 2.30E-04	2.15E-04	1.50E-05	2.14E-04	1.07E+00	pCi/kg beef per pCi/day ingested
	Resident farmer scenario default value		2.30E-04	2.30E-04	2.30E-04														
	IAEA 2010 (from Strok & Smodis 2012)																		
	Rayno 1980		2.00E-04	2.00E-04	2.00E-04														
	Fesenko *et al* 2007a&b																		
	Fesenko *et al* 2009																		
	Howard *et al* 2009																		
	Strok & Smodis 2012																		
	Higley & Bitwerk 2007																		
	Range & median		2.30E-04	2.00E-04	2.15E-04														
	Arithmetic mean ± 1.96 σ		2.30E-04	2.00E-04	2.15E-04														
	Geometric mean ± 1.96 geometric σ		2.30E-04	2.00E-04	2.14E-04														
		Uranium				3.90E-04	----- -----	----- 3.4E-04	8.1E-03 1.6E-02	-----	2.5E-04 6.3E-04	-----	----- 3.00E-04	2.50E-04 1.59E-02	3.70E-03	5.65E-03	9.70E-04	4.89E+00	pCi/kg beef per pCi/day ingested
	Resident farmer scenario default value		3.90E-04	3.90E-04	3.90E-04														
	IAEA 2010 (from Strok & Smodis 2012)																		
	Rayno 1980		3.40E-04	3.40E-04	3.40E-04														
	Fesenko *et al* 2007a&b		1.59E-02	8.08E-03	1.20E-02														
	Fesenko *et al* 2009																		
	Howard *et al* 2009		6.30E-04	2.50E-04	4.40E-04														
	Strok & Smodis 2012																		
	Higley & Bitwerk 2007		3.00E-04	3.00E-04	3.00E-04														
	Range & median		1.59E-02	2.50E-04	8.09E-03														
	Arithmetic mean ± 1.96 σ		9.35E-03	-1.95E-03	3.70E-03														
	Geometric mean ± 1.96 geometric σ		4.75E-03	1.98E-04	9.70E-04														

