

# Pre-Decisional Draft

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## DETERMINATION OF RADIONUCLIDES AND PATHWAYS CONTRIBUTING TO DOSE IN 1945

Hanford Environmental Dose  
Reconstruction Project  
Dose Code Recovery Activities  
- Calculation 003

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## PREFACE

This report documents one of a series of scoping calculations performed as part of the dose code recovery activities for the Hanford Environmental Dose Reconstruction Project. These scoping calculations form a mutually-dependent set that build upon each other, and each is best read in the context of the others. The complete list of scoping reports is given below.

<u>Title</u>	<u>Calculation Number</u>
Scoping Calculation for Components of the Cow-Milk Dose Pathway for Evaluating the Dose Contribution from Iodine-131	001
Determination of the Contribution of Livestock Water Ingestion to Dose from the Cow-Milk Pathway	002
Determination of Radionuclides and Pathways Contributing to Dose in 1945	003
Determination of Radionuclides and Pathways Contributing to Cumulative Dose	004
Determination of Dose Distributions and Parameter Sensitivity	005
Determination of the Feasibility of Reducing the Spatial Domain of the HEDR Dose Code	006
Determination of the Spatial Resolution Required for the HEDR Dose Code	007
Determination of the Temporal Resolution Required for the HEDR Dose Code	008

Additional scoping calculations are in progress or planned, and each will be documented in similar project reports.

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## 1.0 INTRODUCTION

A series of scoping calculations has been undertaken to evaluate the absolute and relative contributions of different radionuclides and exposure pathways to doses that may have been received by individuals living in the vicinity of the Hanford Site. These scoping calculations may include some radionuclides and pathways that were included in the Phase I air-pathway dose evaluations, as well as other potential exposure pathways being evaluated for possible inclusion in future Hanford Environmental Dose Reconstruction Project (HEDR) modeling efforts.

This scoping calculation (Calculation 003) examined the contributions of numerous radionuclides to dose via environmental exposures and accumulation in foods. This study builds on the work initiated in the first scoping study of iodine in cow's milk (Calculation 001). Addressed in this calculation were the contributions to organ and effective dose of infants and adults from 1) air submersion and groundshine external dose, 2) inhalation, 3) ingestion of soil by humans, 4) ingestion of leafy vegetables, 5) ingestion of other vegetables and fruits, 6) ingestion of meat, 7) ingestion of eggs, and 8) ingestion of cows' milk from Feeding Regime 1 as described in Calculation 001.

Recommendations determined from scoping calculations are provided to the HEDR Technical Steering Panel (TSP) with the intent of providing a definitive technical basis to assist in deciding whether specific radionuclides and exposure pathways should or should not be included in the main computer code used for the HEDR dose estimation process for individuals.

## 2.0 TECHNICAL METHODS

Effective doses and critical-organ doses were calculated for a highly exposed infant and adult in a highly exposed area and time period. Parameters in the calculations were selected to be approximate average, median, or best-estimate values, rather than conservative, upper-bound values. Individuals were assumed to have a rural lifestyle, with milk supplied by a backyard cow supported on Feeding Regime 1 (HEDR staff 1991, page 2.17).

Calculations used are based on methods presented in Napier et al. (1988 volume 1, pages 4.66 - 4.76) and Napier (1991, pages A.2 - A.6). Doses are calculated on a monthly basis using steady-state assumptions but changing the time-dependent parameter values monthly.

The location of exposure selected was the region of Franklin County included as part of Census District 4 (Figure 1). This area lies directly east of the Hanford site, and was shown in the Phase I air-pathway report (HEDR staff 1991, Appendix C) to be one of the most highly affected regions. The time period selected was the year 1945, which accounted for about 80% of the releases during 1944 through 1947 (Heeb 1992, page 4.36).

Surface deposition and integrated air-concentration data used were not Phase I values; rather they were recalculated (J. V. Ramsdell Jr., personal communication, October 1992) using the RATCHET atmospheric dispersion code (Ramsdell and Burk 1992) based upon the latest Hanford iodine-131 source term information reported by Heeb (Heeb 1992, page 4.36). Because of time constraints, monthly surface deposition and integrated air concentrations from only a single realization were used in these scoping calculations (J. V. Ramsdell Jr., personal communication, October 1992). Recent results from Ramsdell indicate that the particular realization used is well within a factor of two for all months of the maximums of the 100 realizations ultimately planned to be used for this particular location, and, therefore, this realization is considered to be a conservative, but reasonable, representation of this location (J.V Ramsdell, personal communication, November 1992).

The Ramsdell data were presented by their location on an atmospheric dispersion grid map; as discussed by Shipler and Napier (1992, page 2) and

shown in Ikenberry et al. (1992, page 1.4). The node selected lies with the area encompassed by Franklin County Census District 4, and appeared to be the highest node value in the general area for this realization.

