

Appendix B: Verification Benchmark Problem

Verification of DOSEMM involved comparison of radionuclide concentrations in environmental media and doses with a spreadsheet application that has been used at the Idaho National Laboratory (INL) to produce the Annual Site Environmental Report (ASER) (INL 2016). Releases from the INTEC facility were evaluated and include particulate radionuclides (transuranics and fission and activation products), noble gases, iodine isotopes, and tritium (as tritiated water) and ^{14}C . Environmental media concentrations and doses were calculated at a single receptor location where the maximum off-site dose was reported. In general, DOSEMM uses the same equations for calculating radionuclide transfer through the food chain, except for tritium and ^{14}C . The ASER model uses factors derived from CAP88 (Moore et al. 1979) modeling, where DOSEMM uses the specific activity models as described in NCRP (1996). Model parameters including concentration ratios, soil parameters, and dose coefficients were mostly taken from the ASER model. For tritium and ^{14}C , parameters from Moore et al. (1979) and NCRP (1996) were used.

Radionuclide concentrations in environmental media for the two models are provided in Table B-1, and effective doses are provided in Table B-2. Air concentrations were generally the same between the two models for all particulate radionuclides and iodine. DOSEMM concentrations for tritium, ^{14}C , and the noble gases were slightly higher because X/Q values used for these radionuclides did not include deposition. The ASER spreadsheet only allows for a single X/Q value representing a non-depositing radionuclide. Deposition is calculated in ASER by entering a deposition velocity for particles and iodine. Plume depletion is calculated outside the spreadsheet and only iodine is accounted for. To provide consistent X and ψ input to benchmark DOSEMM, the spreadsheet was modified to use a separate X/Q value for particles, tritium and ^{14}C , and noble gases, and another for iodine. The X/Q values used in DOSEMM and the ASER spreadsheet were derived from the CALPUFF model simulations described in Rood and Sondrup (2014). In DOSEMM, X/Q values for particles were based on a 1- μm particle, and for iodine on a 15- μm particle. Tritium, ^{14}C , and noble gases did not include deposition; thus, ψ/Q values were zero at all nodes, and X/Q values reflect no depletion. Because little depletion occurs for small particles, the X/Q values for particles from DOSEMM were used in the ASER spreadsheet for tritium, ^{14}C , and noble gases. The slightly higher predicted DOSEMM air concentration compared to ASER for tritium, ^{14}C , and noble gases reflects no plume depletion in DOSEMM. The X/Q value for iodine in DOSEMM was used in the ASER spreadsheet. Deposition velocities used in the ASER spreadsheets were calculated by taking the ratio of the ψ/Q to X/Q values used in DOSEMM.

Another difference was noted in the ground external exposure dose. For consistency with DOSEMM, the ground exposure dose in ASER was calculated assuming one year of deposition. However, DOSEMM accounts for decay, ingrowth, and leaching during the year while ASER does not. Thus, radionuclides that had any significant decay or leaching during the year as calculated by DOSEMM had lower doses compared to ASER. DOSEMM also accounts for ingrowth of radioactive progeny; ^{241}Am ingrowth from ^{241}Pu makes a substantial difference in the ground external exposure dose, which results in the DOSEMM dose being a factor of 2 higher than the ASER dose.

Finally, notable differences were observed for the tritium and ^{14}C doses. Tritium and ^{14}C doses calculated in DOSEMM are a function of only a few parameters, and model results were checked with hand calculations to assure that they were done correctly. These differences can be

attributed to differences in the implementation of the specific activity model in DOSEMM and ASER spreadsheets.

The DOSEMM input and output files are provided as an attachment to this appendix. Model runs were separated into four files: particulates, noble gases, iodine, and tritium and ^{14}C . Model parameters are printed to the output files except for the source term, which is provided also in four separate files.

Table B-1. Radionuclide Concentrations in Environmental Media for the DOSEMM Verification Problem

DOSEMM	Air		Leafy			
	concentration (pCi m ⁻³)	Deposition (pCi m ⁻²)	vegetable (pCi kg ⁻¹)	Produce (pCi kg ⁻¹)	Milk (pCi L ⁻¹)	Beef (pCi kg ⁻¹)
Pu-241	5.04E-06	3.25E-02	1.79E-04	1.79E-04	3.53E-08	3.52E-06
Am-241	7.65E-09	4.94E-05	2.88E-07	2.88E-07	1.09E-10	2.72E-09
Cs-137	2.59E-05	1.67E-01	2.12E-03	2.12E-03	1.61E-03	6.02E-03
Pu-238	1.66E-07	1.07E-03	6.13E-06	6.13E-06	1.17E-09	1.17E-07
Pu-239	3.12E-07	2.01E-03	1.18E-05	1.18E-05	2.22E-09	2.22E-07
Pu-240	1.64E-07	1.06E-03	6.23E-06	6.23E-06	1.17E-09	1.17E-07
Sr-90	1.98E-05	1.28E-01	7.43E-03	7.43E-03	4.88E-04	1.95E-03
Co-60	4.14E-08	2.67E-04	2.19E-06	2.19E-06	5.91E-07	5.87E-06
I-129	5.87E-06	2.26E+00	3.33E-02	3.33E-02	2.81E-02	1.97E-02
I-131	2.71E-02	1.05E+04	7.68E+00	7.68E+00	8.39E+00	1.24E+00
H-3	2.23E-01	a	3.75E+01	3.75E+01	4.56E+01	2.84E+01
C-14	1.48E-08	a	2.79E-05	2.79E-05	1.39E-05	1.89E-05
Kr-85	1.14E+00	a	b	b	b	b
Ar-41	4.58E-01	a	b	b	b	b
ASER spreadsheet	Air		Leafy			
	conc (pCi m ⁻³)	Deposition (pCi m ⁻²)	vegetable (pCi kg ⁻¹)	Produce (pCi kg ⁻¹)	Milk (pCi L ⁻¹)	Beef (pCi kg ⁻¹)
Pu-241	5.02E-06	3.23E-02	1.77E-04	1.77E-04	3.49E-08	3.49E-06
Am-241	7.64E-09	4.92E-05	2.87E-07	2.87E-07	1.08E-10	2.71E-09
Cs-137	2.58E-05	1.66E-01	2.10E-03	2.10E-03	1.60E-03	5.99E-03
Pu-238	1.65E-07	1.06E-03	6.09E-06	6.09E-06	1.17E-09	1.17E-07
Pu-239	3.11E-07	2.00E-03	1.18E-05	1.18E-05	2.21E-09	2.21E-07
Pu-240	1.64E-07	1.05E-03	6.19E-06	6.19E-06	1.16E-09	1.16E-07
Sr-90	1.98E-05	1.27E-01	7.19E-03	7.19E-03	4.79E-04	1.92E-03
Co-60	4.13E-08	2.66E-04	2.17E-06	2.17E-06	5.87E-07	5.87E-06
I-129	5.86E-06	2.29E+00	3.37E-02	3.37E-02	2.84E-02	1.99E-02
I-131	2.71E-14	1.06E+04	7.81E+00	7.81E+00	8.52E+00	1.27E+00
H-3	2.10E-01	a	c	c	c	c
C-14	1.40E-08	a	c	c	c	c
Kr-85	1.08E+00	a	b	b	b	b
Ar-41	4.29E-01	a	b	b	b	b
Ratios			Leafy			
DOSEMM/ASER	Air	Deposition	vegetable	Produce	Milk	Beef

Table B-1. Radionuclide Concentrations in Environmental Media for the DOSEMM Verification Problem

Pu-241	1.00	1.01	1.01	1.01	1.01	1.01
Am-241	1.00	1.00	1.00	1.00	1.00	1.00
Cs-137	1.00	1.01	1.01	1.01	1.01	1.01
Pu-238	1.00	1.01	1.01	1.01	1.01	1.01
Pu-239	1.00	1.01	1.01	1.01	1.01	1.01
Pu-240	1.00	1.01	1.01	1.01	1.01	1.01
Sr-90	1.00	1.01	1.03	1.03	1.02	1.02
Co-60	1.00	1.01	1.01	1.01	1.01	1.00
I-129	1.00	0.99	0.99	0.99	0.99	0.99
I-131	1.00	0.99	0.98	0.98	0.99	0.98
H-3	1.06	a	c	c	c	c
C-14	1.06	a	c	c	c	c
Kr-85	1.06	a	b	b	b	b
Ar-41	1.07	a	b	b	b	b

^aNo deposition calculated for these radionuclides

^bThese radionuclides do not accumulate in the food chain

^cConcentrations in food products were not explicitly calculated in ASER.

Table B-2. Effective Doses by Exposure Pathway for the DOSEMM Verification Problem

DOSEMM	Inhalation (rem)	Vegetables (rem)	Meat (rem)	Milk (rem)	Ground (rem)	Submersion (rem)	Total (rem)
Pu-241	3.45E-07	6.09E-10	5.26E-12	6.95E-14	6.39E-15	3.73E-17	3.45E-07
Am-241	2.23E-08	4.23E-11	1.75E-13	9.20E-15	2.71E-13	6.06E-16	2.24E-08
Cs-137	3.21E-08	2.06E-08	2.57E-08	9.03E-09	1.06E-08	7.72E-11	9.81E-08
Pu-238	5.42E-07	1.00E-09	8.42E-12	1.11E-13	7.79E-14	6.79E-17	5.43E-07
Pu-239	1.12E-06	2.13E-09	1.75E-11	2.31E-13	6.67E-14	1.27E-16	1.13E-06
Pu-240	5.91E-07	1.12E-09	9.21E-12	1.21E-13	7.46E-14	6.58E-17	5.92E-07
Sr-90	9.67E-08	1.47E-07	1.69E-08	5.58E-09	1.64E-09	2.28E-13	2.68E-07
Co-60	4.06E-11	5.34E-12	6.28E-12	8.33E-13	6.74E-11	5.75E-13	1.21E-10
I-129	1.88E-08	2.53E-06	6.53E-07	1.23E-06	3.29E-09	1.94E-13	4.43E-06
I-131	2.10E-05	1.20E-04	8.49E-06	7.57E-05	1.59E-05	5.35E-08	2.41E-04
H-3	1.28E-07	5.15E-07	1.71E-07	3.62E-07			1.18E-06
C-14	2.70E-12	1.16E-11	3.45E-12	3.34E-12			2.11E-11
Kr-85						3.20E-08	3.20E-08
Ar-41						3.29E-06	3.29E-06
Total	2.39E-05	1.23E-04	9.36E-06	7.73E-05	1.59E-05	3.38E-06	2.53E-04
ASER	Inhalation (rem)	Vegetables (rem)	Meat (rem)	Milk (rem)	Ground (rem)	Submersion (rem)	Total (rem)
Pu-241	3.43E-07	6.04E-10	5.23E-12	6.89E-14	6.32E-15	3.72E-17	3.43E-07
Am-241	2.23E-08	4.21E-11	1.74E-13	9.16E-15	1.34E-13	6.04E-16	2.23E-08
Cs-137	3.20E-08	2.05E-08	2.55E-08	8.98E-09	1.07E-08	7.70E-11	9.77E-08
Pu-238	5.40E-07	9.97E-10	8.37E-12	1.10E-13	7.74E-14	6.77E-17	5.41E-07

Table B-2. Effective Doses by Exposure Pathway for the DOSEMM Verification Problem

Pu-239	1.12E-06	2.12E-09	1.74E-11	2.29E-13	6.65E-14	1.27E-16	1.12E-06
Pu-240	5.89E-07	1.11E-09	9.16E-12	1.21E-13	7.39E-14	6.57E-17	5.90E-07
Sr-90	9.63E-08	1.42E-07	1.66E-08	5.47E-09	1.65E-09	2.27E-13	2.62E-07
Co-60	4.05E-11	5.31E-12	6.29E-12	8.29E-13	6.70E-11	5.74E-13	1.21E-10
I-129	1.88E-08	2.56E-06	6.61E-07	1.24E-06	5.25E-09	1.94E-13	4.49E-06
I-131	2.10E-05	1.22E-04	8.66E-06	7.68E-05	1.43E-05	5.34E-08	2.43E-04
H-3	1.21E-07	5.61E-07	2.05E-07	3.44E-07			1.23E-06
C-14	2.55E-12	1.13E-11	1.43E-12	5.60E-12			2.08E-11
Kr-85						3.03E-08	3.03E-08
Ar-41						3.08E-06	3.08E-06
Total	2.39E-05	1.25E-04	9.57E-06	7.84E-05	1.44E-05	3.16E-06	2.55E-04

Ratios

DOSEMM/ASER	Inhalation	Vegetables	Meat	Milk	Ground	Submersion	Total
Pu-241	1.00	1.01	1.01	1.01	0.98	1.00	1.00
Am-241	1.00	1.00	1.00	1.00	2.03	1.00	1.00
Cs-137	1.00	1.01	1.01	1.01	1.00	1.00	1.00
Pu-238	1.00	1.01	1.01	1.01	1.00	1.00	1.00
Pu-239	1.00	1.01	1.01	1.01	1.00	1.00	1.00
Pu-240	1.00	1.01	1.01	1.01	1.01	1.00	1.00
Sr-90	1.00	1.03	1.02	1.02	0.99	1.00	1.02
Co-60	1.00	1.01	1.00	1.01	1.01	1.00	1.00
I-129	1.00	0.99	0.99	0.99	0.63	1.00	0.99
	1.00	0.98	0.98	0.99	1.11	1.00	0.99
H-3	1.06	0.92	0.83	1.05			0.96
C-14	1.06	1.03	2.42	0.60			1.01
Kr-85						1.06	1.06
Ar-41						1.07	1.07
Total Dose	1.00	0.98	0.98	0.99			0.99

Verification and Benchmark of Resuspension Equation

The ASER spreadsheet does not include resuspension. Therefore, the formulation of the resuspension equation in DOSEMM was benchmarked with the resuspension equation published in Reg Guide 3.51 NRC (1982) for a constant deposition rate and using the ASER radionuclides and release rates (ignoring Am-241 because the NRC equation does not include progeny ingrowth). Assuming a constant deposition rate, the air concentration from resuspension (C_{arip}) is given in Reg Guide 3.51 as

$$C_{arip}(t) = 0.01C_{adip} 10^{-5} \left[\frac{1 - \exp[-(\lambda R_i + \lambda)(t - a)]}{(\lambda R_i + \lambda)} + \frac{10^{-4} \delta(t) \exp[-\lambda R_i(t - a)] - \exp(\lambda R_i t)}{\lambda R_i} \right] \quad (\text{B-1})$$

where

λ_r	=	short-term resuspension decay constant (5.06 yr ⁻¹)
λR_i	=	effective removal rate constant from soil (yr ⁻¹)
$\delta(t)$	=	is zero if $t \leq 1.82$ and is unity
$0.01 C_{adip}$	=	air concentration times the deposition velocity (Ci m ⁻² yr ⁻¹)
a	=	is equal to $(t - 1.82)$ if $t > 1.82$, otherwise $a = 0$.

The short and long-term resuspension factors were 10^{-5} and 10^{-9} m⁻¹ respectively and the short-term resuspension decay constant was 5.06 yr⁻¹ (50 d half time). Equation B-1 provides the concentration at time t . The 1-year time-integrated concentration was approximated by numeric integration using a time step of 0.02 yr (7.3 d). This value was compared to the DOSEMM value at one year using $nresol=1$, $nresol=12$ and $iflag$ equal to true or false. The $nresol$ variable defines the number of periods in a year the release and X/Q and ψ/Q values are discretized with a year. For this case, the release rate was the same for all periods, but the concentration and deposition factors (X/Q and ψ/Q) values varied by period. For $nresol=1$, weighted average X/Q and ψ/Q values were used in DOSEMM (Table B-3). For use in the NRC equation, the total deposition rate over the year was used and was the same regardless of the setting of $nresol$. When $iflag$ is set to true and $nresol=12$, then integration limits for short-term resuspension are set incrementally within the year. The first integration limit for the first period is from the beginning of the year end of the year. The second limit is from the beginning of the second period to the end of the year (~0.91 yr). And the third limit is from the beginning of the third period to the end of the year (~0.83 yr) and so forth.

Table B-3. X/Q (s m⁻³) and ψ/Q (m⁻²) Values

	Period											
	1	2	3	4	5	6	7	8	9	10	11	12
X/Q	5.42E-08	3.86E-08	5.14E-08	3.46E-08	3.38E-08	3.86E-08	4.47E-08	4.89E-08	3.99E-08	4.70E-08	5.23E-08	7.45E-08
ψ/Q	6.20E-12	3.59E-12	1.14E-11	1.09E-11	1.75E-11	2.44E-12	6.73E-12	1.45E-11	1.73E-11	9.99E-12	6.30E-12	7.16E-12

The DOSEMM solution closest to the integrated NRC equation was with $nresol=12$ and $iflag=true$ (Table B-4). DOSEMM still slightly overestimated time-integrated concentrations. When $nresol=12$ or 1 and $iflag=false$, then DOSE overestimated the time-integrated concentration by about a factor of 1.24. This difference is not considered significant considering to overall uncertainty and variability in the resuspension model.

Table B-4 Parameters and Resuspension Benchmark Results

Parameter	Pu-241	Cs-137	Pu-238	Pu-239	Pu-240	Sr-90	Co-60
Radioactive decay (1/yr)	4.83E-02	2.31E-02	7.90E-03	2.88E-05	1.06E-04	2.41E-02	1.32E-01
Leach rate constant(1/yr)	1.19E-04	5.18E-05	1.19E-04	1.19E-04	1.19E-04	7.90E-03	2.38E-04
Effective removal (1/yr)	4.84E-02	2.31E-02	8.02E-03	1.48E-04	2.25E-04	3.20E-02	1.32E-01
C_{adip} (pCi m ⁻² -yr ⁻¹)	3.25E-02	1.67E-01	1.07E-03	2.01E-03	1.06E-03	1.28E-01	2.67E-04
NRC Conc (pCi m ⁻³)	6.32E-08	3.27E-07	2.10E-09	3.95E-09	2.08E-09	2.50E-07	5.12E-10
NRC TIC (pCi-yr m ⁻³)	5.12E-08	2.64E-07	1.70E-09	3.20E-09	1.68E-09	2.02E-07	4.16E-10
DOSEMM (pCi-yr/m ³)a	5.43E-08	2.79E-07	1.79E-09	3.37E-09	1.77E-09	2.14E-07	4.45E-10
DOSEMM (pCi-yr/m ³)b	6.34E-08	3.26E-07	2.09E-09	3.94E-09	2.07E-09	2.50E-07	5.20E-10
DOSEMM (pCi-yr/m ³)c	6.24E-08	3.25E-07	2.09E-09	3.96E-09	2.08E-09	2.47E-07	4.92E-10

a. nresol=12 and iflag=true

b. nresol=12 and iflag=false

c. nresol=1

To test the long-term resuspension factor, the source was turned off after one year and the resuspension concentration at 10 years was computed with DOSEMM. Recall that after the sufficient time, short-term resuspension is negligible and resuspension is governed by the long-term factor. Thus, the 1-yr time-integrated concentration from resuspension long after deposition has ceased is the surface soil concentration (C_i m⁻²) times the long-term resuspension factor (10^{-9} m⁻¹) times 1-yr. Table B-5 shows DOSEMM correctly predicts the time-integrated resuspension concentration 10-years after deposition has ceased.

Table B-5. Long-Term Resuspension Benchmark Results

Quantity	Pu-241	Cs-137	Pu-238	Pu-239	Pu-240	Sr-90	Co-60
TIC DOSEMM (pCi-yr/m ³)	1.96E-11	1.31E-10	9.82E-13	2.01E-12	1.06E-12	9.15E-11	6.71E-14
Soil Conc, 2025 (pCi/m ²)	1.96E-02	1.31E-01	9.82E-04	2.01E-03	1.06E-03	9.15E-02	6.71E-05

Appendix B References

- INL (Idaho National Laboratory). 2016. *Idaho National Laboratory Site Environmental Report*. DOE/ID-12082(15). Idaho National Laboratory, Environmental Surveillance, Education, and Research Program, Idaho Falls, Idaho.
- Moore, R.E., C.F. Baes III, L.M. McDowell-Boyer, A.P. Watson, F.O. Hoffman, J.C. Pleasant, and C.W. Miller. 1979. *AIRDOS-EPA: A Computerized Methodology for Estimating Environmental Concentrations and Dose to Man from Airborne Releases of Radionuclides*. EPA 520/1-79-009. EPA Office of Radiation Programs, Washington, D.C.
- NCRP (National Council on Radiation Protection and Measurements). 1996. *Screening Models for Releases of Radionuclides to Atmosphere, Surface, Water, and Ground*. NCRP Report No 123. NCRP, Bethesda, Maryland.

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- NRC. 1982. "Calculational Models for Estimating Radiation Doses to Man from Airborne Radioactive Materials Resulting from Uranium Milling Operations." *Regulatory Guide 3.51*. Washington, D.C.
- Rood, A.S. and A.J. Sondrup. 2014. *Development and Demonstration of a Methodology to Quantitatively Assess Ambient the INL Ambient Air Monitoring Network*. INL-EXT-33194. Idaho National Laboratory, Idaho Falls, Idaho.

Attachment to Appendix B: DOSEMM Input and Output Files

Particulate Parameter Definition File (Input)

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$ Title
'DOSEMM run for 2015 ASER - Particulate releases from INTEC' [title]
$ debug: turn on/off debug output
$ lgame: turn on/off lgame output
.FALSE. .FALSE. SFOOD [debug lgame]
$ Grid parameters
$ nx: number of nodes in EW direction
$ ny: number of nodes in NS direction
$ dx: node spacing
$ xsw: UTME coordinate of SW corner of domain
$ ysw: UTMN coordinate of SW corner of domain
$ ndiscrete: number of discrete receptors
120 100 2000 255000 4725000 36 [nx,ny,dx,xsw,ysw,ndiscrete]
$ repeat for each discrete receptor
341316, 4827515 1 BEA-TRA
343508, 4825927 2 BEA-CFP
335063, 4818552 3 BEA-RWMC
339762, 4822062 4 BEA-VAN B
416371, 4818571 5 BEA-IRC
391668, 4782760 6 BEA-BLKFT
360950, 4857752 7 BEA-SMC
358520, 4848894 8 BEA-GATE 4
352512, 4820235 9 BEA-ARA
337640, 4823710 10 BEA-REST
414380, 4818193 11 BEA-IF
345564, 4834399 12 BEA-NRF
341727, 4828168 13 BEA-RTC
337858, 4819578 14 BEA-EBR 1
366673, 4828121 15 BEA-MFC
440759, 4860651 16 BEA-SUGAR
348964, 4823312 17 BEA-PBF
344158, 4826806 18 BEA-INTEC
342602, 4821788 19 BEA-CFA
346110, 4829754 20 BEA-EFS
292750, 4815336 21 BEA-CRATERS
339764, 4822062 22 ESER-VAN
292751, 4815336 23 ESER-CRA
314683, 4832742 24 ESER-ARC
440759, 4860651 25 ESER-SUG
414376, 4818191 26 ESER-IDA
401640, 4892296 27 ESER-DUB
376885, 4874727 28 ESER-MON
375764, 4823554 29 ESER-FAA
346614, 4819341 30 ESER-MAI
346114, 4829751 31 ESER-EFS
353080, 4811691 32 ESER-ATO
391668, 4782752 33 ESER-MOU
352495, 4881840 34 ESER-BLU
381307, 4855031 35 ESER-TER
340891, 4849794 36 ESER-HOW

$ nsrcs: number of sources
$ nresol: number of subperiods in a year (1,2,3,4,6,12)
$ byear: beginning year of simulation
$ npartsize: number of particle size classes
1 12 2015 1 [nsrcs,nresol,byear,npartsize]
$ partsize(nparsize): AMAD particle size (um)
1 [partsize(nparsize)]
$ partmod(nparsize): particle size modifiers for resuspension
1.0 [partmod(nparsize)]
$ Source Block Variables Block- These variables are repeated for each source
$ srcname(nsrcs): Source name
$ srctype(nsrcs): Type of source (P= point A = Area)
$ partindx(nsrcs): Index to particle size released
$ (utms(nsrcs,j): UTME (j=1) and UTMN(j=2) of the source
$ filechiq(nsrcs): file name for chi/q file
$ filepsiq(nsrcs): file name for psi/q file
$ filerel(nsrcs): file name for releases
$ soption(nsrcs): plotting option: 0=exclude source from plots, 1=include source in plot
$ End of Source Block
$ Repeat Source Block for Each Source

INTEC P 1 [srcname(nsrcs)] srctype partindx
343830. 4825807. [utms(nsrcs,1) utms(nsrcs,2)]
$'...'./chiqvalues/INTEC_con_PM10.out' [filechiq(nsrcs)]
$'...'./chiqvalues/INTEC_dep_PM10.out' [filepsiq(nsrcs)]
$'...'./chiqvalues/INTEC_con3y-lum.out' [filechiq(nsrcs)]
$'...'./chiqvalues/INTEC_dep3y-lum.out' [filepsiq(nsrcs)]
$'...'./sourceterm/INTEC-Part.rel' [filerel(nsrcs)]
1 soption - plotting option [soption(nsrcs)]

$ ncontam: number of contaminants -FOR RADON SOURCES, NCONTAM MUST = 1
$ ctype: contaminant type, RA=radionuclide, NR=nonrad, RN=radon
$ norgans: number of organs
9 RA 1 [ncontam ctype norgans]
$ READ ONLY IF CTYPE=RA
$ organ(norgan): organ names

'Effective' [organ(norgan)]

```



```

$ READ ONLY IF CTYPE=RA
$ dcffile(1..4): dose conversion files for inhalation, ingestion, external, and submersion
'../infiles/INH.txt' [dcffile(1)]
'../infiles/ING.txt' [dcffile(2)]
'../infiles/EXT.txt' [dcffile(3)]
'../infiles/SUB.txt' [dcffile(4)]
'../infiles/GRD.txt' [dcffile(5)]
8.3e-2 8.3e-2 [intcut,extcit] half-life cutoff for
inclusion of progeny with parent dcf (years)
$ cname(ncntam): names of contaminants
Pu-241 Am-241 Np-237 Cs-137 Pu-238 Pu-239 Pu-240 Sr-90 Co-60 [cname(ncntam)]
$ bratio(ncntam): Branching ratio
1.0 1. 0. 0. 0. 0. 0. 0. [bratio(ncntam)]
$ READ ONLY IF CTYPE=RA
$ adtype(ncntam,nsrcs): inhalation absorption type
$ DCF
D D D D D D D D [adtype(ncntam,nsrcs)] CFA
'../infiles/NuclideData.dat' [filenuc]
'../infiles/ElementData.dat' [filelement]

$ READ ONLY IF CTYPE<>RN
$ rflt: long term resuspension factor (1.0e-9 from NRC 1975 and 1982 1/m)
$ rfst: short term resuspension factor (1-yr integrated value with intial value of 1e-5 (2.0E-6 1/m)
$ thkres: soil thickness for resuspension
$ thklch: soil thickness for leaching
$ infil: infiltration rate (m/yr)
$ theta: moisture content see RESRAD calculations
$ strc: short term resuspension time function (NRC half-time value of ~1-year yields 0.6769 1/yr)
$ rho: bulk density (g/cc)
$ aws: average wind speed (m/s)
1.0e-9 2.0e-6 0.03 0.15 0.010 0.2 0.6769 1.4 3.666
[rflt,rfst,thkres,thklch,infil,theta,strc,rho,aws]
$ READ ONLY IF CTYPE<>RN and FMODEL=CAP88
$ ddl: Fraction of radioactivity retained on leafy vegetables and produce after washing. (0.50)
$ fsubg: Fraction of produce grown in garden of interest (1.00)
$ fsubl: Fraction of leafy vegetables grown in garden of interest (1.00)
$ fsubp: Fraction of year animals graze on pasture (0.40)
$ fsubs: Fraction of daily feed that is pasture grass when animal grazes on pasture (0.43)
$ lamw: Removal rate for weathering from plants, d-1 (10-d half life = 0.0029 hr-1 = 0.0696 d-1 [cap88 default])
$ p: Effective surface density of soil kg/m2 (215.00)
0.50, 1.0, 1.0, 0.4, 0.43, 0.0696 215.0 [ddl,fsubg,fsubl,fsubp,fsubs,lamw,p]