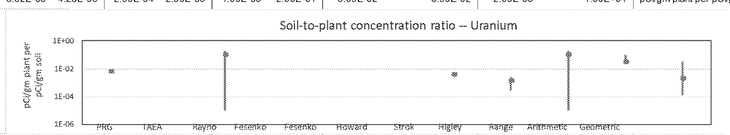


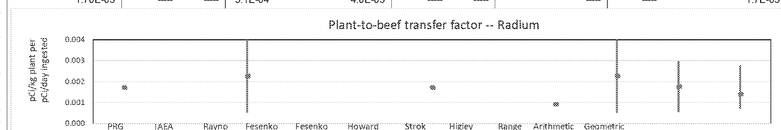


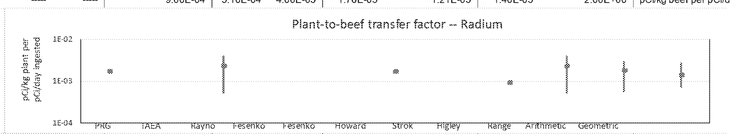


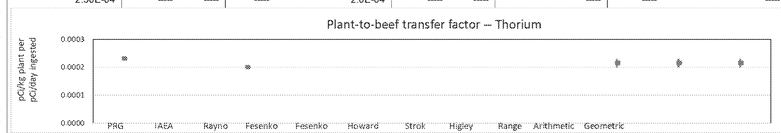


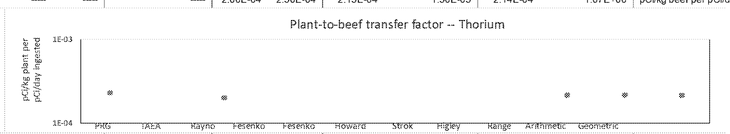


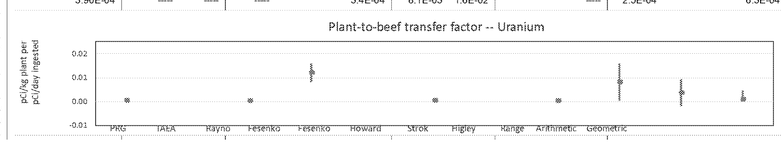


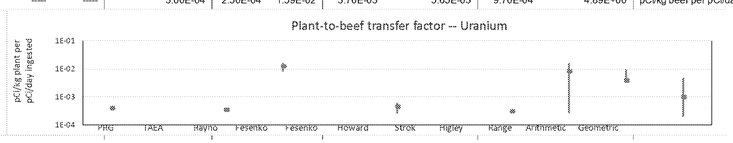




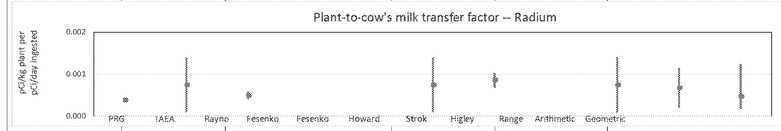


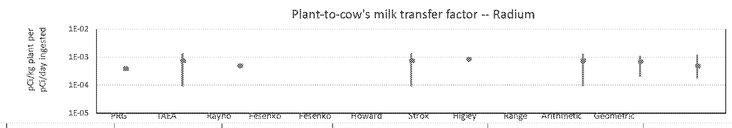


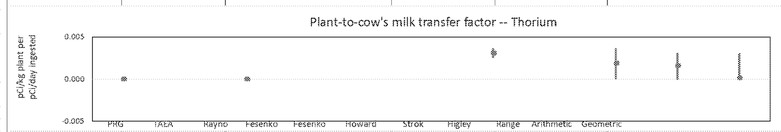


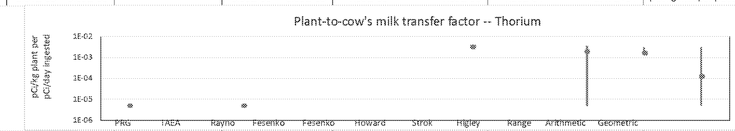


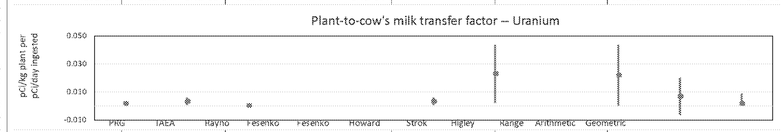
TF_{dairy}	feed-and-soil-to-cow-milk transfer factor	Radium				3.80E-04	9.0E-05	1.4E-03	4.0E-04	5.9E-04	-----	-----	-----	9.0E-05	1.4E-03	6.84E-04	1.04E-03	-----	9.00E-05	1.40E-03	6.74E-04	4.76E-04	4.65E-04	2.68E+00	pCi/kg milk per pCi/day ingested
	Resident farmer scenario default value		3.80E-04	3.80E-04	3.80E-04																			
	IAEA 2010 (from Strok & Smodis 2012)		9.00E-05	1.40E-03	7.45E-04																			
	Rayno 1980		4.00E-04	5.90E-04	4.95E-04																			
	Fesenko *et al* 2007a&b																							
	Fesenko *et al* 2009																							
	Howard *et al* 2009		1.40E-03	9.00E-05	7.45E-04																			
	Strok & Smodis 2012		1.04E-03	6.84E-04	8.60E-04																			
	Higley & Bitwerk 2007																							
	Range & median		1.40E-03	9.00E-05	7.45E-04																			
	Arithmetic mean ± 1.96 σ		1.15E-03	1.99E-04	6.74E-04																			
	Geometric mean ± 1.96 geometric σ		1.24E-03	1.73E-04	4.65E-04																			
		Thorium				5.00E-06	-----	-----	-----	5.0E-06	-----	-----	-----	-----	-----	2.51E-03	3.69E-03	-----	5.00E-06	3.69E-03	1.55E-03	1.60E-03	1.23E-04	2.47E+01	pCi/kg milk per pCi/day ingested
	Resident farmer scenario default value		5.00E-06	5.00E-06	5.00E-06																			
	IAEA 2010 (from Strok & Smodis 2012)																							
	Rayno 1980		5.00E-06	5.00E-06	5.00E-06																			
	Fesenko *et al* 2007a&b																							
	Fesenko *et al* 2009																							
	Howard *et al* 2009																							
	Strok & Smodis 2012		3.69E-03	2.51E-03	3.10E-03																			
	Higley & Bitwerk 2007																							
	Range & median		3.69E-03	5.00E-06	1.85E-03																			
	Arithmetic mean ± 1.96 σ		3.15E-03	-4.99E-05	1.55E-03																			
	Geometric mean ± 1.96 geometric σ		3.05E-03	4.99E-06	1.23E-04																			
		Uranium				1.80E-03	5.0E-04	6.1E-03	1.4E-04	6.1E-04	-----	-----	-----	5.0E-04	6.1E-03	1.92E-03	4.38E-02	-----	1.40E-04	4.38E-02	6.83E-03	1.32E-02	1.70E-03	5.14E+00	pCi/kg milk per pCi/day ingested
	Resident farmer scenario default value		1.80E-03	1.80E-03	1.80E-03																			
	IAEA 2010 (from Strok & Smodis 2012)		6.10E-03	5.00E-04	3.30E-03																			
	Rayno 1980		6.10E-04	1.40E-04	3.75E-04																			
	Fesenko *et al* 2007a&b																							
	Fesenko *et al* 2009																							
	Howard *et al* 2009		6.10E-03	5.00E-04	3.30E-03																			
	Strok & Smodis 2012		1.92E-03	4.38E-02	2.28E-02																			
	Higley & Bitwerk 2007																							
	Range & median		4.38E-02	1.40E-04	2.20E-02																			
	Arithmetic mean ± 1.96 σ		2.01E-02	-6.42E-03	6.83E-03																			
	Geometric mean ± 1.96 geometric σ		8.75E-03	3.31E-04	1.70E-03																			
$TF_{dairy(goat)}$	feed-and-soil-to-goat-milk transfer factor	Uranium				-----	-----	-----	-----	-----	8.1E-04	2.0E-03	-----	-----	0	-----	-----	-----	8.12E-04	1.99E-03	1.40E-03	5.88E-04	1.27E-03	1.56E+00	pCi/L milk per pCi/day ingested