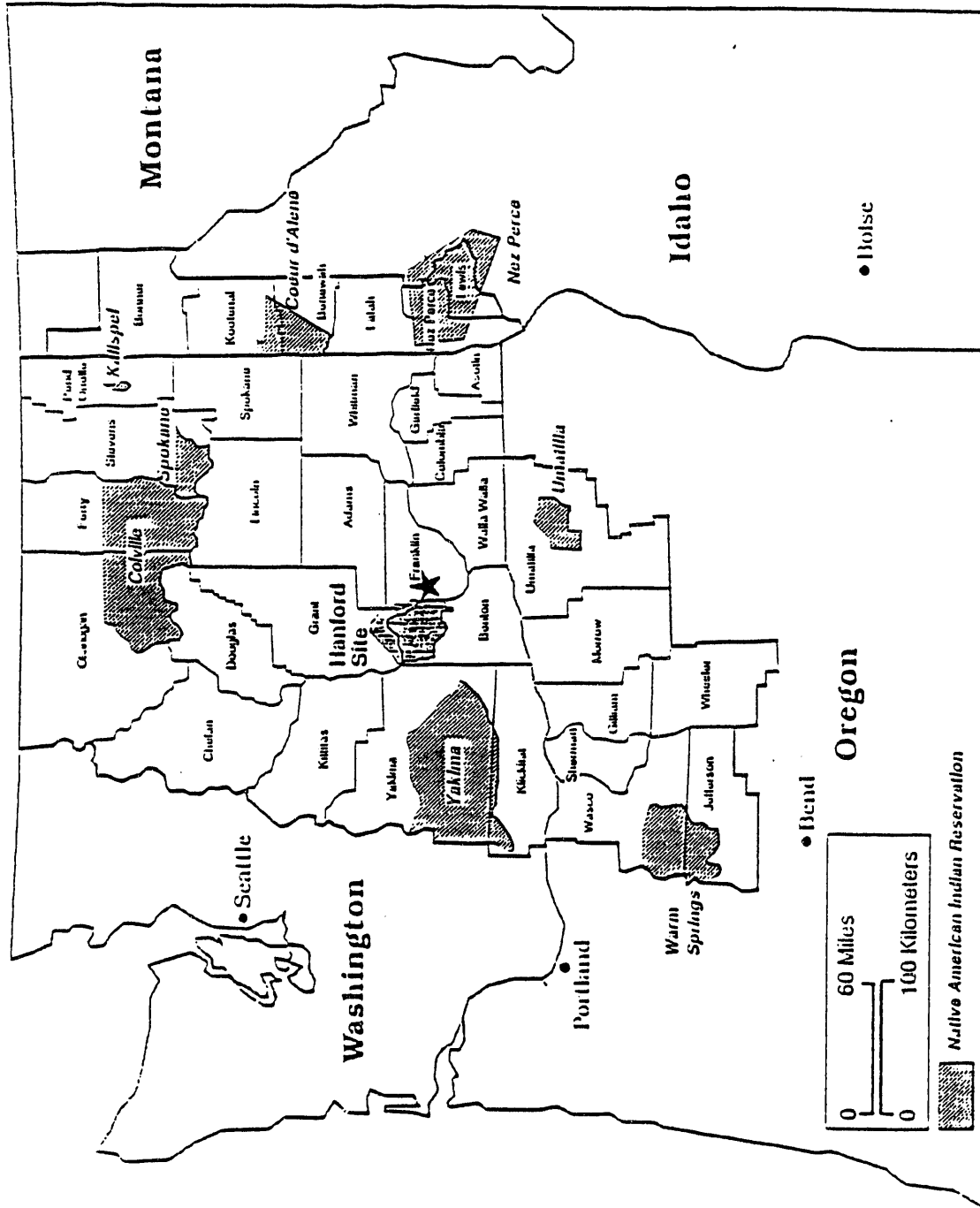
The surface deposition and integrated air-concentration values for iodine-131 for the 12 months of 1945 for node location 18,25 (x,y) used in the scoping calculations are shown in Table 1. Also shown are Heeb's (1992) estimates of monthly radioiodine release for these months. These data were used to estimate monthly integrated atmospheric dispersion parameters for this node. The dispersion parameters relate time-integrated air concentration to a unit release.

**TABLE 1.** Surface Deposition, Time-Integrated Air Concentration, and Derived Dispersion Factors Used in the Scoping Calculations

1945	Scoping Calculation for Node 18, 25		Monthly I-131 Releases and Dispersion Factor by Month	
	Surface Deposition Ci/m <sup>2</sup>	Time-Integrated Air Concentration Ci·s/m <sup>3</sup>	Monthly Release Ci	Dispersion Factor sec/m <sup>3</sup>
January	4.4 x 10 <sup>-8</sup>	1.8 x 10 <sup>-5</sup>	1221	1.47 x 10 <sup>-8</sup>
February	8.1 x 10 <sup>-8</sup>	1.4 x 10 <sup>-5</sup>	2126	6.58 x 10 <sup>-9</sup>
March	1.8 x 10 <sup>-7</sup>	2.9 x 10 <sup>-5</sup>	2082	1.39 x 10 <sup>-8</sup>
April	6.3 x 10 <sup>-7</sup>	1.5 x 10 <sup>-4</sup>	28746	5.21 x 10 <sup>-9</sup>
May	5.0 x 10 <sup>-6</sup>	6.9 x 10 <sup>-4</sup>	74482	9.26 x 10 <sup>-9</sup>
June	1.3 x 10 <sup>-6</sup>	2.5 x 10 <sup>-4</sup>	46466	5.38 x 10 <sup>-9</sup>
July	2.1 x 10 <sup>-6</sup>	5.6 x 10 <sup>-4</sup>	47036	1.19 x 10 <sup>-8</sup>
August	1.7 x 10 <sup>-6</sup>	5.5 x 10 <sup>-4</sup>	72090	7.63 x 10 <sup>-9</sup>
September	5.3 x 10 <sup>-6</sup>	2.7 x 10 <sup>-3</sup>	88682	3.04 x 10 <sup>-8</sup>
October	3.1 x 10 <sup>-6</sup>	1.7 x 10 <sup>-3</sup>	92066	1.85 x 10 <sup>-8</sup>
November	7.3 x 10 <sup>-7</sup>	1.9 x 10 <sup>-4</sup>	37752	5.03 x 10 <sup>-9</sup>
December	2.3 x 10 <sup>-6</sup>	9.9 x 10 <sup>-4</sup>	62340	1.59 x 10 <sup>-8</sup>