$ qsubf: Consumption rate of contaminated feed or forage by an animal (dry wt), kg/da (15.60)
$ r1: Fallout interception fraction (pasture) (0.57)
$ r2: Fallout interception fraction (vegetables) (0.2)
$ th1: Time delay-ingestion of pasture grass by animals, days (0.00)
$ th2: Time delay-ingestion of stored feed by animals, days (90 days, 2,160.00 hrs)
$ th3: Time delay-ingestion of leafy vegetables by man, days (14 days 336.00 hrs)
$ th4: Time delay-ingestion of produce by man, days (14 days, 336.00 hr)
15.6 0.57, 0.2, 0.0, 90, 14, 14 [qsubf,r1,r2,th1,th2,th3,th4]
$ Note: CAP88 default parameters are in CAP88Def.FAC in the CAP88-3.0 directory
$ tsubB: Buildup time in soil, years (100 yrs, 876,000.00 hrs)
$ tsubE1: Period of exposure (grassy pasture), days (30 days, 720.00 hr)
$ tsubE2: Period of exposure (crops/leafy vegetables), days (60 days, 1,440.00 hr)
$ tsubF: Transport time: animal feed-milk-man, d (2.00)
$ tsubS: Average time from slaughter of meat animal to consumption, d (20.00)
$ tsubW: Time over which wild game is consumed (days)
$ ysubV1: Productivity: agriculture (grass-cow-milk-man pathway), kg/m2 (0.28) dry wt
$ ysubV2: Productivity: produce and leafy vegetables (wet), kg/m2 (0.716)
$ ysubV3: Productivity: produce and other vegetables (wet), kg/m2 (0.57)
100. 30. 60. 2.0 20.0 60.0 0.28 0.716 0.57 [tsubB, tsubE1, tsubE2,tsubF,tsubS,tsubW,ysubV1,ysubV2,ysubV3]

$ absH: absolute humidity, g/m3, (8 g/m3)
$ concC: atmospheric concentration of carbon, g/m3 (0.18 g/m3)
$ fw: fraction of veg that is water (0.97 -assumed)
$ fc: fraction of veg that is carbon (0.105 - derived from Till and Meyer, Table 9.2)
$ fwb: fraction of beef that is water (0.97 - assumed)
$ fwm: fraction of milk that is water (1.0 - assumed)
$ fcb: fraction of beef that is carbon (0.25 - derived from Till and Meyer, Table 9.2)
$ fcm: fraction of milk that is carbon (0.07 - derived from Till and Meyer, Table 9.2)
8.0, 0.18, 0.97, 0.105 0.97, 1.0, 0.25, 0.07 [absH, concC, fw, fc, fwb, fwm, fcb, fcm]
$ END READ ONLY IF CTYPE<>RN AND FMODEL=CAP88

$ READ ONLY IF CTYPE=RN
$ lambdaE: fractional air exchange of building with outdoors (1/s)
$ Murry and Burmaster 1995 give a range of 0.14(5th p) - 1.38(95th p) with a median of 0.4 h-1
$ Killough used the median value ([0.4 1/h]/3600 s = 1.11E-4 1/s)
$ dbar: diameter corresponding to mean surface area of condensation nuclei (m)
$ NCRP (1984) gives Dbar - 0.125 um as a typical average
$ vbar: average velocity of unattached RaA ions (m/s) NCRP 1984 gives a value of 1.38E2 m/s
$ cnuc: concentration of condensation nuclei indoors (nuclei/m**3)
$ NCRP 1984 gives typical range of 15000-120000 nucleu/cc. Killough uses 3E10 nuclei/m**3 (30000 nuclei/cc)
$ vunatt: deposition vel for plateau of unattached RaA on interior surfaces (m/s).
$ Knutson 1988 gives 8 m/hr (2.22E-3 m/s)
$ vatt: deposition vel for plateau of attached RaA on interior surfaces
$ Knutson 1988 gives 0.2 m/hr (5.55E-5 1/s)
$ stvol: indoor surface to volume ratio (1.0 to 3.0 1/m. Killough used 2.0 1/m)
$ 1.11e-4 1.25E-7 138. 3.0E10 2.22E-3 5.55E-5 2.0 [lambdaE Dbar vbar cnuc vunatt vatt
stvol]
$ END OF READ ONLUT IF CTYPE=RN

$ coption(ncntam): Contaminant plot option, 0= no plot, 1=plot
0 0 0 0 0 0 0 0 0 [coption(ncntam)]
$ Type of plot - Set to 0 to not plot, 1 to plot

```

```

$ poption(1) = plot tic
$ poption(2) = plot average concentration
$ poption(3) = plot deposition
0 0 0 [poption(i),i=1,3]
$ cf(4): conversion factors for output
$ cf(1) cf for tic and avg conc
$ cf(2) cf for deposition and soil concentration, set to 2.22E7 for pCi/g in 0-3 cm layer assuming rho=1.5 g/cc
$ cf(3) cf for vegetables
$ cf(4) df for milk
$ cf(5) cf for meat and wild game
$ cf(6) cf for deposition and subsurface soil concentration, set to 4.44e6 for pCi/g in 0-15 cm layer assuming
rho=1.5 g/cc

1.0e12 'pCi/m3' [cf(1)] air concentration
1.0e12 'pCi/m2' [cf(2)] annual deposition
converted to conc in 0-15 cm layer
1.0e12 'pCi/m2' [cf(3)] surface soil
concentration
1.0e12 'pCi/kg' [cf(4)] veg concentrations
1.0e12 'pCi/L' [cf(5)] milk concentrations
1.0e12 'pCi/kg' [cf(6)] beef and wild game
concentrations
1.0e12 'pCi/m2' [cf(7)] subsurface soil
concentrations

$ READ ONLY IF ORGAN(1)<=>NONE
$ filexp: receptor intake rates
'../infiles/refperson_intakes.dat' [filexp]
1 nrecept
$ utmr(nrecept,1), utmr(nrecept,2): UTM East (1) and UTM North (2) coordinates of source
$ syr(nrecept): start year of exposure (year)
$ spr(nrecept): starting sub-period
$ eyr(nrecept): end year of exposure period (year)
$ epr(nrecept): ending sub-period
$ yob(nrecept): year of birth
$ fi(nrecept): fraction of time spent indoors
$ ef(nrecept): exposure frequency (h/d)
$ et(nrecept): exposure time (d/yr)
$ inh(nrecept): inhalation rate modifying factor (inhalation rate in m*3/hr)
$ ingm(nrecept): soil ingestion modification factor (soil ingestion in g/d)
$ ingv(nrecept): vegetable ingestion modification factor
$ ingb(nrecept): beef ingestion modification factor
$ ingm(nrecept): milk ingestion modification factor
$ ingw(nrecept): wild game ingestion modification factor
$ cindo(nrecept): ratio of indoor to outdoor air
$ esf: external exposure indoor shielding factor
$ ssf: submersion indoor shielding factor

$MEI03 Frenchman's cabin
333528,4810277, 2015 1 2015 12 1957 [utmr(1,1) utm(i,2) syr spr eyr epr yob]
0.0 24.0 365 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 [fi(i),ef(i),et(i),inh(i),ingm(i),ingv(i),ingb(i),
ingm(i), ingw(i), cindo(i)], esf(i), ssf(i)
$ nsim: number of Monte Carlo simulations - set nsim=0 for no monte carlo sampling
$ srand: random number seed
0 -23432 [nsim,srand]
$ fileu: uncertainty parameter definitions - Read only if nsim>0
$ fileu: uncertainty parameter definitions - Read only if nsim>0
'../distributions.par' [fileu]
'../dcfs/dcfuncert.dat'
$ END

```

H-3 and C-14 Parameter Definition File (Input)

```

$ Title
'DOSEMM run for 2015 ASER - H-3 and C-14 releases from INTEC' [title]
$ debug: turn on/off debug output
$ lgame: turn on/off lgame output
.FALSE. .FALSE. SFOOD [debug lgame]
$ Grid parameters
$ nx: number of nodes in EW direction
$ ny: number of nodes in NS direction
$ dx: node spacing
$ xsw: UTME coordinate of SW corner of domain
$ ysw: UTMN coordinate of SW corner of domain
$ ndiscrete: number of discrete receptors
120 100 2000 255000 4725000 36 [nx,ny,dx,xsw,ysw,ndiscrete]
$ repeat for each discrete receptor
341316 , 4827515 1 BEA-TRA
343508 , 4825927 2 BEA-CPP
335063 , 4818552 3 BEA-RWMC
339762 , 4822062 4 BEA-VAN B
416371 , 4818571 5 BEA-IRC
391668 , 4782760 6 BEA-BLKFT
360950 , 4857752 7 BEA-SMC
358520 , 4848894 8 BEA-GATE 4
352512 , 4820235 9 BEA-ARA
337640 , 4823710 10 BEA-REST
414380 , 4818193 11 BEA-IF
345564 , 4834399 12 BEA-NRF
341727 , 4828168 13 BEA-RTC
337858 , 4819578 14 BEA-EBR 1
366673 , 4828121 15 BEA-MFC
440759 , 4860651 16 BEA-SUGAR
348964 , 4823312 17 BEA-PBF

```

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344158 , 4826806 18 BEA-INTEC
342602 , 4821788 19 BEA-CFA
346110 , 4829754 20 BEA-EFS
292750 , 4815336 21 BEA-CRATERS
339764 , 4822062 22 ESER-VAN
292751 , 4815336 23 ESER-CRA
314683 , 4832742 24 ESER-ARC
440759 , 4860651 25 ESER-SUG
414376 , 4818191 26 ESER-IDA
401640 , 4892296 27 ESER-DUB
376885 , 4874727 28 ESER-MON
375764 , 4823554 29 ESER-FAA
346614 , 4819341 30 ESER-MAI
346114 , 4829751 31 ESER-EFS
353080 , 4811691 32 ESER-ATO
391668 , 4782752 33 ESER-MOU
352495 , 4881840 34 ESER-BLU
381307 , 4855031 35 ESER-TER
340891 , 4849794 36 ESER-HOW

$ nsrcs: number of sources
$ nresol: number of subperiods in a year (1,2,3,4,6,12)
$ byear: beginning year of simulation
$ npartsize: number of partile size classes
1 12 2015 1 [nsrcs,nresol,byear,npartsize]
$ partsize(nparsize): AMAD particle size (um)
1.0 [partsize(nparsize)]
$ partmod(nparsize): particle size modifiers for resuspension
1.0 [partmod(nparsize)]
$ Source Block Variables Block- These varaibles are repeated for each source
$ srcname(nsrcs): Source name
$ srctype(nsrcs): Type of source (P= point A = Area)
$ partindx(nsrcs): Index to particle size released
$ (utms(nsrcs,j): UTME (j=1) and UTMN(j=2) of the source
$ filechiq(nsrcs): file name for chi/q file
$ filepsiq(nsrcs): file name for psi/q file
$ filerel(nsrcs): file name for releases
$ soption(nsrcs): plotting option: 0=exclude soure from plots, 1=include source in plot
$ End of Source Block
$ Repeat Source Block for Each Source

INTEC P 1 [srcname(nsrcs)] srctype partindx
343830. 4825807. [utms(nsrcs,1) utms(nsrcs,2)]
'../chiqvalues/INTEC_con_PM0.out' [filechiq(nsrcs)]
'../chiqvalues/INTEC_dep_PM0.out' [filepsiq(nsrcs)]
'../sourceterm/INTEC-H3C14.rel' [filerel(nsrcs)]
1 soption - plotting option [soption(nsrcs)]

$ ncontam: number of contaminants -FOR RADON SOURCES, NCONTAM MUST = 1
$ ctype: contaminant type, RA=radionuclide, NR=nonrad, RN=radon
$ norgans: number of organs
2 RA 1 [ncontam ctype norgans]
$ READ ONLY IF CTYPE=RA
$ organ(norgan): organ names

'Effective' [organ(norgan)]
$ READ ONLY IF CTYPE=RA
$ dcffile(1..4): dose conversion files for inhalation, ingestion, external, and submersion
'../infiles/INH.txt' [dcffile(1)]
'../infiles/ING.txt' [dcffile(2)]
'../infiles/EXT.txt' [dcffile(3)]
'../infiles/SUB.txt' [dcffile(4)]
'../infiles/GRD.txt' [dcffile(5)]
8.3e-2 8.3e-2 [intcut,extcit] half-life cutoff for inclusion of progeny with parent dcf
(years)
$ cname(ncontam): names of contaminants
H-3 C-14 [cname(ncontam)]
$ bratio(ncontam): Branching ratio
0.0 0.0 [bratio(ncontam)]
$ READ ONLY IF CTYPE=RA
$ adtype(ncontam,nsrcs): inhalation absorption type
$ DCF
D D [adtype(ncontam,nsrcs)] CFA
'../infiles/NuclideData.dat' [filenuc]
'../infiles/ElementData.dat' [fileelement]

$ READ ONLY IF CTYPE<>RN
$ rflt: long term resuspension factor (1.0e-9 from NRC 1975 and 1982 1/m)
$ rfst: short term resuspension factor (1-yr integrated value with initial value of 1e-5 (2.0E-6 1/m)
$ thkres: soil thickness for resuspension
$ thklch: soil thickness for leaching
$ infil: infiltration rate (m/yr)
$ theta: moisture content see RESRAD calculations
$ strc: short term resuspension time function (NRC half-time value of ~1-year yields 0.6769 1/yr)
$ rho: bulk density (g/cc)
$ aws: average wind speed (m/s)
1.0e-9 2.0e-6 0.03 0.15 0.10 0.2 0.6769 1.4 4.0
[rflt,rfst,thkres,thklch,infil,theta,strc,rho,aws]
$ READ ONLY IF CTYPE<>RN and FMODEL=CAP88
$ ddl: Fraction of radioactivity retained on leafy vegetables and produce after washing. (0.50)
$ fsubg: Fraction of produce grown in garden of interest (1.00)
$ fsubl: Fraction of leafy vegetables grown in garden of interest (1.00)
$ fsubp: Fraction of year animals graze on pasture (0.40)
$ fsubs: Fraction of daily feed that is pasture grass when animal grazes on pasture (0.43)

```

```

$ lamw: Removal rate for weathering from plants, d-1 (10-d half life = 0.0029 hr-1 = 0.0696 d-1 [cap88 default])
$ p: Effective surface density of soil kg/m2 (215.00)
0.50, 1.0, 1.0, 0.4, 0.43, 0.0696 215.0 [ddl,fsubg,fsubl,fsubp,fsubs,lamw,p]

$ qsubf: Consumption rate of contaminated feed or forage by an animal (dry wt), kg/da (15.60)
$ r1: Fallout interception fraction (pasture) (0.57)
$ r2: Fallout interception fraction (vegetables) (0.2)
$ th1: Time delay-ingestion of pasture grass by animals, days (0.00)
$ th2: Time delay-ingestion of stored feed by animals, days (90 days, 2,160.00 hrs)
$ th3: Time delay-ingestion of leafy vegetables by man, days (14 days 336.00 hrs)
$ th4: Time delay-ingestion of produce by man, days (14 days, 336.00 hr)
15.6 0.57, 0.2, 0.0, 90, 14, 14 [qsubf,r1,r2,th1,th2,th3,th4]
$ Note: CAP88 default parameters are in CAP88Def.FAC in the CAP88-3.0 directory
$ tsubB: Buildup time in soil, years (100 yrs, 876,000.00 hrs)
$ tsubE1: Period of exposure (grassy pasture), days (30 days, 720.00 hr)
$ tsubE2: Period of exposure (crops/leafy vegetables), days (60 days, 1,440.00 hr)
$ tsubF: Transport time: animal feed-milk-man, d (2.00)
$ tsubS: Average time from slaughter of meat animal to consumption, d (20.00)
$ tsubW: Time over which wild game is consumed (days)
$ ysubV1: Productivity: agriculture (grass-cow-milk-man pathway), kg/m2 (0.28) dry wt
$ ysubV2: Productivity: produce and leafy vegetables (wet), kg/m2 (0.716)
$ ysubV3: Productivity: produce and other vegetables (wet), kg/m2 (0.57)
0. 30. 60. 2.0 20.0 60.0 0.28 0.716 0.57 [tsubB, tsubE1, tsubE2,tsubF,tsubS,tsubW,ysubV1,ysubV2,ysubV3]

$ absH: absolute humidity, g/m3, (8 g/m3)
$ concC: atmospheric concentration of carbon, g/m3 (0.18 g/m3)
$ fw: fraction of veg that is water (0.97 -assumed, 0.824 in CAP88)
$ fc: fraction of veg that is carbon (0.105 - derived from Till and Meyer, Table 9.2, 0.339 in CAP88)
$ fwB: fraction of beef that is water (0.97 - assumed, 0.623 in CAP88)
$ fwm: fraction of milk that is water (1.0 - assumed)
$ fcb: fraction of beef that is carbon (0.25 - derived from Till and Meyer, Table 9.2,0.491 in CAP88, 0.23 NCRP)
$ fcm: fraction of milk that is carbon (0.07 - derived from Till and Meyer, Table 9.2, 0.169 in CAP88)
4.9, 0.18, 0.824, 0.339 0.623, 1.0, 0.23, 0.169 [absH, concC, fw, fc, fwB, fwm, fcb, fcm]
$ END READ ONLY IF CTYPE<>RN AND FMODEL=CAP88

$ READ ONLY IF CTYPE=RN
$ lambdaE: fractional air exchange of building with outdoors (1/s)
$ Murry and Burmaster 1995 give a range of 0.14(5th p) - 1.38(95th p) with a median of 0.4 h-1
$ Killough used the median value ([0.4 1/h]/3600 s = 1.11E-4 1/s)
$ dbar: diameter corresponding to mean surface area of condensation nuclei (m)
$ NCRP (1984) gives Dbar - 0.125 um as a typical average
$ vbar: average velocity of unattached RaA ions (m/s) NCRP 1984 gives a value of 1.38E2 m/s
$ cnuc: concentration of condensation nuclei indoors (nuclei/m**3)
$ NCRP 1984 gives typical range of 15000-120000 nucleu/cc. Killough uses 3E10 nuclei/m**3 (30000 nuclei/cc)
$ vunatt: deposition vel for plateau of unattached RaA on interior surfaces (m/s).
$ Knutson 1988 gives 8 m/hr (2.22E-3 m/s)
$ vatt: deposition vel for plateau of attached RaA on interior surfaces
$ Knutson 1988 gives 0.2 m/hr (5.55E-5 1/s)
$ stvol: indoor surface to volume ratio (1.0 to 3.0 1/m. Killough used 2.0 1/m)
$ 1.11e-4 1.25E-7 138. 3.0E10 2.22E-3 5.55E-5 2.0 [lambdaE Dbar vbar cnuc vunatt vatt
stvol]
$ END OF READ ONLUT IF CTYPE=RN

$ coption(ncontam): Contaminant plot option, 0= no plot, 1=plot
0 0 [coption(ncontam)]
$ Type of plot - Set to 0 to not plot, 1 to plot
$ poption(1) = plot tic
$ poption(2) = plot average concentration
$ poption(3) = plot deposition
0 0 0 [pooption(i),i=1,3]
$ cf(4): conversion factors for output
$ cf(1) cf for tic and avg conc
$ cf(2) cf for deposition and soil concentration, set to 2.22E7 for pCi/g in 0-3 cm layer assuming rho=1.5 g/cc
$ cf(3) cf for vegetables
$ cf(4) df for milk
$ cf(5) cf for meat and wild game
$ cf(6) cf for deposition and subsurface soil concentration, set to 4.44e6 for pCi/g in 15 cm layer assuming
rho=1.5 g/cc

1.0e12 'pCi/m3' [cf(1)] air concentration
4.46e6 'pCi/g' [cf(2)] annual deposition converted to conc in 0-15 cm
layer
1.0e12 'pCi/m2' [cf(3)] surface soil concentration
1.0e12 'pCi/kg' [cf(4)] veg concentrations
1.0e12 'pCi/L' [cf(5)] milk concentrations
1.0e12 'pCi/kg' [cf(6)] beef and wild game concentrations
1.0e12 'pCi/m2' [cf(7)] subsurface soil concentrations

$ READ ONLY IF ORGAN(1)<=>NONE
$ fileexp: receptor intake rates
'../../infiles/refperson_intakes.dat' [fileexp]
1 nrecept
$ utmr(nrecept,1), utmr(nrecept,2): UTM East (1) and UTM North (2) coordinates of source
$ syr(nrecept): start year of exposure (year)
$ spr(nrecept): starting sub-period
$ eyr(nrecept): end year of exposure period (year)
$ epr(nrecept): ending sub-period
$ yob(nrecept): year of birth
$ fi(nrecept): fraction of time spent indoors
$ ef(nrecept): exposure frequency (h/d)
$ et(nrecept): exposure time (d/yr)
$ inhM(nrecept): inhalation rate modifying factor (inhalation rate in m**3/hr)
$ ingSM(nrecept): soil ingestion modification factor (soil ingestion in g/d)
$ ingVM(nrecept): vegetable ingestion modification factor

```

```

$ ingbm(nrecept): beef ingestion modification factor
$ ingmm(nrecept): milk ingestion modification factor
$ ingwm(nrecept): wild game ingestion modification factor
$ cindoor(nrecept): ratio of indoor to outdoor air
$ esf: external exposure indoor shielding factor
$ ssf: submersion indoor shielding factor

SMEI03 Frenchman's cabin
333528,4810277, 2015 1 2015 12 1957 [utm(1,1) utm(i,2) syr spr eyr epr yob]
0.0 24.0 365 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 [fi(i),ef(i),et(i),inhm(i),ingsm(i),ingvm(i),ingbm(i),
ingmm(i), ingwm(i), cindoor(i)], esf(i), ssf(i)
$ nsim: number of Monte Carlo simulations - set nsim=0 for no monthe carlo sampling
$ srand: random number seed
0 -23432 [nsim,srand]
$ fileu: uncertainty parameter definitions - Read only if nsim>0
$ filev: uncertainty parameter definitions - Read only if nsim>0
'./distributions.par' [fileu]
'././dcfs/dcfuncert.dat'
$ END

```

Iodine Parameter Definition File (Input)

```

$ Title
'DOSEMM run for 2015 ASER - iodine releases from INTEC' [title]
$ debug: turn on/off debug output
$ lgame: turn on/off lgame output
.FALSE. .FALSE. SFOOD [debug lgame]
$ Grid parameters
$ nx: number of nodes in EW direction
$ ny: number of nodes in NS direction
$ dx: node spacing
$ xsw: UTME coordinate of SW corner of domain
$ ysw: UTMN coordinate of SW corner of domain
$ ndiscrete: number of discrete receptors
120 100 2000 255000 4725000 36 UTM 12 [nx,ny,dx,xsw,ysw,ndiscrete,gtype,utmzone]
$ repeat for each discrete receptor
341316 , 4827515 1 BEA-TRA
343508 , 4825927 2 BEA-CPP
335063 , 4818552 3 BEA-RWMC
339762 , 4822062 4 BEA-VAN B
416371 , 4818571 5 BEA-IRC
391668 , 4782760 6 BEA-BLKFT
360950 , 4857752 7 BEA-SMC
358520 , 4848894 8 BEA-GATE 4
352512 , 4820235 9 BEA-ARA
337640 , 4823710 10 BEA-REST
414380 , 4818193 11 BEA-IF
345564 , 4834399 12 BEA-NRF
341727 , 4828168 13 BEA-RTC
337858 , 4819578 14 BEA-EBR 1
366673 , 4828121 15 BEA-MFC
440759 , 4860651 16 BEA-SUGAR
348964 , 4823312 17 BEA-PBF
344158 , 4826806 18 BEA-INTEC
342602 , 4821788 19 BEA-CFA
346110 , 4829754 20 BEA-EFS
292750 , 4815336 21 BEA-CRATERS
339764 , 4822062 22 ESER-VAN
292751 , 4815336 23 ESER-CRA
314683 , 4832742 24 ESER-ARC
440759 , 4860651 25 ESER-SUG
414376 , 4818191 26 ESER-IDA
401640 , 4892296 27 ESER-DUB
376885 , 4874727 28 ESER-MON
375764 , 4823554 29 ESER-FAA
346614 , 4819341 30 ESER-MAI
346114 , 4829751 31 ESER-EFS
353080 , 4811691 32 ESER-ATO
391668 , 4782752 33 ESER-MOU
352495 , 4881840 34 ESER-BLU
381307 , 4855031 35 ESER-TER
340891 , 4849794 36 ESER-HOW

$ nsrcs: number of sources
$ nresol: number of subperiods in a year (1,2,3,4,6,12)
$ byear: begining year of simulation
$ npartsize: number of partile size classes
1 12 2015 1 [nsrcs,nresol,byear,npartsize]
$ partsize(nparsize): AMAD particle size (um)
1 [partsize(nparsize)]
$ partmod(nparsize): particle size modifiers for resuspension
1.0 [partmod(nparsize)]
$ Source Block Variables Block- These varaibles are repeated for each source
$ srcname(nsrcs): Source name
$ srctype(nsrcs): Type of source (P= point A = Area)
$ partindx(nsrcs): Index to particle size released
$ (utms(nsrcs,j): UTME (j=1) and UTMN(j=2) of the source
$ filechiq(nsrcs): file name for chi/q file
$ filepsiq(nsrcs): file name for psi/q file
$ filerel(nsrcs): file name for releases
$ soption(nsrcs): plotting option: 0=exclude soure from plots, 1=include source in plot
$ End of Source Block
$ Repeat Source Block for Each Source

```

INTEC P 1

[srcname(nsrcs)] srctype partindx

```

343830. 4825807.                                [utms(nsracs,1) utms(nsracs,2)]
'../chigvalues/INTEC_con_PM15.out'                [filechig(nsracs)]
'../chigvalues/INTEC_dep_PM15.out'                [filepsig(nsracs)]
'../sourceterm/INTEC-iodine.rel'                  [filerel(nsracs)]
1                                                    [soption(nsracs)]
                                                    soption - plotting option

$ ncontam: number of contaminants -FOR RADON SOURCES, NCONTAM MUST = 1
$ ctype: contaminant type, RA=radionuclide, NR=nonrad, RN=radon
$ norgans: number of organs
2 RA 1 [ncontam ctype norgans]
$ READ ONLY IF CTYPE=RA
$ organ(norgan): organ names

'Effective' [organ(norgan)]
$ READ ONLY IF CTYPE=RA
$ dcffile(1.4): dose conversion files for inhalation, ingestion, external, and submersion
'../infiles/INH.txt' [dcffile(1)]
'../infiles/ING.txt' [dcffile(2)]
'../infiles/EXT.txt' [dcffile(3)]
'../infiles/SUB.txt' [dcffile(4)]
'../infiles/GRD.txt' [dcffile(5)]
8.3e-2 8.3e-2 [intcut,extcut] half-life cutoff for
inclusion of progeny with parent dcf (years)
$ cname(ncontam): names of contaminants
I-129 I-131 [cname(ncontam)]
$ bratio(ncontam): Branching ratio
0.0 0.0 0.0 0.0 [bratio(ncontam)]
$ READ ONLY IF CTYPE=RA
$ adtype(ncontam,nsracs): inhalation absorption type
$ DCF
D D D D D [adtype(ncontam,nsracs)] CFA
'../infiles/NuclideData.dat' [filenucl]
'../infiles/ElementData.dat' [fileelement]

$ READ ONLY IF CTYPE<>RN
$ rflt: long term resuspension factor (1.0e-9 from NRC 1975 and 1982 1/m)
$ rfst: short term resuspension factor (1-yr integrated value with intial value of 1e-5 (2.0E-6 1/m)
$ thkres: soil thickness for resuspension
$ thklch: soil thickness for leaching
$ infil: infiltration rate (m/yr)
$ theta: moisture content see RESRAD calculations
$ strc: short term resuspension time function (NRC half-time value of ~1-year yields 0.6769 1/yr)
$ rho: bulk density (g/cc)
$ aws: average wind speed (m/s)
1.0e-9 2.0e-6 0.03 0.15 0.010 0.2 0.6769 1.4 3.66
[rflt,rfst,thkres,thklch,infil,theta,strc,rho,aws]
$ READ ONLY IF CTYPE<>RN and FMODEL=CAP88
$ ddl: Fraction of radioactivity retained on leafy vegetables and produce after washing. (0.50)
$ fsubg: Fraction of produce grown in garden of interest (1.00)
$ fsubl: Fraction of leafy vegetables grown in garden of interest (1.00)
$ fsubp: Fraction of year animals graze on pasture (0.40)
$ fsubs: Fraction of daily feed that is pasture grass when animal grazes on pasture (0.43)
$ lamw: Removal rate for weathering from plants, d-1 (10-d half life = 0.0029 hr-1 = 0.0696 d-1 [cap88 default])
$ p: Effective surface density of soil kg/m2 (215.00)
0.50, 1.0, 1.0, 0.4, 0.43, 0.0696 215.0 [ddl,fsubg,fsubl,fsubp,fsubs,lamw,p]

$ qsubf: Consumption rate of contaminated feed or forage by an animal (dry wt), kg/da (15.60)
$ r1: Fallout interception fraction (pasture) (0.57)
$ r2: Fallout interception fraction (vegetables) (0.2)
$ th1: Time delay-ingestion of pasture grass by animals, days (0.00)
$ th2: Time delay-ingestion of stored feed by animals, days (90 days, 2,160.00 hrs)
$ th3: Time delay-ingestion of leafy vegetables by man, days (14 days 336.00 hrs)
$ th4: Time delay-ingestion of produce by man, days (14 days, 336.00 hr)
15.6 0.57, 0.2, 0.0, 90, 14, 14 [qsubf,r1,r2,th1,th2,th3,th4]
$ Note: CAP88 default parameters are in CAP88Def.FAC in the CAP88-3.0 directory
$ tsubB: Buildup time in soil, years (100 yrs, 876,000.00 hrs)
$ tsubE1: Period of exposure (grassy pasture), days (30 days, 720.00 hr)
$ tsubE2: Period of exposure (crops/leafy vegetables), days (60 days, 1,440.00 hr)
$ tsubF: Transport time: animal feed-milk-man, d (2.00)
$ tsubS: Average time from slaughter of meat animal to consumption, d (20.00)
$ tsubW: Time over which wild game is consumed (days)
$ ysubV1: Productivity: agriculture (grass-cow-milk-man pathway), kg/m2 (0.28) dry wt
$ ysubV2: Productivity: produce and leafy vegetables (wet), kg/m2 (0.716)
$ ysubV3: Productivity: produce and other vegetables (wet), kg/m2 (0.57)
100. 30. 60. 2.0 20.0 60.0 0.28 0.716 [tsubB, tsubE1, tsubE2,tsubF,tsubS,tsubW,ysubV1,ysubV2,ysubV3]

$ absH: absolute humidity, g/m3, (8 g/m3)
$ concC: atmospheric concentration of carbon, g/m3 (0.18 g/m3)
$ fw: fraction of veg that is water (0.97 -assumed)
$ fc: fraction of veg that is carbon (0.105 - derived from Till and Meyer, Table 9.2)
$ fwb: fraction of beef that is water (0.97 - assumed)
$ fwm: fraction of milk that is water (1.0 - assumed)
$ fcb: fraction of beef that is carbon (0.25 - derived from Till and Meyer, Table 9.2)
$ fcm: fraction of milk that is carbon (0.07 - derived from Till and Meyer, Table 9.2)
8.0, 0.18, 0.97, 0.105 0.97, 1.0, 0.25, 0.07 [absH, concC, fw, fc, fwb, fwm, fcb, fcm]
$ END READ ONLY IF CTYPE<>RN AND FMODEL=CAP88

$ READ ONLY IF CTYPE=RN
$ lambdaE: fractional air exchange of building with outdoors (1/s)
$ Murry and Burmaster 1995 give a range of 0.14(5th p) - 1.38(95th p) with a median of 0.4 h-1
$ Killough used the median value ([0.4 1/h]/3600 s = 1.11E-4 1/s)
$ dbar: diameter corresponding to mean surface area of condensation nuclei (m)
$ NCRP (1984) gives Dbar - 0.125 um as a typical average
$ vbar: average velocity of unattached RaA ions (m/s) NCRP 1984 gives a value of 1.38E2 m/s