	Resident farmer scenario default value																							
	IAEA 2010 (from Strok & Smodis 2012)																							
	Rayno 1980																							
	Fesenko *et al* 2007a&b		1.99E-03	8.12E-04	1.40E-03																			
	Fesenko *et al* 2009																							
	Howard *et al* 2009																							
	Strok & Smodis 2012																							
	Higley & Bitwerk 2007																							
	Range & median		1.99E-03	8.12E-04	1.40E-03																			
	Arithmetic mean ± 1.96 σ		1.99E-03	8.12E-04	1.40E-03																			
	Geometric mean ± 1.96 geometric σ		1.99E-03	8.12E-04	1.27E-03																			
TF_{po}	feed-and-soil-to-poultry transfer factor	Uranium				7.50E-01	-----	-----	-----	-----	1.1E-02	1.9E-02	-----	3.00E-01	1.20E+00	-----	-----	-----	1.11E-02	1.20E+00	4.56E-01	4.59E-01	1.41E-01	6.83E+00	pCi/kg poultry per pCi/day ingested
	Resident farmer scenario default value		7.50E-01	7.50E-01	7.50E-01																			
	IAEA 2010 (from Strok & Smodis 2012)																							
	Rayno 1980																							
	Fesenko *et al* 2007a&b		1.89E-02	1.11E-02	1.50E-02																			
	Fesenko *et al* 2009																							
	Howard *et al* 2009		1.20E+00	3.00E-01	7.50E-01																			
	Strok & Smodis 2012																							
	Higley & Bitwerk 2007																							
	Range & median		1.20E+00	1.11E-02	6.06E-01																			
	Arithmetic mean ± 1.96 σ		9.15E-01	-2.98E-03	4.56E-01																			
	Geometric mean ± 1.96 geometric σ		9.66E-01	2.07E-02	1.41E-01																			
TF_{e}	feed-and-soil-to-egg transfer factor	Uranium				1.10E+00	-----	-----	-----	-----	-----	-----	1.25E+00	9.20E-01	1.20E+00	-----	-----	-----	9.20E-01	1.25E+00	1.12E+00	1.26E-01	1.11E+00	1.13E+00	pCi/kg egg per pCi/day ingested
	Resident farmer scenario default value		1.10E+00	1.10E+00	1.10E+00																			
	IAEA 2010 (from Strok & Smodis 2012)																							
	Rayno 1980																							
	Fesenko *et al* 2007a&b																							
	Fesenko *et al* 2009		1.25E+00	1.25E+00	1.25E+00																			
	Howard *et al* 2009		1.20E+00	9.20E-01	1.06E+00																			
	Strok & Smodis 2012																							
	Higley & Bitwerk 2007																							
	Range & median		1.25E+00	9.20E-01	1.09E+00																			
	Arithmetic mean ± 1.96 σ		1.24E+00	9.91E-01	1.12E+00																			
	Geometric mean ± 1.96 geometric σ		1.25E+00	9.87E-01	1.11E+00																			
TF_{swine}	feed-and-soil-to-swine transfer factor	Uranium				4.40E-02	-----	-----	-----	-----	4.2E-03	2.0E-02	-----	2.6E-02	6.2E-02	-----	-----	-----	4.16E-03	6.20E-02	3.12E-02	2.00E-02	2.26E-02	2.55E+00	pCi/kg swine per pCi/day ingested
	Resident farmer scenario default value		4.40E-02	4.40E-02	4.40E-02																			
	IAEA 2010 (from Strok & Smodis 2012)																							
	Rayno 1980																							
	Fesenko *et al* 2007a&b		1.98E-02	4.16E-03	1.20E-02																			
	Fesenko *et al* 2009																							
	Howard *et al* 2009		6.20E-02	2.60E-02	4.40E-02																			
	Strok & Smodis 2012																							
	Higley & Bitwerk 2007																							
	Range & median		6.20E-02	4.16E-03	3.31E-02																			
	Arithmetic mean ± 1.96 σ		5.12E-02	1.12E-02	3.12E-02																			
	Geometric mean ± 1.96 geometric σ		5.74E-02	8.87E-03	2.26E-02																			