## 2.1 CALCULATION OF EXTERNAL DOSES

Two types of external doses were calculated and summed. These included both dose from submersion in contaminated air and dose from irradiation from material deposited on the ground. A semi-infinite plume approximation was used for the air submersion, and an infinite flat plane approximation was used for the deposited material (DOE 1988b). Continuous exposure was assumed (8760



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FIGURE 1. Approximate Location (\*) Within the HEDR Study Area Selected for Scoping Calculations



hours per year), with no modifications for shielding. The time-integrated air concentrations were used for submersion, and the month-end deposition values were assumed to represent uniform contamination levels throughout the month for the deposited material. The basic equation is

$$Dose\ External_i = X_i DF_{as} + S_{end\ i} DF_{ex}$$

where  $X_i$  = the time-integrated air concentration for month  $i$ , Ci-sec/mo-m<sup>3</sup>  
 $DF_{as}$  = the air-submersion dose factor, rem/sec per Ci/m<sup>3</sup>  
 $S_{end\ i}$  = the surface deposition of radionuclide on the ground at the end of month  $i$   
 $DF_{ex}$  = the groundshine dose factor, rem/mo per Ci/m<sup>2</sup>.

The month-end depositions for radionuclides other than I-131 were approximated assuming that the air concentrations represented by the time-integrated concentration  $X_i$  were uniform throughout the month, accounting for radioactive decay, and compounding from month to month. This was calculated as

$$S_{end\ i} = S_{end\ i-1} e^{(-\lambda_r 30)} + X_i V_d \frac{(1 - e^{-\lambda_r 30})}{30 \lambda_r}$$

where  $\lambda_r$  = the radiological decay constant, d<sup>-1</sup>  
 $V_d$  = the deposition velocity, m/s, taken to be 0.01 for iodines, 0.001 for other particulates, and 0 for noble gases.

## 2.2 INHALATION

Dose from inhalation during month  $i$  was calculated as

$$Dose\ Inhalation_i = X_i BR DF_{inh}$$

where BR = the breathing rate, m<sup>3</sup>/s (separate values used for infant and adult)

DF<sub>inh</sub> = the inhalation dose factor, rem/Ci inhaled.

Inhalation dose factors for adults were taken from DOE (1988a), and those for infants from ICRP (1989).

### 2.3 HUMAN SOIL INGESTION

People routinely ingest small amounts of soil, in association with food or from minor hand to mouth contact. The dose potentially resulting from ingestion of radionuclides in surface soil via this pathway was estimated as

$$Dose\ Soil_i = (S_{end\ i} / \rho) C_{soil} 30 DF_{ing}$$

where C<sub>soil</sub> = the consumption rate of soil, kg/day, assumed to be 0.001 for infants and 0.0001 for adults

ρ = the surface soil areal density, assumed to be 13 kg/m<sup>2</sup> (mixing to a depth of 1 cm)

30 = conversion factor, days/month

DF<sub>ing</sub> = the ingestion dose factor, rem/Ci ingested.

Inhalation dose factors for adults were taken from DOE (1988a), and those for infants from ICRP (1989).

### 2.4 CONSUMPTION OF VEGETABLES AND FRUITS

The dose from consumption of fresh leafy vegetables was modeled as

$$Dose\ Veg_i = (D_{end\ i} r TF WC + S_{end\ i} CR/\rho) IR 30 DF_{ing}$$

where D<sub>end i</sub> = the month-end deposition, not accounting for prior months' accumulations, similar to S<sub>end</sub> but without the term accounting for prior months

$r$  = the foliar interception fraction divided by the biomass,  $m^2/kg$ , calculated as

$$r = (1 - e^{(-Y \alpha f_s)}) / (Y f_s)$$

where  $Y$  = the maximum dry biomass of a plant,  $kg/m^2$  dry  
 $\alpha$  = empirical interception parameter,  $m^2/kg$  - A value of 2.9 was used for all plant types.  
 $f_s$  = available fraction of maximum wet biomass, unitless, varies by month and plant type, see Calculation 001  
 $WC$  = the weathering correction to account for the difference between simple radiological decay on the soil surface and weathering plus decay on the leaves, calculated as

$$WC = (1 - e^{-(\lambda_r + \lambda_w) 30}) \lambda_r / [(1 - e^{-\lambda_r 30}) (\lambda_r + \lambda_w)]$$

(this term is needed use of the total month-end deposition value alone neglects weathering removal processes from vegetation)

where  $\lambda_w$  = the weathering rate constant,  $d^{-1}$ , taken to be 0.693/14  
 $TF$  = the translocation factor, unitless, to account for translocation from foliar surfaces to the interior of the edible portion of the plant, taken to be 1.0 for leafy vegetables and 0.05 for others  
 $CR$  = the soil-to-plant concentration ratio, unitless, to account for root uptake  
 $IP_v$  = the ingestion rate of the vegetable or fruit type,  $kg/d$ .

Ingestion of produce after the end of the harvest season requires that the dose rate at the time of harvest be calculated first using the above equation; that dose rate is then decayed to the current month and integrated over the current month, as

$$Dose\ Veg_{postharvest} = Dose\ Veg_h e^{-\lambda_r t_p} \frac{(1 - e^{-\lambda_r 30})}{30 \lambda_r}$$

where the first exponential term represents the decay to the start of the current month, time  $t_p$ , and the second term represents the integral of the intake over the current month.