```

```

$ cnuc: concentration of condensation nuclei indoors (nuclei/m**3)
$      NCRP 1984 gives typical range of 15000-120000 nucleu/cc. Killough uses 3E10 nuclei/m**3 (30000 nuclei/cc)
$ vunatt: deposition vel for plateau of unattached RaA on interior surfaces (m/s).
$      Knutson 1988 gives 8 m/hr (2.22E-3 m/s)
$ vatt:  deposition vel for plateau of attached RaA on interior surfaces
$      Knutson 1988 gives 0.2 m/hr (5.55E-5 1/s)
$ stvol: indoor surface to volume ratio (1.0 to 3.0 1/m. Killough used 2.0 1/m)
$ 1.11e-4 1.25E-7 138. 3.0E10 2.22E-3 5.55E-5 2.0 [lambdaE Dbar vbar cnuc vunatt vatt
stvol]
$ END OF READ ONLUT IF CTYPE=RN

$ coption(ncontam): Contaminant plot option, 0= no plot, 1=plot
0 0 0 0 0 [coption(ncontam)]
$ Type of plot - Set to 0 to not plot, 1 to plot
$ poption(1) = plot tic
$ poption(2) = plot average concentration
$ poption(3) = plot deposition
0 0 0 [poption(i),i=1,3]
$ cf(4): conversion factors for output
$ cf(1) cf for tic and avg conc
$ cf(2) cf for deposition and soil concentration, set to 2.22E7 for pCi/g in 0-3 cm layer assuming rho=1.5 g/cc
$ cf(3) cf for vegetables
$ cf(4) df for milk
$ cf(5) cf for meat and wild game
$ cf(6) cf for deposition and subsurface soil concentration, set to 4.44e6 for pCi/g in 0-15 cm layer assuming
rho=1.5 g/cc
1.0e12 'pCi/m3' [cf(1)] air concentration
1.0e12 'pCi/m2' [cf(2)] annual deposition
converted to conc in 0-15 cm layer
1.0e12 'pCi/m2' [cf(3)] surface soil
concentration
1.0e12 'pCi/kg' [cf(4)] veg concentrations
1.0e12 'pCi/L' [cf(5)] milk concentrations
1.0e12 'pCi/kg' [cf(6)] beef and wild game
concentrations
1.0e12 'pCi/m2' [cf(7)] subsurface soil
concentrations

$ READ ONLY IF ORGAN(1)<=>NONE
$ filexp: receptor intake rates
'../infiles/refperson_intakes.dat' [filexp]
1 nrecept
$ utmr(nrecept,1), utmr(nrecept,2): UTM East (1) and UTM North (2) coordinates of source
$ syr(nrecept): start year of exposure (year)
$ spr(nrecept): starting sub-period
$ eyr(nrecept): end year of exposure period (year)
$ epr(nrecept): ending sub-period
$ yob(nrecept): year of birth
$ fi(nrecept): fraction of time spent indoors
$ ef(nrecept): exposure frequency (h/d)
$ et(nrecept): exposure time (d/yr)
$ inhnm(nrecept): inhalation rate modifying factor (inhalation rate in m**3/hr)
$ ingmsm(nrecept): soil ingestion modification factor (soil ingestion in g/d)
$ ingvm(nrecept): vegetable ingestion modification factor
$ ingbm(nrecept): beef ingestion modification factor
$ ingmm(nrecept): milk ingestion modification factor
$ ingwm(nrecept): wild game ingestion modification factor
$ cindoor(nrecept): ratio of indoor to outdoor air
$ esf: external exposure indoor shielding factor
$ ssf: submersion indoor shielding factor

$MEI03 Frenchman's cabin
333528,4810277, 2015 1 2015 12 1957 [utmr(1,1) utm(i,2) syr spr eyr epr yob]
0.0 24.0 365 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 [fi(i),ef(i),et(i),inhm(i),ingmsm(i),ingvm(i),ingbm(i),
ingmm(i),ingwm(i), cindoor(i)], esf(i), ssf(i)]

$ nsim: number of Monte Carlo simulations - set nsim=0 for no monthe carlo sampling
$ srand: random number seed
0 -23432 [nsim,srand]
$ fileu: uncertainty parameter definitions - Read only if nsim>0
$ fileu: uncertainty parameter definitions - Read only if nsim>0
'../distributions.par' [fileu]
'../dcfs/defuncert.dat'
$ END

```

Nobel Gas Parameter Definition File (Input)

```

$ Title
'DOSEMM run for 2015 ASER - nobel gas releases from INTEC' [title]
$ debug: turn on/off debug output
$ lgame: turn on/off lgame output
.FALSE. .FALSE. NONE [debug lgame]
$ Grid parameters
$ nx: number of nodes in EW direction
$ ny: number of nodes in NS direction
$ dx: node spacing
$ xsw: UTME coordinate of SW corner of domain
$ ysw: UTMN coordinate of SW corner of domain
$ ndiscrete: number of discrete receptors
120 100 2000 255000 4725000 36 [nx,ny,dx,xsw,ysw,ndiscrete]
$ repeat for each discrete receptor
341316 , 4827515 1 BEA-TRA
343508 , 4825927 2 BEA-CPP
335063 , 4818552 3 BEA-RWMC

```

```

339762 , 4822062    4 BEA-VAN B
416371 , 4818571    5 BEA-IRC
391668 , 4782760    6 BEA-BLKFT
360950 , 4857752    7 BEA-SMC
358520 , 4848894    8 BEA-GATE 4
352512 , 4820235    9 BEA-ARA
337640 , 4823710   10 BEA-REST
414380 , 4818193   11 BEA-IF
345564 , 4834399   12 BEA-NRF
341727 , 4828168   13 BEA-RTC
337858 , 4819578   14 BEA-EBR 1
366673 , 4828121   15 BEA-MFC
440759 , 4860651   16 BEA-SUGAR
348964 , 4823312   17 BEA-PBF
344158 , 4826806   18 BEA-INTEC
342602 , 4821788   19 BEA-CFA
346110 , 4829754   20 BEA-EFS
292750 , 4815336   21 BEA-CRATERS
339764 , 4822062   22 ESER-VAN
292751 , 4815336   23 ESER-CRA
314683 , 4832742   24 ESER-ARC
440759 , 4860651   25 ESER-SUG
414376 , 4818191   26 ESER-IDA
401640 , 4892296   27 ESER-DUB
376885 , 4874727   28 ESER-MON
375764 , 4823554   29 ESER-FAA
346614 , 4819341   30 ESER-MAI
346114 , 4829751   31 ESER-EFS
353080 , 4811691   32 ESER-ATO
391668 , 4782752   33 ESER-MOU
352495 , 4881840   34 ESER-BLU
381307 , 4855031   35 ESER-TER
340891 , 4849794   36 ESER-HOW

$ nsrcs: number of sources
$ nresol: number of subperiods in a year (1,2,3,4,6,12)
$ byear: beginning year of simulation
$ npartsiz: number of partile size classes
1 12 2015 1 [nsrcs,nresol,byear,npartsiz]
$ partsize(npartsiz): AMAD particle size (um)
1.0 [partsize(npartsiz)]
$ partmod(npartsiz): particle size modifiers for resuspension
1.0 [partmod(npartsiz)]
$ Source Block Variables Block- These variables are repeated for each source
$ srcname(nsrcs): Source name
$ srctype(nsrcs): Type of source (P= point A = Area)
$ partindx(nsrcs): Index to particle size released
$ (utms(nsrcs,j): UTME (j=1) and UTMN(j=2) of the source
$ filechiq(nsrcs): file name for chi/q file
$ filepsiq(nsrcs): file name for psi/q file
$ filerel(nsrcs): file name for releases
$ soption(nsrcs): plotting option: 0=exclude soure from plots, 1=include source in plot
$ End of Source Block
$ Repeat Source Block for Each Source

INTEC P 1 [srcname(nsrcs)] srctype partindx
343830. 4825807. [utms(nsrcs,1) utms(nsrcs,2)]
'.../chiqvalues/INTEC_con_PM0.out' [filechiq(nsrcs)]
'.../chiqvalues/INTEC_dep_PM0.out' [filepsiq(nsrcs)]
'.../sourceterm/INTEC-NG.rel' [filerel(nsrcs)]
1 soption - plotting option [soption(nsrcs)]

$ ncontam: number of contaminants -FOR RADON SOURCES, NCONTAM MUST = 1
$ ctype: contaminant type, RA=radionuclide, NR=nonrad, RN=radon
$ norgans: number of organs
2 RA 1 [ncontam ctype norgans]
$ READ ONLY IF CTYPE=RA
$ organ(norgan): organ names

'Effective' [organ(norgan)]
$ READ ONLY IF CTYPE=RA
$ dcffile(1..4): dose conversion files for inhalation, ingestion, external, and submersion
'.../infiles/INH.txt' [dcffile(1)]
'.../infiles/ING.txt' [dcffile(2)]
'.../infiles/EXT.txt' [dcffile(3)]
'.../infiles/SUB.txt' [dcffile(4)]
'.../infiles/GRD.txt' [dcffile(5)]
8.3e-2 8.3e-2 [intcut,extcit] half-life cutoff for inclusion of progeny with parent dcf (years)
$ cname(ncontam): names of contaminants
Kr-85 Ar-41 [cname(ncontam)]
$ bratio(ncontam): Branching ratio
0.0 0.0 0.0 0.0 0.0 [bratio(ncontam)]
$ READ ONLY IF CTYPE=RA
$ adtype(ncontam,nsrcs): inhalation absorpction type
$ DCF
D D D D [adtype(ncontam,nsrcs)] CFA
'.../infiles/NuclideData.dat' [filenucl]
'.../infiles/ElementData.dat' [fileelement]

$ READ ONLY IF CTYPE<>RN
$ rflt: long term resuspension factor (1.0e-9 from NRC 1975 and 1982 1/m)
$ rfst: short term resuspension factor (1-yr integrated value with intial value of 1e-5 (2.0E-6 1/m)
$ thkres: soil thickness for resuspension
$ thklch: soil thickness for leaching

```



```

$ infil: infiltration rate (m/yr)
$ theta: moisture content see RESRAD calculations
$ strc: short term resuspension time function (NRC half-time value of ~1-year yields 0.6769 1/yr)
$ rho: bulk density (g/cc)
$ aws: average wind speed (m/s)
1.0e-9 2.0e-6 0.03 0.15 0.10 0.2 0.6769 1.4 3.66
[rflt,rfst,thkres,thklch,infil,theta,strc,rho,aws]
$ READ ONLY IF CTYPE<>RN and FMODEL=CAP88
$
$ ddl: Fraction of radioactivity retained on leafy vegetables and produce after washing. (0.50)
$ fsubg: Fraction of produce grown in garden of interest (1.00)
$ fsubl: Fraction of leafy vegetables grown in garden of interest (1.00)
$ fsubp: Fraction of year animals graze on pasture (0.40)
$ fsubs: Fraction of daily feed that is pasture grass when animal grazes on pasture (0.43)
$ lamw: Removal rate for weathering from plants, d-1 (10-d half life = 0.0029 hr-1 = 0.0696 d-1 [cap88 default])
$ p: Effective surface density of soil kg/m2 (215.00)
$ 0.50, 1.0, 1.0, 0.4, 0.43, 0.0696 215.0 [ddl,fsubg,fsubl,fsubp,fsubs,lamw,p]

$
$ qsubf: Consumption rate of contaminated feed or forage by an animal (dry wt), kg/da (15.60)
$ r1: Fallout interception fraction (pasture) (0.57)
$ r2: Fallout interception fraction (vegetables) (0.2)
$ th1: Time delay-ingestion of pasture grass by animals, days (0.00)
$ th2: Time delay-ingestion of stored feed by animals, days (90 days, 2,160.00 hrs)
$ th3: Time delay-ingestion of leafy vegetables by man, days (14 days 336.00 hrs)
$ th4: Time delay-ingestion of produce by man, days (14 days, 336.00 hr)
$ 15.6 0.57, 0.2, 0.0, 90, 14, 14 [qsubf,r1,r2,th1,th2,th3,th4]
$ Note: CAP88 default parameters are in CAP88Def.FAC in the CAP88-3.0 directory
$ tsubE: Buildup time in soil, years (100 yrs, 876,000.00 hrs)
$ tsubE1: Period of exposure (grassy pasture), days (30 days, 720.00 hr)
$ tsubE2: Period of exposure (crops/leafy vegetables), days (60 days, 1,440.00 hr)
$ tsubF: Transport time: animal feed-milk-man, d (2.00)
$ tsubS: Average time from slaughter of meat animal to consumption, d (20.00)
$ tsubW: Time over which wild game is consumed (days)
$ ysubV1: Productivity: agriculture (grass-cow-milk-man pathway), kg/m2 (0.28) dry wt
$ ysubV2: Productivity: produce and leafy vegetables (wet), kg/m2 (0.716)
$ ysubV3: Productivity: produce and other vegetables (wet), kg/m2 (0.57)
$ 0. 30. 60. 2.0 20.0 60.0 0.28 0.716 0.57 [tsubE, tsubE1, tsubE2,tsubF,tsubS,tsubW,ysubV1,ysubV2,ysubV3]

$
$ absH: absolute humidity, g/m3, (8 g/m3)
$ concC: atmospheric concentration of carbon, g/m3 (0.18 g/m3)
$ fw: fraction of veg that is water (0.97 -assumed)
$ fc: fraction of veg that is carbon (0.105 - derived from Till and Meyer, Table 9.2)
$ fwB: fraction of beef that is water (0.97 - assumed)
$ fwm: fraction of milk that is water (1.0 - assumed)
$ fcb: fraction of beef that is carbon (0.25 - derived from Till and Meyer, Table 9.2)
$ fcm: fraction of milk that is carbon (0.07 - derived from Till and Meyer, Table 9.2)
$ 8.0, 0.18, 0.97, 0.105 0.97, 1.0, 0.25, 0.07 [absH, concC, fw, fc, fwB, fwm, fcb, fcm]
$ END READ ONLY IF CTYPE<>RN AND FMODEL=CAP88

$ READ ONLY IF CTYPE=RN
$ lambdaE: fractional air exchange of building with outdoors (1/s)
$ Murry and Burmaster 1995 give a range of 0.14(5th p) - 1.38(95th p) with a median of 0.4 h-1
$ Killough used the median value ([0.4 1/h]/3600 s = 1.11E-4 1/s)
$ dbar: diameter corresponding to mean surface area of condensation nuclei (m)
$ NCRP (1984) gives Dbar - 0.125 um as a typical average
$ vbar: average velocity of unattached RaA ions (m/s) NCRP 1984 gives a value of 1.38E2 m/s
$ cnuc: concentration of condensation nuclei indoors (nuclei/m**3)
$ NCRP 1984 gives typical range of 15000-120000 nuclei/cc. Killough uses 3E10 nuclei/m**3 (30000 nuclei/cc)
$ vunatt: deposition vel for plateau of unattached RaA on interior surfaces (m/s).
$ Knutson 1988 gives 8 m/hr (2.22E-3 m/s)
$ vatt: deposition vel for plateau of attached RaA on interior surfaces
$ Knutson 1988 gives 0.2 m/hr (5.55E-5 1/s)
$ stvol: indoor surface to volume ratio (1.0 to 3.0 1/m. Killough used 2.0 1/m)
$ 1.11e-4 1.25E-7 138. 3.0E10 2.22E-3 5.55E-5 2.0 [lambdaE Dbar vbar cnuc vunatt vatt
stvol]
$ END OF READ ONLUT IF CTYPE=RN

$ coption(ncontam): Contaminant plot option, 0= no plot, 1=plot
0 0 0 0 0 [coption(ncontam)]
$ Type of plot - Set to 0 to not plot, 1 to plot
$ poption(1) = plot tic
$ poption(2) = plot average concentration
$ poption(3) = plot deposition
0 0 0 [pooption(i),i=1,3]
$ cf(4): conversion factors for output
$ cf(1) cf for tic and avg conc
$ cf(2) cf for deposition and soil concentration, set to 2.22E7 for pCi/g in 0-3 cm layer assuming rho=1.5 g/cc
$ cf(3) cf for vegetables
$ cf(4) df for milk
$ cf(5) cf for meat and wild game
$ cf(6) cf for deposition and subsurface soil concentration, set to 4.44e6 for pCi/g in 0-15 cm layer assuming
rho=1.5 g/cc

1.0e12 'pCi/m3' [cf(1)] air concentration
4.46e6 'pCi/g' [cf(2)] annual deposition
converted to conc in 0-15 cm layer
1.0e12 'pCi/m2' [cf(3)] surface soil
concentration
1.0e12 'pCi/kg' [cf(4)] veg concentrations
1.0e12 'pCi/L' [cf(5)] milk concentrations
1.0e12 'pCi/kg' [cf(6)] beef and wild game
concentrations
1.0e12 'pCi/m2' [cf(7)] subsurface soil
concentrations

```

```

$ READ ONLY IF ORGAN(1)<=>NONE
$ filexp: receptor intake rates
'../../infiles/refperson_intakes.dat' [fileexp]
1 nrecept
$ utmr(nrecept,1), utmr(nrecept,2): UTM East (1) and UTM North (2) coordinates of source
$ syr(nrecept): start year of exposure (year)
$ spr(nrecept): starting sub-period
$ eyr(nrecept): end year of exposure period (year)
$ epr(nrecept): ending sub-period
$ yob(nrecept): year of birth
$ fi(nrecept): fraction of time spent indoors
$ ef(nrecept): exposure frequency (h/d)
$ et(nrecept): exposure time (d/yr)
$ inh(m(nrecept): inhalation rate modifying factor (inhalation rate in m**3/hr)
$ ing(m(nrecept): soil ingestion modification factor (soil ingestion in g/d)
$ ingv(m(nrecept): vegetable ingestion modification factor
$ ingb(m(nrecept): beef ingestion modification factor
$ ingm(m(nrecept): milk ingestion modification factor
$ ingw(m(nrecept): wild game ingestion modification factor
$ cindo(m(nrecept): ratio of indoor to outdoor air
$ esf: external exposure indoor shielding factor
$ ssf: submersion indoor shielding factor

$MEI03 Frenchman's cabin
33528,4810277, 2015 1 2015 12 1957 [utmr(1,1) utm(i,2) syr spr eyr epr yob]
0.0 24.0 365 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 [fi(i),ef(i),et(i),inh(m(i),ing(m(i),ingv(m(i),ingb(m(i),
ingm(m(i), ingw(m(i), cindo(m(i)], esf(i), ssf(i)
$ nsim: number of Monte Carlo simulations - set nsim=0 for no monte carlo sampling
$ srand: random number seed
0 -23432 [nsim,srand]
$ fileu: uncertainty parameter definitions - Read only if nsim>0
$ fileu: uncertainty parameter definitions - Read only if nsim>0
'../../distributions.par' [fileu]
'../../defs/defuncert.dat'
$ END

```

Particulate Output File

```

*****
* This output was produced by the model: *
* *
* DOSEMM *
* *
* Dose Multi Media. A numerical model for *
* multi-media assessment of dose from *
* atmospheric releases. Pathways include direct *
* inhalation, resuspension, soil ingestion, *
* vegetable, milk, and meat ingestion, external, *
* and submersion doses. Fortran 95 Ver *
* Version date: *
* 190429 *
* Arthur S. Rood *
* K-Spar Inc. 4835 W Foxtrail Lane *
* Idaho Falls, ID 83402 *
* asr@kspar.net *
*****
Date: 05/22/2019 Time: 07:35:40.889
Input File: particulate.par
-----
START OF PARAMETER DEFINITION FILE
-----
'DOSEMM run for 2015 ASER - Particulate releases from INTEC' [title]
.FALSE. .FALSE. SPOOD [debug lgame]
120 100 2000 255000 4725000 36 UTM 12 [nx,ny,dx,xsw,ysw,ndiscrete,gtype,utmzone]
341316, 4827515 1 BEA-TRA
343508, 4825927 2 BEA-CPP
335063, 4818552 3 BEA-RWMC
339762, 4822062 4 BEA-VAN B
416371, 4818571 5 BEA-IRC
391668, 4782760 6 BEA-BLKFT
360950, 4857752 7 BEA-SMC
358520, 4848894 8 BEA-GATE 4
352512, 4820235 9 BEA-ARA
337640, 4823710 10 BEA-REST
414380, 4818193 11 BEA-IF
345564, 4834399 12 BEA-NRF
341727, 4828168 13 BEA-RTC
337858, 4819578 14 BEA-EBR 1
366673, 4828121 15 BEA-MFC
440759, 4860651 16 BEA-SUGAR
348964, 4823312 17 BEA-PBF
344158, 4826806 18 BEA-INTEC
342602, 4821788 19 BEA-CFA
346110, 4829754 20 BEA-EFS
292750, 4815336 21 BEA-CRATERS
339764, 4822062 22 ESER-VAN
292751, 4815336 23 ESER-CRA
314683, 4832742 24 ESER-ARC
440759, 4860651 25 ESER-SUG
414376, 4818191 26 ESER-IDA
401640, 4892296 27 ESER-DUB
376885, 4874727 28 ESER-MON
375764, 4823554 29 ESER-FAA
346614, 4819341 30 ESER-MAI

```


1	0.000E+00	2.400E+01	3.650E+02	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00		
1.000E+00	1.000E+00	1.000E+00	1.000E+00								
Src	Description	Src_Type	Part_Size (um)	UTME(m)	UTMN(m)						
1	INTEC	P	1.00	343830.0	4825807.0						
Chi/Q values for Receptors											
Src Rec Dist(m) Bearing(deg) Node_Number Chi/Q (s/m*3) for point srcs, s/m for area sources (period 1..nresol)											
1	1	18636.	213.56	5080	5.423E-08	3.862E-08	5.140E-08	3.456E-08	3.380E-08	3.855E-08	4.469E-08
4.889E-08	3.986E-08	4.695E-08	5.234E-08	7.453E-08							
Psi/Q values for Receptors											
Src# Rec# Node Number Psi/Q (1/m**2 for point srcs, unitless for area sources (period 1..nresol)											
1	1	5080	6.199E-12	3.591E-12	1.137E-11	1.086E-11	1.754E-11	2.437E-12	6.730E-12	1.446E-11	1.730E-11
9.992E-12	6.296E-12	7.160E-12									
Food Chain Parameters											
Fraction of radioactivity retained on leafy vegetables and produce after washing: 5.000E-01											
Fraction of produce grown in garden of interest: 1.000E+00											
Fraction of leafy vegetables grown in garden of interest: 1.000E+00											
Fraction of year animals graze on pasture: 4.000E-01											
Fraction of daily feed that is pasture grass when animal grazes on pasture: 4.300E-01											
Removal rate for weathering from plants, d-1: 6.960E-02											
Effective surface density of soil, kg/m2: 2.150E+02											
Consumption rate of contaminated feed or forage by an animal (dry wt), kg/day: 1.560E+01											
Fallout interception fraction, pasture: 5.700E-01											
Fallout interception fraction (vegetables): 2.000E-01											
Time delay-ingestion of pasture grass by animals, days: 0.000E+00											
Time delay-ingestion of stored feed by animals, days: 9.000E+01											
Time delay-ingestion of leafy vegetables by man, days: 1.400E+01											
Time delay-ingestion of produce by man, days: 1.400E+01											
Buildup time in soil, years: 1.000E+02											
Period of exposure (grass pasture), days: 3.000E+01											
Period of exposure (crops/leafy vegetables), days: 6.000E+01											
Transport time: animal feed-milk-man, days: 2.000E+00											
Average time from slaughter of meat animal to consumption, days: 2.000E+01											
Time over which wild game is consumed, days: 6.000E+01											
Productivity: agriculture (grass-cow-milk-man pathway), kg/m2 2.800E-01											
Productivity: produce and leafy vegetables (wet), kg/m2: 7.160E-01											
Productivity: produce and other vegetables (wet), kg/m2: 7.160E-01											
Absolute humidity, g/m3: 8.000E+00											
Atmospheric concentration of carbon, g/m3: 1.800E-01											
Fraction of veg that is water: 9.700E-01											
Fraction of veg that is carbon: 1.050E-01											
Fraction of beef that is water: 9.700E-01											
Fraction of milk that is water: 1.000E+00											
Fraction of beef that is carbon: 2.500E-01											
Fraction of milk that is carbon: 7.000E-02											
Contaminant	Lambda (1/yr)	Surface LR (1/yr)	Subsurface LR (1/yr)								
Pu-241	4.830E-02	1.190E-04	2.381E-05								
Am-241	1.604E-03	1.182E-02	2.364E-03								
Np-237	3.233E-07	2.924E-02	5.848E-03								
Cs-137	2.305E-02	5.176E-05	1.035E-05								
Pu-238	7.904E-03	1.190E-04	2.381E-05								
Pu-239	2.875E-05	1.190E-04	2.381E-05								
Pu-240	1.056E-04	1.190E-04	2.381E-05								
Sr-90	2.408E-02	7.899E-03	1.580E-03								
Co-60	1.315E-01	2.381E-04	4.761E-05								
Resuspension parameters											
Short-term resuspension factor (1/m): 2.000E-06											
Long-term resuspension factor (1/m): 1.000E-09											
Short-term resuspension decay constant (1/yr): 6.769E-01											
Ingrowth factors. Fraction of progeny that grow in from parent during dt (years): 8.4931507706642151E-002											
TO >>>>	Pu-241	Am-241	Np-237	Cs-137	Pu-238	Pu-239	Pu-240	Sr-90	Co-60		
Pu-241	0.000E+00	1.359E-04	1.867E-12	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	
Am-241	0.000E+00	0.000E+00	2.746E-08	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	
Np-237	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	
Cs-137	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	
Pu-238	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	
Pu-239	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	
Pu-240	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	
Sr-90	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	
Co-60	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	
Time-Integrated Concentration (Ci-yr/m**3) x cf pCi/m3 cf= 1.000E+12											
Year	Src	Rec	Pu-241	Am-241	Np-237	Cs-137	Pu-238	Pu-239	Pu-240	Sr-90	Co-60
2015	1	1	5.039E-06	7.652E-09	2.426E-19	2.589E-05	1.656E-07	3.121E-07	1.642E-07	1.983E-05	4.143E-08

2015 ALL	1	5.039E-06	7.652E-09	2.426E-19	2.589E-05	1.656E-07	3.121E-07	1.642E-07	1.983E-05	4.143E-08	

Annual Deposition (Ci/m**2) x cf pCi/m2 cf= 1.000E+12											
Year	Src	Rec	Pu-241	Am-241	Np-237	Cs-137	Pu-238	Pu-239	Pu-240	Sr-90	Co-60
2015	1	1	3.251E-02	4.937E-05	1.565E-15	1.671E-01	1.069E-03	2.014E-03	1.060E-03	1.279E-01	2.673E-04
2015 ALL	1	1	3.251E-02	4.937E-05	1.565E-15	1.671E-01	1.069E-03	2.014E-03	1.060E-03	1.279E-01	2.673E-04