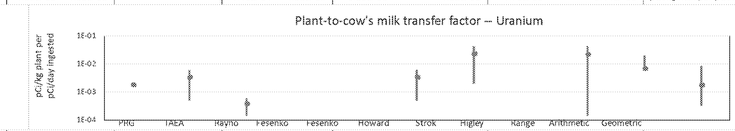


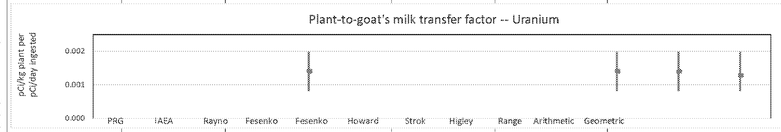


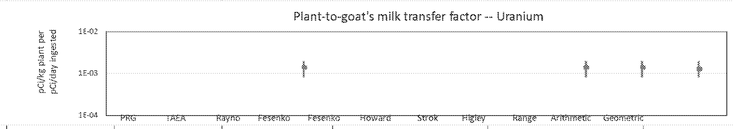


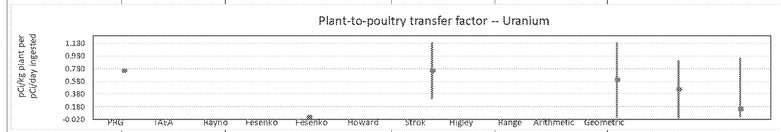


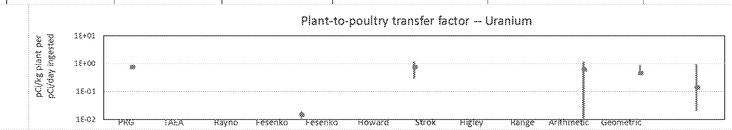


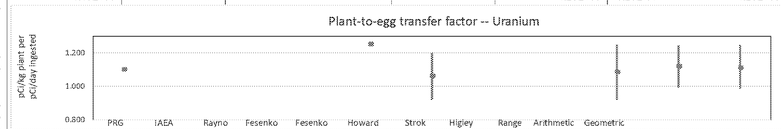


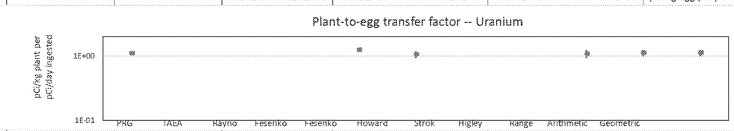


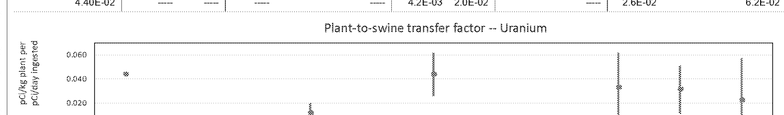


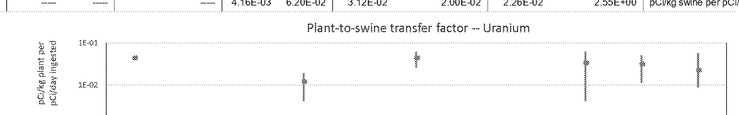












ref: http://epa-prgs.ornl.gov/cgi-bin/radionuclides/rprg_search

U.S. ENVIRONMENTAL PROTECTION AGENCY
Region 9 Superfund Division
Operations and Scientific Support Section

PRG Calculator Worksheet -- Agriculture (Resident Farmer) Scenario Calculated Results

refs: http://epa-prgs.ornl.gov/radionuclides/equations.shtml
http://epa-prgs.ornl.gov/cgi-bin/radionuclides/prg_search
http://epa-prgs.ornl.gov/radionuclides/EFH_Final_1997_EPA600P95002Fa.pdf

$$PRG_{soil\text{-}f\text{-}tot}\ (pCi/g) = \frac{1}{\frac{1}{PRG_{soil\text{-}f\text{-}irg}} + \frac{1}{PRG_{soil\text{-}f\text{-}ith}} + \frac{1}{PRG_{soil\text{-}f\text{-}wt}} + \frac{1}{PRG_{soil\text{-}f\text{-}proc\text{-}irg}} + \frac{1}{PRG_{soil\text{-}f\text{-}eggs\text{-}irg}} + \frac{1}{PRG_{soil\text{-}f\text{-}po\text{-}irg}} + \frac{1}{PRG_{soil\text{-}f\text{-}fsh\text{-}irg}} + \frac{1}{PRG_{soil\text{-}f\text{-}beef\text{-}irg}} + \frac{1}{PRG_{soil\text{-}f\text{-}dairy\text{-}irg}} + \frac{1}{PRG_{soil\text{-}f\text{-}sw\text{-}irg}}}$$

$$= \frac{1}{\frac{1}{\text{\#DIV/0!}} + \frac{1}{\text{\#DIV/0!}} + \frac{1}{\text{\#DIV/0!}} + \frac{1}{\text{\#DIV/0!}} + \frac{1}{\text{\#DIV/0!}} + \frac{1}{\text{\#DIV/0!}} + \frac{1}{\text{\#DIV/0!}} + \frac{1}{\text{\#DIV/0!}} + \frac{1}{\text{\#DIV/0!}} + \frac{1}{\text{\#DIV/0!}}}$$

