Attachment 6

TODD JACKSON

WESTON® MANAGERS DESIGNERS/CONSULTANTS
Roy F. Weston, Inc.
Suite 400
3 Hawthorn Parkway
Vernon Hills, Illinois 60061-1450
847-918-4000 • Fax 847-918-4055

October 18, 1999

Mr. Randy Godfrey, Engineering Manager
U.S. Department of the Army
New England District, Corps of Engineers
696 Virginia Road
Concord, MA 01724-2751

Re: Contract No. DACA31-96-D-0006
Addendum to Justification for Derived Concentration Guidelines
St. Albans Veterans Administration Extended Care Facility, Queens, New York
WESTON W.O. No.: 10971-219-201-0001
DCN: VAHOSP-1001899-AABX

Dear Mr. Godfrey:

Enclosed please find three (3) copies of the above-referenced addendum. If you have any immediate questions or wish to discuss this, please do not hesitate to contact me at (847) 918-4087 or John Rhyner at (516) 873-3814.

Very Truly Yours,

ROY F. WESTON, INC.

Michael Madonia
Senior Client Service Manager

MM/ts
Enclosure

cc: H. Honerlah, CENAB, one (1) copy of plan
J. Rhyner, WESTON
M. Madonia, WESTON
M. Van Der Karr, WESTON
DCN Files

ADDENDUM TO JUSTIFICATION FOR DERIVED CONCENTRATION GUIDELINES FOR STRONTIUM-90 CONCENTRATION IN SOIL

This addendum supplements the "Justification for Derived Concentration Guidelines" 24 June 1999 report, prepared by Roy F. Weston, Inc. to support future decontamination and decommissioning operations at the St. Albans Veterans Administration Extended Care Center (VAECC). A revised Derived Concentration Guideline Level (DCGL) of 35 pCi/g for strontium-90 concentration in soil supercedes the recommended value in the 24 June 1999 document. The revised DCGL is proposed after application of initial parameters for the RESRAD 5.91 code as recommended in comments received in a October 14, 1999 memorandum from the U.S. Nuclear Regulatory Commission (NRC). Discussed are the parameters that have the highest impact on dose, worst case yet realistic exposure scenarios, deviations from the NRC generic parameters or RESRAD default values, and values for soil DCGLs that are both ALARA and technically feasible from a decommissioning standpoint.

Site Description

The VAECC comprises 15 buildings covering approximately 700,000 ft^2 in highly urbanized Queens, New York. The potentially contaminated soil is under building 90 and covers a footprint of approximately 900 m^2 below basement level. The maximum possible contaminated area is 900 m^2. Solid matrix samples in soil demonstrated that the depth of contamination was limited to the first six inches under the building.

Initial Trial Runs of RESRAD

After inputting the generic initial parameters and contaminated zone conditions, trial runs were performed to identify the important parameters and exposure pathways. The RESRAD output showed that the majority of the potential dose in the initial years was from plant intake and, to a lesser extent, from meat and milk ingestion. The predominant path for livestock uptake is through plant ingestion. Dose from these pathways steadily decreased from radioactive decay and leaching. At approximately year 20 after the start of dose considerations, the radioactivity reaches

groundwater. While the dose from plant, meat and milk ingestion approaches zero at year 20, there is now a potential dose from drinking water from a well.

Understanding the Critical Modeling Parameter

The equilibrium constant K_d directly correlates to the leaching rate. Lower values imply that the contaminant leaches more quickly out of the contaminated zone and into the groundwater. While this will raise the potential drinking water dose in approximately 20 years after the beginning of the scenario, the potential dose from plants, meat and milk decreases much more rapidly. This decrease occurs because the contamination no longer remains in the topsoil available for root uptake. Thus while changing the K_d increases one of the major exposure pathways, it decreases the other.

Exposure Scenarios

The family farm scenario recommended as default includes all environmental pathways. Members of the family may receive doses from direct external exposure to radiation, inhalation of resuspended dust from surface contamination, inhalation of radon, ingestion of contaminated soil, ingestion of plant foods, ingestion of meat from livestock, ingestion of milk from this livestock, and ingestion of aquatic animals from a nearby pond that has been contaminated. The radon pathway can be eliminated since the only contaminant found in the soil is strontium-90.

Further refinements to the default initial parameters should be made based on site conditions as previously described. This includes future land use and the nature of the contamination. Only the parameters that have an impact on the major exposure pathways need to be considered. Table 1 shows the initial parameters used that are different from the RESRAD default values. Italicized rows show where site-specific information is different from the NRC's suggested or RESRAD default values. Assumptions and differences are explained as follows.

- With the contaminated soil directly under the building at a sub-floor level, it is assumed that the potential contamination will not leach until the building is removed. This leaves the potential dose from plant, meat, and milk intact.

- It is unlikely that the building will be removed in the near future. Since strontium-90 decays with a half-life of 29 years, it is expected that half of the contamination will decay before the

building is removed. However, the effect of radioactive decay before the beginning of the scenario is not taken as an assumption.

- The RESRAD manual suggests an upper boundary for the fraction of plant foot diet from contaminated plants is 0.5. This fraction is based on the family needing to supplement at least half of their fruits, vegetables and grains from off-site sources. The fraction of contaminated plant food will be assumed to be 0.25. This value should be considered conservative due to the urban setting of inner New York City. The NRC default value is 1 while the RESRAD default is calculated as 0.45.

- Likewise, it is unlikely that livestock would be raised in this location. Furthermore, it is estimated that 20,000 m^2 of land is required to feed livestock. Since the impacted area is only 900 m^2, even if livestock were raised at this location, only a small fraction of their feed would be potentially contaminated. The fraction of contaminated meat and milk will be assumed to be 0.25, although it is expected to be zero. The NRC default value is 1 while the RESRAD default is calculated as 0.045.

- Literature suggests that the equilibrium constant of strontium-90 in soil is between 8 and 280. Three runs of RESRAD are performed using Kd values of 3, 30 (the default RESRAD value), and 300. All three zones of interest that include the contaminated zone, unsaturated or vadose zone, and the saturated or ground water zone will use the same value for a particular run. This will show the effects of leaching both on the potential plant related pathways and well water pathways. Note that a sensitivity analysis for all three zones with a factor of ten variance above and below a Kd value of 30 will not show the potential drinking water dose at 20 years.

- While the calculation times do not effect the dose, they are chosen to show the effects in the first year and at 20 years after the beginning of the scenario.

Table 1

Parameter	User Input	RESRAD Default
Area of contaminated zone (m**2)	9.000E+01	1.000E+04
Thickness of contaminated zone (m)	1.500E-01	2.000E+00
Times for calculations (yr)	1.000E-01	1.000E+00
Times for calculations (yr)	5.000E-01	3.000E+00
Times for calculations (yr)	1.000E+00	1.000E+01
Times for calculations (yr)	3.000E+00	3.000E+01
Times for calculations (yr)	1.000E+01	1.000E+02
Times for calculations (yr)	2.000E+01	3.000E+02
Times for calculations (yr)	3.000E+01	1.000E+03
Times for calculations (yr)	5.000E+01	0.000E+00
Initial principal radionuclide (pCi/g): Sr-90	3.500E+01	0.000E+00
Concentration in groundwater (pCi/L): Sr-90	not used	0.000E+00
Cover depth (m)	0.000E+00	0.000E+00
Irrigation (m/yr)	5.000E-01	2.000E-01
Well pumping rate (m**3/yr)	1.180E+02	2.500E+02
Distribution coefficients for Sr-90		
*Contaminated zone (cm**3/g)*	*3, 30, and 300*	*3.000E+01*
*Unsaturated zone 1 (cm**3/g)*	*3, 30, and 300*	*3.000E+01*
*Saturated zone (cm**3/g)*	*3, 30, and 300*	*3.000E+01*
Inhalation rate (m**3/yr)	1.169E+04	8.400E+03
Mass loading for inhalation (g/m**3)	3.140E-06	1.000E-04
Shielding factor, external gamma	5.512E-01	7.000E-01
Fraction of time spent indoors	6.571E-01	5.000E-01
Fraction of time spent outdoors (on site)	1.101E-01	2.500E-01
Fruits, vegetables and grain consumption (kg/yr)	1.120E+02	1.600E+02
Leafy vegetable consumption (kg/yr)	2.140E+01	1.400E+01
Milk consumption (L/yr)	2.330E+02	9.200E+01
Meat and poultry consumption (kg/yr)	6.510E+01	6.300E+01
Fish consumption (kg/yr)	2.060E+01	5.400E+00