## 2.5 INGESTION OF MEAT

Dose resulting from ingestion of meat was estimated on the basis of range-fed beef. Cows were assumed to be slaughtered as required to maintain a supply of meat. All meat was assumed to be consumed "fresh"; only a 15-day period from slaughter to consumption was used. This series of assumptions should be conservative: it is unlikely that people who raised their own beef cattle in rural locations would have such a minimal holdup time before consumption on a regular basis. The calculation assumed that the cattle were on pasture grass 100% of the year. The doses were estimated as

$$Dose\ meat_i = (D_{endi} WC r + S_{endi} \frac{CR}{\rho}) IR_{cattle} TF_{beef} IR_{meat} 30 DF_{ing} e^{-\lambda_r 15}$$

where  $IR_{cattle}$  = the ingestion rate of pasture grass by beef cattle, kg/day dry

$TF_{beef}$  = the feed-to-meat transfer coefficient, day/kg.

Ingestion rates for meat for adults and infants were taken from Nelson and Yang (1948).

## 2.6 INGESTION OF EGGS

Calculation of dose from ingestion of eggs produced by free-ranging hens was performed in a manner analogous to that for beef. The chickens were assumed to eat a portion of their diet as grass, and also to consume a significant amount of soil. The hens were assumed to range freely all year long, and to provide fresh eggs with essentially no holdup. Doses were calculated as

$$Dose\ eggs_i = ((D_{end\ i} WC\ r + S_{end\ i} \frac{CR}{\rho}) IR_{hen} + S_{end\ i} IR_{cs}) TF_{egg} IR_{egg} 30 DF_{ir}$$

where  $IR_{hen}$  = the chicken's ingestion rate of grasses, kg/day  
 $IR_{cs}$  = the chicken's ingestion rate of soil, kg/day  
 $TF_{egg}$  = the feed-to-egg transfer coefficient, day/kg

## 2.7 MILK INGESTION

For conservatism, the milk was assumed to be provided by a backyard cow grazing under Feeding Regime 1. All equations and parameters were copied from the spreadsheet prepared for Calculation 001 (Ikenberry and Napier 1992). The soil components were updated to use the running month-end quantity,  $S_{end\ i}$ , rather than just the monthly average deposition,  $D_{end\ i}$ .

## 2.8 RADIONUCLIDE INVENTORY ESTIMATES

For all radionuclides other than iodine-131, estimates had to be made of the quantity processed through the Hanford separations plants in 1945. Heeb (1992) provides total monthly throughput and monthly mass-weighted cooling times. These are recapitulated in Table 2. A calculation was performed using the ORIGEN2 computer code to provide representative contents of one ton of fuel discharged from a Hanford production reactor operating at conditions typical of 1945 (C. Heeb and U. Jenquin, personal communication, October 1992). The quantities of radioactivity of 14 radionuclides identified as being the highest contributors to dose in Phase I (Napier 1991), or else of identified public interest, are given in Table 3. The contents are provided at three separate cooling times after discharge; it is evident that radioactive decay prior to release is important. The monthly amounts processed through the separations facilities were estimated for each month using logarithmic interpolation of the values in this table for the month-average cooling time.

TABLE 2. Monthly Throughput and Average Cooling Times of Fuel in 1945

<u>Month</u>	<u>Tons</u>	<u>Cooling (days)</u>
Jan	3.7	39
Feb	6.9	53
Mar	6.7	52
Apr	35.3	42
May	49.8	36
Jun	33.9	35
Jul	39.8	40
Aug	61.2	39
Sep	70.8	39
Oct	116.5	44
Nov	99.9	52
Dec	92.9	47

TABLE 3. Curies/Ton of Representative Hanford Fuel (Burnup of 200MWd/T, Power Level of 1 MW/T) at Various Cooling Times

<u>Radionuclide</u>	<u>30 Days</u>	<u>40 Days</u>	<u>50 Days</u>
I 131	1984	838	354
Ru106	2011	1974	1937
Ru103	17310	14510	12160
Co60	12.6	12.6	12.5
I 132	65	7.7	0.9
Xe133	1328	354	95
Ce144	15600	15200	14860
Pu239	15.5	15.5	15.5
Sr90	573	573	572
Cs137	636	636	635
I 129	0.00017	0.00017	0.00017
Kr85	74	74	74
Zr95	33240	29830	26770
Sr99	22910	19970	17410

## 2.9 RADIOACTIVE DECAY AND DAUGHTER INGROWTH

Several of the radionuclides listed in Table 3 are members of decay chains, and have either precursors or successors in these chains. Fortunately for this scoping study, the behavior and impact of these radionuclides could be described with simple one-member exponential decay with a few assumptions. In the radionuclide chains Ru-106/Rh-106, Ru-103/Rh-103, Ce-144/Pr-144,

Cs-137/Ba-137m, and Zr-95/Nb-95, the parent is sufficiently long lived, and the daughters sufficiently short lived, that the chains could be considered to be in secular equilibrium at all times in the environment. The effective decay energies were summed, and the ingestion and inhalation dose factors adjusted to account for these chains. The chain Te-132/I-132 was considered in estimating the amount of I-132 remaining in the fuel and thus releasable, but the release fractions (described below) were sufficiently disparate that the I-132 could be considered in isolation in the environment.