= #DIV/0! pCi/gm

Total risk $r_{soil\text{-}f\text{-}tot}$ = $r_{soil\text{-}f\text{-}irg}$ + $r_{soil\text{-}f\text{-}ith}$ + $r_{soil\text{-}f\text{-}wt}$ + $r_{soil\text{-}f\text{-}proc\text{-}irg}$ + $r_{soil\text{-}f\text{-}eggs\text{-}irg}$ + $r_{soil\text{-}f\text{-}po\text{-}irg}$ + $r_{soil\text{-}f\text{-}fsh\text{-}irg}$ + $r_{soil\text{-}f\text{-}beef\text{-}irg}$ + $r_{soil\text{-}f\text{-}dairy\text{-}irg}$ + $r_{soil\text{-}f\text{-}sw\text{-}irg}$

= #DIV/0! + #DIV/0! + #DIV/0! + #DIV/0! + #DIV/0! + #DIV/0! + #DIV/0! + #DIV/0! + #DIV/0! + #DIV/0!

= #DIV/0! at #DIV/0! pCi/gm (Check sum of contributing risks)

Fraction of total risk = #DIV/0! + #DIV/0! + #DIV/0! + #DIV/0! + #DIV/0! + #DIV/0! + #DIV/0! + #DIV/0! + #DIV/0! + #DIV/0!

= #DIV/0! at #DIV/0! pCi/gm (Check sum of contributing risks)

RISK FOR A SELECTED SOIL CONCENTRATION
Enter concentration: pCi/gm
Calculated risk: #DIV/0!

$$PRG_{soil\text{-}f\text{-}soil\text{-}irg}\ (pCi/g) = \frac{TR \times t_r \times \lambda}{(1 - e^{-\lambda t}) \times SF_{ii}\ (risk/pCi) \times IFS_{f\text{-}adj}\ (115\ mg/day) \times EF_f\ (350\ day/yr) \times ED_f\ (40\ yr) \times (g/1000\ mg)}$$

$$= \frac{1.00E\text{-}06 \times 40 \times 2.665951}{1.0000 \times 0.0000E{+}00 \times \text{\#DIV/0!} \times 350 \times 0 \times 0.001}$$

= #DIV/0! pCi/gm

$$IFS_{f\text{-}adj}\ (115\ mg/day) = \frac{(IRS_{f\text{-}c}\ (200\ mg/day) \times ED_{f\text{-}c}\ (6\ yr)) + (IRS_{f\text{-}a}\ (100\ mg/day) \times ED_{f\text{-}a}\ (34\ yr))}{ED_f\ (40\ yr)}$$

$$= \frac{(1 \times 0) + (1 \times 0)}{0}$$

= #DIV/0! mg/day

$$PRG_{soil\text{-}f\text{-}soil\text{-}ers}\ (pCi/g) = \frac{TR \times t_r \times \lambda}{(1 - e^{-\lambda t}) \times SF_i\ (risk/pCi) \times IFA_{f\text{-}adj}\ (18.5\ m^3/day) \times EF_f\ (350\ day/yr) \times ED_f\ (40\ yr) \times \frac{1}{PEF\ (m^3/kg)} \times ET_f\ (24\ hr/day) \times (1\ day/24\ hr) \times (1000\ g/kg)}$$

$$= \frac{1.00E\text{-}06 \times 40 \times 2.665951}{1.0000 \times 0.0000E{+}00 \times \text{\#DIV/0!} \times 350 \times 0 \times \frac{1}{1.85000E{+}01} \times 24 \times 0.041667 \times 1000}$$

= #DIV/0! pCi/gm

$$IFA_{f\text{-}adj}\ (18\ m^3/day) = \frac{(IRA_{f\text{-}c}\ (10\ m^3/day) \times ED_{f\text{-}c}\ (6\ yr)) + (IRA_{f\text{-}a}\ (20\ m^3/day) \times ED_{f\text{-}a}\ (34\ yr))}{ED_f\ (40\ yr)}$$

$$= \frac{(0 \times 0) + (0 \times 0)}{0}$$

= #DIV/0! m^3/day

$$PRG_{soil\text{-}f\text{-}soil\text{-}ear}\ (pCi/g) = \frac{TR \times t_r \times \lambda}{(1 - e^{-\lambda t}) \times SF_{ie}\ (risk/yr\ per\ pCi/g) \times ACF \times EF_f\ (350\ day/yr) \times (1\ yr/365\ day) \times ED_f\ (40\ yr) \times [ET_{f\text{-}o}\ (0.507) + (ET_{f\text{-}i}\ (0.417) \times GSF\ (0.4))]}$$

$$= \frac{1.00E\text{-}06 \times 40 \times 2.665951}{1.0000 \times 0.0000E{+}00 \times 0.923 \times 350 \times 0.002740 \times 0 \times [12.168 + (10.008 \times 1.0)]}$$