Soil ingestion rate (g/yr)	1.826E+01	3.650E+01
Drinking water intake (L/yr)	4.785E+02	5.100E+02
Contamination fraction of drinking water	1.000E+00	1.000E+00
Contamination fraction of household water	not used	1.000E+00
Contamination fraction of livestock water	1.000E+00	1.000E+00
Contamination fraction of irrigation water	1.000E+00	1.000E+00
Contamination fraction of aquatic food	1.000E+00	5.000E-01
Contamination fraction of plant food	*5.000E-01*	*-1 (0.45)*
Contamination fraction of meat	*2.500E-01*	*-1 (0.045)*
Contamination fraction of milk	*2.500E-01*	*-1 (0.045)*
Livestock fodder intake for meat (kg/day)	2.710E+01	6.800E+01
Livestock fodder intake for milk (kg/day)	6.325E+01	5.500E+01
Livestock water intake for meat (L/day)	5.000E+01	5.000E+01
Livestock water intake for milk (L/day)	6.000E+01	1.600E+02
Livestock soil intake (kg/day)	5.000E-01	5.000E-01
Mass loading for foliar deposition (g/m**3)	1.000E-04	1.000E-04
Depth of soil mixing layer (m)	1.500E-01	1.500E-01
Depth of roots (m)	9.000E-01	9.000E-01
Drinking water fraction from ground water	1.000E+00	1.000E+00
Household water fraction from ground water	not used	1.000E+00
Growing Season for Non-Leafy (years)	2.500E-01	1.700E-01
Growing Season for Leafy (years)	1.230E-01	2.500E-01
Growing Season for Fodder (years)	1.500E-01	8.000E-02
Fraction of grain in beef cattle feed	*not used*	*8.000E-01*
Fraction of grain in milk cow feed	*not used*	*2.000E-01*
Storage times of contaminated foodstuffs (days):		
Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01
Leafy vegetables	1.000E+00	1.000E+00
Milk	1.000E+00	1.000E+00
Meat and poultry	2.000E+01	2.000E+01
Livestock fodder	0.000E+00	4.500E+01
Emanating power of Rn-222 gas	not used	2.500E-01

Results of RESRAD Simulations

Basis for 10?

A value of 35 pCi/g is chosen as the DCGL for strontium-90 in soil at the VAECC. This number is chosen based on RESRAD runs using a K_d value of 30. Using a value of 35 pCi/gm provides a 20% safety margin from the allowable yearly dose of 25 mrem (the calculated maximum dose using a K_d of 30 is 20.5 mrem/yr). A value of 30 for K_d is also conservative over site specific values that should be closer to 10. As later seen in the RESRAD data, lower values of Kd result in less potential dose. Furthermore, the DCGL value of 35 pCi/g is not decay corrected for the minimum length of time the building is expected to remain. Using 35 pCi/g as the initial strontium-90 concentration, the complete RESRAD summary report for a K_d value of 30 is shown in Attachment 1. Attachment 2 contains graphical output that easily demonstrates the important pathways, the time frame when dose might be expected, and the effects of using values of 3, 30 and 300 for the equilibrium constant K_d. Table 2 summarizes the data. The dose at time = 0 is also the maximum potential dose.

Table 2

Pathway	Kd value	Potential dose at time = zero (mrem/yr)	Potential dose at approximately 20 years (mrem/yr)
Total	3	14.5	3.0
Plant	3	11.9	0.4
Meat and Milk	3	2.4	0.3
Drinking Water	3	0	2.2
Total	30	20.5	1.6
Plant	30	16.8	1.3
Meat and Milk	30	3.4	0.3
Drinking Water	30	0	0
Total	300	21.4	9.5
Plant	300	17.5	7.8
Meat and Milk	300	3.5	1.5
Drinking Water	300	0	0

Conclusions

Using a value of 35 pCi/gm as the DCGL for strontium-90 in soil will both be ALARA and allow efficient decommissioning of the facility. This value may also be used for strontium-90 in bulk material such as concrete. This value could be higher by a factor of two if the building is not removed for 30 years. The maximum projected potential dose under the proposed scenario at any time and for any K_d value is 21 mrem/yr. This occurs during the first year for average values of K_d. The predominant pathway is plant ingestion immediately after the scenario begins. This rapidly begins to disappear and the pathway is realistically gone by year 50 with a K_d value of 30. Potential effects from drinking water appear at approximately 20 years only for low values of K_d. However, low values of K_d will also allow any potential doses from the plant pathway to disappear by year 10. Very high values of K_d will prolong any potential effects of the plant pathway. However, this pathway steadily decreases and is below 3 mrem/yr by year 50.

ATTACHMENT 1

RESRAD SUMMARY REPORT

FOR Kd = 30

Table of Contents

Part I: Mixture Sums and Single Radionuclide Guidelines

Dose Conversion Factor (and Related) Parameter Summary
File: Default.LIB

Menu	Parameter	Current Value	Default	Parameter Name
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	Sr-90+D	1.310E-03	1.310E-03	DCF2(1)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	Sr-90+D	1.530E-04	1.530E-04	DCF3(1)
D-34	Food transfer factors:			
D-34	Sr-90+D , plant/soil concentration ratio, dimensionless	3.000E-01	3.000E-01	RTF(1,1)
D-34	Sr-90+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-03	8.000E-03	RTF(1,2)
D-34	Sr-90+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-03	2.000E-03	RTF(1,3)
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-5	Sr-90+D , fish	6.000E+01	6.000E+01	BIOFAC(1,1)
D-5	Sr-90+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(1,2)