## 2.10 RADIONUCLIDE RELEASE FRACTIONS

The key to determining the relative importance of the radionuclides in the fuel is the fraction of the separation plant throughput that is emitted to the atmosphere. Assessments commonly assume that the release fraction for noble gasses (Xe and Kr) is 1.0. Heeb demonstrated that the release fraction for iodine (I-131, I-132, and I-129) is 0.9. In Phase I scoping, a relatively large value was also given to ruthenium isotopes (Ru-103 and Ru-106). This was done to compensate for the initial impression that relatively large amounts of ruthenium were emitted in episodic events. Historical documents now available to HEDR now indicate that problems perceived in terms of "hot particles" were, in fact, manifestations of a much more general release of "mists" from the dissolver vessels. Greager and MacReady (January 1948, page 2) state that "the amount of radioactivity associated with the rust particles is only a small portion of the total activity carried by the airstream. The bulk of this entrained activity is presumed to be in the form of liquid droplets which constitute a 'mist' given off from the processing tanks during normal operations." Parker (March 1948, page 28) continues, "It is concluded that the main picture of fission product deposition" (other than iodine-131, Ed.) "approaches a continuous distribution rather than a particulate one. To summarize the inferences from old data, the emission of active droplets has been known from the start of operations." Furthermore, Healy (August 1948, page 7) shows that radiochemical analysis of non-iodine fission products on sage from the 200-West Area shows a radionuclide spectrum very much like that presented in Table 3, and specifically reporting on both ruthenium isotopes. Analysis of data in these reports, as well as later reports describing the

efficiencies of filters applied afterwards, leads to an upper bound release fraction for the first few years of operation for all other radionuclides of  $1 \times 10^{-5}$  (i.e., 1 part in 100,000 escaping from the dissolvers).

The particulate release fraction may also be estimated from early vegetation monitoring data. Parker (March 1948) describes vegetation contamination after one year of operations as being mostly iodine-131 with 0.05% other fission products. Healy (August 1948) also provides such information for 1945, 1946, and 1947. The activity ratios of deposited particulate radionuclides to deposited iodine-131 support release fractions of less than  $1 \times 10^{-5}$  for all non-volatile radionuclides.

Calculated amounts released, derived monthly integrated air concentrations at the Franklin County location of interest, and resulting month-end depositions are provided in Tables 4, 5, and 6, respectively.



TABLE 4. Estimated Quantity of Each Radionuclide Released per Month in 1945

NUCLIDE	J	F	M	A	M	J	J	A	S	O	N	D	1945
I 131	4.4E+03	2.4E+03	2.6E+03	3.2E+04	7.4E+04	5.6E+04	4.3E+04	7.2E+04	8.3E+04	8.9E+04	3.8E+04	5.5E+04	555089
RU106	7.3E-02	1.3E-01	1.3E-01	6.9E-01	9.9E-01	6.8E-01	7.9E-01	1.2E+00	1.4E+00	2.3E+00	1.9E+00	1.8E+00	12
RU103	5.5E-01	8.0E-01	7.9E-01	4.9E+00	7.8E+00	5.4E+00	5.8E+00	9.0E+00	1.0E+01	1.6E+01	1.2E+01	1.2E+01	85
CO60	4.6E-04	8.6E-04	8.4E-04	4.4E-03	6.3E-03	4.3E-03	5.0E-03	7.7E-03	8.9E-03	1.5E-02	1.2E-02	1.2E-02	0.08
I 132	4.5E+01	4.2E+00	5.1E+00	2.3E+02	1.2E+03	9.8E+02	3.9E+02	7.5E+02	8.7E+02	4.9E+02	7.6E+01	2.0E+02	5188.55
XE133	2.1E+03	6.3E+02	7.0E+02	1.4E+04	4.3E+04	3.3E+04	2.0E+04	3.6E+04	4.1E+04	3.5E+04	1.0E+04	1.9E+04	254835
CE144	5.6E-01	1.0E+00	9.9E-01	5.3E+00	7.7E+00	5.2E+00	6.1E+00	9.3E+00	1.1E+01	1.8E+01	1.5E+01	1.4E+01	93
PU239	5.7E-04	1.1E-03	1.0E-03	5.5E-03	7.7E-03	5.3E-03	6.2E-03	9.5E-03	1.1E-02	1.8E-02	1.5E-02	1.4E-02	0.10
SR90	2.1E-02	3.9E-02	3.8E-02	2.0E-01	2.9E-01	1.9E-01	2.3E-01	3.5E-01	4.1E-01	6.7E-01	5.7E-01	5.3E-01	4
CS137	2.4E-02	4.4E-02	4.3E-02	2.2E-01	3.2E-01	2.2E-01	2.5E-01	3.9E-01	4.5E-01	7.4E-01	6.3E-01	5.9E-01	4
I 129	5.7E-04	1.1E-03	1.0E-03	5.4E-03	7.6E-03	5.2E-03	6.1E-03	9.4E-03	1.1E-02	1.8E-02	1.5E-02	1.4E-02	9E-02
KR85	2.7E+02	5.1E+02	5.0E+02	2.6E+03	3.7E+03	2.5E+03	2.9E+03	4.5E+03	5.2E+03	8.6E+03	7.4E+03	6.9E+03	45688
ZR95	1.1E+00	1.8E+00	1.8E+00	1.0E+01	1.6E+01	1.1E+01	1.2E+01	1.8E+01	2.1E+01	3.3E+01	2.6E+01	2.6E+01	178
SR89	7.5E-01	1.2E+00	1.1E+00	6.9E+00	1.1E+01	7.3E+00	7.9E+00	1.2E+01	1.4E+01	2.2E+01	1.7E+01	1.7E+01	118

TABLE 5. Estimated Monthly Time-Integrated Air Concentration at Location of Interest, Ci-sec/m<sup>3</sup>