Annual Accumulated Soil Concentration in surface layer (Ci/m**2) x cf pCi/m2 cf= 1.000E+12											
Year	Src	Rec	Pu-241	Am-241	Np-237	Cs-137	Pu-238	Pu-239	Pu-240	Sr-90	Co-60
2015	1	1	3.176E-02	9.958E-05	3.244E-11	1.652E-01	1.065E-03	2.014E-03	1.060E-03	1.260E-01	2.510E-04
2015 ALL	1	1	3.176E-02	9.958E-05	3.244E-11	1.652E-01	1.065E-03	2.014E-03	1.060E-03	1.260E-01	2.510E-04

Time-Integrated Resuspended Concentration (Ci-yr/m**3) x cf pCi/m3 cf= 1.000E+12											
Year	Src	Rec	Pu-241	Am-241	Np-237	Cs-137	Pu-238	Pu-239	Pu-240	Sr-90	Co-60
2015	1	1	4.693E-08	1.465E-10	4.837E-17	2.414E-07	1.545E-09	2.913E-09	1.533E-09	1.848E-07	3.845E-10
2015 ALL	1	1	4.693E-08	1.465E-10	4.837E-17	2.414E-07	1.545E-09	2.913E-09	1.533E-09	1.848E-07	3.845E-10

Annual Accumulated Soil Concentration in subsurface layer (Ci/m**2) x cf pCi/m2 cf= 1.000E+12											
Year	Src	Rec	Pu-241	Am-241	Np-237	Cs-137	Pu-238	Pu-239	Pu-240	Sr-90	Co-60
2015	1	1	1.813E-06	5.570E-07	6.153E-13	4.115E-06	6.111E-08	1.157E-07	6.089E-08	4.792E-04	2.831E-08
2015 ALL	1	1	1.813E-06	5.570E-07	6.153E-13	4.115E-06	6.111E-08	1.157E-07	6.089E-08	4.792E-04	2.831E-08

Leafy Vegetable Concentrations (Ci/kg) x cf pCi/kg cf= 1.000E+12											
Year	Src	Rec	Pu-241	Am-241	Np-237	Cs-137	Pu-238	Pu-239	Pu-240	Sr-90	Co-60
2015	1	1	1.785E-04	2.884E-07	2.304E-17	2.116E-03	6.125E-06	1.184E-05	6.227E-06	7.433E-03	2.185E-06
2015 ALL	1	1	1.785E-04	2.884E-07	2.304E-17	2.116E-03	6.125E-06	1.184E-05	6.227E-06	7.433E-03	2.185E-06

Other Vegetable Concentrations (Ci/kg) x cf pCi/kg cf= 1.000E+12											
Year	Src	Rec	Pu-241	Am-241	Np-237	Cs-137	Pu-238	Pu-239	Pu-240	Sr-90	Co-60
2015	1	1	1.785E-04	2.884E-07	2.304E-17	2.116E-03	6.125E-06	1.184E-05	6.227E-06	7.433E-03	2.185E-06
2015 ALL	1	1	1.785E-04	2.884E-07	2.304E-17	2.116E-03	6.125E-06	1.184E-05	6.227E-06	7.433E-03	2.185E-06

Milk Concentrations (Ci/L) x cf pCi/L cf= 1.000E+12											
Year	Src	Rec	Pu-241	Am-241	Np-237	Cs-137	Pu-238	Pu-239	Pu-240	Sr-90	Co-60
2015	1	1	3.525E-08	1.088E-10	9.708E-21	1.607E-03	1.174E-09	2.220E-09	1.168E-09	4.881E-04	5.905E-07
2015 ALL	1	1	3.525E-08	1.088E-10	9.708E-21	1.607E-03	1.174E-09	2.220E-09	1.168E-09	4.881E-04	5.905E-07

Beef Concentrations (Ci/kg) x cf pCi/kg cf= 1.000E+12											
Year	Src	Rec	Pu-241	Am-241	Np-237	Cs-137	Pu-238	Pu-239	Pu-240	Sr-90	Co-60
2015	1	1	3.516E-06	2.719E-09	1.942E-18	6.018E-03	1.173E-07	2.220E-07	1.168E-07	1.950E-03	5.867E-06
2015 ALL	1	1	3.516E-06	2.719E-09	1.942E-18	6.018E-03	1.173E-07	2.220E-07	1.168E-07	1.950E-03	5.867E-06

Dose Conversion Factor Notes											
External DCF for Cs-137 includes Ba-137m											
External DCF for Sr-90 includes Y-90											
Submersion DCF for Cs-137 includes Ba-137m											
Ground DCF for Cs-137 includes Ba-137m											
Ground DCF for Sr-90 includes Y-90											

Inhalation Dose Conversion Factors (rem/Ci)											
Rad	Sol	AMAD(um)	Age	Effective							
Pu-241	D	1.0	0	8.510E+06							
Pu-241	D	1.0	1	8.510E+06							
Pu-241	D	1.0	5	8.510E+06							
Pu-241	D	1.0	10	8.510E+06							
Pu-241	D	1.0	15	8.510E+06							
Pu-241	D	1.0	20	8.510E+06							
Am-241	D	1.0	0	3.630E+08							
Am-241	D	1.0	1	3.630E+08							
Am-241	D	1.0	5	3.630E+08							
Am-241	D	1.0	10	3.630E+08							
Am-241	D	1.0	15	3.630E+08							
Am-241	D	1.0	20	3.630E+08							
Np-237	D	1.0	0	1.840E+08							
Np-237	D	1.0	1	1.840E+08							
Np-237	D	1.0	5	1.840E+08							
Np-237	D	1.0	10	1.840E+08							
Np-237	D	1.0	15	1.840E+08							
Np-237	D	1.0	20	1.840E+08							
Cs-137	D	1.0	0	1.543E+05							
Cs-137	D	1.0	1	1.543E+05							
Cs-137	D	1.0	5	1.543E+05							
Cs-137	D	1.0	10	1.543E+05							
Cs-137	D	1.0	15	1.543E+05							
Cs-137	D	1.0	20	1.543E+05							
Pu-238	D	1.0	0	4.070E+08							
Pu-238	D	1.0	1	4.070E+08							
Pu-238	D	1.0	5	4.070E+08							
Pu-238	D	1.0	10	4.070E+08							
Pu-238	D	1.0	15	4.070E+08							
Pu-238	D	1.0	20	4.070E+08							
Pu-239	D	1.0	0	4.477E+08							
Pu-239	D	1.0	1	4.477E+08							
Pu-239	D	1.0	5	4.477E+08							
Pu-239	D	1.0	10	4.477E+08							

Pu-239	D	1.0	15	4.477E+08
Pu-239	D	1.0	20	4.477E+08
Pu-240	D	1.0	0	4.477E+08
Pu-240	D	1.0	1	4.477E+08
Pu-240	D	1.0	5	4.477E+08
Pu-240	D	1.0	10	4.477E+08
Pu-240	D	1.0	15	4.477E+08
Pu-240	D	1.0	20	4.477E+08
Sr-90	D	1.0	0	6.068E+05
Sr-90	D	1.0	1	6.068E+05
Sr-90	D	1.0	5	6.068E+05
Sr-90	D	1.0	10	6.068E+05
Sr-90	D	1.0	15	6.068E+05
Sr-90	D	1.0	20	6.068E+05
Co-60	D	1.0	0	1.229E+05
Co-60	D	1.0	1	1.229E+05
Co-60	D	1.0	5	1.221E+05
Co-60	D	1.0	10	1.221E+05
Co-60	D	1.0	15	1.221E+05
Co-60	D	1.0	20	1.221E+05

Ingestion Dose Conversion Factors (rem/Ci)

Rad	Age	Effective
Pu-241	0	1.760E+04
Pu-241	1	1.760E+04
Pu-241	5	1.760E+04
Pu-241	10	1.760E+04
Pu-241	15	1.760E+04
Pu-241	20	1.760E+04
Am-241	0	7.550E+05
Am-241	1	7.550E+05
Am-241	5	7.550E+05
Am-241	10	7.550E+05
Am-241	15	7.550E+05
Am-241	20	7.550E+05
Np-237	0	3.960E+05
Np-237	1	3.960E+05
Np-237	5	3.960E+05
Np-237	10	3.960E+05
Np-237	15	3.960E+05
Np-237	20	3.960E+05
Cs-137	0	5.020E+04
Cs-137	1	5.020E+04
Cs-137	5	5.020E+04
Cs-137	10	5.020E+04
Cs-137	15	5.020E+04
Cs-137	20	5.020E+04
Pu-238	0	8.440E+05
Pu-238	1	8.440E+05
Pu-238	5	8.440E+05
Pu-238	10	8.440E+05
Pu-238	15	8.440E+05
Pu-238	20	8.440E+05
Pu-239	0	9.280E+05
Pu-239	1	9.280E+05
Pu-239	5	9.280E+05
Pu-239	10	9.280E+05
Pu-239	15	9.280E+05
Pu-239	20	9.280E+05
Pu-240	0	9.280E+05
Pu-240	1	9.280E+05
Pu-240	5	9.280E+05
Pu-240	10	9.280E+05
Pu-240	15	9.280E+05
Pu-240	20	9.280E+05
Sr-90	0	1.020E+05
Sr-90	1	1.020E+05
Sr-90	5	1.020E+05
Sr-90	10	1.020E+05
Sr-90	15	1.020E+05
Sr-90	20	1.020E+05
Co-60	0	1.260E+04
Co-60	1	1.260E+04
Co-60	5	1.260E+04
Co-60	10	1.260E+04
Co-60	15	1.260E+04
Co-60	20	1.260E+04

External Dose Conversion Factors (rem-m**2/(Ci-s))

Rad	Age	Effective
Pu-241	0	6.370E-09
Pu-241	1	6.370E-09
Pu-241	5	6.370E-09
Pu-241	10	6.370E-09
Pu-241	15	6.370E-09
Pu-241	20	6.370E-09
Am-241	0	8.630E-05
Am-241	1	8.630E-05
Am-241	5	8.630E-05
Am-241	10	8.630E-05
Am-241	15	8.630E-05
Am-241	20	8.630E-05

Np-237	0	9.320E-05
Np-237	1	9.320E-05
Np-237	5	9.320E-05
Np-237	10	9.320E-05
Np-237	15	9.320E-05
Np-237	20	9.320E-05
Cs-137	0	2.036E-03
Cs-137	1	2.036E-03
Cs-137	5	2.036E-03
Cs-137	10	2.036E-03
Cs-137	15	2.036E-03
Cs-137	20	2.036E-03
Pu-238	0	2.320E-06
Pu-238	1	2.320E-06
Pu-238	5	2.320E-06
Pu-238	10	2.320E-06
Pu-238	15	2.320E-06
Pu-238	20	2.320E-06
Pu-239	0	1.050E-06
Pu-239	1	1.050E-06
Pu-239	5	1.050E-06
Pu-239	10	1.050E-06
Pu-239	15	1.050E-06
Pu-239	20	1.050E-06
Pu-240	0	2.230E-06
Pu-240	1	2.230E-06
Pu-240	5	2.230E-06
Pu-240	10	2.230E-06
Pu-240	15	2.230E-06
Pu-240	20	2.230E-06
Sr-90	0	4.121E-04
Sr-90	1	4.121E-04
Sr-90	5	4.121E-04
Sr-90	10	4.121E-04
Sr-90	15	4.121E-04
Sr-90	20	4.121E-04
Co-60	0	8.510E-03
Co-60	1	8.510E-03
Co-60	5	8.510E-03
Co-60	10	8.510E-03
Co-60	15	8.510E-03
Co-60	20	8.510E-03

Submersion Dose Conversion Factors (rem-m**3/(Ci-s))

Rad	Age	Effective
Pu-241	0	2.350E-07
Pu-241	1	2.350E-07
Pu-241	5	2.350E-07
Pu-241	10	2.350E-07
Pu-241	15	2.350E-07
Pu-241	20	2.350E-07
Am-241	0	2.510E-03
Am-241	1	2.510E-03
Am-241	5	2.510E-03
Am-241	10	2.510E-03
Am-241	15	2.510E-03
Am-241	20	2.510E-03
Np-237	0	3.290E-03
Np-237	1	3.290E-03
Np-237	5	3.290E-03
Np-237	10	3.290E-03
Np-237	15	3.290E-03
Np-237	20	3.290E-03
Cs-137	0	9.456E-02
Cs-137	1	9.456E-02
Cs-137	5	9.456E-02
Cs-137	10	9.456E-02
Cs-137	15	9.456E-02
Cs-137	20	9.456E-02
Pu-238	0	1.300E-05
Pu-238	1	1.300E-05
Pu-238	5	1.300E-05
Pu-238	10	1.300E-05
Pu-238	15	1.300E-05
Pu-238	20	1.300E-05
Pu-239	0	1.290E-05
Pu-239	1	1.290E-05
Pu-239	5	1.290E-05
Pu-239	10	1.290E-05
Pu-239	15	1.290E-05
Pu-239	20	1.290E-05
Pu-240	0	1.270E-05
Pu-240	1	1.270E-05
Pu-240	5	1.270E-05
Pu-240	10	1.270E-05
Pu-240	15	1.270E-05
Pu-240	20	1.270E-05
Sr-90	0	3.650E-04
Sr-90	1	3.650E-04
Sr-90	5	3.650E-04
Sr-90	10	3.650E-04
Sr-90	15	3.650E-04
Sr-90	20	3.650E-04

2015 Effective	1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
0.000E+00	0.000E+00	1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
All Effective	1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
0.000E+00	0.000E+00										

Leafy Vegetable Ingestion Dose (rem)											
Year	Organ	Rec	Pu-241	Am-241	Np-237	Cs-137	Pu-238	Pu-239	Pu-240	Sr-90	Co-60
Total											

2015 Effective	1	5.654E-11	3.920E-12	1.642E-22	1.912E-09	9.306E-11	1.977E-10	1.040E-10	1.365E-08		
4.956E-13	1.601E-08	1	5.654E-11	3.920E-12	1.642E-22	1.912E-09	9.306E-11	1.977E-10	1.040E-10	1.365E-08	
All Effective	1	5.654E-11	3.920E-12	1.642E-22	1.912E-09	9.306E-11	1.977E-10	1.040E-10	1.365E-08		
4.956E-13	1.601E-08										

Other Vegetable Ingestion Dose (rem)											
Year	Organ	Rec	Pu-241	Am-241	Np-237	Cs-137	Pu-238	Pu-239	Pu-240	Sr-90	Co-60
Total											

2015 Effective	1	5.528E-10	3.833E-11	1.606E-21	1.869E-08	9.099E-10	1.933E-09	1.017E-09	1.334E-07		
4.846E-12	1.566E-07	1	5.528E-10	3.833E-11	1.606E-21	1.869E-08	9.099E-10	1.933E-09	1.017E-09	1.334E-07	
All Effective	1	5.528E-10	3.833E-11	1.606E-21	1.869E-08	9.099E-10	1.933E-09	1.017E-09	1.334E-07		
4.846E-12	1.566E-07										

Beef Ingestion Dose (rem)											
Year	Organ	Rec	Pu-241	Am-241	Np-237	Cs-137	Pu-238	Pu-239	Pu-240	Sr-90	Co-60
Total											

2015 Effective	1	5.261E-12	1.745E-13	6.535E-23	2.568E-08	8.416E-12	1.751E-11	9.214E-12	1.691E-08		
6.284E-12	4.263E-08	1	5.261E-12	1.745E-13	6.535E-23	2.568E-08	8.416E-12	1.751E-11	9.214E-12	1.691E-08	
All Effective	1	5.261E-12	1.745E-13	6.535E-23	2.568E-08	8.416E-12	1.751E-11	9.214E-12	1.691E-08		
6.284E-12	4.263E-08										

Milk Ingestion Dose (rem)											
Year	Organ	Rec	Pu-241	Am-241	Np-237	Cs-137	Pu-238	Pu-239	Pu-240	Sr-90	Co-60
Total											

2015 Effective	1	6.948E-14	9.197E-15	4.306E-25	9.033E-09	1.109E-13	2.308E-13	1.214E-13	5.576E-09		
8.333E-13	1.461E-08	1	6.948E-14	9.197E-15	4.306E-25	9.033E-09	1.109E-13	2.308E-13	1.214E-13	5.576E-09	
All Effective	1	6.948E-14	9.197E-15	4.306E-25	9.033E-09	1.109E-13	2.308E-13	1.214E-13	5.576E-09		
8.333E-13	1.461E-08										

External Exposure Dose (rem)											
Year	Organ	Rec	Pu-241	Am-241	Np-237	Cs-137	Pu-238	Pu-239	Pu-240	Sr-90	Co-60
Total											

2015 Effective	1	6.381E-15	2.711E-13	9.553E-20	1.061E-08	7.789E-14	6.668E-14	7.451E-14	1.637E-09		
6.736E-11	1.231E-08	1	6.381E-15	2.711E-13	9.553E-20	1.061E-08	7.789E-14	6.668E-14	7.451E-14	1.637E-09	
All Effective	1	6.381E-15	2.711E-13	9.553E-20	1.061E-08	7.789E-14	6.668E-14	7.451E-14	1.637E-09		
6.736E-11	1.231E-08										

Submersion Exposure Dose (rem)											
Year	Organ	Rec	Pu-241	Am-241	Np-237	Cs-137	Pu-238	Pu-239	Pu-240	Sr-90	Co-60
Total											

2015 Effective	1	3.734E-17	6.057E-16	2.517E-26	7.722E-11	6.790E-17	1.270E-16	6.578E-17	2.282E-13		
5.749E-13	7.803E-11	1	3.734E-17	6.057E-16	2.517E-26	7.722E-11	6.790E-17	1.270E-16	6.578E-17	2.282E-13	
All Effective	1	3.734E-17	6.057E-16	2.517E-26	7.722E-11	6.790E-17	1.270E-16	6.578E-17	2.282E-13		
5.749E-13	7.803E-11										

All Pathway Doses (rem)											
Year	Organ	Rec	Pu-241	Am-241	Np-237	Cs-137	Pu-238	Pu-239	Pu-240	Sr-90	Co-60
Total											

2015 Effective	1	3.483E-07	2.278E-08	7.194E-17	9.840E-08	5.476E-07	1.135E-06	5.973E-07	2.688E-07		
1.214E-10	3.018E-06	1	3.483E-07	2.278E-08	7.194E-17	9.840E-08	5.476E-07	1.135E-06	5.973E-07	2.688E-07	
All Effective	1	3.483E-07	2.278E-08	7.194E-17	9.840E-08	5.476E-07	1.135E-06	5.973E-07	2.688E-07		
1.214E-10	3.018E-06										

Successful Execution of DOSEMM											
Execution Time 0.3472049999999999 seconds											

H-3 and C-14 Output File

```

*****
* This output was produced by the model: *
* * *
* DOSEMM *
* * *
* Dose Multi Media. A numerical model for *
* multi-media assessment of dose from *
* atmospheric releases. Pathways include direct *
* inhalation, resuspension, soil ingestion, *

```

```

* vegetable, milk, and meat ingestion, external,*
* and submersion doses. Fortran 95 Ver      *
*          Version date:                    *
*          190429                          *
*          Arthur S. Rood                   *
*          K-Spar Inc. 4835 W Foxtrail Lane *
*          Idaho Falls, ID 83402           *
*          asr@kspar.net                    *
*****
Date: 05/22/2019 Time: 07:35:17.594
Input File: h3c14.par
-----
START OF PARAMETER DEFINITION FILE
-----
'DOSEMM run for 2015 ASER - H-3 and C-14 releases from INTEC' [title]
.FALSE. .FALSE. SFOOD [debug lgame]
120 100 2000 255000 4725000 36 UTM 12 [nx,ny,dx,xsw,ysw,ndiscrete,gtype,utmzone]
341316 , 4827515 1 BEA-TRA
343508 , 4825927 2 BEA-CPP
335063 , 4818552 3 BEA-RWMC
339762 , 4822062 4 BEA-VAN B
416371 , 4818571 5 BEA-IRC
391668 , 4782760 6 BEA-BLKFT
360950 , 4857752 7 BEA-SMC
358520 , 4848894 8 BEA-GATE 4
352512 , 4820235 9 BEA-ARA
337640 , 4823710 10 BEA-REST
414380 , 4818193 11 BEA-IF
345564 , 4834399 12 BEA-NRF
341727 , 4828168 13 BEA-RTC
337858 , 4819578 14 BEA-EBR 1
366673 , 4828121 15 BEA-MFC
440759 , 4860651 16 BEA-SUGAR
348964 , 4823312 17 BEA-PBF
344158 , 4826806 18 BEA-INTEC
342602 , 4821788 19 BEA-CFA
346110 , 4829754 20 BEA-EFS
292750 , 4815336 21 BEA-CRATERS
339764 , 4822062 22 ESER-VAN
292751 , 4815336 23 ESER-CRA
314683 , 4832742 24 ESER-ARC
440759 , 4860651 25 ESER-SUG
414376 , 4818191 26 ESER-IDA
401640 , 4892296 27 ESER-DUB
376885 , 4874727 28 ESER-MON
375764 , 4823554 29 ESER-FAA
346614 , 4819341 30 ESER-MAI
346114 , 4829751 31 ESER-EFS
353080 , 4811691 32 ESER-ATO
391668 , 4782752 33 ESER-MOU
352495 , 4881840 34 ESER-BLU
381307 , 4855031 35 ESER-TER
340891 , 4849794 36 ESER-HOW
1 12 2015 1 [nsrsrcs,nresol,byear,npartsiz]
1.0 [partsize(npartsiz)]
1.0 [partmod(npartsiz)]
INTEC P 1 [srcname(nsrsrcs)] srctype partindx
343830. 4825807. [utms(nsrsrcs,1) utms(nsrsrcs,2)]
'../../chigvalues/INTEC_con_PM0.out' [filechiq(nsrsrcs)]
'../../chigvalues/INTEC_dep_PM0.out' [filepsiq(nsrsrcs)]
'../../sourceterm/INTEC-H3C14.rel' [filerel(nsrsrcs)]
1 soption - plotting option [soption(nsrsrcs)]
2 RA 1 [ncontam ctype norgans]
'Effective' [organ(norgan)]
'../../infiles/INH.txt' [dcffile(1)]
'../../infiles/ING.txt' [dcffile(2)]
'../../infiles/EXT.txt' [dcffile(3)]
'../../infiles/SUB.txt' [dcffile(4)]
'../../infiles/GRD.txt' [dcffile(5)]
8.3e-2 8.3e-2 [intcut,extcit] half-life cutoff for inclusion of progeny with parent dcf
(years)
H-3 C-14 [cname(ncontam)]
0.0 0.0 [bratio(ncontam)]
D D [adtype(ncontam,nsrsrcs)] CFA
'../../infiles/NuclideData.dat' [filenuc]
'../../infiles/ElementData.dat' [fileelement]
1.0e-9 2.0e-6 0.03 0.15 0.10 0.2 0.6769 1.4 4.0
[rflf,rfst,thkres,thklch,infil,theta,strc,rho,aws]
0.50, 1.0, 1.0, 0.4, 0.43, 0.0696 215.0 [ddl,fsubg,fsubl,fsubp,fsubs,lamw,p]
15.6 0.57, 0.2, 0.0, 90, 14, 14 [qsubf,r1,r2,th1,th2,th3,th4]
0. 30. 60. 2.0 20.0 60.0 0.28 0.716 0.57 [tsubB, tsubE1, tsubE2,tsubF,tsubS,tsubW,ysubV1,ysubV2,ysubV3]
4.9, 0.18, 0.824, 0.339 0.623, 1.0, 0.23, 0.169 [absH, concC, fw, fc, fwb, fwm, fcb, fcm]
0 0 [coption(ncontam)]
0 0 [poption(i),i=1,3]
1.0e12 'pCi/m3' [cf(1)] air concentration
4.46e6 'pCi/g' [cf(2)] annual deposition converted to conc in 0-15 cm
layer
1.0e12 'pCi/m2' [cf(3)] surface soil concentration
1.0e12 'pCi/kg' [cf(4)] veg concentrations
1.0e12 'pCi/L' [cf(5)] milk concentrations
1.0e12 'pCi/kg' [cf(6)] beef and wild game concentrations
1.0e12 'pCi/m2' [cf(7)] subsurface soil concentrations
'../../infiles/refperson_intakes.dat' [fileexp]
1 nrecept