Site-Specific Parameter Summary

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R011	Area of contaminated zone (m**2)	9.000E+01	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	1.500E-01	2.000E+00	---	THICK0
R011	Length parallel to aquifer flow (m)	1.000E+02	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	2.500E+01	3.000E+01	---	BRDL
R011	Time since placement of material (yr)	0.000E+00	0.000E+00	---	TI
R011	Times for calculations (yr)	1.000E-01	1.000E+00	---	T(2)
R011	Times for calculations (yr)	5.000E-01	3.000E+00	---	T(3)
R011	Times for calculations (yr)	1.000E+00	1.000E+01	---	T(4)
R011	Times for calculations (yr)	3.000E+00	3.000E+01	---	T(5)
R011	Times for calculations (yr)	1.000E+01	1.000E+02	---	T(6)
R011	Times for calculations (yr)	2.000E+01	3.000E+02	---	T(7)
R011	Times for calculations (yr)	3.000E+01	1.000E+03	---	T(8)
R011	Times for calculations (yr)	5.000E+01	0.000E+00	---	T(9)
		not used	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g): Sr-90	3.500E+01	0.000E+00	---	S1(1)
R012	Concentration in groundwater (pCi/L): Sr-90	not used	0.000E+00	---	W1(1)
R013	Cover depth (m)	0.000E+00	0.000E+00	---	COVER0
R013	Density of cover material (g/cm**3)	not used	1.500E+00	---	DENSCV
R013	Cover depth erosion rate (m/yr)	not used	1.000E-03	---	VCV
R013	Density of contaminated zone (g/cm**3)	1.500E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	4.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity	2.000E-01	2.000E-01	---	FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	1.000E+02	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	5.300E+00	5.300E+00	---	BCZ
R013	Average annual wind speed (m/sec)	2.000E+00	2.000E+00	---	WIND
R013	Humidity in air (g/m**3)	not used	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	5.000E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	1.000E+00	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	5.000E-01	2.000E-01	---	RI
R013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	2.000E-01	2.000E-01	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	1.000E+06	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	1.000E-03	1.000E-03	---	EPS
R014	Density of saturated zone (g/cm**3)	1.500E+00	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	4.000E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	2.000E-01	2.000E-01	---	EPSZ
R014	Saturated zone field capacity	2.000E-01	2.000E-01	---	FCSZ
R014	Saturated zone hydraulic conductivity (m/yr)	1.000E+02	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	2.000E-02	2.000E-02	---	HGWT
R014	Saturated zone b parameter	5.300E+00	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	1.000E-03	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	1.000E+01	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	1.180E+02	2.500E+02	---	UW
R015	Number of unsaturated zone strata	1	1	---	NS

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R015	Unsat. zone 1, thickness (m)	4.000E+00	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	1.500E+00	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	4.000E-01	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	2.000E-01	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, field capacity (New parameter?)	2.000E-01	2.000E-01	---	FCUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	5.300E+00	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCUZ(1)
R016	Distribution coefficients for Sr-90				
R016	Contaminated zone (cm**3/g)	3.000E+01	3.000E+01	---	DCNUCC(1)
R016	Unsaturated zone 1 (cm**3/g)	3.000E+01	3.000E+01	---	DCNUCU(1,1
R016	Saturated zone (cm**3/g)	3.000E+01	3.000E+01	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	9.571E-02	ALEACH(1)
R016	Solubility constant	3.000E+00	0.000E+00	---	SOLUBK(1)
R017	Inhalation rate (m**3/yr)	1.169E+04	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	3.140E-06	1.000E-04	---	MLINH
R017	Exposure duration	3.000E+01	3.000E+01	---	ED
R017	Shielding factor, inhalation ("indoor dust filtration factor")	4.000E-01	4.000E-01	---	SHF3
R017	Shielding factor, external gamma	5.512E-01	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	6.571E-01	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	1.101E-01	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	1.000E+00	1.000E+00	>0 shows circular AREA.	FS
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	not used	5.000E+01	---	RAD SHAPE(
R017	Outer annular radius (m), ring 2:	not used	7.071E+01	---	RAD SHAPE(
R017	Outer annular radius (m), ring 3:	not used	0.000E+00	---	RAD SHAPE(
R017	Outer annular radius (m), ring 4:	not used	0.000E+00	---	RAD SHAPE(
R017	Outer annular radius (m), ring 5:	not used	0.000E+00	---	RAD SHAPE(
R017	Outer annular radius (m), ring 6:	not used	0.000E+00	---	RAD SHAPE(
R017	Outer annular radius (m), ring 7:	not used	0.000E+00	---	RAD SHAPE(
R017	Outer annular radius (m), ring 8:	not used	0.000E+00	---	RAD SHAPE(
R017	Outer annular radius (m), ring 9:	not used	0.000E+00	---	RAD SHAPE(
R017	Outer annular radius (m), ring 10:	not used	0.000E+00	---	RAD SHAPE(1
R017	Outer annular radius (m), ring 11:	not used	0.000E+00	---	RAD SHAPE(1
R017	Outer annular radius (m), ring 12:	not used	0.000E+00	---	RAD_SHAPE(1
R017	Fractions of annular areas within AREA:				
R017	Ring 1	not used	1.000E+00	---	FRACA(1)
R017	Ring 2	not used	2.732E-01	---	FRACA(2)
R017	Ring 3	not used	0.000E+00	---	FRACA(3)
R017	Ring 4	not used	0.000E+00	---	FRACA(4)
R017	Ring 5	not used	0.000E+00	---	FRACA(5)
R017	Ring 6	not used	0.000E+00	---	FRACA(6)
R017	Ring 7	not used	0.000E+00	---	FRACA(7)
R017	Ring 8	not used	0.000E+00	---	FRACA(8)
R017	Ring 9	not used	0.000E+00	---	FRACA(9)
R017	Ring 10	not used	0.000E+00	---	FRACA(10)
R017	Ring 11	not used	0.000E+00	---	FRACA(11)
R017	Ring 12	not used	0.000E+00	---	FRACA(12)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R018	Fruits, vegetables and grain consumption (kg/yr)	1.120E+02	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	2.140E+01	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	2.330E+02	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	6.510E+01	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	2.060E+01	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	9.000E-01	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	1.826E+01	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	4.785E+02	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	1.000E+00	1.000E+00	---	FDW
R018	Contamination fraction of household water	not used	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	1.000E+00	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	1.000E+00	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	1.000E+00	5.000E-01	---	FR9
R018	Contamination fraction of plant food	5.000E-01	-1	---	FPLANT
R018	Contamination fraction of meat	2.500E-01	-1	---	FMEAT
R018	Contamination fraction of milk	2.500E-01	-1	---	FMILK
R019	Livestock fodder intake for meat (kg/day)	2.710E+01	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	6.325E+01	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	5.000E+01	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	6.000E+01	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	5.000E-01	5.000E-01	---	LSI
R019	Mass loading for foliar deposition (g/m**3)	1.000E-04	1.000E-04	---	MLFD
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
R019	Depth of roots (m)	9.000E-01	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	1.000E+00	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	not used	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	1.000E+00	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	1.000E+00	1.000E+00	---	FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	7.000E-01	7.000E-01	---	YV(1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	1.500E+00	1.500E+00	---	YV(2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	1.100E+00	1.100E+00	---	YV(3)
R19B	Growing Season for Non-Leafy (years)	2.500E-01	1.700E-01	---	TE(1)
R19B	Growing Season for Leafy (years)	1.230E-01	2.500E-01	---	TE(2)
R19B	Growing Season for Fodder (years)	1.500E-01	8.000E-02	---	TE(3)
R19B	Translocation Factor for Non-Leafy	1.000E-01	1.000E-01	---	TIV(1)
R19B	Translocation Factor for Leafy	1.000E+00	1.000E+00	---	TIV(2)
R19B	Translocation Factor for Fodder	1.000E+00	1.000E+00	---	TIV(3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	2.500E-01	2.500E-01	---	RDRY(1)
R19B	Dry Foliar Interception Fraction for Leafy	2.500E-01	2.500E-01	---	RDRY(2)
R19B	Dry Foliar Interception Fraction for Fodder	2.500E-01	2.500E-01	---	RDRY(3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	2.500E-01	2.500E-01	---	RWET(1)
R19B	Wet Foliar Interception Fraction for Leafy	2.500E-01	2.500E-01	---	RWET(2)
R19B	Wet Foliar Interception Fraction for Fodder	2.500E-01	2.500E-01	---	RWET(3)
R19B	Weathering Removal Constant for Vegetation	2.000E+01	2.000E+01	---	WLAM
C14	C-12 concentration in water (g/cm**3)	not used	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	not used	9.800E-01	---	CAIR