NUCLIDE	J	F	M	A	M	J	J	A	S	O	N	D
I 131	6.43E-05	1.60E-05	3.39E-05	1.68E-04	7.04E-04	3.03E-04	5.12E-04	5.50E-04	2.54E-03	1.65E-03	1.93E-04	8.73E-04
RU106	1.08E-09	8.75E-10	1.84E-09	3.62E-09	9.17E-09	3.63E-09	9.35E-09	9.23E-09	4.26E-08	4.21E-08	9.70E-09	2.87E-08
RU103	8.05E-07	5.24E-09	1.10E-08	2.58E-08	7.18E-08	2.89E-08	6.87E-08	6.89E-08	3.18E-07	2.91E-07	5.90E-08	1.89E-07
CO60	6.85E-12	5.67E-12	1.17E-11	2.31E-11	5.80E-11	2.29E-11	5.95E-11	5.86E-11	2.71E-10	2.70E-10	6.28E-11	1.85E-10
I 132	6.67E-07	2.78E-08	7.06E-08	1.18E-06	1.07E-05	5.25E-06	4.68E-06	5.71E-06	2.63E-05	9.02E-06	3.81E-07	3.26E-06
XE133	3.17E-05	4.17E-06	9.76E-06	7.20E-05	3.98E-04	1.80E-04	2.41E-04	2.71E-04	1.25E-03	6.44E-04	5.26E-05	2.98E-04
CE144	8.33E-09	6.70E-09	1.38E-08	2.79E-08	7.09E-08	2.81E-08	7.21E-08	7.13E-08	3.29E-07	3.24E-07	7.44E-08	2.21E-07
PU239	8.45E-12	7.04E-12	1.45E-11	2.86E-11	7.15E-11	2.83E-11	7.34E-11	7.24E-11	3.34E-10	3.33E-10	7.79E-11	2.29E-10
SR90	3.12E-10	2.60E-10	5.34E-10	1.05E-09	2.64E-09	1.04E-09	2.71E-09	2.67E-09	1.23E-08	1.23E-08	2.88E-09	8.44E-09
CS137	3.47E-10	2.88E-10	5.93E-10	1.17E-09	2.93E-09	1.16E-09	3.01E-09	2.97E-09	1.37E-08	1.37E-08	3.19E-09	9.37E-09
I 129	8.35E-12	6.95E-12	1.43E-11	2.82E-11	7.06E-11	2.79E-11	7.25E-11	7.14E-11	3.30E-10	3.29E-10	7.69E-11	2.26E-10
KR85	4.04E-06	3.36E-06	6.91E-06	1.36E-05	3.41E-05	1.35E-05	3.51E-05	3.46E-05	1.60E-04	1.59E-04	3.72E-05	1.09E-04
ZR95	1.64E-08	1.18E-08	2.44E-08	5.38E-08	1.44E-07	5.74E-08	1.41E-07	1.41E-07	6.50E-07	6.15E-07	1.32E-07	4.08E-07
SR89	1.10E-08	7.59E-09	1.58E-08	3.58E-08	9.73E-08	3.90E-08	9.46E-08	9.45E-08	4.36E-07	4.07E-07	8.52E-08	2.68E-07

TABLE 6. Estimated Month-End Quantity Deposited at Location of Interest, Ci/m<sup>2</sup>

NUCLIDE	J	F	M	A	M	J	J	A	S	O	N	D
I 131	2.3E-07	5.74E-08	1.29E-07	4.01E-07	2.52E-06	1.09E-06	1.84E-06	1.97E-06	9.1E-06	5.9E-06	6.92E-07	3.13E-06
RU106	1.05E-12	8.51E-13	1.75E-12	3.52E-12	8.92E-12	3.53E-12	9.09E-12	8.98E-12	4.14E-11	4.1E-11	9.43E-12	2.79E-11
RU103	6.26E-12	4.07E-12	8.51E-12	2E-11	5.58E-11	2.25E-11	5.34E-11	5.36E-11	2.47E-10	2.26E-10	4.59E-11	1.47E-10
CO60	6.81E-15	5.64E-15	1.16E-14	2.3E-14	5.77E-14	2.28E-14	5.91E-14	5.83E-14	2.69E-13	2.68E-13	6.25E-14	1.84E-13
I 132	3.07E-11	1.28E-12	3.26E-12	5.46E-11	4.94E-10	2.42E-10	2.16E-10	2.63E-10	1.21E-09	4.16E-10	1.75E-11	1.5E-10
XE133	0	0	0	0	0	0	0	0	0	0	0	0
CE144	8.03E-12	6.44E-12	1.33E-11	2.69E-11	6.84E-11	2.71E-11	6.96E-11	6.87E-11	3.17E-10	3.13E-10	7.17E-11	2.13E-10
PU239	8.45E-15	7.04E-15	1.45E-14	2.86E-14	7.15E-14	2.83E-14	7.34E-14	7.24E-14	3.34E-13	3.33E-13	7.79E-14	2.29E-13
SR90	3.12E-13	2.6E-13	5.33E-13	1.05E-12	2.64E-12	1.04E-12	2.71E-12	2.67E-12	1.23E-11	1.23E-11	2.87E-12	8.43E-12
CS137	3.44E-13	2.88E-13	5.92E-13	1.17E-12	2.93E-12	1.16E-12	3.01E-12	2.96E-12	1.37E-11	1.37E-11	3.19E-12	9.34E-12
I 129	8.35E-14	6.95E-14	1.43E-13	2.82E-13	7.06E-13	2.79E-13	7.25E-13	7.14E-13	3.3E-12	3.29E-12	7.69E-13	2.26E-12
KR85	0	0	0	0	0	0	0	0	0	0	0	0
ZR95	1.4E-11	1.01E-11	2.09E-11	4.59E-11	1.23E-10	4.91E-11	1.21E-10	1.2E-10	5.55E-10	5.25E-10	1.13E-10	3.48E-10
SR89	9.04E-12	6.22E-12	1.3E-11	2.93E-11	7.98E-11	3.2E-11	7.76E-11	7.75E-11	3.58E-10	3.33E-10	6.98E-11	2.19E-10