```

```

333528,4810277, 2015 1 2015 12 1957      [utmr(1,1) utm(i,2) syr spr eyr epr yob]
0.0 24.0 365 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0
[fi(i),ef(i),et(i),inhm(i),ingsm(i),ingvm(i),ingbm(i), ingmm(i), ingwm(i), cindoor(i)], esf(i), ssf(i)
0 -23432 [nsim,srand]

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END OF PARAMETER DEFINITION FILE

Contaminant Data

Radionuclide	Half-Life(y)	Progeny	kd(mL/g)	Bv(dw)	Biv(dw)	TcMilk(d/L)	TcMeat(d/kg)
H-3	1.233E+01	STABLE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
C-14	5.730E+03	STABLE	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Receptor Node Numbers and Coordinates

Rec	UTME (m)	UTMN (m)	Node Number
1	333528.	4810277.	5080

Age-Dependent Intake Rates

Age (yr)	Inh (m**3/hr)	Soil (g/hr)	LVEg (kg/yr)	OVEg (kg/yr)	Milk (L/yr)	Meat (kg/yr)	Game (kg/yr)
0.0	3.650E-01	2.500E-03	1.430E+01	1.773E+01	4.720E+01	3.580E+01	0.000E+00
1.0	5.620E-01	4.170E-03	2.788E+01	3.246E+01	4.560E+01	3.460E+01	6.380E+01
5.0	5.350E-01	6.960E-03	3.620E+01	3.516E+01	4.940E+01	3.750E+01	6.580E+01
10.0	5.530E-01	5.000E-03	4.300E+01	2.938E+01	6.480E+01	4.920E+01	1.059E+02
15.0	6.230E-01	4.170E-03	4.878E+01	2.231E+01	9.060E+01	6.880E+01	1.059E+02
20.0	9.170E-01	0.000E+00	1.800E+01	1.760E+02	1.120E+02	8.500E+01	0.000E+00
120.0	9.170E-01	0.000E+00	1.800E+01	1.760E+02	1.120E+02	8.500E+01	0.000E+00

Receptor Exposure Factors

RecNo	Frac Indoors	Exps_Freq	Exps_Time	Inhal_ModFact	Soil_ModFact	Veg_ModFact	Meat_ModFact	Milk_ModFact
WGme_ModFact	Air I/O	Ext I/O	Fac Sub I/O	Fa!!				
(unitless)	(unitless)	(h/d)	(d/yr)	(unitless)	(unitless)	(unitless)	(unitless)	(unitless)
1	0.000E+00	2.400E+01	3.650E+02	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
1.000E+00	1.000E+00	1.000E+00	1.000E+00					

Src Description Src_Type Part_Size (um) UTME (m) UTMN (m)

1	INTEC	P	1.00	343830.0	4825807.0
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Chi/Q values for Receptors

Src	Rec	Dist (m)	Bearing (deg)	Node Number	Chi/Q (s/m*3)	for point srcs,	s/m for area sources	(period 1..nresol)
1	1	18636.	213.56	5080	2.917E-08	3.728E-08	1.019E-07	4.683E-08
5.540E-08	4.003E-08	4.737E-08	2.023E-08	8.221E-08				

Psi/Q values for Receptors

Src#	Rec#	Node Number	Psi/Q (1/m**2)	for point srcs,	unitless for area sources	(period 1..nresol)
1	1	5080	0.000E+00	0.000E+00	0.000E+00	0.000E+00
0.000E+00	0.000E+00	0.000E+00				

Food Chain Parameters

Fraction of radioactivity retained on leafy vegetables and produce after washing:	5.000E-01
Fraction of produce grown in garden of interest:	1.000E+00
Fraction of leafy vegetables grown in garden of interest:	1.000E+00
Fraction of year animals graze on pasture:	4.000E-01
Fraction of daily feed that is pasture grass when animal grazes on pasture:	4.300E-01
Removal rate for weathering from plants, d-1:	6.960E-02
Effective surface density of soil, kg/m2:	2.150E+02
Consumption rate of contaminated feed or forage by an animal (dry wt), kg/day:	1.560E+01
Fallout interception fraction, pasture:	5.700E-01
Fallout interception fraction (vegetables):	2.000E-01
Time delay-ingestion of pasture grass by animals, days:	0.000E+00
Time delay-ingestion of stored feed by animals, days:	9.000E+01
Time delay-ingestion of leafy vegetables by man, days:	1.400E+01
Time delay-ingestion of produce by man, days:	1.400E+01
Buildup time in soil, years:	0.000E+00
Period of exposure (grass pasture), days:	3.000E+01
Period of exposure (crops/leafy vegetables), days:	6.000E+01
Transport time: animal feed-milk-man, days:	2.000E+00
Average time from slaughter of meat animal to consumption, days:	2.000E+01
Time over which wild game is consumed, days:	6.000E+01
Productivity: agriculture (grass-cow-milk-man pathway), kg/m2	2.800E-01
Productivity: produce and leafy vegetables (wet), kg/m2:	7.160E-01
Productivity: produce and other vegetables (wet), kg/m2:	5.700E-01
Absolute humidity, g/m3:	4.900E+00
Atmospheric concentration of carbon, g/m3:	1.800E-01
Fraction of veg that is water:	8.240E-01
Fraction of veg that is carbon:	3.390E-01
Fraction of beef that is water:	6.230E-01
Fraction of milk that is water:	1.000E+00
Fraction of beef that is carbon:	2.300E-01

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Fraction of milk that is carbon: 1.690E-01
-----
Contaminant  Lambda (1/yr)  Surface LR (1/yr)  Subsurface LR (1/yr)
-----
H-3          5.622E-02         1.667E+01          3.333E+00
C-14         1.210E-04          1.667E+01          3.333E+00
-----
Resuspension parameters
-----
Short-term resuspension factor (1/m): 2.000E-06
Long-term resuspension factor (1/m): 1.000E-09
Short-term resuspension decay constant (1/yr): 6.769E-01
-----
Ingrowth factors. Fraction of progeny that grow in from parent during dt (years): 8.4931507706642151E-002
TO >>>>  H-3      C-14
H-3      0.000E+00  0.000E+00
C-14     0.000E+00  0.000E+00
-----
Time-Integrated Concentration (Ci-yr/m**3) x cf pCi/m3 cf= 1.000E+12
Year Src Rec  H-3      C-14
-----
2015  1  1  2.233E-01  1.479E-08
2015 ALL 1  2.233E-01  1.479E-08
-----
Annual Deposition (Ci/m**2) x cf pCi/g cf= 4.460E+06
Year Src Rec  H-3      C-14
-----
2015  1  1  0.000E+00  0.000E+00
2015 ALL 1  0.000E+00  0.000E+00
-----
Annual Accumulated Soil Concentration in surface layer (Ci/m**2) x cf pCi/m2 cf= 1.000E+12
Year Src Rec  H-3      C-14
-----
2015  1  1  0.000E+00  0.000E+00
2015 ALL 1  0.000E+00  0.000E+00
-----
Time-Integrated Resuspended Concentration (Ci-yr/m**3) x cf pCi/m3 cf= 1.000E+12
Year Src Rec  H-3      C-14
-----
2015  1  1  0.000E+00  0.000E+00
2015 ALL 1  0.000E+00  0.000E+00
-----
Annual Accumulated Soil Concentration in subsurface layer Ci/m**2) x cf pCi/m2 cf= 1.000E+12
Year Src Rec  H-3      C-14
-----
2015  1  1  0.000E+00  0.000E+00
2015 ALL 1  0.000E+00  0.000E+00
-----
Leafy Vegetable Concentrations (Ci/kg) x cf pCi/kg cf= 1.000E+12
Year Src Rec  H-3      C-14
-----
2015  1  1  3.746E+01  2.785E-05
2015 ALL 1  3.746E+01  2.785E-05
-----
Other Vegetable Concentrations (Ci/kg) x cf pCi/kg cf= 1.000E+12
Year Src Rec  H-3      C-14
-----
2015  1  1  3.746E+01  2.785E-05
2015 ALL 1  3.746E+01  2.785E-05
-----
Milk Concentrations (Ci/L) x cf pCi/L cf= 1.000E+12
Year Src Rec  H-3      C-14
-----
2015  1  1  4.556E+01  1.388E-05
2015 ALL 1  4.556E+01  1.388E-05
-----
Beef Concentrations (Ci/kg) x cf pCi/kg cf= 1.000E+12
Year Src Rec  H-3      C-14
-----
2015  1  1  2.839E+01  1.889E-05
2015 ALL 1  2.839E+01  1.889E-05
-----
Dose Conversion Factor Notes
-----
Inhalation Dose Conversion Factors (rem/Ci)
Rad      Sol  AMAD(um)  Age      Effective
-----
H-3      D    1.0        0        7.141E+01
H-3      D    1.0        1        7.141E+01
H-3      D    1.0        5        7.141E+01
H-3      D    1.0        10       7.141E+01
H-3      D    1.0        15       7.141E+01
H-3      D    1.0        20       7.141E+01
C-14     D    1.0        0        2.276E+04
C-14     D    1.0        1        2.276E+04
C-14     D    1.0        5        2.276E+04
C-14     D    1.0        10       2.276E+04
C-14     D    1.0        15       2.276E+04
C-14     D    1.0        20       2.276E+04
-----
Ingestion Dose Conversion Factors (rem/Ci)
Rad      Age      Effective
-----
H-3      0        7.090E+01

```

H-3	1	7.090E+01
H-3	5	7.090E+01
H-3	10	7.090E+01
H-3	15	7.090E+01
H-3	20	7.090E+01
C-14	0	2.150E+03
C-14	1	2.150E+03
C-14	5	2.150E+03
C-14	10	2.150E+03
C-14	15	2.150E+03
C-14	20	2.150E+03

External Dose Conversion Factors (rem-m**2/(Ci-s))

Rad	Age	Effective
H-3	0	0.000E+00
H-3	1	0.000E+00
H-3	5	0.000E+00
H-3	10	0.000E+00
H-3	15	0.000E+00
H-3	20	0.000E+00
C-14	0	4.760E-08
C-14	1	4.760E-08
C-14	5	4.760E-08
C-14	10	4.760E-08
C-14	15	4.760E-08
C-14	20	4.760E-08

Submersion Dose Conversion Factors (rem-m**3/(Ci-s))

Rad	Age	Effective
H-3	0	0.000E+00
H-3	1	0.000E+00
H-3	5	0.000E+00
H-3	10	0.000E+00
H-3	15	0.000E+00
H-3	20	0.000E+00
C-14	0	9.640E-06
C-14	1	9.640E-06
C-14	5	9.640E-06
C-14	10	9.640E-06
C-14	15	9.640E-06
C-14	20	9.640E-06

Soil Vol Dose Conversion Factors (rem-m**3/(Ci-s))

Rad	Age	Effective
H-3	0	0.000E+00
H-3	1	0.000E+00
H-3	5	0.000E+00
H-3	10	0.000E+00
H-3	15	0.000E+00
H-3	20	0.000E+00
C-14	0	2.180E-10
C-14	1	2.180E-10
C-14	5	2.180E-10
C-14	10	2.180E-10
C-14	15	2.180E-10
C-14	20	2.180E-10

Inhalation Dose from direct emissions (rem)

Year	Organ	Rec	H-3	C-14	Total
2015	Effective	1	1.281E-07	2.703E-12	1.281E-07
All	Effective	1	1.281E-07	2.703E-12	1.281E-07

Inhalation Dose from resuspension (rem)

Year	Organ	Rec	H-3	C-14	Total
2015	Effective	1	0.000E+00	0.000E+00	0.000E+00
All	Effective	1	0.000E+00	0.000E+00	0.000E+00

Soil Ingestion Doses (rem)

Year	Organ	Rec	H-3	C-14	Total
2015	Effective	1	0.000E+00	0.000E+00	0.000E+00
All	Effective	1	0.000E+00	0.000E+00	0.000E+00

Leafy Vegetable Ingestion Dose (rem)

Year	Organ	Rec	H-3	C-14	Total
2015	Effective	1	4.781E-08	1.078E-12	4.781E-08
All	Effective	1	4.781E-08	1.078E-12	4.781E-08

Other Vegetable Ingestion Dose (rem)

Year	Organ	Rec	H-3	C-14	Total
2015	Effective	1	4.675E-07	1.054E-11	4.675E-07
All	Effective	1	4.675E-07	1.054E-11	4.675E-07

Beef Ingestion Dose (rem)

Year	Organ	Rec	H-3	C-14	Total
2015	Effective	1	1.711E-07	3.453E-12	1.711E-07

```

All Effective          1  1.711E-07  3.453E-12  1.711E-07
-----
Milk Ingestion Dose (rem)
Year   Organ   Rec   H-3       C-14       Total
-----
2015 Effective        1  3.618E-07  3.343E-12  3.618E-07
All Effective         1  3.618E-07  3.343E-12  3.618E-07
-----
External Exposure Dose (rem)
Year   Organ   Rec   H-3       C-14       Total
-----
2015 Effective        1  0.000E+00  0.000E+00  0.000E+00
All Effective         1  0.000E+00  0.000E+00  0.000E+00
-----
Submersion Exposure Dose (rem)
Year   Organ   Rec   H-3       C-14       Total
-----
2015 Effective        1  0.000E+00  4.495E-18  4.495E-18
All Effective         1  0.000E+00  4.495E-18  4.495E-18
-----
All Pathway Doses (rem)
Year   Organ   Rec   H-3       C-14       Total
-----
2015 Effective        1  1.176E-06  2.111E-11  1.176E-06
All Effective         1  1.176E-06  2.111E-11  1.176E-06
Successful Execution of DOSEMM
Execution Time  0.32562800000000003          seconds
    
```

Iodine Output File

```

*****
*   This output was produced by the model:   *
*                                           *
*                   DOSEMM                  *
*                                           *
* Dose Multi Media. A numerical model for   *
* multi-media assessment of dose from      *
* atmospheric releases. Pathways include direct *
* inhalation, resuspension, soil ingestion, *
* vegetable, milk, and meat ingestion, external,*
* and submersion doses. Fortran 95 Ver    *
* Version date:                             *
* 190429                                     *
* Arthur S. Rood                             *
* K-Spar Inc. 4835 W Foxtrail Lane         *
* Idaho Falls, ID 83402                    *
* asr@kspar.net                             *
*****
Date: 05/22/2019 Time: 07:35:28.046
Input File: iodine.par
    
```

```

-----
START OF PARAMETER DEFINITION FILE
-----
'DOSEMM run for 2015 ASER - iodine releases from INTEC' [title]
.FALSE. .FALSE. SFOOD [debug lgame]
120 100 2000 255000 4725000 36 UTM 12 [nx,ny,dx,xsw,ysw,ndiscrete,gtype,utmzone]
341316 , 4827515 1 BEA-TRA
343508 , 4825927 2 BEA-CPP
335063 , 4818552 3 BEA-RWMC
339762 , 4822062 4 BEA-VAN B
416371 , 4818571 5 BEA-IRC
391668 , 4782760 6 BEA-BLKFT
360950 , 4857752 7 BEA-SMC
358520 , 4848894 8 BEA-GATE 4
352512 , 4820235 9 BEA-ARA
337640 , 4823710 10 BEA-REST
414380 , 4818193 11 BEA-IF
345564 , 4834399 12 BEA-NRF
341727 , 4828168 13 BEA-RTC
337858 , 4819578 14 BEA-EBR 1
366673 , 4828121 15 BEA-MFC
440759 , 4860651 16 BEA-SUGAR
348964 , 4823312 17 BEA-PBF
344158 , 4826806 18 BEA-INTEC
342602 , 4821788 19 BEA-CFA
346110 , 4829754 20 BEA-EFS
292750 , 4815336 21 BEA-CRATERS
339764 , 4822062 22 ESER-VAN
292751 , 4815336 23 ESER-CRA
314683 , 4832742 24 ESER-ARC
440759 , 4860651 25 ESER-SUG
414376 , 4818191 26 ESER-IDA
401640 , 4892296 27 ESER-DUB
376885 , 4874727 28 ESER-MON
375764 , 4823554 29 ESER-FAA
346614 , 4819341 30 ESER-MAI
346114 , 4829751 31 ESER-EFS
353080 , 4811691 32 ESER-ATO
391668 , 4782752 33 ESER-MOU
352495 , 4881840 34 ESER-BLU
381307 , 4855031 35 ESER-TER
340891 , 4849794 36 ESER-HOW
1 12 2015 1 [nsrsrc,nresol,byear,npartsize]
1 [partsize(npartsize)]
    
```

```

1.0 [partmod(npartsiz)]
INTEC P 1 [srcname(nsrgs)] srctype partindx
343830. 4825807. [utms(nsrgs,1) utms(nsrgs,2)]
'.../chiqvalues/INTEC_con_PM15.out' [filechiq(nsrgs)]
'.../chiqvalues/INTEC_dep_PM15.out' [filepsiq(nsrgs)]
'.../sourceterm/INTEC-iodine.rel' [filerel(nsrgs)]
1 soption - plotting option [soption(nsrgs)]
2 RA 1 [ncontam ctype norgans]
'Effective' [organ(norgan)]
'.../infiles/INH.txt' [dcffile(1)]
'.../infiles/ING.txt' [dcffile(2)]
'.../infiles/EXT.txt' [dcffile(3)]
'.../infiles/SUB.txt' [dcffile(4)]
'.../infiles/GRD.txt' [dcffile(5)]
8.3e-2 8.3e-2 [intcut,extcit] half-life cutoff for
inclusion of progeny with parent dcf (years)
I-129 I-131 [cname(ncontam)]
0.0 0. 0. 0. 0. [bratio(ncontam)]
D D D D D [adtype(ncontam,nsrgs)] CFA
'.../infiles/NuclideData.dat' [filenuc]
'.../infiles/ElementData.dat' [fileelement]
1.0e-9 2.0e-6 0.03 0.15 0.010 0.2 0.6769 1.4 3.66
[rf1t,rfst,thkres,thklch,infil,theta,src,rho,aws]
0.50, 1.0, 1.0, 0.4, 0.43, 0.0696 215.0 [ddl,fsubg,fsubl,fsubp,fsubs,lamw,p]
15.6 0.57, 0.2, 0.0, 90, 14, 14 [qsubf,r1,r2,th1,th2,th3,th4]
100. 30. 60. 2.0 20.0 60.0 0.28 0.716 0.716 [tsubB, tsubE1, tsubE2,tsubF,tsubS,tsubW,ysubV1,ysubV2,ysubV3]
8.0, 0.18, 0.97, 0.105 0.97, 1.0, 0.25, 0.07 [absH, concC, fw, fc, fwB, fwm, fcb, fcm]
0 0 0 0 0 [coption(ncontam)]
0 0 0 [poption(i),i=1,3]
1.0e12 'pCi/m3' [cf(1)] air concentration
1.0e12 'pCi/m2' [cf(2)] annual deposition
converted to conc in 0-15 cm layer
1.0e12 'pCi/m2' [cf(3)] surface soil
concentration
1.0e12 'pCi/kg' [cf(4)] veg concentrations
1.0e12 'pCi/L' [cf(5)] milk concentrations
1.0e12 'pCi/kg' [cf(6)] beef and wild game
concentrations
1.0e12 'pCi/m2' [cf(7)] subsurface soil
concentrations
'.../infiles/refperson_intakes.dat' [fileexp]
1 nrecept
333528,4810277, 2015 1 2015 12 1957 [utmr(1,1) utm(i,2) syr spr eyr epr yob]
0.0 24.0 365 1.0 1.0 1.0 1.0 1.0 1.0 1.0
[fi(i),ef(i),et(i),inhm(i),ingsm(i),ingvm(i),ingbm(i), ingmm(i), ingwm(i), cindoor(i)], esf(i), ssf(i)
0 -23432 [nsim,srand]
-----
END OF PARAMETER DEFINITION FILE
-----
Contaminant Data
Radionuclide Half-Life(y) Progeny kd(mL/g) Bv(dw) Biv(dw) TcMilk(d/L) TcMeat(d/kg)
-----
I-129 1.570E+07 STABLE 1.000E-01 2.000E-02 2.000E-02 1.000E-02 7.000E-03
I-131 2.199E-02 Xe-131m 1.000E-01 2.000E-02 2.000E-02 1.000E-02 7.000E-03
-----
Receptor Node Numbers and Coordinates
Rec UTME (m) UTMN (m) Node Number
-----
1 333528. 4810277. 5080
-----
Age-Dependent Intake Rates
Age (yr) Inh (m*3/hr) Soil (g/hr) LVeg (kg/yr) OVeg (kg/yr) Milk (L/yr) Meat (kg/yr) Game (kg/yr)
-----
0.0 3.650E-01 2.500E-03 1.430E+01 1.773E+01 4.720E+01 3.580E+01 0.000E+00
1.0 5.620E-01 4.170E-03 2.788E+01 3.246E+01 4.560E+01 3.460E+01 6.380E+01
5.0 5.350E-01 6.960E-03 3.620E+01 3.516E+01 4.940E+01 3.750E+01 6.580E+01
10.0 5.530E-01 5.000E-03 4.300E+01 2.938E+01 6.480E+01 4.920E+01 1.059E+02
15.0 6.230E-01 4.170E-03 4.878E+01 2.231E+01 9.060E+01 6.880E+01 1.059E+02
20.0 9.170E-01 0.000E+00 1.800E+01 1.760E+02 1.120E+02 8.500E+01 0.000E+00
120.0 9.170E-01 0.000E+00 1.800E+01 1.760E+02 1.120E+02 8.500E+01 0.000E+00
-----
Receptor Exposure Factors
RecNo Frac_Indoors Exps_Freq Exps_Time Inhal_ModFact Soil_ModFact Veg_ModFact Meat_ModFact Milk_ModFact
WGme_ModFact Air I/O Ext I/O Fac Sub I/O Fa!!
(unitless) (unitless) (h/d) (d/yr) (unitless) (unitless) (unitless) (unitless) (unitless)
(unitless) (unitless) (unitless) (unitless)
-----
1 0.000E+00 2.400E+01 3.650E+02 1.000E+00 1.000E+00 1.000E+00 1.000E+00 1.000E+00
1.000E+00 1.000E+00 1.000E+00 1.000E+00
-----
Src Description Src_Type Part_Size (um) UTME (m) UTMN (m)
-----
1 INTEC P 1.00 343830.0 4825807.0
-----
Chi/Q values for Receptors
Src Rec Dist(m) Bearing(deg) Node_Number Chi/Q (s/m*3) for point srcs, s/m for area sources (period 1..nresol)
-----
1 1 18636. 213.56 5080 3.740E-09 7.128E-09 1.748E-08 8.262E-09 6.962E-09 1.039E-08 9.930E-09
1.019E-08 7.716E-09 7.770E-09 1.995E-09 1.129E-08

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-----
Psi/Q values for Receptors
Src# Rec# Node Number Psi/Q (1/m**2 for point srcs, unitless for area sources (period 1..nresol)
-----
1 1 5080 4.552E-11 8.508E-11 2.007E-10 1.074E-10 1.021E-10 1.200E-10 1.229E-10 1.208E-10 1.085E-10
1.005E-10 2.426E-11 1.213E-10
-----

Food Chain Parameters
-----
Fraction of radioactivity retained on leafy vegetables and produce after washing: 5.000E-01
Fraction of produce grown in garden of interest: 1.000E+00
Fraction of leafy vegetables grown in garden of interest: 1.000E+00
Fraction of year animals graze on pasture: 4.000E-01
Fraction of daily feed that is pasture grass when animal grazes on pasture: 4.300E-01
Removal rate for weathering from plants, d-1: 6.960E-02
Effective surface density of soil, kg/m2: 2.150E+02
Consumption rate of contaminated feed or forage by an animal (dry wt), kg/day: 1.560E+01
Fallout interception fraction, pasture: 5.700E-01
Fallout interception fraction (vegetables): 2.000E-01
Time delay-ingestion of pasture grass by animals, days: 0.000E+00
Time delay-ingestion of stored feed by animals, days: 9.000E+01
Time delay-ingestion of leafy vegetables by man, days: 1.400E+01
Time delay-ingestion of produce by man, days: 1.400E+01
Buildup time in soil, years: 1.000E+02
Period of exposure (grass pasture), days: 3.000E+01
Period of exposure (crops/leafy vegetables), days: 6.000E+01
Transport time: animal feed-milk-man, days: 2.000E+00
Average time from slaughter of meat animal to consumption, days: 2.000E+01
Time over which wild game is consumed, days: 6.000E+01
Productivity: agriculture (grass-cow-milk-man pathway), kg/m2 2.800E-01
Productivity: produce and leafy vegetables (wet), kg/m2: 7.160E-01
Productivity: produce and other vegetables (wet), kg/m2: 7.160E-01
Absolute humidity, g/m3: 8.000E+00
Atmospheric concentration of carbon, g/m3: 1.800E-01
Fraction of veg that is water: 9.700E-01
Fraction of veg that is carbon: 1.050E-01
Fraction of beef that is water: 9.700E-01
Fraction of milk that is water: 1.000E+00
Fraction of beef that is carbon: 2.500E-01
Fraction of milk that is carbon: 7.000E-02

Contaminant Lambda (1/yr) Surface LR (1/yr) Subsurface LR (1/yr)
-----
I-129 4.415E-08 9.804E-01 1.961E-01
I-131 3.152E+01 9.804E-01 1.961E-01
-----

Resuspension parameters
-----
Short-term resuspension factor (1/m): 2.000E-06
Long-term resuspension factor (1/m): 1.000E-09
Short-term resuspension decay constant (1/yr): 6.769E-01

Ingrowth factors. Fraction of progeny that grow in from parent during dt (years): 8.4931507706642151E-002
TO >>>> I-129 I-131
I-129 0.000E+00 0.000E+00
I-131 0.000E+00 0.000E+00

Time-Integrated Concentration (Ci-yr/m**3) x cf pCi/m3 cf= 1.000E+12
Year Src Rec I-129 I-131
-----
2015 1 1 5.865E-06 2.712E-02
2015 ALL 1 5.865E-06 2.712E-02

Annual Deposition (Ci/m**2) x cf pCi/m2 cf= 1.000E+12
Year Src Rec I-129 I-131
-----
2015 1 1 2.264E+00 1.047E+04
2015 ALL 1 2.264E+00 1.047E+04

Annual Accumulated Soil Concentration in surface layer (Ci/m**2) x cf pCi/m2 cf= 1.000E+12
Year Src Rec I-129 I-131
-----
2015 1 1 1.419E+00 3.552E+02
2015 ALL 1 1.419E+00 3.552E+02

Time-Integrated Resuspended Concentration (Ci-yr/m**3) x cf pCi/m3 cf= 1.000E+12
Year Src Rec I-129 I-131
-----
2015 1 1 3.151E-06 5.229E-03
2015 ALL 1 3.151E-06 5.229E-03

Annual Accumulated Soil Concentration in subsurface layer Ci/m**2) x cf pCi/m2 cf= 1.000E+12
Year Src Rec I-129 I-131
-----
2015 1 1 7.892E-01 9.501E+00
2015 ALL 1 7.892E-01 9.501E+00

Leafy Vegetable Concentrations (Ci/kg) x cf pCi/kg cf= 1.000E+12
Year Src Rec I-129 I-131
-----
2015 1 1 3.331E-02 7.675E+00

```



```

2015 ALL 1 3.331E-02 7.675E+00
-----
Other Vegetable Concentrations (Ci/kg) x cf pCi/kg cf= 1.000E+12
Year Src Rec I-129 I-131
-----
2015 1 1 3.331E-02 7.675E+00
2015 ALL 1 3.331E-02 7.675E+00
-----
Milk Concentrations (Ci/L) x cf pCi/L cf= 1.000E+12
Year Src Rec I-129 I-131
-----
2015 1 1 2.808E-02 8.390E+00
2015 ALL 1 2.808E-02 8.390E+00
-----
Beef Concentrations (Ci/kg) x cf pCi/kg cf= 1.000E+12
Year Src Rec I-129 I-131
-----
2015 1 1 1.965E-02 1.241E+00
2015 ALL 1 1.965E-02 1.241E+00
-----

```

```

Dose Conversion Factor Notes
External DCF for I-131 includes Xe-131m
Ground DCF for I-131 includes Xe-131m
-----

```

```

Inhalation Dose Conversion Factors (rem/Ci)
Rad Sol AMAD(um) Age Effective
-----
I-129 D 1.0 0 3.996E+05
I-129 D 1.0 1 3.996E+05
I-129 D 1.0 5 3.996E+05
I-129 D 1.0 10 3.996E+05
I-129 D 1.0 15 3.996E+05
I-129 D 1.0 20 3.996E+05
I-131 D 1.0 0 9.657E+04
I-131 D 1.0 1 9.657E+04
I-131 D 1.0 5 9.657E+04
I-131 D 1.0 10 9.657E+04
I-131 D 1.0 15 9.657E+04
I-131 D 1.0 20 9.657E+04
-----

```

```

Ingestion Dose Conversion Factors (rem/Ci)
Rad Age Effective
-----
I-129 0 3.910E+05
I-129 1 3.910E+05
I-129 5 3.910E+05
I-129 10 3.910E+05
I-129 15 3.910E+05
I-129 20 3.910E+05
I-131 0 3.910E+05
I-131 1 3.910E+05
I-131 5 8.050E+04
I-131 10 8.050E+04
I-131 15 8.050E+04
I-131 20 8.050E+04
-----

```

```

External Dose Conversion Factors (rem-m**2/(Ci-s))
Rad Age Effective
-----
I-129 0 7.260E-05
I-129 1 7.260E-05
I-129 5 7.260E-05
I-129 10 7.260E-05
I-129 15 7.260E-05
I-129 20 7.260E-05
I-131 0 1.410E-03
I-131 1 1.410E-03
I-131 5 1.410E-03
I-131 10 1.410E-03
I-131 15 1.410E-03
I-131 20 1.410E-03
-----

```

```

Submersion Dose Conversion Factors (rem-m**3/(Ci-s))
Rad Age Effective
-----
I-129 0 1.050E-03
I-129 1 1.050E-03
I-129 5 1.050E-03
I-129 10 1.050E-03
I-129 15 1.050E-03
I-129 20 1.050E-03
I-131 0 6.250E-02
I-131 1 6.250E-02
I-131 5 6.250E-02
I-131 10 6.250E-02
I-131 15 6.250E-02
I-131 20 6.250E-02
-----

```

```

Soil Vol Dose Conversion Factors (rem-m**3/(Ci-s))
Rad Age Effective
-----
I-129 0 1.900E-07
I-129 1 1.900E-07
I-129 5 1.900E-07
-----

```

I-129	10	1.900E-07
I-129	15	1.900E-07
I-129	20	1.900E-07
I-131	0	4.038E-05
I-131	1	4.038E-05
I-131	5	4.038E-05
I-131	10	4.038E-05
I-131	15	4.038E-05
I-131	20	4.038E-05

Inhalation Dose from direct emissions (rem)

Year	Organ	Rec	I-129	I-131	Total
2015	Effective	1	1.883E-08	2.104E-05	2.106E-05
All	Effective	1	1.883E-08	2.104E-05	2.106E-05

Inhalation Dose from resuspension (rem)

Year	Organ	Rec	I-129	I-131	Total
2015	Effective	1	1.011E-08	4.057E-06	4.067E-06
All	Effective	1	1.011E-08	4.057E-06	4.067E-06

Soil Ingestion Doses (rem)

Year	Organ	Rec	I-129	I-131	Total
2015	Effective	1	0.000E+00	0.000E+00	0.000E+00
All	Effective	1	0.000E+00	0.000E+00	0.000E+00

Leafy Vegetable Ingestion Dose (rem)

Year	Organ	Rec	I-129	I-131	Total
2015	Effective	1	2.344E-07	1.112E-05	1.136E-05
All	Effective	1	2.344E-07	1.112E-05	1.136E-05

Other Vegetable Ingestion Dose (rem)

Year	Organ	Rec	I-129	I-131	Total
2015	Effective	1	2.292E-06	1.087E-04	1.110E-04
All	Effective	1	2.292E-06	1.087E-04	1.110E-04

Beef Ingestion Dose (rem)

Year	Organ	Rec	I-129	I-131	Total
2015	Effective	1	6.532E-07	8.492E-06	9.145E-06
All	Effective	1	6.532E-07	8.492E-06	9.145E-06

Milk Ingestion Dose (rem)

Year	Organ	Rec	I-129	I-131	Total
2015	Effective	1	1.229E-06	7.565E-05	7.688E-05
All	Effective	1	1.229E-06	7.565E-05	7.688E-05

External Exposure Dose (rem)

Year	Organ	Rec	I-129	I-131	Total
2015	Effective	1	3.280E-09	1.587E-05	1.588E-05
All	Effective	1	3.280E-09	1.587E-05	1.588E-05

Submersion Exposure Dose (rem)

Year	Organ	Rec	I-129	I-131	Total
2015	Effective	1	1.942E-13	5.346E-08	5.346E-08
All	Effective	1	1.942E-13	5.346E-08	5.346E-08

All Pathway Doses (rem)

Year	Organ	Rec	I-129	I-131	Total
2015	Effective	1	4.442E-06	2.450E-04	2.495E-04
All	Effective	1	4.442E-06	2.450E-04	2.495E-04