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
C14	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	---	DMC
C14	C-14 evasion flux rate from soil (1/sec)	not used	7.000E-07	---	EVSN
C14	C-12 evasion flux rate from soil (1/sec)	not used	1.000E-10	---	REVSN
C14	Fraction of grain in beef cattle feed	not used	8.000E-01	---	AVFG4
C14	Fraction of grain in milk cow feed	not used	2.000E-01	---	AVFG5
STOR	Storage times of contaminated foodstuffs (days):				
STOR	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	---	STOR T(1)
STOR	Leafy vegetables	1.000E+00	1.000E+00	---	STOR T(2)
STOR	Milk	1.000E+00	1.000E+00	---	STOR T(3)
STOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR T(4)
STOR	Fish	7.000E+00	7.000E+00	---	STOR T(5)
STOR	Crustacea and mollusks	7.000E+00	7.000E+00	---	STOR T(6)
STOR	Well water	1.000E+00	1.000E+00	---	STOR T(7)
STOR	Surface water	1.000E+00	1.000E+00	---	STOR T(8)
STOR	Livestock fodder	0.000E+00	4.500E+01	---	STOR_T(9)
R021	Thickness of building foundation (m)	not used	1.500E-01	---	FLOOR
R021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	---	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV
R021	Total porosity of the building foundation	not used	1.000E-01	---	TPFL
R021	Volumetric water content of the cover material	not used	5.000E-02	---	PH2OCV
R021	Volumetric water content of the foundation	not used	3.000E-02	---	PH2OFL
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	not used	2.000E-06	---	DIFCV
R021	in foundation material	not used	3.000E-07	---	DIFFL
R021	in contaminated zone soil	not used	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	not used	2.000E+00	---	HMIX
R021	Average building air exchange rate (1/hr)	not used	5.000E-01	---	REXG
R021	Height of the building (room) (m)	not used	2.500E+00	---	HRM
R021	Building interior area factor	not used	0.000E+00	---	FAI
R021	Building depth below ground surface (m)	not used	-1.000E+00	---	DMFL
R021	Emanating power of Rn-222 gas	not used	2.500E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)
TITL	Number of graphical time points	32	---	---	NPTS
TITL	Maximum number of integration points for dose	17	---	---	LYMAX
TITL	Maximum number of integration points for risk	513	---	---	KYMAX

Summary of Pathway Selections

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

Contaminated Zone Dimensions	
Area:	90.00 square meters
Thickness:	0.15 meters
Cover Depth:	0.00 meters

Initial Soil Concentrations, pCi/q	
Sr-90	3.500E+01

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 25 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E-01	5.000E-01	1.000E+00	3.000E+00	1.000E+01	2.000E+01	3.000E+01	5.000E+01
TDOSE(t):	2.054E+01	2.029E+01	1.929E+01	1.811E+01	1.407E+01	5.809E+00	1.634E+00	4.569E-01	3.495E-02
M(t):	8.217E-01	8.117E-01	7.717E-01	7.246E-01	5.629E-01	2.324E-01	6.536E-02	1.828E-02	1.398E-03

Maximum TDOSE(t): 2.054E+01 mrem/yr at t = 0.000E+00 years

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

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr
Sr-90	3.390E-01	0.0165	6.092E-05	0.0000	0.000E+00	0.0000	1.683E+01	0.8192	1.221E+00	0.0595	2.147E+00	0.1045	6.343E-03
Total	3.390E-01	0.0165	6.092E-05	0.0000	0.000E+00	0.0000	1.683E+01	0.8192	1.221E+00	0.0595	2.147E+00	0.1045	6.343E-03

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

Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Path
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.054E+01
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.054E+01

*Sum of all water independent and dependent pathways.

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

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr
Sr-90	3.350E-01	0.0165	6.016E-05	0.0000	0.000E+00	0.0000	1.662E+01	0.8192	1.207E+00	0.0595	2.120E+00	0.1045	6.263E-03
Total	3.350E-01	0.0165	6.016E-05	0.0000	0.000E+00	0.0000	1.662E+01	0.8192	1.207E+00	0.0595	2.120E+00	0.1045	6.263E-03

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

Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Path
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.029E+01
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.029E+01

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 5.000E-01 years

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr
Sr-90	3.192E-01	0.0165	5.720E-05	0.0000	0.000E+00	0.0000	1.580E+01	0.8192	1.147E+00	0.0595	2.016E+00	0.1045	5.955E-03
Total	3.192E-01	0.0165	5.720E-05	0.0000	0.000E+00	0.0000	1.580E+01	0.8192	1.147E+00	0.0595	2.016E+00	0.1045	5.955E-03

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 5.000E-01 years

Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Path
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.929E+01
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.929E+01

*Sum of all water independent and dependent pathways.

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

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr
Sr-90	3.005E-01	0.0166	5.370E-05	0.0000	0.000E+00	0.0000	1.484E+01	0.8192	1.077E+00	0.0595	1.893E+00	0.1045	5.591E-03
Total	3.005E-01	0.0166	5.370E-05	0.0000	0.000E+00	0.0000	1.484E+01	0.8192	1.077E+00	0.0595	1.893E+00	0.1045	5.591E-03

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

Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Path
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.811E+01
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.811E+01

*Sum of all water independent and dependent pathways.

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

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr
Sr-90	2.360E-01	0.0168	4.171E-05	0.0000	0.000E+00	0.0000	1.153E+01	0.8190	8.367E-01	0.0594	1.470E+00	0.1045	4.343E-03
Total	2.360E-01	0.0168	4.171E-05	0.0000	0.000E+00	0.0000	1.153E+01	0.8190	8.367E-01	0.0594	1.470E+00	0.1045	4.343E-03

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

Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Path
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.407E+01
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.407E+01

*Sum of all water independent and dependent pathways.

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

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr
Sr-90	1.013E-01	0.0174	1.721E-05	0.0000	0.000E+00	0.0000	4.755E+00	0.8184	3.451E-01	0.0594	6.065E-01	0.1044	1.791E-03
Total	1.013E-01	0.0174	1.721E-05	0.0000	0.000E+00	0.0000	4.755E+00	0.8184	3.451E-01	0.0594	6.065E-01	0.1044	1.791E-03

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

Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Path
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.809E+00
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.809E+00

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 2.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr
Sr-90	3.018E-02	0.0185	4.835E-06	0.0000	0.000E+00	0.0000	1.336E+00	0.8176	9.697E-02	0.0593	1.704E-01	0.1043	5.033E-04
Total	3.018E-02	0.0185	4.835E-06	0.0000	0.000E+00	0.0000	1.336E+00	0.8176	9.697E-02	0.0593	1.704E-01	0.1043	5.033E-04

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 2.000E+01 years

Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Path
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.634E+00
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.634E+00

*Sum of all water independent and dependent pathways.

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

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr
Sr-90	8.959E-03	0.0196	1.350E-06	0.0000	0.000E+00	0.0000	3.731E-01	0.8166	2.709E-02	0.0593	4.759E-02	0.1042	1.406E-04
Total	8.959E-03	0.0196	1.350E-06	0.0000	0.000E+00	0.0000	3.731E-01	0.8166	2.709E-02	0.0593	4.759E-02	0.1042	1.406E-04

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

Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Path
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.569E-01
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.569E-01

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 5.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr
Sr-90	7.788E-04	0.0223	1.030E-07	0.0000	0.000E+00	0.0000	2.846E-02	0.8144	2.066E-03	0.0591	3.630E-03	0.1039	1.072E-05
Total	7.788E-04	0.0223	1.030E-07	0.0000	0.000E+00	0.0000	2.846E-02	0.8144	2.066E-03	0.0591	3.630E-03	0.1039	1.072E-05

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 5.000E+01 years

Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Path
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.495E-02
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.495E-02

*Sum of all water independent and dependent pathways.