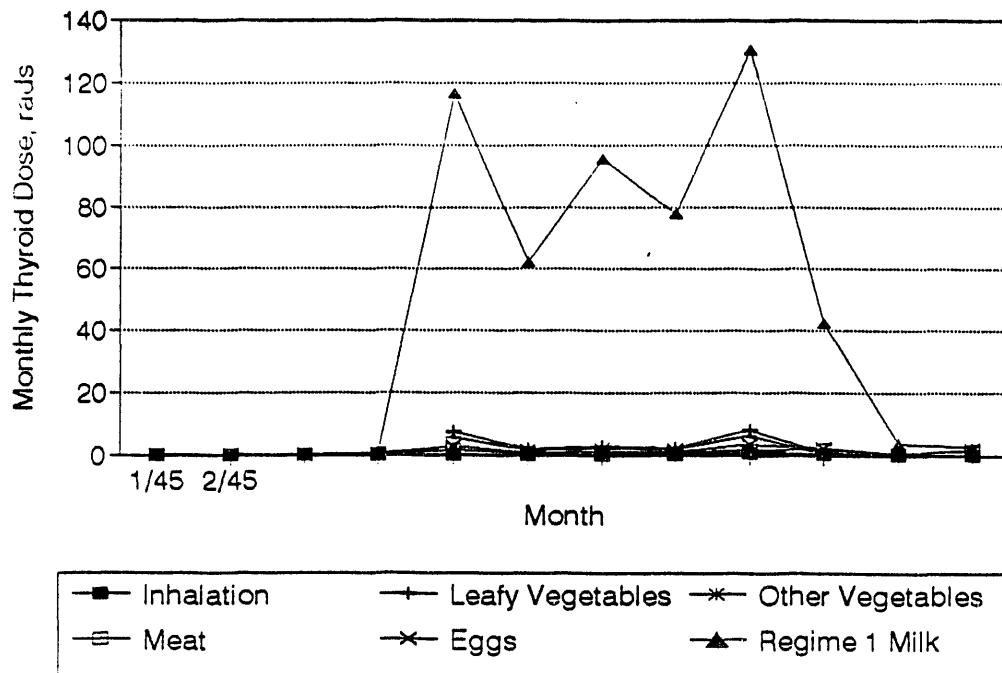
### 3.0 RESULTS/DISCUSSION

The results of calculations for each of the pathway components for each of the radionuclides for the year 1945 in Census District 4 of Franklin County are presented in Tables 7 and 8 for infants and adults, respectively. Each table presents both effective dose equivalent (whole-body dose) and critical-organ dose (the dose to the organ receiving the highest dose). Doses are presented for each of the eight pathways described above.

Although not the maximum doses that could be calculated, the doses in Tables 7 and 8 are for individuals in a highly-impacted location, living a lifestyle that would tend to maximize doses. It is the opinion of the author that it is unlikely that median or mean doses calculated with more detailed models would exceed those presented here, for any radionuclide. A separate scoping study is underway to evaluate the position of this deterministic result in the overall range of possible dose results.

The results presented here support those drawn by Napier (1991) that I-131 and the milk-ingestion pathway are the most important to the HEDR study. Tables 9 and 10 present the percentage contribution to the total dose of each radionuclide and pathway combination. Iodine-131 alone provides over 99.9% of the dose to both the infant and the adult. Iodine-131 by the milk pathway provides nearly 90% of the dose (for Feeding Regime 1). Even if the milk pathway is totally excluded, Iodine-131 provides over 99% of the dose via the other pathways.

Pathways of exposure other than milk can be seen to be relatively important for the other radionuclides. External dose dominates for the noble gasses. Inhalation is controlling for Pu-239, Zr-95, and Ru-106. Ingestion of meat is important for Sr-90. However, in the context of the total dose from Hanford operations, since no radionuclides are emitted in isolation, the controlling radionuclide/pathway combination is I-131/milk. This is illustrated in Figure 2. The dominance of this single radionuclide is so notable that it calls into question the need for detailed analyses of the others.



**FIGURE 2. Pathway Contributions**

The results of this scoping study parallel those of Phase I (Napier 1991). With the revision of the release fraction for ruthenium isotopes, the ruthenium isotopes fall to the general level of the other fission products. The major difference between the two studies is that this one deals with absolute magnitudes, rather than relative ratios. This type of comparison was not possible until the declassification of the radionuclide production information (Gydesen 1992a; 1992b) and the recent development of the source term model (Heeb 1992).

The dose decision levels provided by the Technical Steering Panel (Shleien 1992) require a two-part analysis of doses—an annual dose and a cumulative dose over the period of Hanford operations. This scoping study addresses the annual doses for 1945 only, although they are by far the largest. A separate scoping study is under way to extend the results of this study over the period of interest through 1972.