Successful Execution of DOSEMM
 Execution Time 0.3501849999999997 seconds

Nobel Gas Output File

```

*****
* This output was produced by the model: *
* *
* DOSEMM *
* *
* Dose Multi Media. A numerical model for *
* multi-media assessment of dose from *
* atmospheric releases. Pathways include direct *
* inhalation, resuspension, soil ingestion, *
* vegetable, milk, and meat ingestion, external, *
* and submersion doses. Fortran 95 Ver *
* Version date: *
* 190429 *
* Arthur S. Rood *
* K-Spar Inc. 4835 W Foxtrail Lane *
* Idaho Falls, ID 83402 *
* asr@kspar.net *
*****
    
```

Date: 05/19/2019 Time: 18:50:05.889
 Input File: ng.par

```

-----
START OF PARAMETER DEFINITION FILE
-----
'DOSEMM run for 2015 ASER - nobel gas releases from INTEC' [title]
.FALSE. .FALSE. NONE [debug lgame]
120 100 2000 255000 4725000 36 UTM 12 [nx,ny,dx,xsw,ysw,ndiscrete,gtype,utmzone]
341316 , 4827515 1 BEA-TRA
343508 , 4825927 2 BEA-CPP
335063 , 4818552 3 BEA-RWMC
339762 , 4822062 4 BEA-VAN B
416371 , 4818571 5 BEA-IRC
391668 , 4782760 6 BEA-BLKFT
360950 , 4857752 7 BEA-SMC
358520 , 4848894 8 BEA-GATE 4
352512 , 4820235 9 BEA-ARA
337640 , 4823710 10 BEA-REST
414380 , 4818193 11 BEA-IF
345564 , 4834399 12 BEA-NRF
341727 , 4828168 13 BEA-RTC
337858 , 4819578 14 BEA-EBR 1
366673 , 4828121 15 BEA-MFC
440759 , 4860651 16 BEA-SUGAR
348964 , 4823312 17 BEA-PBF
344158 , 4826806 18 BEA-INTEC
342602 , 4821788 19 BEA-CFA
346110 , 4829754 20 BEA-EFS
292750 , 4815336 21 BEA-CRATERS
339764 , 4822062 22 ESER-VAN
292751 , 4815336 23 ESER-CRA
314683 , 4832742 24 ESER-ARC
440759 , 4860651 25 ESER-SUG
414376 , 4818191 26 ESER-IDA
401640 , 4892296 27 ESER-DUB
376885 , 4874727 28 ESER-MON
375764 , 4823554 29 ESER-FAA
346614 , 4819341 30 ESER-MAI
346114 , 4829751 31 ESER-EFS
353080 , 4811691 32 ESER-ATO
391668 , 4782752 33 ESER-MOU
352495 , 4881840 34 ESER-BLU
381307 , 4855031 35 ESER-TER
340891 , 4849794 36 ESER-HOW
1 12 2015 1 [nsrsrcs,nresol,byear,npartsize]
1.0 [partsize(npartsize)]
1.0 [partmod(npartsize)]
INTEC P 1 [srcname(nsrsrcs)] srctype partindx
343830. 4825807. [utms(nsrsrcs,1) utms(nsrsrcs,2)]
'../../chigvalues/INTEC_con_PM0.out' [filechig(nsrsrcs)]
'../../chigvalues/INTEC_dep_PM0.out' [filepsig(nsrsrcs)]
'../../sourceterm/INTEC-NG.tel' [filerel(nsrsrcs)]
1 soption - plotting option [soption(nsrsrcs)]
2 RA 1 [ncontam ctype norgans]
'Effective' [organ(norgan)]
'../../infiles/INH.txt' [dcffile(1)]
'../../infiles/ING.txt' [dcffile(2)]
'../../infiles/EXT.txt' [dcffile(3)]
'../../infiles/SUB.txt' [dcffile(4)]
'../../infiles/GRD.txt' [dcffile(5)]
8.3e-2 8.3e-2 [intcut,extcoit] half-life cutoff for inclusion of progeny with parent dof (years)
Kr-85 Ar-41 [cname(ncontam)]
0.0 0.0 0.0 0.0 0.0 [bratio(ncontam)]
D D D D D [adtype(ncontam,nsrsrcs)] CFA
'../../infiles/NuclideData.dat' [filenuc]
'../../infiles/ElementData.dat' [filelement]
1.0e-9 2.0e-6 0.03 0.15 0.10 0.2 0.6769 1.4 3.66
[rflt,rfst,thkres,thklch,infil,theta,src,rho,aws]
0 0 0 0 0 [coption(ncontam)]
0 0 0 [poption(i),i=1,3]
1.0e12 'pCi/m3' [cf(1)] air concentration
4.46e6 'pCi/g' [cf(2)] annual deposition
converted to conc in 0-15 cm layer
1.0e12 'pCi/m2' [cf(3)] surface soil
concentration
1.0e12 'pCi/kg' [cf(4)] veg concentrations
1.0e12 'pCi/L' [cf(5)] milk concentrations
1.0e12 'pCi/kg' [cf(6)] beef and wild game
concentrations
1.0e12 'pCi/m2' [cf(7)] subsurface soil
concentrations
'../../infiles/refperson_intakes.dat' [fileexp]
1 nrecept
333528,4810277, 2015 1 2015 12 1957 [utm(1,1) utm(i,2) syr spr eyr epr yob]
0.0 24.0 365 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0
[fi(i),ef(i),et(i),inhm(i),ingsm(i),ingvm(i),ingbm(i), ingmm(i), ingwm(i), cindoor(i)], esf(i), ssf(i)
0 -23432 [nsim,srand]
-----
END OF PARAMETER DEFINITION FILE
-----
Contaminant Data
Radionuclide Half-Life(y) Progeny kd(mL/g) Bv(dw) Biv(dw) TcMilk(d/L) TcMeat(d/kg)
-----
Kr-85 1.076E+01 STABLE 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
Ar-41 2.080E-04 STABLE 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
-----

```

Receptor Node Numbers and Coordinates
 Rec UTME (m) UTMN (m) Node Number

 1 333528. 4810277. 5080

Age-Dependent Intake Rates

Age (yr)	Inh (m**3/hr)	Soil (g/hr)	LVeg (kg/yr)	OVeg (kg/yr)	Milk (L/yr)	Meat (kg/yr)	Game (kg/yr)
0.0	3.650E-01	2.500E-03	1.430E+01	1.773E+01	4.720E+01	3.580E+01	0.000E+00
1.0	5.620E-01	4.170E-03	2.788E+01	3.246E+01	4.560E+01	3.460E+01	6.380E+01
5.0	5.350E-01	6.960E-03	3.620E+01	3.516E+01	4.940E+01	3.750E+01	6.580E+01
10.0	5.530E-01	5.000E-03	4.300E+01	2.938E+01	6.480E+01	4.920E+01	1.059E+02
15.0	6.230E-01	4.170E-03	4.878E+01	2.231E+01	9.060E+01	6.880E+01	1.059E+02
20.0	9.170E-01	0.000E+00	1.800E+01	1.760E+02	1.120E+02	8.500E+01	0.000E+00
120.0	9.170E-01	0.000E+00	1.800E+01	1.760E+02	1.120E+02	8.500E+01	0.000E+00

Receptor Exposure Factors

RecNo	Frac_Indoors	Exps_Freq	Exps_Time	Inhal_ModFact	Soil_ModFact	Veg_ModFact	Meat_ModFact	Milk_ModFact
WGme_ModFact	Air I/O	Ext I/O	Fac Sub I/O	Fa!!				
(unitless)	(unitless)	(h/d)	(d/yr)	(unitless)	(unitless)	(unitless)	(unitless)	(unitless)
1	0.000E+00	2.400E+01	3.650E+02	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00

Src Description Src_Type Part_Size (um) UTME (m) UTMN (m)

 1 INTEC P 1.00 343830.0 4825807.0

Chi/Q values for Receptors

Src Rec Dist (m) Bearing (deg) Node_Number Chi/Q (s/m**3) for point srcs, s/m for area sources (period 1..nresol)

1	1	18636.	213.56	5080	2.917E-08	3.728E-08	1.019E-07	4.683E-08	3.368E-08	5.188E-08	4.307E-08
5.540E-08	4.003E-08	4.737E-08	2.023E-08	8.221E-08							

Psi/Q values for Receptors

Src# Rec# Node Number Psi/Q (1/m**2 for point srcs, unitless for area sources (period 1..nresol))

1	1	5080	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
0.000E+00	0.000E+00	0.000E+00									

Contaminant Lambda (1/yr) Surface LR (1/yr) Subsurface LR (1/yr)

Kr-85	6.442E-02	1.667E+01	3.333E+00
Ar-41	3.332E+03	1.667E+01	3.333E+00

Ingrowth factors. Fraction of progeny that grow in from parent during dt (years): 8.4931507706642151E-002

TO >>>>	Kr-85	Ar-41
Kr-85	0.000E+00	0.000E+00
Ar-41	0.000E+00	0.000E+00

Time-Integrated Concentration (Ci-yr/m**3) x cf pCi/m3 cf= 1.000E+12

Year	Src	Rec	Kr-85	Ar-41
2015	1	1	1.143E+00	4.576E-01
2015	ALL	1	1.143E+00	4.576E-01

Annual Deposition (Ci/m**2) x cf pCi/g cf= 4.460E+06

Year	Src	Rec	Kr-85	Ar-41
2015	1	1	0.000E+00	0.000E+00
2015	ALL	1	0.000E+00	0.000E+00

Annual Accumulated Soil Concentration in surface layer (Ci/m**2) x cf pCi/m2 cf= 1.000E+12

Year	Src	Rec	Kr-85	Ar-41
2015	1	1	0.000E+00	0.000E+00
2015	ALL	1	0.000E+00	0.000E+00

Time-Integrated Resuspended Concentration (Ci-yr/m**3) x cf pCi/m3 cf= 1.000E+12

Year	Src	Rec	Kr-85	Ar-41
2015	1	1	0.000E+00	0.000E+00
2015	ALL	1	0.000E+00	0.000E+00

Annual Accumulated Soil Concentration in subsurface layer Ci/m**2) x cf pCi/m2 cf= 1.000E+12

Year	Src	Rec	Kr-85	Ar-41
2015	1	1	0.000E+00	0.000E+00
2015	ALL	1	0.000E+00	0.000E+00

Leafy Vegetable Concentrations (Ci/kg) x cf pCi/kg cf= 1.000E+12

Year	Src	Rec	Kr-85	Ar-41
2015	1	1	0.000E+00	0.000E+00
2015	ALL	1	0.000E+00	0.000E+00

```
-----
Other Vegetable Concentrations (Ci/kg) x cf pCi/kg cf= 1.000E+12
Year Src Rec  Kr-85      Ar-41
-----
2015  1  1  0.000E+00  0.000E+00
2015 ALL 1  0.000E+00  0.000E+00
-----
```

```
Milk Concentrations (Ci/L) x cf pCi/L cf= 1.000E+12
Year Src Rec  Kr-85      Ar-41
-----
2015  1  1  0.000E+00  0.000E+00
2015 ALL 1  0.000E+00  0.000E+00
-----
```

```
Beef Concentrations (Ci/kg) x cf pCi/kg cf= 1.000E+12
Year Src Rec  Kr-85      Ar-41
-----
2015  1  1  0.000E+00  0.000E+00
2015 ALL 1  0.000E+00  0.000E+00
-----
```

Dose Conversion Factor Notes

```
-----
Inhalation Dose Conversion Factors (rem/Ci)
Rad      Sol  AMAD(um) Age      Effective
-----
Kr-85    D    1.0      0          0.000E+00
Kr-85    D    1.0      1          0.000E+00
Kr-85    D    1.0      5          0.000E+00
Kr-85    D    1.0     10          0.000E+00
Kr-85    D    1.0     15          0.000E+00
Kr-85    D    1.0     20          0.000E+00
Ar-41    D    1.0      0          0.000E+00
Ar-41    D    1.0      1          0.000E+00
Ar-41    D    1.0      5          0.000E+00
Ar-41    D    1.0     10          0.000E+00
Ar-41    D    1.0     15          0.000E+00
Ar-41    D    1.0     20          0.000E+00
-----
```

```
-----
Ingestion Dose Conversion Factors (rem/Ci)
Rad      Age      Effective
-----
Kr-85    0          0.000E+00
Kr-85    1          0.000E+00
Kr-85    5          0.000E+00
Kr-85    10         0.000E+00
Kr-85    15         0.000E+00
Kr-85    20         0.000E+00
Ar-41    0          0.000E+00
Ar-41    1          0.000E+00
Ar-41    5          0.000E+00
Ar-41    10         0.000E+00
Ar-41    15         0.000E+00
Ar-41    20         0.000E+00
-----
```

```
-----
External Dose Conversion Factors (rem-m**2/(Ci-s))
Rad      Age      Effective
-----
Kr-85    0          3.900E-05
Kr-85    1          3.900E-05
Kr-85    5          3.900E-05
Kr-85    10         3.900E-05
Kr-85    15         3.900E-05
Kr-85    20         3.900E-05
Ar-41    0          4.500E-03
Ar-41    1          4.500E-03
Ar-41    5          4.500E-03
Ar-41    10         4.500E-03
Ar-41    15         4.500E-03
Ar-41    20         4.500E-03
-----
```

```
-----
Submersion Dose Conversion Factors (rem-m**3/(Ci-s))
Rad      Age      Effective
-----
Kr-85    0          8.880E-04
Kr-85    1          8.880E-04
Kr-85    5          8.880E-04
Kr-85    10         8.880E-04
Kr-85    15         8.880E-04
Kr-85    20         8.880E-04
Ar-41    0          2.280E-01
Ar-41    1          2.280E-01
Ar-41    5          2.280E-01
Ar-41    10         2.280E-01
Ar-41    15         2.280E-01
Ar-41    20         2.280E-01
-----
```

```
-----
Soil Vol Dose Conversion Factors (rem-m**3/(Ci-s))
Rad      Age      Effective
-----
Kr-85    0          2.680E-07
Kr-85    1          2.680E-07
Kr-85    5          2.680E-07
Kr-85    10         2.680E-07
Kr-85    15         2.680E-07
Kr-85    20         2.680E-07
-----
```

```

Ar-41      0      1.570E-04
Ar-41      1      1.570E-04
Ar-41      5      1.570E-04
Ar-41     10      1.570E-04
Ar-41     15      1.570E-04
Ar-41     20      1.570E-04
-----
Inhalation Dose from direct emissions (rem)
Year  Organ  Rec  Kr-85  Ar-41  Total
-----
2015 Effective      1  0.000E+00  0.000E+00  0.000E+00
All Effective       1  0.000E+00  0.000E+00  0.000E+00
-----
Inhalation Dose from resuspension (rem)
Year  Organ  Rec  Kr-85  Ar-41  Total
-----
2015 Effective      1  0.000E+00  0.000E+00  0.000E+00
All Effective       1  0.000E+00  0.000E+00  0.000E+00
-----
Soil Ingestion Doses (rem)
Year  Organ  Rec  Kr-85  Ar-41  Total
-----
2015 Effective      1  0.000E+00  0.000E+00  0.000E+00
All Effective       1  0.000E+00  0.000E+00  0.000E+00
-----
Leafy Vegetable Ingestion Dose (rem)
Year  Organ  Rec  Kr-85  Ar-41  Total
-----
2015 Effective      1  0.000E+00  0.000E+00  0.000E+00
All Effective       1  0.000E+00  0.000E+00  0.000E+00
-----
Other Vegetable Ingestion Dose (rem)
Year  Organ  Rec  Kr-85  Ar-41  Total
-----
2015 Effective      1  0.000E+00  0.000E+00  0.000E+00
All Effective       1  0.000E+00  0.000E+00  0.000E+00
-----
Beef Ingestion Dose (rem)
Year  Organ  Rec  Kr-85  Ar-41  Total
-----
2015 Effective      1  0.000E+00  0.000E+00  0.000E+00
All Effective       1  0.000E+00  0.000E+00  0.000E+00
-----
Milk Ingestion Dose (rem)
Year  Organ  Rec  Kr-85  Ar-41  Total
-----
2015 Effective      1  0.000E+00  0.000E+00  0.000E+00
All Effective       1  0.000E+00  0.000E+00  0.000E+00
-----
External Exposure Dose (rem)
Year  Organ  Rec  Kr-85  Ar-41  Total
-----
2015 Effective      1  0.000E+00  0.000E+00  0.000E+00
All Effective       1  0.000E+00  0.000E+00  0.000E+00
-----
Submersion Exposure Dose (rem)
Year  Organ  Rec  Kr-85  Ar-41  Total
-----
2015 Effective      1  3.202E-08  3.290E-06  3.322E-06
All Effective       1  3.202E-08  3.290E-06  3.322E-06
-----
All Pathway Doses (rem)
Year  Organ  Rec  Kr-85  Ar-41  Total
-----
2015 Effective      1  3.202E-08  3.290E-06  3.322E-06
All Effective       1  3.202E-08  3.290E-06  3.322E-06
Successful Execution of DOSEMM
Execution Time  0.32613199999999998      seconds

```

Resuspension Output File

```

*****
*          This output was produced by the model:          *
*          *                                                *
*          DOSEMM                                          *
*          *                                                *
*          Dose Multi Media. A numerical model for        *
*          multi-media assessment of dose from            *
*          atmospheric releases. Pathways include direct *
*          inhalation, resuspension, soil ingestion,     *
*          vegetable, milk, and meat ingestion, external,*
*          and submersion doses. Fortran 95 Ver          *
*          Version date:                                   *
*          190429                                          *
*          Arthur S. Rood                                  *
*          K-Spar Inc. 4835 W Foxtrail Lane               *
*          Idaho Falls, ID 83402                          *
*          asr@kspar.net                                   *
*****
Date: 05/22/2019 Time: 07:34:29.898
Input File: particulate.par