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

Parent (i)	Product (j)	Branch Fraction*	t=	0.000E+00	1.000E-01	5.000E-01	DSR(j,t) 1.000E+00	(mrem/yr)/(pCi/q) 3.000E+00	1.000E+01	2.000E+01	3.000E+01	5.000E+01
Sr-90	Sr-90	1.000E+00		5.870E-01	5.798E-01	5.512E-01	5.175E-01	4.021E-01	1.660E-01	4.668E-02	1.305E-02	9.985E-04

*Branch Fraction is the cumulative factor for the j't principal radionuclide daughter: CUMBRF(j) = BRF(1)*BRF(2)* ... BRF(j).
The DSR includes contributions from associated (half-life ≤ 0.5 yr) daughters.

Single Radionuclide Soil Guidelines G(i,t) in pCi/q
Basic Radiation Dose Limit = 25 mrem/yr

Nuclide (i)	t=	0.000E+00	1.000E-01	5.000E-01	1.000E+00	3.000E+00	1.000E+01	2.000E+01	3.000E+01	5.000E+01
Sr-90		4.259E+01	4.312E+01	4.535E+01	4.830E+01	6.217E+01	1.506E+02	5.355E+02	1.915E+03	2.504E+04

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

Nuclide (i)	Initial pCi/q	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/q)	DSR(i,tmax)	G(i,tmax) (pCi/q)
Sr-90	3.500E+01	0.000E+00	5.870E-01	4.259E+01	5.870E-01	4.259E+01

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

Nuclide (j)	Parent (i)	BRF(i)	DOSE(j,t), mrem/yr								
		t=	0.000E+00	1.000E-01	5.000E-01	1.000E+00	3.000E+00	1.000E+01	2.000E+01	3.000E+01	5.000E+01
Sr-90	Sr-90	1.000E+00	2.054E+01	2.029E+01	1.929E+01	1.811E+01	1.407E+01	5.809E+00	1.634E+00	4.569E-01	3.495E-02

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

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	BRF(i)	S(j,t), pCi/g								
		t=	0.000E+00	1.000E-01	5.000E-01	1.000E+00	3.000E+00	1.000E+01	2.000E+01	3.000E+01	5.000E+01
Sr-90	Sr-90	1.000E+00	3.500E+01	3.458E+01	3.297E+01	3.106E+01	2.445E+01	1.059E+01	3.206E+00	9.704E-01	8.890E-02