= #DIV/0! pCi/gm

$$PRG_{soil\text{-}f\text{-}prod\text{-}irrg}\ (pCi/g) = \frac{TR \times t_r \times \lambda}{(1 - e^{-\lambda t_r}) \times SF_0\ (risk/pCi) \times EF_f\ (350\ day/yr) \times (1\ yr/365\ day) \times ED_f\ (40\ yr) \times [\ IFF_{f\text{-}adj}\ (18.235\ kg/yr) + IFV_{f\text{-}adj}\ (9.41\ kg/yr)\ ] \times 1000\ g/kg \times TF_{p\text{-}w}\ (pCi/gram\ plant\ per\ pCi/gram\ soil) \times CPF_f\ (1.0)}$$

$$= \frac{1.0000 \times 0.0000E{+}00 \times 350 \times 0.002740 \times 0 \times [\ \#DIV/0! + \#DIV/0!\ ] \times 1000 \times 161.6000 \times 0.4}{1.00E{-}06 \times 40 \times 2.665951}$$

$$= \#DIV/0!\ pCi/gm$$

$$IFF_{f\text{-}adj}\ (18.235\ kg/yr) = \frac{(\ IRF_{f\text{-}c}\ (5.4\ kg/yr) \times ED_{f\text{-}c}\ (6\ yr)\ ) + (\ IRF_{f\text{-}a}\ (20.5\ kg/yr) \times ED_{f\text{-}a}\ (34\ yr)\ )}{ED_f\ (40\ yr)}$$

$$= \frac{(\ 0.0 \times 0\ ) + (\ 0.0 \times 0\ )}{0}$$

$$= \#DIV/0!\ kg/yr$$

$$IFV_{f\text{-}adj}\ (9.41\ kg/yr) = \frac{(\ IRVf_{f\text{-}c}\ (3.8\ kg/yr) \times ED_{f\text{-}c}\ (6\ yr)\ ) + (\ IRV_{f\text{-}a}\ (10.4\ kg/yr) \times ED_{f\text{-}a}\ (34\ yr)\ )}{ED_f\ (40\ yr)}$$

$$= \frac{(\ 34.0 \times 0\ ) + (\ 0.0 \times 0\ )}{0}$$

$$= \#DIV/0!\ kg/yr$$

$$PRG_{soil\text{-}f\text{-}egg\text{-}irrg}\ (pCi/g) = \frac{TR \times t_r \times \lambda}{(1 - e^{-\lambda t_r}) \times SF_0\ (risk/pCi) \times EF_f\ (350\ day/yr) \times (1\ yr/365\ day) \times ED_f\ (40\ yr) \times IFE_{f\text{-}adj}\ (13.01\ kg/yr) \times 1000\ g/kg \times \{\ [\ TF_w\ (day/kg) \times FI_{po}\ (0.2\ kg/day) \times TFp\text{-}d\ (pCi/gram\ plant\ per\ pCi/gram\ soil)\ ] + [\ TF_w\ (day/kg) \times FI_{po\text{-}s}\ (0.022\ kg/day)\ ]\ \}}$$

$$= \frac{1.0000 \times 0.0000E{+}00 \times 350 \times 0.002740 \times 0 \times \#DIV/0! + 1000 \times \{\ [\ 46.9475 \times 100.0 \times 113.5250\ ] + [\ 46.9475 \times 0.000\ ]\ \}}{1.00E{-}06 \times 40 \times 2.665951}$$

$$= \#DIV/0!\ pCi/gm$$

$$IFE_{f\text{-}adj}\ (13.01\ kg/yr) = \frac{(\ IRF_{f\text{-}c}\ (2.3\ kg/yr) \times ED_{f\text{-}c}\ (6\ yr)\ ) + (\ IRF_{f\text{-}a}\ (14.9\ kg/yr) \times ED_{f\text{-}a}\ (34\ yr)\ )}{ED_f\ (40\ yr)}$$