```

START OF PARAMETER DEFINITION FILE

```

'DOSEMM run for 2015 ASER - Particulate releases from INTEC' [title]
.FALSE. .FALSE. SFOOD [debug lgame]
120 100 2000 255000 4725000 36 UTM 12 [nx,ny,dx,xsw,ysw,ndiscrete,gtype,utmzone]
341316, 4827515 1 BEA-TRA
343508, 4825927 2 BEA-CPP
335063, 4818552 3 BEA-RWMC
339762, 4822062 4 BEA-VAN B
416371, 4818571 5 BEA-IRC
391668, 4782760 6 BEA-BLKFT
360950, 4857752 7 BEA-SMC
358520, 4848894 8 BEA-GATE 4
352512, 4820235 9 BEA-ARA
337640, 4823710 10 BEA-REST
414380, 4818193 11 BEA-IF
345564, 4834399 12 BEA-NRF
341727, 4828168 13 BEA-RTC
337858, 4819578 14 BEA-EBR 1
366673, 4828121 15 BEA-MFC
440759, 4860651 16 BEA-SUGAR
348964, 4823312 17 BEA-PBF
344158, 4826806 18 BEA-INTEC
342602, 4821788 19 BEA-CFA
346110, 4829754 20 BEA-EFS
292750, 4815336 21 BEA-CRATERS
339764, 4822062 22 ESER-VAN
292751, 4815336 23 ESER-CRA
314683, 4832742 24 ESER-ARC
440759, 4860651 25 ESER-SUG
414376, 4818191 26 ESER-IDA
401640, 4892296 27 ESER-DUB
376885, 4874727 28 ESER-MON
375764, 4823554 29 ESER-FAA
346614, 4819341 30 ESER-MAI
346114, 4829751 31 ESER-EFS
353080, 4811691 32 ESER-ATO
391668, 4782752 33 ESER-MOU
352495, 4881840 34 ESER-BLU
381307, 4855031 35 ESER-TER
340891, 4849794 36 ESER-HOW
1 12 2015 1 [nsrsrcs,nresol,byear,npartsiz]
1 [partsize(npartsiz)]
1.0 [partmod(npartsiz)]
INTEC P 1 [srcname(nsrsrcs)] srctype partindx
343830. 4825807. [utms(nsrsrcs,1) utms(nsrsrcs,2)]
'../../chiquvalues/INTEC_con3y-lum.out' [filechiq(nsrsrcs)]
'../../chiquvalues/INTEC_dep3y-lum.out' [filepsiq(nsrsrcs)]
'../../sourceterm/INTEC-Part.rel' [filerel(nsrsrcs)]
1 soption - plotting option [soption(nsrsrcs)]
9 RA 1 [ncontam ctype norgans]
'Effective' [organ(norgan)]
'../../infiles/INH.txt' [dcffile(1)]
'../../infiles/ING.txt' [dcffile(2)]
'../../infiles/EXT.txt' [dcffile(3)]
'../../infiles/SUB.txt' [dcffile(4)]
'../../infiles/GRD.txt' [dcffile(5)]
8.3e-2 8.3e-2 [intcut,extcit] half-life cutoff for
inclusion of progeny with parent dcf (years)
Pu-241 Am-241 Np-237 Cs-137 Pu-238 Pu-239 Pu-240 Sr-90 Co-60 [cname(ncontam)]
1.0 1. 0. 0. 0. 0. 0. 0. [bratio(ncontam)]
D D D D D D D D D [adtype(ncontam,nsrsrcs)] CFA
'../../infiles/NuclideData.dat' [filenuc]
'../../infiles/ElementData.dat' [filelement]
1.0e-9 1.0e-5 0.03 0.15 0.010 0.2 5.06 1.4 3.666
[rflt,rfst,thkres,thkich,infil,theta,strc,rho,aws]
0.50, 1.0, 1.0, 0.4, 0.43, 0.0696 215.0 [ddl,fsubg,fsubl,fsubp,fsubs,lamw,p]
15.6 0.57, 0.2, 0.0, 90, 14, 14 [qsubf,r1,r2,th1,th2,th3,th4]
100. 30. 60. 2.0 20.0 60.0 0.28 0.716 0.716 [tsubB, tsubE1, tsubE2,tsubF,tsubS,tsubW,ysubV1,ysubV2,ysubV3]
8.0, 0.18, 0.97, 0.105 0.97, 1.0, 0.25, 0.07 [absH, concC, fw, fc, fwb, fwm, fcb, fcm]
0 0 0 0 0 0 0 0 0 [coption(ncontam)]
0 0 [poption(i),i=1,3]
1.0e12 'pCi/m3' [cf(1)] air concentration
1.0e12 'pCi/m2' [cf(2)] annual deposition
converted to conc in 0-15 cm layer
1.0e12 'pCi/m2' [cf(3)] surface soil
concentration
1.0e12 'pCi/kg' [cf(4)] veg concentrations
1.0e12 'pCi/L' [cf(5)] milk concentrations
1.0e12 'pCi/kg' [cf(6)] beef and wild game
concentrations
1.0e12 'pCi/m2' [cf(7)] subsurface soil
concentrations
'../../infiles/refperson_intakes.dat' [fileexp]
1 nreceipt
333528,4810277, 2015 1 2025 12 1957 [utmr(1,1) utm(i,2) syr spr eyr epr yob]
0.0 24.0 365 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0
[fi(i),ef(i),et(i),inhm(i),ingsm(i),ingvm(i),ingbm(i), ingmm(i), ingwm(i), cindoor(i)], esf(i), ssf(i)
0 -23432 [nsim,srand]

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 END OF PARAMETER DEFINITION FILE

 Contaminant Data
 Radionuclide Half-Life(y) Progeny kd(mL/g) Bv(dw) Biv(dw) TcMilk(d/L) TcMeat(d/kg)

Pu-241	1.435E+01	Am-241	2.000E+03	1.000E-03	1.000E-03	1.000E-06	1.000E-04
Am-241	4.322E+02	Np-237	2.000E+01	1.000E-03	1.000E-03	2.000E-06	5.000E-05
Np-237	2.144E+06	STABLE	8.000E+00	2.000E-02	2.000E-02	5.000E-06	1.000E-03
Cs-137	3.007E+01	Ba-137m	4.600E+03	4.000E-02	4.000E-02	8.000E-03	3.000E-02
Pu-238	8.770E+01	U-234	2.000E+03	1.000E-03	1.000E-03	1.000E-06	1.000E-04
Pu-239	2.411E+04	STABLE	2.000E+03	1.000E-03	1.000E-03	1.000E-06	1.000E-04
Pu-240	6.563E+03	STABLE	2.000E+03	1.000E-03	1.000E-03	1.000E-06	1.000E-04
Sr-90	2.879E+01	Y-90	3.000E+01	3.000E-01	3.000E-01	2.000E-03	8.000E-03
Co-60	5.270E+00	STABLE	1.000E+03	8.000E-02	8.000E-02	2.000E-03	2.000E-02

Receptor Node Numbers and Coordinates
 Rec UTME (m) UTMN (m) Node Number

1 333528. 4810277. 5080

Age-Dependent Intake Rates

Age (yr)	Inh (m**3/hr)	Soil (g/hr)	LVeg (kg/yr)	OVeg (kg/yr)	Milk (L/yr)	Meat (kg/yr)	Game (kg/yr)
0.0	3.650E-01	2.500E-03	1.430E+01	1.773E+01	4.720E+01	3.580E+01	0.000E+00
1.0	5.620E-01	4.170E-03	2.788E+01	3.246E+01	4.560E+01	3.460E+01	6.380E+01
5.0	5.350E-01	6.960E-03	3.620E+01	3.516E+01	4.940E+01	3.750E+01	6.580E+01
10.0	5.530E-01	5.000E-03	4.300E+01	2.938E+01	6.480E+01	4.920E+01	1.059E+02
15.0	6.230E-01	4.170E-03	4.878E+01	2.231E+01	9.060E+01	6.880E+01	1.059E+02
20.0	9.170E-01	0.000E+00	1.800E+01	1.760E+02	1.120E+02	8.500E+01	0.000E+00
120.0	9.170E-01	0.000E+00	1.800E+01	1.760E+02	1.120E+02	8.500E+01	0.000E+00

Receptor Exposure Factors

RecNo	Frac_Indoors	Exps_Freq	Exps_Time	Inhal_ModFact	Soil_ModFact	Veg_ModFact	Meat_ModFact	Milk_ModFact
WGme_ModFact	Air I/O	Ext I/O	Fac Sub I/O	Fa!!				
(unitless)	(unitless)	(h/d)	(d/yr)	(unitless)	(unitless)	(unitless)	(unitless)	(unitless)
(unitless)	(unitless)	(unitless)	(unitless)					
1	0.000E+00	2.400E+01	3.650E+02	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
1.000E+00	1.000E+00	1.000E+00	1.000E+00					

Src	Description	Src_Type	Part_Size (um)	UTME (m)	UTMN (m)
1	INTEC	P	1.00	343830.0	4825807.0

Chi/Q values for Receptors

Src Rec Dist(m) Bearing(deg) Node_Number Chi/Q (s/m*3) for point srcs, s/m for area sources (period 1..nresol)

1	1	18636.	213.56	5080	5.423E-08	3.862E-08	5.140E-08	3.456E-08	3.380E-08	3.855E-08	4.469E-08
4.889E-08	3.986E-08	4.695E-08	5.234E-08	7.453E-08							

Psi/Q values for Receptors

Src# Rec# Node Number Psi/Q (1/m**2 for point srcs, unitless for area sources (period 1..nresol)

1	1	5080	6.199E-12	3.591E-12	1.137E-11	1.086E-11	1.754E-11	2.437E-12	6.730E-12	1.446E-11	1.730E-11
9.992E-12	6.296E-12	7.160E-12									

Food Chain Parameters

Fraction of radioactivity retained on leafy vegetables and produce after washing:	5.000E-01
Fraction of produce grown in garden of interest:	1.000E+00
Fraction of leafy vegetables grown in garden of interest:	1.000E+00
Fraction of year animals graze on pasture:	4.000E-01
Fraction of daily feed that is pasture grass when animal grazes on pasture:	4.300E-01
Removal rate for weathering from plants, d-1:	6.960E-02
Effective surface density of soil, kg/m2:	2.150E+02
Consumption rate of contaminated feed or forage by an animal (dry wt), kg/day:	1.560E+01
Fallout interception fraction, pasture:	5.700E-01
Fallout interception fraction (vegetables):	2.000E-01
Time delay-ingestion of pasture grass by animals, days:	0.000E+00
Time delay-ingestion of stored feed by animals, days:	9.000E+01
Time delay-ingestion of leafy vegetables by man, days:	1.400E+01
Time delay-ingestion of produce by man, days:	1.400E+01
Buildup time in soil, years:	1.000E+02
Period of exposure (grass pasture), days:	3.000E+01
Period of exposure (crops/leafy vegetables), days:	6.000E+01
Transport time: animal feed-milk-man, days:	2.000E+00
Average time from slaughter of meat animal to consumption, days:	2.000E+01
Time over which wild game is consumed, days:	6.000E+01
Productivity: agriculture (grass-cow-milk-man pathway), kg/m2	2.800E-01
Productivity: produce and leafy vegetables (wet), kg/m2:	7.160E-01
Productivity: produce and other vegetables (wet), kg/m2:	7.160E-01
Absolute humidity, g/m3:	8.000E+00
Atmospheric concentration of carbon, g/m3:	1.800E-01
Fraction of veg that is water:	9.700E-01
Fraction of veg that is carbon:	1.050E-01
Fraction of beef that is water:	9.700E-01
Fraction of milk that is water:	1.000E+00
Fraction of beef that is carbon:	2.500E-01
Fraction of milk that is carbon:	7.000E-02

Contaminant Lambda (1/yr) Surface LR (1/yr) Subsurface LR (1/yr)

Pu-241	4.830E-02	1.190E-04	2.381E-05								
Am-241	1.604E-03	1.182E-02	2.364E-03								
Np-237	3.233E-07	2.924E-02	5.848E-03								
Cs-137	2.305E-02	5.176E-05	1.035E-05								
Pu-238	7.904E-03	1.190E-04	2.381E-05								
Pu-239	2.875E-05	1.190E-04	2.381E-05								
Pu-240	1.056E-04	1.190E-04	2.381E-05								
Sr-90	2.408E-02	7.899E-03	1.580E-03								
Co-60	1.315E-01	2.381E-04	4.761E-05								

Resuspension parameters											

Short-term resuspension factor (1/m):	1.000E-05										
Long-term resuspension factor (1/m):	1.000E-09										
Short-term resuspension decay constant (1/yr):	5.060E+00										

Ingrowth factors. Fraction of progeny that grow in from parent during dt (years): 8.4931507706642151E-002											
TO >>>>	Pu-241	Am-241	Np-237	Cs-137	Pu-238	Pu-239	Pu-240	Sr-90	Co-60		
Pu-241	0.000E+00	1.359E-04	1.867E-12	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00		
Am-241	0.000E+00	0.000E+00	2.746E-08	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00		
Np-237	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00		
Cs-137	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00		
Pu-238	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00		
Pu-239	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00		
Pu-240	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00		
Sr-90	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00		
Co-60	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00		

Time-Integrated Concentration (Ci-yr/m**3) x cf pCi/m3 cf= 1.000E+12											
Year	Src	Rec	Pu-241	Am-241	Np-237	Cs-137	Pu-238	Pu-239	Pu-240	Sr-90	Co-60
2015	1	1	5.039E-06	7.652E-09	2.426E-19	2.589E-05	1.656E-07	3.121E-07	1.642E-07	1.983E-05	4.143E-08
2016	1	1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2017	1	1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2018	1	1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2019	1	1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2020	1	1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2021	1	1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2022	1	1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2023	1	1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2024	1	1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2025	1	1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2015	ALL	1	5.039E-06	7.652E-09	2.426E-19	2.589E-05	1.656E-07	3.121E-07	1.642E-07	1.983E-05	4.143E-08
2016	ALL	1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2017	ALL	1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2018	ALL	1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2019	ALL	1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2020	ALL	1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2021	ALL	1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2022	ALL	1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2023	ALL	1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2024	ALL	1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2025	ALL	1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Annual Deposition (Ci/m**2) x cf pCi/m2 cf= 1.000E+12											
Year	Src	Rec	Pu-241	Am-241	Np-237	Cs-137	Pu-238	Pu-239	Pu-240	Sr-90	Co-60
2015	1	1	3.251E-02	4.937E-05	1.565E-15	1.671E-01	1.069E-03	2.014E-03	1.060E-03	1.279E-01	2.673E-04
2016	1	1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2017	1	1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2018	1	1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2019	1	1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2020	1	1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2021	1	1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2022	1	1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2023	1	1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2024	1	1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2025	1	1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2015	ALL	1	3.251E-02	4.937E-05	1.565E-15	1.671E-01	1.069E-03	2.014E-03	1.060E-03	1.279E-01	2.673E-04
2016	ALL	1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2017	ALL	1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2018	ALL	1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2019	ALL	1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2020	ALL	1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2021	ALL	1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2022	ALL	1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2023	ALL	1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2024	ALL	1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2025	ALL	1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Annual Accumulated Soil Concentration in surface layer (Ci/m**2) x cf pCi/m2 cf= 1.000E+12											
Year	Src	Rec	Pu-241	Am-241	Np-237	Cs-137	Pu-238	Pu-239	Pu-240	Sr-90	Co-60
2015	1	1	3.176E-02	9.958E-05	3.244E-11	1.652E-01	1.065E-03	2.014E-03	1.060E-03	1.260E-01	2.510E-04
2016	1	1	3.026E-02	1.464E-04	7.885E-11	1.615E-01	1.056E-03	2.014E-03	1.059E-03	1.220E-01	2.200E-04
2017	1	1	2.883E-02	1.903E-04	1.379E-10	1.578E-01	1.048E-03	2.013E-03	1.059E-03	1.182E-01	1.929E-04
2018	1	1	2.747E-02	2.315E-04	2.083E-10	1.542E-01	1.039E-03	2.013E-03	1.059E-03	1.145E-01	1.690E-04
2019	1	1	2.617E-02	2.700E-04	2.890E-10	1.506E-01	1.031E-03	2.013E-03	1.059E-03	1.109E-01	1.482E-04
2020	1	1	2.493E-02	3.061E-04	3.788E-10	1.472E-01	1.023E-03	2.012E-03	1.058E-03	1.074E-01	1.299E-04
2021	1	1	2.376E-02	3.398E-04	4.768E-10	1.438E-01	1.015E-03	2.012E-03	1.058E-03	1.040E-01	1.138E-04
2022	1	1	2.263E-02	3.712E-04	5.820E-10	1.406E-01	1.006E-03	2.012E-03	1.057E-03	1.007E-01	9.979E-05
2023	1	1	2.156E-02	4.006E-04	6.934E-10	1.373E-01	9.984E-04	2.011E-03	1.058E-03	9.755E-02	8.747E-05
2024	1	1	2.054E-02	4.279E-04	8.104E-10	1.342E-01	9.904E-04	2.011E-03	1.057E-03	9.448E-02	7.668E-05
2025	1	1	1.957E-02	4.533E-04	9.321E-10	1.311E-01	9.825E-04	2.011E-03	1.057E-03	9.151E-02	6.721E-05

2015	ALL	1	3.176E-02	9.958E-05	3.244E-11	1.652E-01	1.065E-03	2.014E-03	1.060E-03	1.260E-01	2.510E-04
2016	ALL	1	3.026E-02	1.464E-04	7.885E-11	1.615E-01	1.056E-03	2.014E-03	1.059E-03	1.220E-01	2.200E-04
2017	ALL	1	2.883E-02	1.903E-04	1.379E-10	1.578E-01	1.048E-03	2.013E-03	1.059E-03	1.182E-01	1.929E-04
2018	ALL	1	2.747E-02	2.315E-04	2.083E-10	1.542E-01	1.039E-03	2.013E-03	1.059E-03	1.145E-01	1.690E-04
2019	ALL	1	2.617E-02	2.700E-04	2.890E-10	1.506E-01	1.031E-03	2.013E-03	1.059E-03	1.109E-01	1.482E-04
2020	ALL	1	2.493E-02	3.061E-04	3.788E-10	1.472E-01	1.023E-03	2.012E-03	1.058E-03	1.074E-01	1.299E-04
2021	ALL	1	2.376E-02	3.398E-04	4.768E-10	1.438E-01	1.015E-03	2.012E-03	1.058E-03	1.040E-01	1.138E-04
2022	ALL	1	2.263E-02	3.712E-04	5.820E-10	1.406E-01	1.006E-03	2.012E-03	1.058E-03	1.007E-01	9.979E-05
2023	ALL	1	2.156E-02	4.006E-04	6.934E-10	1.373E-01	9.984E-04	2.011E-03	1.058E-03	9.755E-02	8.747E-05
2024	ALL	1	2.054E-02	4.279E-04	8.104E-10	1.342E-01	9.904E-04	2.011E-03	1.057E-03	9.448E-02	7.668E-05
2025	ALL	1	1.957E-02	4.533E-04	9.321E-10	1.311E-01	9.825E-04	2.011E-03	1.057E-03	9.151E-02	6.721E-05

Time-Integrated Resuspended Concentration (Ci-yr/m**3) x cf pCi/m3 cf= 1.000E+12

Year	Src	Rec	Pu-241	Am-241	Np-237	Cs-137	Pu-238	Pu-239	Pu-240	Sr-90	Co-60
2015	1	1	6.341E-08	1.979E-10	6.535E-17	3.262E-07	2.088E-09	3.936E-09	2.071E-09	2.497E-07	5.195E-10
2016	1	1	4.139E-10	1.314E-12	4.338E-19	2.184E-09	1.419E-11	2.696E-11	1.418E-11	1.657E-09	3.120E-12
2017	1	1	3.161E-11	1.021E-13	3.370E-20	1.711E-10	1.128E-12	2.161E-12	1.137E-12	1.286E-10	2.192E-13
2018	1	1	2.792E-11	9.185E-14	3.030E-20	1.550E-10	1.038E-12	2.003E-12	1.054E-12	1.155E-10	1.782E-13
2019	1	1	2.659E-11	8.907E-14	2.937E-20	1.514E-10	1.029E-12	2.002E-12	1.053E-12	1.118E-10	1.561E-13
2020	1	1	2.533E-11	8.643E-14	2.849E-20	1.479E-10	1.021E-12	2.002E-12	1.053E-12	1.083E-10	1.368E-13
2021	1	1	2.414E-11	8.391E-14	2.765E-20	1.445E-10	1.013E-12	2.001E-12	1.053E-12	1.049E-10	1.199E-13
2022	1	1	2.299E-11	8.148E-14	2.684E-20	1.412E-10	1.005E-12	2.001E-12	1.052E-12	1.016E-10	1.051E-13
2023	1	1	2.191E-11	7.914E-14	2.606E-20	1.380E-10	9.965E-13	2.001E-12	1.052E-12	9.840E-11	9.215E-14
2024	1	1	2.087E-11	7.690E-14	2.531E-20	1.349E-10	9.886E-13	2.000E-12	1.052E-12	9.530E-11	8.078E-14
2025	1	1	1.989E-11	7.474E-14	2.459E-20	1.318E-10	9.807E-13	2.000E-12	1.052E-12	9.231E-11	7.080E-14
2015	ALL	1	6.341E-08	1.979E-10	6.535E-17	3.262E-07	2.088E-09	3.936E-09	2.071E-09	2.497E-07	5.195E-10
2016	ALL	1	4.139E-10	1.314E-12	4.338E-19	2.184E-09	1.419E-11	2.696E-11	1.418E-11	1.657E-09	3.120E-12
2017	ALL	1	3.161E-11	1.021E-13	3.370E-20	1.711E-10	1.128E-12	2.161E-12	1.137E-12	1.286E-10	2.192E-13
2018	ALL	1	2.792E-11	9.185E-14	3.030E-20	1.550E-10	1.038E-12	2.003E-12	1.054E-12	1.155E-10	1.782E-13
2019	ALL	1	2.659E-11	8.907E-14	2.937E-20	1.514E-10	1.029E-12	2.002E-12	1.053E-12	1.118E-10	1.561E-13
2020	ALL	1	2.533E-11	8.643E-14	2.849E-20	1.479E-10	1.021E-12	2.002E-12	1.053E-12	1.083E-10	1.368E-13
2021	ALL	1	2.414E-11	8.391E-14	2.765E-20	1.445E-10	1.013E-12	2.001E-12	1.053E-12	1.049E-10	1.199E-13
2022	ALL	1	2.299E-11	8.148E-14	2.684E-20	1.412E-10	1.005E-12	2.001E-12	1.052E-12	1.016E-10	1.051E-13
2023	ALL	1	2.191E-11	7.914E-14	2.606E-20	1.380E-10	9.965E-13	2.001E-12	1.052E-12	9.840E-11	9.215E-14
2024	ALL	1	2.087E-11	7.690E-14	2.531E-20	1.349E-10	9.886E-13	2.000E-12	1.052E-12	9.530E-11	8.078E-14
2025	ALL	1	1.989E-11	7.474E-14	2.459E-20	1.318E-10	9.807E-13	2.000E-12	1.052E-12	9.231E-11	7.080E-14

Annual Accumulated Soil Concentration in subsurface layer Ci/m**2) x cf pCi/m2 cf= 1.000E+12

Year	Src	Rec	Pu-241	Am-241	Np-237	Cs-137	Pu-238	Pu-239	Pu-240	Sr-90	Co-60
2015	1	1	1.813E-06	5.570E-07	6.153E-13	4.115E-06	6.111E-08	1.157E-07	6.089E-08	4.792E-04	2.831E-08
2016	1	1	5.330E-06	1.991E-06	2.822E-12	1.238E-05	1.863E-07	3.554E-07	1.870E-07	1.434E-03	7.720E-08
2017	1	1	8.511E-06	3.961E-06	7.171E-12	2.026E-05	3.096E-07	5.951E-07	3.130E-07	2.334E-03	1.136E-07
2018	1	1	1.138E-05	6.430E-06	1.416E-11	2.778E-05	4.309E-07	8.347E-07	4.391E-07	3.182E-03	1.398E-07
2019	1	1	1.396E-05	9.365E-06	2.425E-11	3.494E-05	5.502E-07	1.074E-06	5.650E-07	3.980E-03	1.579E-07
2020	1	1	1.627E-05	1.273E-05	3.784E-11	4.177E-05	6.676E-07	1.314E-06	6.909E-07	4.730E-03	1.693E-07
2021	1	1	1.833E-05	1.650E-05	5.528E-11	4.826E-05	7.831E-07	1.553E-06	8.168E-07	5.434E-03	1.756E-07
2022	1	1	2.016E-05	2.065E-05	7.691E-11	5.443E-05	8.967E-07	1.793E-06	9.426E-07	6.095E-03	1.777E-07
2023	1	1	2.177E-05	2.513E-05	1.030E-10	6.030E-05	1.009E-06	2.032E-06	1.068E-06	6.713E-03	1.796E-07
2024	1	1	2.319E-05	2.994E-05	1.338E-10	6.587E-05	1.118E-06	2.271E-06	1.194E-06	7.292E-03	1.731E-07
2025	1	1	2.443E-05	3.505E-05	1.696E-10	7.116E-05	1.227E-06	2.511E-06	1.320E-06	7.832E-03	1.677E-07
2015	ALL	1	1.813E-06	5.570E-07	6.153E-13	4.115E-06	6.111E-08	1.157E-07	6.089E-08	4.792E-04	2.831E-08
2016	ALL	1	5.330E-06	1.991E-06	2.822E-12	1.238E-05	1.863E-07	3.554E-07	1.870E-07	1.434E-03	7.720E-08
2017	ALL	1	8.511E-06	3.961E-06	7.171E-12	2.026E-05	3.096E-07	5.951E-07	3.130E-07	2.334E-03	1.136E-07
2018	ALL	1	1.138E-05	6.430E-06	1.416E-11	2.778E-05	4.309E-07	8.347E-07	4.391E-07	3.182E-03	1.398E-07
2019	ALL	1	1.396E-05	9.365E-06	2.425E-11	3.494E-05	5.502E-07	1.074E-06	5.650E-07	3.980E-03	1.579E-07
2020	ALL	1	1.627E-05	1.273E-05	3.784E-11	4.177E-05	6.676E-07	1.314E-06	6.909E-07	4.730E-03	1.693E-07
2021	ALL	1	1.833E-05	1.650E-05	5.528E-11	4.826E-05	7.831E-07	1.553E-06	8.168E-07	5.434E-03	1.756E-07
2022	ALL	1	2.016E-05	2.065E-05	7.691E-11	5.443E-05	8.967E-07	1.793E-06	9.426E-07	6.095E-03	1.777E-07
2023	ALL	1	2.177E-05	2.513E-05	1.030E-10	6.030E-05	1.009E-06	2.032E-06	1.068E-06	6.713E-03	1.796E-07
2024	ALL	1	2.319E-05	2.994E-05	1.338E-10	6.587E-05	1.118E-06	2.271E-06	1.194E-06	7.292E-03	1.731E-07
2025	ALL	1	2.443E-05	3.505E-05	1.696E-10	7.116E-05	1.227E-06	2.511E-06	1.320E-06	7.832E-03	1.677E-07

Leafy Vegetable Concentrations (Ci/kg) x cf pCi/kg cf= 1.000E+12

Year	Src	Rec	Pu-241	Am-241	Np-237	Cs-137	Pu-238	Pu-239	Pu-240	Sr-90	Co-60
2015	1	1	1.785E-04	2.884E-07	2.304E-17	2.116E-03	6.125E-06	1.184E-05	6.227E-06	7.433E-03	2.185E-06
2016	1	1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2017	1	1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2018	1	1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2019	1	1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2020	1	1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2021	1	1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2022	1	1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2023	1	1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2024	1	1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2025	1	1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2015	ALL	1	1.785E-04	2.884E-07	2.304E-17	2.116E-03	6.125E-06	1.184E-05	6.227E-06	7.433E-03	2.185E-06
2016	ALL	1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2017	ALL	1	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2018	ALL	1	0.000E+00	0.000E+00	0.000E+00	0.000E+00					

Table with 12 columns representing various radionuclides (Cs-137, Pu-238, Pu-239, Pu-240, Sr-90, Co-60) and rows for years 2016 to 2025. Most values are 0.000E+00, with a few non-zero values in 2015.

Table titled 'Milk Concentrations (Ci/L) x cf pCi/L cf= 1.000E+12'. Columns include Year, Src, Rec, and radionuclides Pu-241, Am-241, Np-237, Cs-137, Pu-238, Pu-239, Pu-240, Sr-90, Co-60. Data for 2015 shows concentrations for Pu-241, Am-241, Np-237, Cs-137, Pu-238, and Pu-239.

Table titled 'Beef Concentrations (Ci/kg) x cf pCi/kg cf= 1.000E+12'. Columns include Year, Src, Rec, and radionuclides Pu-241, Am-241, Np-237, Cs-137, Pu-238, Pu-239, Pu-240, Sr-90, Co-60. Data for 2015 shows concentrations for Pu-241, Am-241, Np-237, Cs-137, Pu-238, and Pu-239.

Dose Conversion Factor Notes
External DCF for Cs-137 includes Ba-137m
External DCF for Sr-90 includes Y-90
Submersion DCF for Cs-137 includes Ba-137m
Ground DCF for Cs-137 includes Ba-137m
Ground DCF for Sr-90 includes Y-90

Table titled 'Inhalation Dose Conversion Factors (rem/Ci)'. Columns include Rad, Sol, AMAD(um), Age, and Effective. Lists conversion factors for Pu-241 and Am-241 at different ages and solubilities.

Am-241	D	1.0	15	3.630E+08
Am-241	D	1.0	20	3.630E+08
Np-237	D	1.0	0	1.840E+08
Np-237	D	1.0	1	1.840E+08
Np-237	D	1.0	5	1.840E+08
Np-237	D	1.0	10	1.840E+08
Np-237	D	1.0	15	1.840E+08
Np-237	D	1.0	20	1.840E+08
Cs-137	D	1.0	0	1.543E+05
Cs-137	D	1.0	1	1.543E+05
Cs-137	D	1.0	5	1.543E+05
Cs-137	D	1.0	10	1.543E+05
Cs-137	D	1.0	15	1.543E+05
Cs-137	D	1.0	20	1.543E+05
Pu-238	D	1.0	0	4.070E+08
Pu-238	D	1.0	1	4.070E+08
Pu-238	D	1.0	5	4.070E+08
Pu-238	D	1.0	10	4.070E+08
Pu-238	D	1.0	15	4.070E+08
Pu-238	D	1.0	20	4.070E+08
Pu-239	D	1.0	0	4.477E+08
Pu-239	D	1.0	1	4.477E+08
Pu-239	D	1.0	5	4.477E+08
Pu-239	D	1.0	10	4.477E+08
Pu-239	D	1.0	15	4.477E+08
Pu-239	D	1.0	20	4.477E+08
Pu-240	D	1.0	0	4.477E+08
Pu-240	D	1.0	1	4.477E+08
Pu-240	D	1.0	5	4.477E+08
Pu-240	D	1.0	10	4.477E+08
Pu-240	D	1.0	15	4.477E+08
Pu-240	D	1.0	20	4.477E+08
Sr-90	D	1.0	0	6.068E+05
Sr-90	D	1.0	1	6.068E+05
Sr-90	D	1.0	5	6.068E+05
Sr-90	D	1.0	10	6.068E+05
Sr-90	D	1.0	15	6.068E+05
Sr-90	D	1.0	20	6.068E+05
Co-60	D	1.0	0	1.229E+05
Co-60	D	1.0	1	1.229E+05
Co-60	D	1.0	5	1.221E+05
Co-60	D	1.0	10	1.221E+05
Co-60	D	1.0	15	1.221E+05
Co-60	D	1.0	20	1.221E+05

 Ingestion Dose Conversion Factors (rem/Ci)

Rad	Age	Effective
Pu-241	0	1.760E+04
Pu-241	1	1.760E+04
Pu-241	5	1.760E+04
Pu-241	10	1.760E+04
Pu-241	15	1.760E+04
Pu-241	20	1.760E+04
Am-241	0	7.550E+05
Am-241	1	7.550E+05
Am-241	5	7.550E+05
Am-241	10	7.550E+05
Am-241	15	7.550E+05
Am-241	20	7.550E+05
Np-237	0	3.960E+05
Np-237	1	3.960E+05
Np-237	5	3.960E+05
Np-237	10	3.960E+05
Np-237	15	3.960E+05
Np-237	20	3.960E+05
Cs-137	0	5.020E+04
Cs-137	1	5.020E+04
Cs-137	5	5.020E+04
Cs-137	10	5.020E+04
Cs-137	15	5.020E+04
Cs-137	20	5.020E+04
Pu-238	0	8.440E+05
Pu-238	1	8.440E+05
Pu-238	5	8.440E+05
Pu-238	10	8.440E+05
Pu-238	15	8.440E+05
Pu-238	20	8.440E+05
Pu-239	0	9.280E+05
Pu-239	1	9.280E+05
Pu-239	5	9.280E+05
Pu-239	10	9.280E+05
Pu-239	15	9.280E+05
Pu-239	20	9.280E+05
Pu-240	0	9.280E+05
Pu-240	1	9.280E+05
Pu-240	5	9.280E+05
Pu-240	10	9.280E+05
Pu-240	15	9.280E+05
Pu-240	20	9.280E+05
Sr-90	0	1.020E+05
Sr-90	1	1.020E+05
Sr-90	5	1.020E+05
Sr-90	10	1.020E+05

Sr-90	15	1.020E+05
Sr-90	20	1.020E+05
Co-60	0	1.260E+04
Co-60	1	1.260E+04
Co-60	5	1.260E+04
Co-60	10	1.260E+04
Co-60	15	1.260E+04
Co-60	20	1.260E+04

External Dose Conversion Factors (rem-m**2/(Ci-s))

Rad	Age	Effective
Pu-241	0	6.370E-09
Pu-241	1	6.370E-09
Pu-241	5	6.370E-09
Pu-241	10	6.370E-09
Pu-241	15	6.370E-09
Pu-241	20	6.370E-09
Am-241	0	8.630E-05
Am-241	1	8.630E-05
Am-241	5	8.630E-05
Am-241	10	8.630E-05
Am-241	15	8.630E-05
Am-241	20	8.630E-05
Np-237	0	9.320E-05
Np-237	1	9.320E-05
Np-237	5	9.320E-05
Np-237	10	9.320E-05
Np-237	15	9.320E-05
Np-237	20	9.320E-05
Cs-137	0	2.036E-03
Cs-137	1	2.036E-03
Cs-137	5	2.036E-03
Cs-137	10	2.036E-03
Cs-137	15	2.036E-03
Cs-137	20	2.036E-03
Pu-238	0	2.320E-06
Pu-238	1	2.320E-06
Pu-238	5	2.320E-06
Pu-238	10	2.320E-06
Pu-238	15	2.320E-06
Pu-238	20	2.320E-06
Pu-239	0	1.050E-06
Pu-239	1	1.050E-06
Pu-239	5	1.050E-06
Pu-239	10	1.050E-06
Pu-239	15	1.050E-06
Pu-239	20	1.050E-06
Pu-240	0	2.230E-06
Pu-240	1	2.230E-06
Pu-240	5	2.230E-06
Pu-240	10	2.230E-06
Pu-240	15	2.230E-06
Pu-240	20	2.230E-06
Sr-90	0	4.121E-04
Sr-90	1	4.121E-04
Sr-90	5	4.121E-04
Sr-90	10	4.121E-04
Sr-90	15	4.121E-04
Sr-90	20	4.121E-04
Co-60	0	8.510E-03
Co-60	1	8.510E-03
Co-60	5	8.510E-03
Co-60	10	8.510E-03
Co-60	15	8.510E-03
Co-60	20	8.510E-03

Submersion Dose Conversion Factors (rem-m**3/(Ci-s))

Rad	Age	Effective
Pu-241	0	2.350E-07
Pu-241	1	2.350E-07
Pu-241	5	2.350E-07
Pu-241	10	2.350E-07
Pu-241	15	2.350E-07
Pu-241	20	2.350E-07
Am-241	0	2.510E-03
Am-241	1	2.510E-03
Am-241	5	2.510E-03
Am-241	10	2.510E-03
Am-241	15	2.510E-03
Am-241	20	2.510E-03
Np-237	0	3.290E-03
Np-237	1	3.290E-03
Np-237	5	3.290E-03
Np-237	10	3.290E-03
Np-237	15	3.290E-03
Np-237	20	3.290E-03
Cs-137	0	9.456E-02
Cs-137	1	9.456E-02
Cs-137	5	9.456E-02
Cs-137	10	9.456E-02
Cs-137	15	9.456E-02
Cs-137	20	9.456E-02

Pu-238	0	1.300E-05
Pu-238	1	1.300E-05
Pu-238	5	1.300E-05
Pu-238	10	1.300E-05
Pu-238	15	1.300E-05
Pu-238	20	1.300E-05
Pu-239	0	1.290E-05
Pu-239	1	1.290E-05
Pu-239	5	1.290E-05
Pu-239	10	1.290E-05
Pu-239	15	1.290E-05
Pu-239	20	1.290E-05
Pu-240	0	1.270E-05
Pu-240	1	1.270E-05
Pu-240	5	1.270E-05
Pu-240	10	1.270E-05
Pu-240	15	1.270E-05
Pu-240	20	1.270E-05
Sr-90	0	3.650E-04
Sr-90	1	3.650E-04
Sr-90	5	3.650E-04
Sr-90	10	3.650E-04
Sr-90	15	3.650E-04
Sr-90	20	3.650E-04
Co-60	0	4.400E-01
Co-60	1	4.400E-01
Co-60	5	4.400E-01
Co-60	10	4.400E-01
Co-60	15	4.400E-01
Co-60	20	4.400E-01

 Soil Vol Dose Conversion Factors (rem-m**3/(Ci-s))
 Rad Age Effective

Pu-241	0	1.050E-10
Pu-241	1	1.050E-10
Pu-241	5	1.050E-10
Pu-241	10	1.050E-10
Pu-241	15	1.050E-10
Pu-241	20	1.050E-10
Am-241	0	7.360E-07
Am-241	1	7.360E-07
Am-241	5	7.360E-07
Am-241	10	7.360E-07
Am-241	15	7.360E-07
Am-241	20	7.360E-07
Np-237	0	1.380E-06
Np-237	1	1.380E-06
Np-237	5	1.380E-06
Np-237	10	1.380E-06
Np-237	15	1.380E-06
Np-237	20	1.380E-06
Cs-137	0	6.340E-05
Cs-137	1	6.340E-05
Cs-137	5	6.340E-05
Cs-137	10	6.340E-05
Cs-137	15	6.340E-05
Cs-137	20	6.340E-05
Pu-238	0	2.310E-09
Pu-238	1	2.310E-09
Pu-238	5	2.310E-09
Pu-238	10	2.310E-09
Pu-238	15	2.310E-09
Pu-238	20	2.310E-09
Pu-239	0	5.220E-09
Pu-239	1	5.220E-09
Pu-239	5	5.220E-09
Pu-239	10	5.220E-09
Pu-239	15	5.220E-09
Pu-239	20	5.220E-09
Pu-240	0	2.230E-09
Pu-240	1	2.230E-09
Pu-240	5	2.230E-09
Pu-240	10	2.230E-09
Pu-240	15	2.230E-09
Pu-240	20	2.230E-09
Sr-90	0	8.088E-07
Sr-90	1	8.088E-07
Sr-90	5	8.088E-07
Sr-90	10	8.088E-07
Sr-90	15	8.088E-07
Sr-90	20	8.088E-07
Co-60	0	3.050E-04
Co-60	1	3.050E-04
Co-60	5	3.050E-04
Co-60	10	3.050E-04
Co-60	15	3.050E-04
Co-60	20	3.050E-04

 Inhalation Dose from direct emissions (rem)
 Year Organ Rec Pu-241 Am-241 Np-237 Cs-137 Pu-238 Pu-239 Pu-240 Sr-90 Co-60
 Total

2015 Effective	1		6.948E-14	9.197E-15	4.306E-25	9.033E-09	1.109E-13	2.308E-13	1.214E-13	5.576E-09	
8.333E-13		1.461E-08									
2016 Effective	1		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	
0.000E+00		0.000E+00									
2017 Effective	1		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	
0.000E+00		0.000E+00									
2018 Effective	1		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	
0.000E+00		0.000E+00									
2019 Effective	1		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	
0.000E+00		0.000E+00									
2020 Effective	1		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	
0.000E+00		0.000E+00									
2021 Effective	1		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	
0.000E+00		0.000E+00									
2022 Effective	1		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	
0.000E+00		0.000E+00									
2023 Effective	1		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	
0.000E+00		0.000E+00									
2024 Effective	1		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	
0.000E+00		0.000E+00									
2025 Effective	1		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	
0.000E+00		0.000E+00									
All Effective	1		6.948E-14	9.197E-15	4.306E-25	9.033E-09	1.109E-13	2.308E-13	1.214E-13	5.576E-09	
8.333E-13		1.461E-08									

External Exposure Dose (rem)											
Year	Organ	Rec	Pu-241	Am-241	Np-237	Cs-137	Pu-238	Pu-239	Pu-240	Sr-90	Co-60
Total											

2015 Effective	1		6.381E-15	2.711E-13	9.553E-20	1.061E-08	7.789E-14	6.668E-14	7.451E-14	1.637E-09	
6.736E-11		1.231E-08									
2016 Effective	1		6.079E-15	3.987E-13	2.326E-19	1.036E-08	7.727E-14	6.667E-14	7.450E-14	1.586E-09	
5.905E-11		1.201E-08									
2017 Effective	1		5.792E-15	5.185E-13	4.074E-19	1.013E-08	7.665E-14	6.667E-14	7.448E-14	1.536E-09	
5.176E-11		1.172E-08									
2018 Effective	1		5.518E-15	6.309E-13	6.164E-19	9.897E-09	7.604E-14	6.666E-14	7.446E-14	1.488E-09	
4.538E-11		1.143E-08									
2019 Effective	1		5.258E-15	7.363E-13	8.565E-19	9.671E-09	7.543E-14	6.665E-14	7.445E-14	1.441E-09	
3.978E-11		1.115E-08									
2020 Effective	1		5.009E-15	8.349E-13	1.124E-18	9.450E-09	7.483E-14	6.664E-14	7.443E-14	1.396E-09	
3.487E-11		1.088E-08									
2021 Effective	1		4.772E-15	9.272E-13	1.417E-18	9.234E-09	7.423E-14	6.663E-14	7.441E-14	1.352E-09	
3.057E-11		1.062E-08									
2022 Effective	1		4.547E-15	1.014E-12	1.733E-18	9.024E-09	7.364E-14	6.662E-14	7.440E-14	1.310E-09	
2.679E-11		1.036E-08									
2023 Effective	1		4.332E-15	1.094E-12	2.068E-18	8.818E-09	7.305E-14	6.661E-14	7.438E-14	1.269E-09	
2.349E-11		1.011E-08									
2024 Effective	1		4.127E-15	1.169E-12	2.421E-18	8.616E-09	7.246E-14	6.660E-14	7.436E-14	1.229E-09	
2.059E-11		9.867E-09									
2025 Effective	1		3.932E-15	1.239E-12	2.789E-18	8.420E-09	7.188E-14	6.659E-14	7.435E-14	1.191E-09	
1.805E-11		9.630E-09									
All Effective	1		5.575E-14	8.834E-12	1.376E-17	1.042E-07	8.234E-13	7.330E-13	8.187E-13	1.544E-08	
4.177E-10		1.201E-07									

Submersion Exposure Dose (rem)											
Year	Organ	Rec	Pu-241	Am-241	Np-237	Cs-137	Pu-238	Pu-239	Pu-240	Sr-90	Co-60
Total											

2015 Effective	1		3.734E-17	6.057E-16	2.517E-26	7.722E-11	6.790E-17	1.270E-16	6.578E-17	2.282E-13	
5.749E-13		7.803E-11									
2016 Effective	1		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	
0.000E+00		0.000E+00									
2017 Effective	1		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	
0.000E+00		0.000E+00									
2018 Effective	1		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	
0.000E+00		0.000E+00									
2019 Effective	1		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	
0.000E+00		0.000E+00									
2020 Effective	1		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	
0.000E+00		0.000E+00									
2021 Effective	1		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	
0.000E+00		0.000E+00									
2022 Effective	1		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	
0.000E+00		0.000E+00									
2023 Effective	1		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	
0.000E+00		0.000E+00									
2024 Effective	1		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	
0.000E+00		0.000E+00									
2025 Effective	1		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	
0.000E+00		0.000E+00									
All Effective	1		3.734E-17	6.057E-16	2.517E-26	7.722E-11	6.790E-17	1.270E-16	6.578E-17	2.282E-13	
5.749E-13		7.803E-11									

All Pathway Doses (rem)											
Year	Organ	Rec	Pu-241	Am-241	Np-237	Cs-137	Pu-238	Pu-239	Pu-240	Sr-90	Co-60
Total											

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2015 Effective      1  3.494E-07  2.293E-08  9.705E-17  9.850E-08  5.494E-07  1.139E-06  5.992E-07  2.691E-07
1.215E-10  3.027E-06
2016 Effective      1  2.830E-11  4.231E-12  8.738E-19  1.037E-08  4.647E-11  9.702E-11  5.109E-11  1.594E-09
5.905E-11  1.225E-08
2017 Effective      1  2.167E-12  8.164E-13  4.572E-19  1.013E-08  3.766E-12  7.838E-12  4.163E-12  1.537E-09
5.176E-11  1.174E-08
2018 Effective      1  1.914E-12  8.987E-13  6.612E-19  9.897E-09  3.469E-12  7.271E-12  3.864E-12  1.489E-09
4.538E-11  1.145E-08
2019 Effective      1  1.823E-12  9.960E-13  8.999E-19  9.671E-09  3.440E-12  7.266E-12  3.861E-12  1.442E-09
3.978E-11  1.117E-08
2020 Effective      1  1.737E-12  1.087E-12  1.167E-18  9.450E-09  3.412E-12  7.265E-12  3.861E-12  1.397E-09
3.487E-11  1.090E-08
2021 Effective      1  1.655E-12  1.172E-12  1.458E-18  9.234E-09  3.385E-12  7.264E-12  3.860E-12  1.353E-09
3.057E-11  1.064E-08
2022 Effective      1  1.576E-12  1.251E-12  1.772E-18  9.024E-09  3.358E-12  7.263E-12  3.859E-12  1.310E-09
2.679E-11  1.038E-08
2023 Effective      1  1.502E-12  1.325E-12  2.107E-18  8.818E-09  3.331E-12  7.262E-12  3.858E-12  1.269E-09
2.349E-11  1.013E-08
2024 Effective      1  1.431E-12  1.393E-12  2.458E-18  8.616E-09  3.304E-12  7.261E-12  3.857E-12  1.230E-09
2.059E-11  9.884E-09
2025 Effective      1  1.363E-12  1.457E-12  2.825E-18  8.420E-09  3.278E-12  7.260E-12  3.856E-12  1.191E-09
1.805E-11  9.646E-09
All Effective       1  3.495E-07  2.295E-08  1.117E-16  1.921E-07  5.494E-07  1.139E-06  5.993E-07  2.829E-07
4.719E-10  3.136E-06
Successful Execution of DOSEMM
Execution Time 0.3385679999999999 seconds
    
```