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

C:\PROGRA~1\RESRAD\RESMAIN3.EXEexecution time = 4.50 seconds

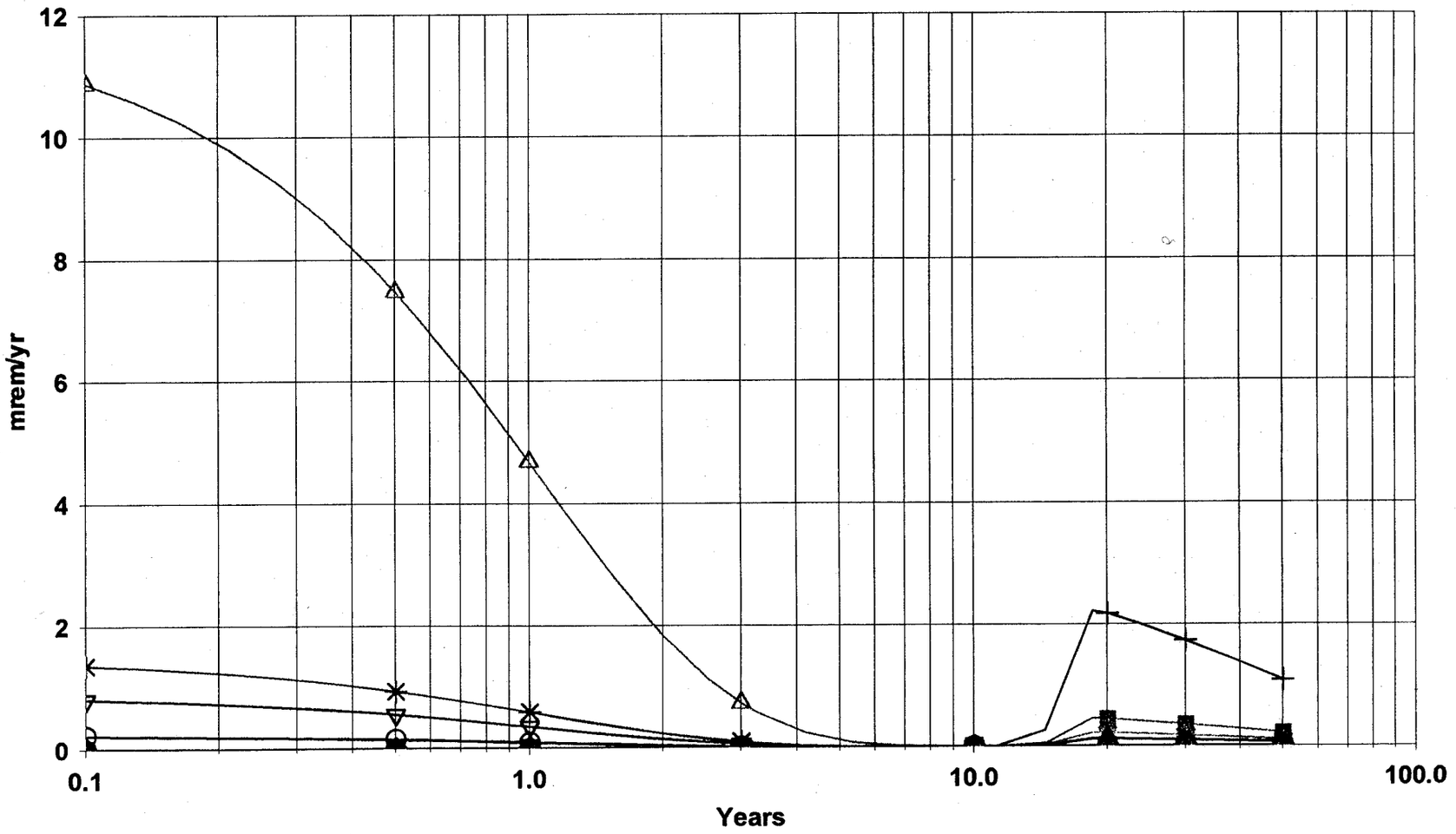
ATTACHMENT 2

GRAPHICAL OUTPUT

GRAPHICAL OUTPUT

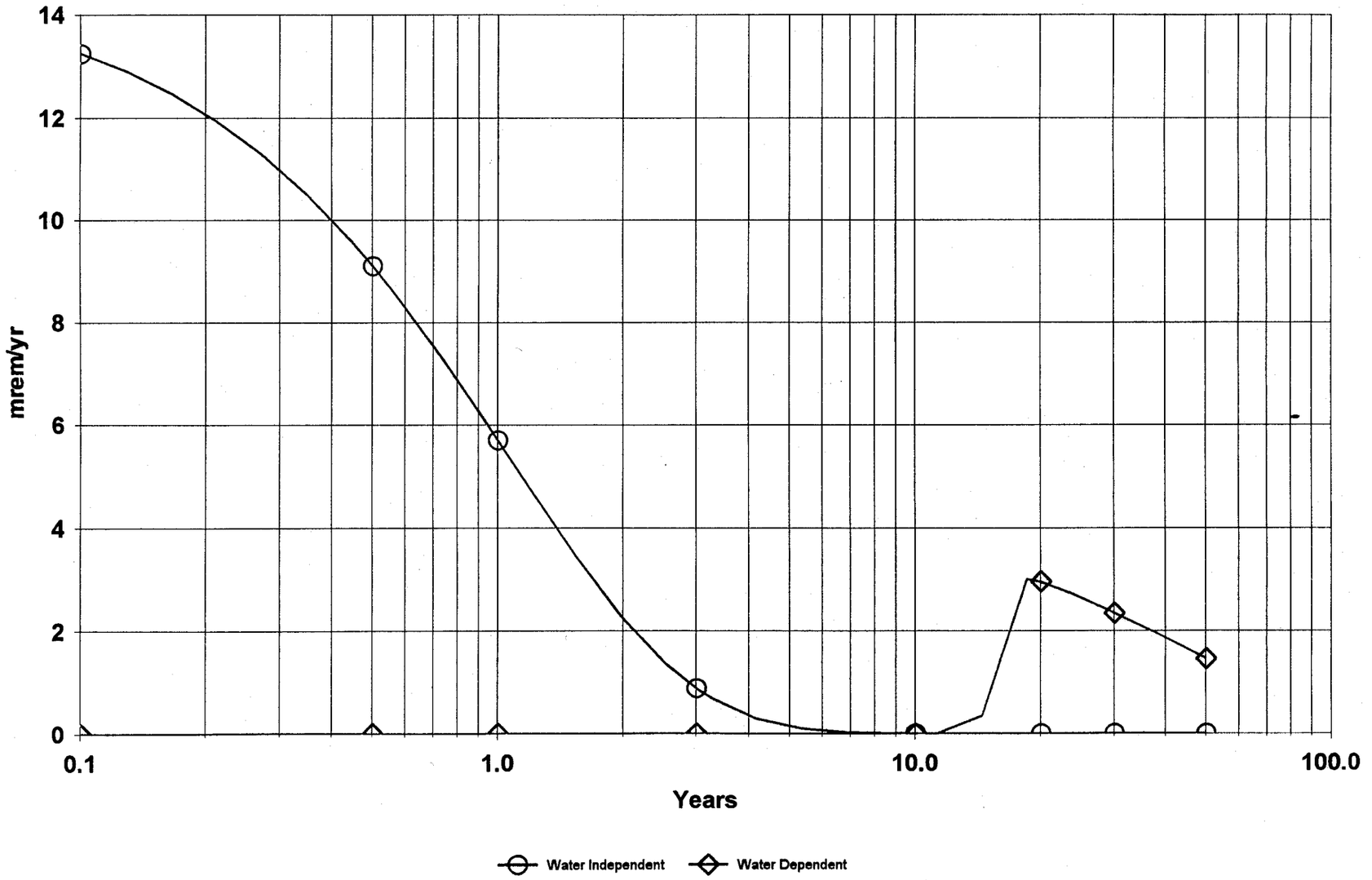
FOR Kd = 3

DOSE: Sr-90, Component Pathways



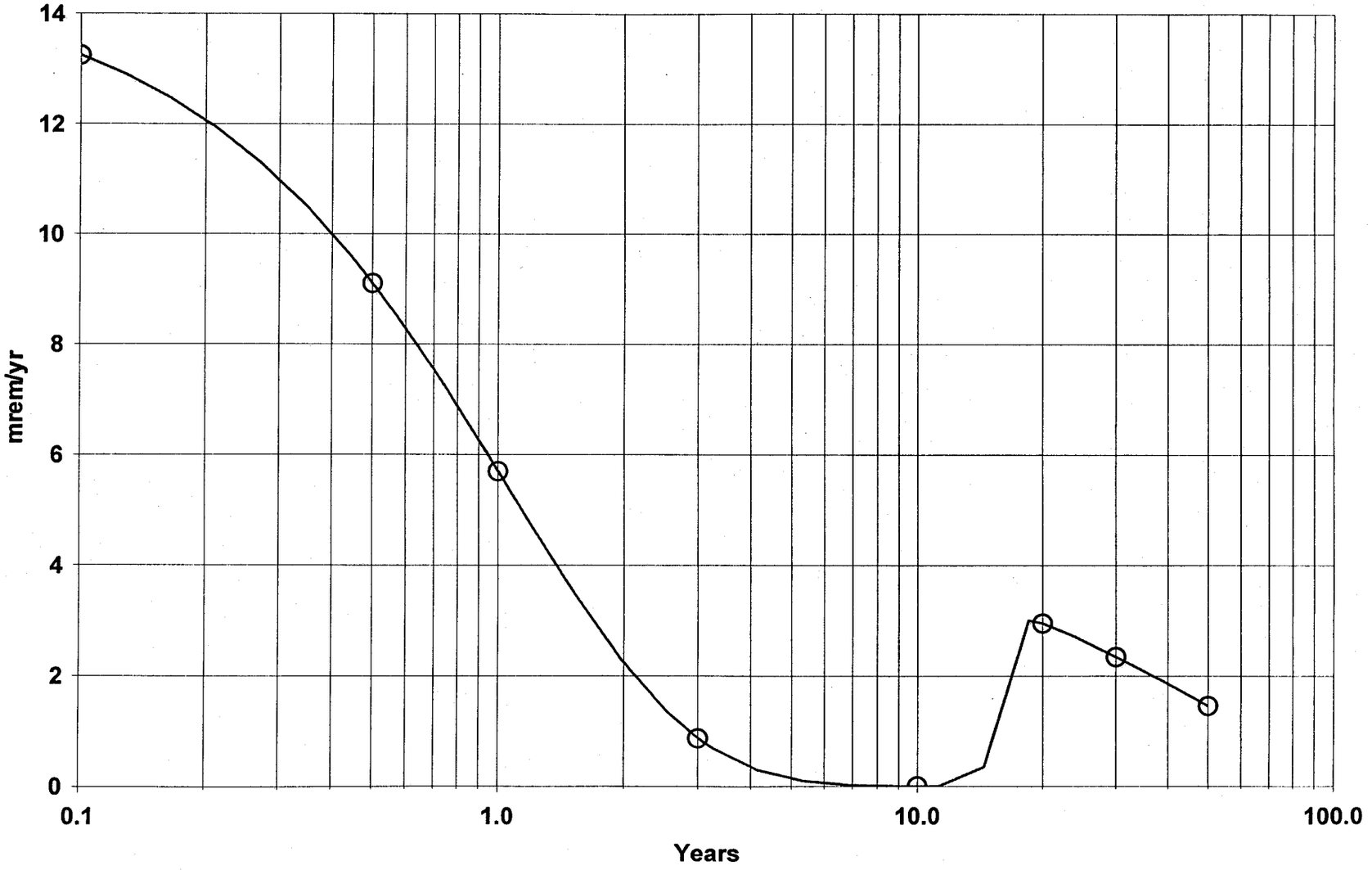
NRCINPT.RAD 10/14/1999 15:48