$$= \frac{(\ 20.0 \times 0\ ) + (\ 0.0 \times 0\ )}{0}$$

$$= \#DIV/0!\ kg/yr$$

$$PRG_{food\text{-}ingestion}\ (pCi/g) = \frac{TR \times t_E \times \lambda \times \left\{ \left[IFP_{c,adj}\ (31.18\ kg/yr) \times ED_c\ (40\ yr) \times \frac{(1\ yr/365\ day)}{(1 - e^{-kt})} \times SF_O\ (ris/pCi) \times EF_c\ (350\ day/yr) \times \frac{1000\ g/kg}{1.00E\text{-}06} \times TFP\text{-}d\ (pCi/gram\ plant/per\ pCi/gram\ soil) \times FP_{ag}\ (0.2\ kg/day) \times TFP_{ag}\ (day/kg) \times FP_{s,c}\ (0.022\ kg/day) \right] + \left[\frac{TF_{food}\ (day/kg)}{2.665951} \times \frac{ED_c\ (40\ yr)}{0} \times \frac{0.0}{\#DIV/0!\ kg/yr} \times \frac{1000}{40} \times \frac{0.000027400}{1.00E\text{-}06} \times \frac{0}{\#DIV/0!} \times \frac{1.0000 \times 0.00000E+00}{\#DIV/0!\ pCi/gm} \times \frac{350}{\#DIV/0!} \times \frac{94.0650}{100.0} \times \frac{113.5250}{0.000} \right] \right\}}{}$$

$$IFP_{c,adj}\ (31.18\ kg/yr) = \frac{\left(IRP_{c,c}\ (5.0\ kg/yr) \times ED_{c,c}\ (6\ yr) \right) + \left(IRP_{c,a}\ (35.8\ kg/yr) \times ED_{c,a}\ (34\ yr) \right)}{ED_c\ (40\ yr)}$$

$$= \frac{\left(178.1 \times 0 \right) + \left(0.0 \times 0 \right)}{0} = \frac{\#DIV/0!\ kg/yr}{}$$

$$PRG_{food\text{-}ingestion}\ (pCi/g) = \frac{TR \times t_E \times \lambda \times \left\{ \left[IFFL_{adj}\ (39.89\ kg/yr) \times \frac{(1\ yr/365\ day)}{(1 - e^{-kt})} \times SF_O\ (ris/pCi) \times EF_c\ (350\ day/yr) \times \frac{1000\ g/kg}{1.00E\text{-}06} \times TF_c\ (L/kg) \times \frac{1}{\sigma\ (0.5)} \times \frac{S\ (0.3)}{\rho\ (1.5\ kg/L)} \right] + \left[\frac{TF_{food}\ (day/kg)}{2.665951} \times \frac{ED_c\ (40\ yr)}{0} \times \frac{0.0}{\#DIV/0!\ kg/yr} \times \frac{1000}{40} \times \frac{0.000027400}{1.00E\text{-}06} \times \frac{0}{\#DIV/0!} \times \frac{1.0000 \times 0.00000E+00}{\#DIV/0!\ pCi/gm} \times \frac{350}{\#DIV/0!} \times \frac{138.0300}{1359292542.3} \times \frac{0.0}{0.0} \times \frac{1}{0.0} \right] \right\}}{A_s\ (10^6\ m^2)}$$

$$IFFL_{adj}\ (39.89\ kg/yr) = \frac{\left(IRFL_{c,c}\ (6.4\ kg/yr) \times ED_{c,c}\ (6\ yr) \right) + \left(IRFL_{c,a}\ (45.8\ kg/yr) \times ED_{c,a}\ (34\ yr) \right)}{ED_c\ (40\ yr)}$$

$$= \frac{\left(126.2 \times 0 \right) + \left(0.0 \times 0 \right)}{0} = \frac{\#DIV/0!\ kg/yr}{}$$

$$PRG_{food\text{-}ingestion}\ (pCi/g) = \frac{TR \times t_E \times \lambda \times \left\{ \left[IFB_{c,adj}\ (43.375\ kg/yr) \times \frac{(1\ yr/365\ day)}{(1 - e^{-kt})} \times SF_O\ (ris/pCi) \times EF_c\ (350\ day/yr) \times \frac{1000\ g/kg}{1.00E\text{-}06} \times K_C\ (L/kg) \times \frac{1}{\sigma\ (0.5)} \times \frac{S\ (0.3)}{\rho\ (1.5\ kg/L)} \right] + \left[\frac{TF_{food}\ (day/kg)}{2.665951} \times \frac{ED_c\ (40\ yr)}{0} \times \frac{0.0}{\#DIV/0!\ kg/yr} \times \frac{1000}{40} \times \frac{0.000027400}{1.00E\text{-}06} \times \frac{0}{\#DIV/0!} \times \frac{1.0000 \times 0.00000E+00}{\#DIV/0!\ pCi/gm} \times \frac{350}{\#DIV/0!} \times \frac{158.7600}{1359292542.3} \times \frac{0.0}{0.0} \times \frac{1}{0.0} \right] \right\}}{A_w\ (10^6\ m^2)}$$

$$IFB_{c,adj}\ (43.38\ kg/yr) = \frac{\left(IRB_{c,c}\ (4.7\ kg/yr) \times ED_{c,c}\ (6\ yr) \right) + \left(IRB_{c,a}\ (50.2\ kg/yr) \times ED_{c,a}\ (34\ yr) \right)}{ED_c\ (40\ yr)}$$

$$= \frac{\left(0.0 \times 0 \right) + \left(0.0 \times 0 \right)}{0} = \frac{\#DIV/0!\ kg/yr}{}$$