Source Term Files

```

Year Month Pu-241 Am-241 Np-237 Cs-137 Pu-238 Pu-239 Pu-240 Sr-90 Co-60 Ci/s
2015 1 1.08E-10 1.64E-13 5.20E-24 5.55E-10 3.55E-12 6.69E-12 3.52E-12 4.25E-10 8.88E-13
2015 2 1.08E-10 1.64E-13 5.20E-24 5.55E-10 3.55E-12 6.69E-12 3.52E-12 4.25E-10 8.88E-13
2015 3 1.08E-10 1.64E-13 5.20E-24 5.55E-10 3.55E-12 6.69E-12 3.52E-12 4.25E-10 8.88E-13
2015 4 1.08E-10 1.64E-13 5.20E-24 5.55E-10 3.55E-12 6.69E-12 3.52E-12 4.25E-10 8.88E-13
2015 5 1.08E-10 1.64E-13 5.20E-24 5.55E-10 3.55E-12 6.69E-12 3.52E-12 4.25E-10 8.88E-13
2015 6 1.08E-10 1.64E-13 5.20E-24 5.55E-10 3.55E-12 6.69E-12 3.52E-12 4.25E-10 8.88E-13
2015 7 1.08E-10 1.64E-13 5.20E-24 5.55E-10 3.55E-12 6.69E-12 3.52E-12 4.25E-10 8.88E-13
2015 8 1.08E-10 1.64E-13 5.20E-24 5.55E-10 3.55E-12 6.69E-12 3.52E-12 4.25E-10 8.88E-13
2015 9 1.08E-10 1.64E-13 5.20E-24 5.55E-10 3.55E-12 6.69E-12 3.52E-12 4.25E-10 8.88E-13
2015 10 1.08E-10 1.64E-13 5.20E-24 5.55E-10 3.55E-12 6.69E-12 3.52E-12 4.25E-10 8.88E-13
2015 11 1.08E-10 1.64E-13 5.20E-24 5.55E-10 3.55E-12 6.69E-12 3.52E-12 4.25E-10 8.88E-13
2015 12 1.08E-10 1.64E-13 5.20E-24 5.55E-10 3.55E-12 6.69E-12 3.52E-12 4.25E-10 8.88E-13
    
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Year Month H-3 C-14 Ci/s
2015 1 4.53E-06 3.00E-13
2015 2 4.53E-06 3.00E-13
2015 3 4.53E-06 3.00E-13
2015 4 4.53E-06 3.00E-13
2015 5 4.53E-06 3.00E-13
2015 6 4.53E-06 3.00E-13
2015 7 4.53E-06 3.00E-13
2015 8 4.53E-06 3.00E-13
2015 9 4.53E-06 3.00E-13
2015 10 4.53E-06 3.00E-13
2015 11 4.53E-06 3.00E-13
2015 12 4.53E-06 3.00E-13
    
```

```

Year Month I-129 I-131 Ci/s
2015 1 6.82E-10 3.17E-06
2015 2 6.82E-10 3.17E-06
2015 3 6.82E-10 3.17E-06
2015 4 6.82E-10 3.17E-06
2015 5 6.82E-10 3.17E-06
2015 6 6.82E-10 3.17E-06
2015 7 6.82E-10 3.17E-06
2015 8 6.82E-10 3.17E-06
2015 9 6.82E-10 3.17E-06
2015 10 6.82E-10 3.17E-06
2015 11 6.82E-10 3.17E-06
2015 12 6.82E-10 3.17E-06
    
```

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Year Month Kr-85 Ar-41 Ci/s
2015 1 2.32E-05 1.59E-05
2015 2 2.32E-05 1.59E-05
2015 3 2.32E-05 1.59E-05
2015 4 2.32E-05 1.59E-05
2015 5 2.32E-05 1.59E-05
2015 6 2.32E-05 1.59E-05
2015 7 2.32E-05 1.59E-05
2015 8 2.32E-05 1.59E-05
2015 9 2.32E-05 1.59E-05
2015 10 2.32E-05 1.59E-05
2015 11 2.32E-05 1.59E-05
2015 12 2.32E-05 1.59E-05
    
```

Element File

\$ Structure of file

```

$Element
$Kd_value dist_type p1 p2 p3 p4
$CRveg_value dist_type p1 p2 p3 p4
$CRforg_value dist_type p1 p2 p3 p4
$TCmilk_value dist_type p1 p2 p3 p4
$TCmeat_value dist_type p1 p2 p3 p4
$ CRveg, CRforg in wet weight, TCmilk, TCmeat from ANL/EAS/TM-103, DOE, August 1993
$ Kd values from the default values in RESRAD onsite Ver 7.0
$ Uncertainty is assumed to be lognormal with a GSD of 1.5 and min and max = 1/10 and 10x the nominal value

Ac Element
2.00E+01 LNORM 2.00E+01 1.5 2.00E+00 2.00E+02 Kd (mL/g)
2.50E-03 LNORM 2.50E-03 1.5 2.50E-04 2.50E-02 CRveg (fw)
1.00E-01 LNORM 1.00E-01 1.5 1.00E-02 1.00E+00 CRforg (fw)
2.00E-05 LNORM 2.00E-05 1.5 2.00E-06 2.00E-04 TCmilk
2.00E-05 LNORM 2.00E-05 1.5 2.00E-06 2.00E-04 TCmeat

Am Element
2.00E+01 LNORM 2.00E+01 1.5 2.00E+00 2.00E+02 Kd (mL/g)
1.00E-03 LNORM 1.00E-03 1.5 1.00E-04 1.00E-02 CRveg (fw)
1.00E-03 LNORM 1.00E-03 1.5 1.00E-04 1.00E-02 CRforg (fw)
2.00E-06 LNORM 2.00E-06 1.5 2.00E-07 2.00E-05 TCmilk
5.00E-05 LNORM 5.00E-05 1.5 5.00E-06 5.00E-04 TCmeat

Ar Element
0.00E+00 NONE 0.00E+00 1.5 0.00E+00 0.00E+00 Kd (mL/g)
0.00E+00 NONE 0.00E+00 1.5 0.00E+00 0.00E+00 CRveg (fw)
0.00E+00 NONE 0.00E+00 1.5 0.00E+00 0.00E+00 CRforg (fw)
0.00E+00 NONE 0.00E+00 1.5 0.00E+00 0.00E+00 TCmilk
0.00E+00 NONE 0.00E+00 1.5 0.00E+00 0.00E+00 TCmeat

Ba Element
0.00E+00 NONE 0.00E+00 1.5 0.00E+00 0.00E+00 Kd (mL/g)
5.00E-03 LNORM 5.00E-03 1.5 5.00E-04 5.00E-02 CRveg (fw)
5.00E-03 LNORM 5.00E-03 1.5 5.00E-04 5.00E-02 CRforg (fw)
5.00E-04 LNORM 5.00E-04 1.5 5.00E-05 5.00E-03 TCmilk
2.00E-04 LNORM 2.00E-04 1.5 2.00E-05 2.00E-03 TCmeat

Bi Element
0.00E+00 NONE 0.00E+00 1.5 0.00E+00 0.00E+00 Kd (mL/g)
1.00E-01 LNORM 1.00E-01 1.5 1.00E-02 1.00E+00 CRveg (fw)
1.00E-01 LNORM 1.00E-01 1.5 1.00E-02 1.00E+00 CRforg (fw)
5.00E-04 LNORM 5.00E-04 1.5 5.00E-05 5.00E-03 TCmilk
2.00E-03 LNORM 2.00E-03 1.5 2.00E-04 2.00E-02 TCmeat

C Element
0.00E+00 NONE 0.00E+00 1.5 0.00E+00 0.00E+00 Kd (mL/g)
0.00E+00 NONE 0.00E+00 1.5 0.00E+00 0.00E+00 CRveg (fw)
0.00E+00 NONE 0.00E+00 1.5 0.00E+00 0.00E+00 CRforg (fw)
0.00E+00 NONE 0.00E+00 1.5 0.00E+00 0.00E+00 TCmilk
0.00E+00 NONE 0.00E+00 1.5 0.00E+00 0.00E+00 TCmeat

Co Element
1.00E+03 LNORM 1.00E+03 1.5 1.00E+02 1.00E+04 Kd (mL/g)
8.00E-02 LNORM 8.00E-02 1.5 8.00E-03 8.00E-01 CRveg (fw)
8.00E-02 LNORM 8.00E-02 1.5 8.00E-03 8.00E-01 CRforg (fw)
2.00E-03 LNORM 2.00E-03 1.5 2.00E-04 2.00E-02 TCmilk
2.00E-02 LNORM 2.00E-02 1.5 2.00E-03 2.00E-01 TCmeat

Cs Element
4.60E+03 LNORM 4.60E+03 1.5 4.60E+02 4.60E+04 Kd (mL/g)
4.00E-02 LNORM 4.00E-02 1.5 4.00E-03 4.00E-01 CRveg (fw)
4.00E-02 LNORM 4.00E-02 1.5 4.00E-03 4.00E-01 CRforg (fw)
8.00E-03 LNORM 8.00E-03 1.5 8.00E-04 8.00E-02 TCmilk
3.00E-02 LNORM 3.00E-02 1.5 3.00E-03 3.00E-01 TCmeat

H Element
0.00E+00 NONE 0.00E+00 1.5 0.00E+00 0.00E+00 Kd (mL/g)
0.00E+00 NONE 0.00E+00 1.5 0.00E+00 0.00E+00 CRveg (fw)
0.00E+00 NONE 0.00E+00 1.5 0.00E+00 0.00E+00 CRforg (fw)
0.00E+00 NONE 0.00E+00 1.5 0.00E+00 0.00E+00 TCmilk
0.00E+00 NONE 0.00E+00 1.5 0.00E+00 0.00E+00 TCmeat

I Element
1.00E-01 LNORM 1.00E-01 1.5 1.00E-02 1.00E+00 Kd (mL/g)
2.00E-02 LNORM 2.00E-02 1.5 2.00E-03 2.00E-01 CRveg (fw)
2.00E-02 LNORM 2.00E-02 1.5 2.00E-03 2.00E-01 CRforg (fw)
1.00E-02 LNORM 1.00E-02 1.5 1.00E-03 1.00E-01 TCmilk
7.00E-03 LNORM 7.00E-03 1.5 7.00E-04 7.00E-02 TCmeat

Kr Element
0.00E+00 NONE 0.00E+00 1.5 0.00E+00 0.00E+00 Kd (mL/g)
0.00E+00 NONE 0.00E+00 1.5 0.00E+00 0.00E+00 CRveg (fw)
0.00E+00 NONE 0.00E+00 1.5 0.00E+00 0.00E+00 CRforg (fw)
0.00E+00 NONE 0.00E+00 1.5 0.00E+00 0.00E+00 TCmilk
0.00E+00 NONE 0.00E+00 1.5 0.00E+00 0.00E+00 TCmeat

Np Element
8.00E+00 LNORM 8.00E+00 1.5 8.00E-01 8.00E+01 Kd (mL/g)
2.00E-02 LNORM 2.00E-02 1.5 2.00E-03 2.00E-01 CRveg (fw)
2.00E-02 LNORM 2.00E-02 1.5 2.00E-03 2.00E-01 CRforg (fw)
5.00E-06 LNORM 5.00E-06 1.5 5.00E-07 5.00E-05 TCmilk
1.00E-03 LNORM 1.00E-03 1.5 1.00E-04 1.00E-02 TCmeat

Pa Element
5.00E+01 LNORM 5.00E+01 1.5 5.00E+00 5.00E+02 Kd (mL/g)
2.50E-03 LNORM 2.50E-03 1.5 2.50E-04 2.50E-02 CRveg (fw)
1.00E-01 LNORM 1.00E-01 1.5 1.00E-02 1.00E+00 CRforg (fw)
5.00E-06 LNORM 5.00E-06 1.5 5.00E-07 5.00E-05 TCmilk
5.00E-03 LNORM 5.00E-03 1.5 5.00E-04 5.00E-02 TCmeat

Pb Element
1.00E+02 LNORM 1.00E+02 1.5 1.00E+01 1.00E+03 Kd (mL/g)
1.00E-02 LNORM 1.00E-02 1.5 1.00E-03 1.00E-01 CRveg (fw)
1.00E-02 LNORM 1.00E-02 1.5 1.00E-03 1.00E-01 CRforg (fw)
3.00E-04 LNORM 3.00E-04 1.5 3.00E-05 3.00E-03 TCmilk
8.00E-04 LNORM 8.00E-04 1.5 8.00E-05 8.00E-03 TCmeat

Po Element

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1.00E+01	LNORM	1.00E+01	1.5	1.00E+00	1.00E+02	Kd (mL/g)
9.00E-03	LNORM	9.00E-03	1.5	9.00E-04	9.00E-02	CRveg (fw)
1.00E-01	LNORM	1.00E-01	1.5	1.00E-02	1.00E+00	CRforg (fw)
3.00E-04	LNORM	3.00E-04	1.5	3.00E-05	3.00E-03	TCmilk
5.00E-03	LNORM	5.00E-03	1.5	5.00E-04	5.00E-02	TCmeat
Pu						
2.00E+03	LNORM	2.00E+03	1.5	2.00E+02	2.00E+04	Kd (mL/g)
1.00E-03	LNORM	1.00E-03	1.5	1.00E-04	1.00E-02	CRveg (fw)
1.00E-03	LNORM	1.00E-03	1.5	1.00E-04	1.00E-02	CRforg (fw)
1.00E-06	LNORM	1.00E-06	1.5	1.00E-07	1.00E-05	TCmilk
1.00E-04	LNORM	1.00E-04	1.5	1.00E-05	1.00E-03	TCmeat
Ra						
7.00E+01	LNORM	7.00E+01	1.5	7.00E+00	7.00E+02	Kd (mL/g)
4.00E-02	LNORM	4.00E-02	1.5	4.00E-03	4.00E-01	CRveg (fw)
4.00E-02	LNORM	4.00E-02	1.5	4.00E-03	4.00E-01	CRforg (fw)
1.00E-03	LNORM	1.00E-03	1.5	1.00E-04	1.00E-02	TCmilk
1.00E-03	LNORM	1.00E-03	1.5	1.00E-04	1.00E-02	TCmeat
Rn						
0.00E+00	LNORM	0.00E+00	1.5	0.00E+00	0.00E+00	Kd (mL/g)
0.00E+00	LNORM	0.00E+00	1.5	0.00E+00	0.00E+00	CRveg (fw)
0.00E+00	LNORM	0.00E+00	1.5	0.00E+00	0.00E+00	CRforg (fw)
0.00E+00	LNORM	0.00E+00	1.5	0.00E+00	0.00E+00	TCmilk
0.00E+00	LNORM	0.00E+00	1.5	0.00E+00	0.00E+00	TCmeat
Sr						
3.00E+01	LNORM	3.00E+01	1.5	3.00E+00	3.00E+02	Kd (mL/g)
3.00E-01	LNORM	3.00E-01	1.5	3.00E-02	3.00E+00	CRveg (fw)
3.00E-01	LNORM	3.00E-01	1.5	3.00E-02	3.00E+00	CRforg (fw)
2.00E-03	LNORM	2.00E-03	1.5	2.00E-04	2.00E-02	TCmilk
8.00E-03	LNORM	8.00E-03	1.5	8.00E-04	8.00E-02	TCmeat
Th						
6.00E+04	LNORM	6.00E+04	1.5	6.00E+03	6.00E+05	Kd (mL/g)
1.00E-03	LNORM	1.00E-03	1.5	1.00E-04	1.00E-02	CRveg (fw)
1.00E-03	LNORM	1.00E-03	1.5	1.00E-04	1.00E-02	CRforg (fw)
5.00E-04	LNORM	5.00E-04	1.5	5.00E-05	5.00E-03	TCmilk
7.00E-03	LNORM	7.00E-03	1.5	7.00E-04	7.00E-02	TCmeat
Tl						
6.00E+04	LNORM	6.00E+04	1.5	6.00E+03	6.00E+05	Kd (mL/g)
1.00E-03	LNORM	1.00E-03	1.5	1.00E-04	1.00E-02	CRveg (fw)
1.00E-03	LNORM	1.00E-03	1.5	1.00E-04	1.00E-02	CRforg (fw)
5.00E-04	LNORM	5.00E-04	1.5	5.00E-05	5.00E-03	TCmilk
7.00E-03	LNORM	7.00E-03	1.5	7.00E-04	7.00E-02	TCmeat
U						
5.00E+01	LNORM	5.00E+01	1.5	5.00E+00	5.00E+02	Kd (mL/g)
2.50E-03	LNORM	2.50E-03	1.5	2.50E-04	2.50E-02	CRveg (fw)
2.50E-03	LNORM	2.50E-03	1.5	2.50E-04	2.50E-02	CRforg (fw)
5.00E-04	LNORM	5.00E-04	1.5	5.00E-05	5.00E-03	TCmilk
7.00E-03	LNORM	7.00E-03	1.5	7.00E-04	7.00E-02	TCmeat
Y						
0.00E+00	LNORM	0.00E+00	1.5	0.00E+00	0.00E+00	Kd (mL/g)
2.50E-03	LNORM	2.50E-03	1.5	2.50E-04	2.50E-02	CRveg (fw)
2.50E-03	LNORM	2.50E-03	1.5	2.50E-04	2.50E-02	CRforg (fw)
2.00E-05	LNORM	2.00E-05	1.5	2.00E-06	2.00E-04	TCmilk
2.00E-03	LNORM	2.00E-03	1.5	2.00E-04	2.00E-02	TCmeat
Xe Element						
0.00E+00	NONE	0.00E+00	1.5	0.00E+00	0.00E+00	Kd (mL/g)
0.00E+00	NONE	0.00E+00	1.5	0.00E+00	0.00E+00	CRveg (fw)
0.00E+00	NONE	0.00E+00	1.5	0.00E+00	0.00E+00	CRforg (fw)
0.00E+00	NONE	0.00E+00	1.5	0.00E+00	0.00E+00	TCmilk
0.00E+00	NONE	0.00E+00	1.5	0.00E+00	0.00E+00	TCmeat

Nuclide File

Nuclide	Element	T1/2(years)	Progeny	DecayFrac
Ac-227	Ac	2.177E+01	Th-227	1
Ac-228	Ac	7.020E-04	Th-228	1
Am-241	Am	4.322E+02	Np-237	1
Am-243	Am	7.370E+03	Np-239	1
Ar-41	Ar	2.080E-04	STABLE	1
Ba-137m	Ba	4.860E-06	STABLE	1
Bi-210	Bi	1.373E-02	Po-210	1
Bi-214	Bi	3.786E-05	Po-214	0.99979
C-14	C	5.730E+03	STABLE	1
Co-60	Co	5.270E+00	STABLE	1
Cs-137	Cs	3.007E+01	Ba-137m	0.946
Cs-138	Cs	6.356E-05	STABLE	1
H-3	H	1.233E+01	STABLE	1
I-129	I	1.570E+07	STABLE	1
I-131	I	2.199E-02	Xe-131m	1
Kr-85	Kr	1.076E+01	STABLE	1
Kr-87	Kr	2.419E-06	STABLE	1
Np-237	Np	2.144E+06	STABLE	1
Np-239	Np	6.455E-03	Pu-239	1
Pa-231	Pa	3.276E+04	Ac-227	1
Pa-234m	Pa	2.226E-07	U-234	0.9984
Pb-210	Pb	2.230E+01	Bi-210	1
Pb-214	Pb	5.098E-05	Bi-214	1
Po-210	Po	3.791E-01	STABLE	1
Po-214	Po	5.200E-12	Pb-210	1
Po-218	Po	5.898E-06	Pb-214	0.998
Pu-238	Pu	8.770E+01	U-234	1

Pu-239	Pu	2.411E+04	STABLE	1
Pu-240	Pu	6.563E+03	STABLE	1
Pu-241	Pu	1.435E+01	Am-241	1
Pu-242	Pu	3.733E+05	U-238	1
Ra-226	Ra	1.600E+03	Rn-222	1
Ra-228	Ra	5.750E+00	Ac-228	1
Rn-222	Rn	1.047E-02	Po-218	1
Sb-125	Sb	2.758E+00	Te-125m	1
Sr-90	Sr	2.879E+01	Y-90	1
Te-125m	Te	1.573E-01	STABLE	1
Th-227	Th	5.128E-02	STABLE	1
Th-228	Th	1.912E+00	Tl-208	0.35
Th-230	Th	7.538E+04	Ra-226	1
Th-232	Th	1.400E+10	Ra-228	1
Th-234	Th	6.570E-02	Pa-234m	1
Tl-208	Tl	5.808E-06	STABLE	1
U-233	U	1.592E+05	Th-229	1
U-234	U	2.455E+05	Th-230	1
U-238	U	4.469E+09	Th-234	1
Xe-131m	Xe	3.244E-02	STABLE	1
Xe-135	Xe	1.040E-03	STABLE	1
Xe-135m	Xe	2.900E-05	Xe-135	1
Xe-138	Xe	2.769E-05	Cs-138	1
Y-90	Y	7.31E-03	STABLE	1

Media Intake File

Age (yr)	InH(m**3/hr)	IngSoil(g/hr)	IngLVeg(kg/yr)	IngProd(kg/yr)	IngMilk(L/yr)	IngMeat (kg/yr)	IngWG(kg/yr)
0.0	0.365	0.00250	14.30	17.73	47.2	35.8	0.0
1.0	0.562	0.00417	27.88	32.46	45.6	34.6	63.8
5.0	0.535	0.00696	36.20	35.16	49.4	37.5	65.8
10.	0.553	0.00500	43.00	29.38	64.8	49.2	105.9
15.	0.623	0.00417	48.78	22.31	90.6	68.8	105.9
20.	0.917	0.00	18.00	176.00	112.0	85.0	0.0
120	0.917	0.00	18.00	176.00	112.0	85.0	0.0



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