DOSE: Sr-90, Water Independent & Dependent Subtotals



NRCINPT.RAD 10/14/1999 15:48

DOSE: Sr-90, All Pathways Summed

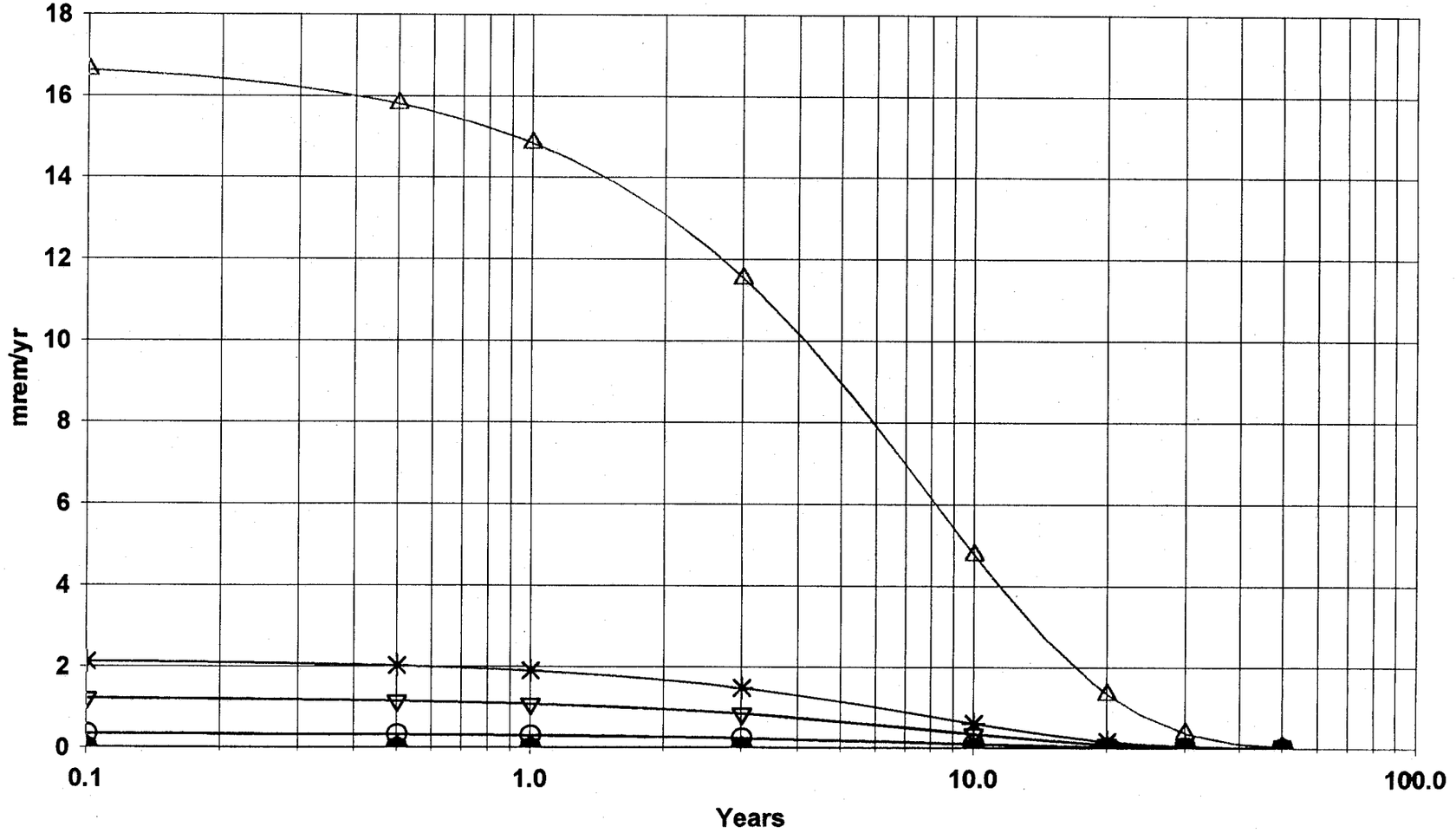


NRCINPT.RAD 10/14/1999 15:48 Includes All Pathways

GRAPHICAL OUTPUT

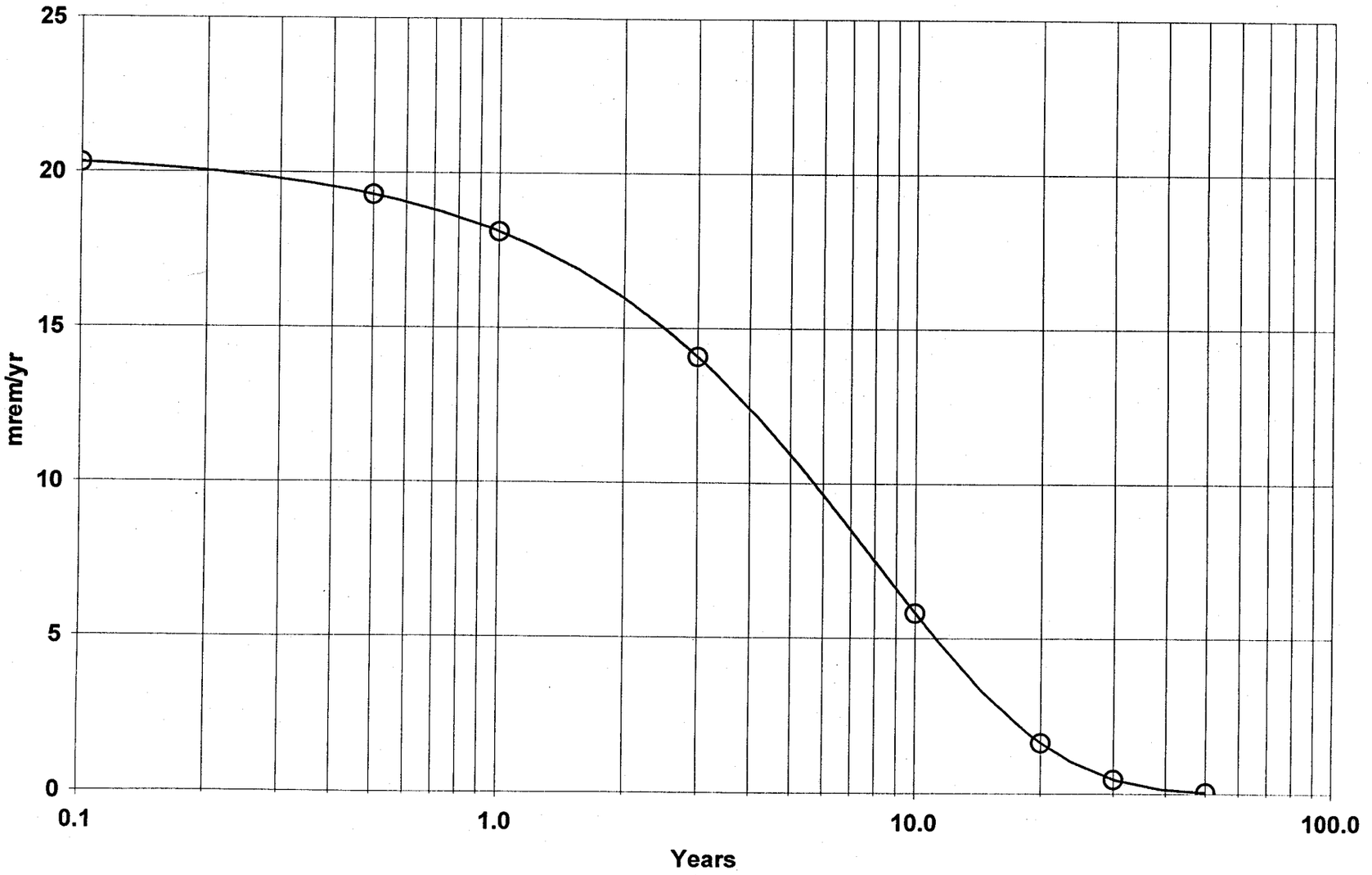
FOR Kd = 30

DOSE: All Nuclides Summed, Component Pathways



NRCINPT.RAD 10/14/1999 15:30