$$PRG_{food\text{-}ingestion}\ (pCi/g) = \frac{TR \times t_E \times \lambda \times \left\{ \left[IFFL_{adj}\ (39.89\ kg/yr) \times \frac{(1\ yr/365\ day)}{(1 - e^{-kt})} \times SF_O\ (ris/pCi) \times EF_c\ (350\ day/yr) \times \frac{1000\ g/kg}{1.00E\text{-}06} \times TF_{dairy}\ (day/kg) \times FD_{c,adj}\ (205.28\ kg/yr) \times ED_c\ (40\ yr) \times \frac{(1\ yr/365\ day)}{(1 - e^{-kt})} \times SF_O\ (ris/pCi) \times EF_c\ (350\ day/yr) \times \frac{1000\ g/kg}{1.00E\text{-}06} \times K_C\ (L/kg) \times \frac{1}{\sigma\ (0.5)} \times \frac{S\ (0.3)}{\rho\ (1.5\ kg/L)} \right] + \left[\frac{FF_{dairy\text{-}w}\ (92\ L/day)}{2.665951} \times \frac{ED_c\ (40\ yr)}{0} \times \frac{0.0}{\#DIV/0!\ kg/yr} \times \frac{126.2}{0} \times \frac{1}{0.0} \right] \right\}}{A_s\ (10^6\ m^2)}$$

x) + Fl_{beef-s} (0.39 kg/day)]

Fl_{beef} (11.77 kg/day) TF_{p-s} (pCi/gram plant per pCi/gram soil)

0.00 x 113.53) + 10.95]

x) + $FL_{Dairy-s}$ (0.41 kg/day)]

Fl_{Dairy} (16.9 kg/day) TF_{p-s} (pCi/gram plant per pCi/gram soil)

$$= \frac{1.0000 \times 0.0000E{+}00 \times 350 \times 0.002740 \times 0 \times \#DIV/0! \times 1000 \times 431.1850 \times \left[\left(\frac{11.8}{1359292542.3 + 0.0 \times [0.0 / 0.0]} \times \frac{1}{1.0} \right) + \left(\right.\right.}{}$$

$$= \#DIV/0! \text{ pCi/gm}$$

$$IFD_{i\text{-}adj}\ (205.28\ kg/yr) = \frac{(IRD_{i\text{-}c}\ (96.9\ kg/yr) \times ED_{i\text{-}c}\ (6\ yr)) + (IRD_{i\text{-}a}\ (224.4\ kg/yr) \times ED_{i\text{-}a}\ (34\ yr))}{ED_i\ (40\ yr)}$$

$$= \frac{(53.0 \times 0) + (0.0 \times 0)}{0}$$

$$= \#DIV/0! \text{ kg/yr}$$

$$PRG_{soil\text{-}5\text{-}swns\text{-}erg}\ (pCi/g) = \frac{TR \times t_i \times \lambda}{\left(\left(1 - e^{-\lambda t_i} \right) \times SF_o\ (risk/pCi) \times EF_f\ (350\ day/yr) \times (1\ yr/365\ day) \times ED_f\ (40\ yr) \times IFSW_{i\text{-}adj}\ (24.22\ kg/yr) \times 1000\ g/kg \times TF_{swns}\ (day/kg) \times \left[\left(\frac{Fl_{swns\text{-}w}\ (11.4\ L/day)}{K_{oc}\ (L/kg) + \sigma\ (0.5) \times [S\ (0.3) / \rho\ (1.5\ kg/L)]} \times \frac{1}{DF_w} \right) + \left(\right.\right.\right.\right.}{}$$

$$= \frac{1.00E{-}06 \times 40 \times 2.665951}{1.0000 \times 0.0000E{+}00 \times 350 \times 0.002740 \times 0 \times \#DIV/0! \times 1000 \times 431.1850 \times \left[\left(\frac{16.9}{1359292542.3 + 0.0 \times [0.0 / 0.0]} \times \frac{1}{1.0} \right) + \left(\right.\right.}{}$$

$$= \#DIV/0! \text{ pCi/gm}$$

$$IFD_{i\text{-}adj}\ (24.22\ kg/yr) = \frac{(IRSW_{i\text{-}c}\ (4.5\ kg/yr) \times ED_{i\text{-}c}\ (6\ yr)) + (IRSW_{i\text{-}a}\ (27.7\ kg/yr) \times ED_{i\text{-}a}\ (34\ yr))}{ED_i\ (40\ yr)}$$

$$= \frac{(92.0 \times 0) + (0.0 \times 0)}{0}$$

$$= \#DIV/0! \text{ kg/yr}$$

156.60 x 113.53) + 0.00]

x) + $FI_{water-S}$ (0.37 kg/day)]

FI_{water} (4.7 kg/day) TF_{p-S} (pCi/gram plant per pCi/gram soil)

179.70 x 113.53) + 0.00]