DOSE: All Nuclides Summed, All Pathways Summed

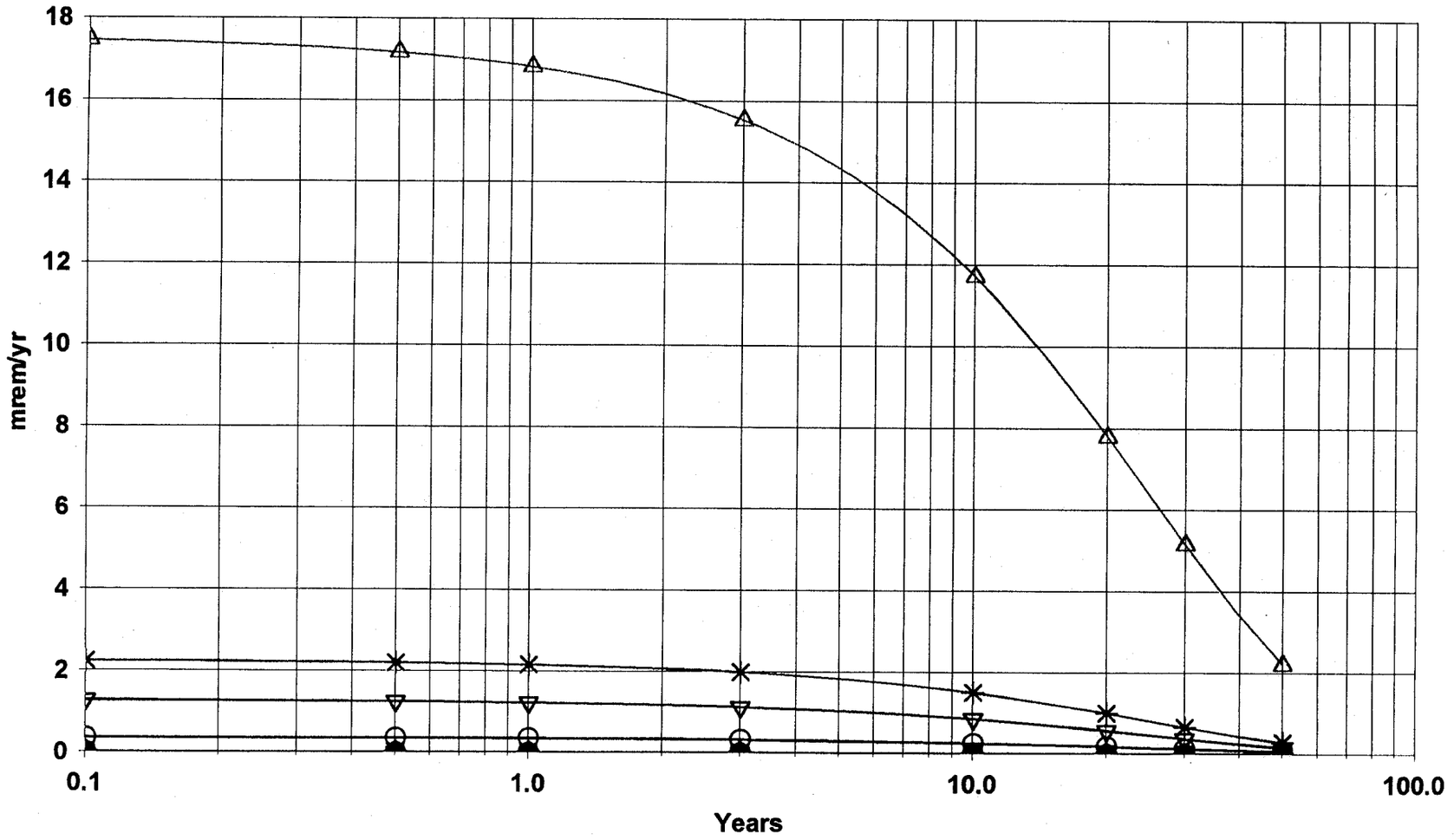


NRCINPT.RAD 10/14/1999 15:30 Includes All Pathways

GRAPHICAL OUTPUT

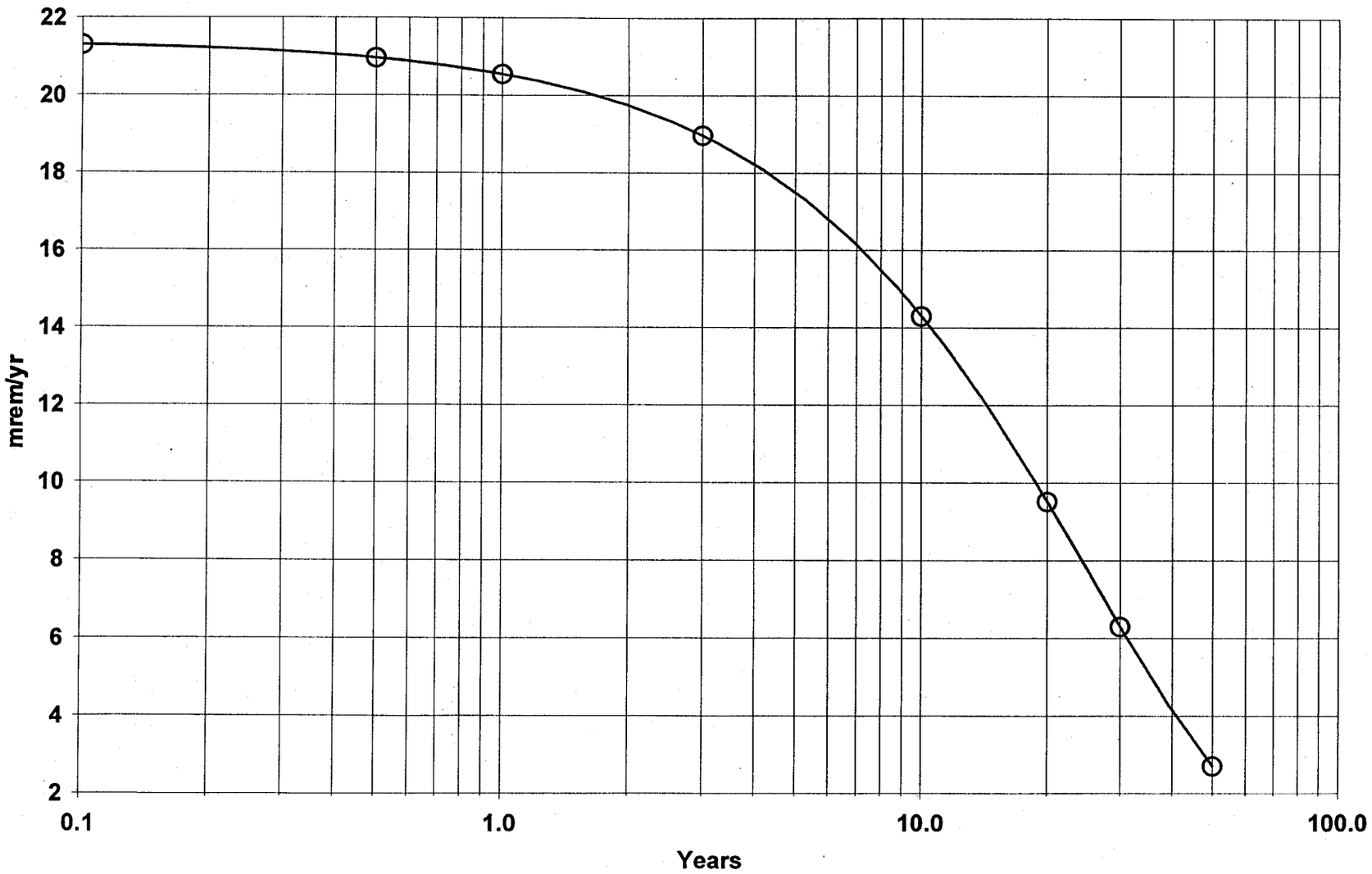
FOR Kd = 300

DOSE: Sr-90, Component Pathways



NRCINPT.RAD 10/14/1999 15:57

DOSE: Sr-90, All Pathways Summed



NRCINPT.RAD 10/14/1999 15:18 Includes All Pathways