**TABLE 7. Summary of 1945 Effective Doses for Infants and Adults by Radionuclide and Pathway**

1. INFANTS										
	External Dose	Inhalation Dose	Human Soil Ingestion	Leafy Veg.	Other Veg. & Fruit	Fresh Meat	Fresh Eggs	Regime 1 Milk Dose	Totals	REM/YR
I 131	8.85E-02	6.76E-02	2.28E-02	6.55E-01	5.03E-01	3.10E-01	4.31E-01	1.45E+01	1.66E+01	
RU106	9.76E-07	1.10E-05	4.11E-07	3.06E-06	2.40E-06	1.16E-06	3.01E-09	7.10E-09	1.90E-05	
RU103	7.29E-06	1.74E-06	1.11E-07	1.39E-06	1.06E-06	4.56E-07	1.48E-09	2.64E-09	1.21E-05	
CO60	7.33E-08	3.95E-08	8.85E-12	1.63E-09	9.23E-10	1.04E-08	6.95E-11	1.22E-10	1.26E-07	
I 132	8.45E-05	4.68E-06	4.80E-08	2.56E-06	1.95E-06	2.91E-53	1.47E-06	5.46E-05	1.50E-04	
XE133	1.94E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.94E-05	
CE144	1.73E-06	6.80E-05	2.77E-06	2.15E-05	1.62E-05	8.00E-06	1.74E-08	4.86E-08	1.18E-04	
PU239	1.56E-11	1.68E-05	5.85E-07	4.04E-06	3.03E-06	1.52E-09	5.13E-09	1.59E-09	2.45E-05	
SR90	5.01E-09	3.90E-07	1.98E-07	1.40E-06	1.38E-06	5.32E-05	2.24E-10	8.22E-05	1.39E-04	
CS137	1.02E-06	4.73E-08	3.40E-08	2.35E-07	1.77E-07	1.33E-06	1.83E-08	6.46E-06	9.31E-06	
I 129	8.66E-09	6.17E-09	4.55E-08	3.16E-07	2.52E-07	5.94E-07	2.21E-07	1.14E-05	1.28E-05	
KR85	2.20E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.20E-07	
ZR95	6.28E-05	1.04E-05	6.18E-07	6.49E-06	4.89E-06	1.37E-09	2.12E-10	1.21E-08	8.52E-05	
SR89	3.11E-09	2.39E-06	5.28E-09	1.58E-06	1.07E-06	9.28E-05	7.43E-10	1.50E-05	1.13E-04	
									16.6189234	
2. ADULTS										
	External Dose	Inhalation Dose	Human Soil Ingestion	Leafy Veg.	Other Veg. & Fruit	Fresh Meat	Fresh Eggs	Regime 1 Milk Dose	Totals	REM/YR
I 131	8.85E-02	5.82E-02	2.29E-04	1.72E-01	9.83E-02	1.39E-01	3.03E-01	7.31E-01	1.59E+00	
RU106	9.76E-07	1.82E-05	2.61E-09	5.16E-07	2.97E-07	3.29E-07	1.34E-09	2.26E-10	2.03E-05	
RU103	7.29E-06	2.28E-06	1.07E-09	3.50E-07	1.99E-07	1.96E-07	9.96E-10	1.27E-10	1.03E-05	
CO60	7.33E-08	3.95E-08	8.85E-12	1.63E-09	9.23E-10	1.04E-08	6.95E-11	1.22E-10	1.26E-07	
I 132	8.45E-05	4.66E-06	3.37E-10	4.66E-07	2.65E-07	9.07E-54	7.24E-07	1.92E-06	9.24E-05	
XE133	1.94E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.94E-05	
CE144	1.73E-06	1.11E-04	1.84E-08	3.73E-06	2.10E-06	2.37E-06	8.12E-09	1.62E-09	1.21E-04	
PU239	1.56E-11	1.66E-04	4.84E-09	6.72E-07	4.87E-07	5.58E-10	2.97E-09	6.55E-11	1.68E-04	
SR90	5.01E-09	2.77E-06	3.37E-09	9.88E-07	7.27E-07	6.40E-05	4.25E-10	1.11E-05	7.67E-05	
CS137	1.02E-06	4.28E-07	2.29E-09	4.15E-07	2.32E-07	3.98E-06	8.66E-08	2.18E-06	8.35E-06	
I 129	8.66E-09	5.79E-08	3.11E-09	5.82E-07	3.34E-07	1.80E-06	1.05E-06	3.88E-06	7.70E-06	
KR85	2.20E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.20E-07	
ZR95	6.28E-05	1.16E-05	6.18E-09	1.69E-06	9.49E-07	6.09E-10	1.48E-10	6.04E-10	7.70E-05	
SR89	3.11E-09	2.39E-06	5.28E-09	1.58E-06	1.07E-06	9.28E-05	7.43E-10	1.50E-05	1.13E-04	

**TABLE 8. Summary of 1945 Critical-organ Doses for Infants and Adults by Radionuclide and Pathway**

1. INFANTS										
	External Dose	Inhalation Dose	Human Soil Ingestion	Leafy Veg.	Other Veg. & Fruit	Fresh Meat	Fresh Eggs	Regime 1 Milk Dose	Totals	REM/YR
I 131	8.85E-02	2.21E+00	8.35E-01	2.40E+01	1.84E+01	1.14E+01	1.58E+01	5.32E+02	6.05E+02	
RU106	9.76E-07	8.83E-05	3.61E-06	2.69E-05	2.11E-05	1.02E-05	2.65E-08	6.26E-08	1.51E-04	
RU103	7.29E-06	1.12E-05	9.50E-07	1.19E-05	9.11E-06	3.91E-06	1.26E-08	2.27E-08	4.44E-05	
CO60	7.33E-08	3.43E-07	2.83E-12	5.21E-10	2.95E-10	3.33E-09	2.22E-11	3.89E-11	4.20E-07	
I 132	8.45E-05	8.48E-05	1.07E-06	5.72E-05	4.36E-05	6.51E-52	3.30E-05	1.22E-03	1.53E-03	
XE133	1.94E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.94E-05	
CE144	1.73E-06	5.40E-04	2.58E-05	2.00E-04	1.51E-04	7.46E-05	1.62E-07	4.53E-07	9.94E-04	
PU239	1.56E-11	1.95E-04	7.54E-06	5.21E-05	3.91E-05	1.96E-08	6.61E-08	2.04E-08	2.93E-04	
SR90	5.01E-09	3.11E-06	1.53E-06	1.08E-05	1.07E-05	4.10E-04	1.73E-09	6.33E-04	1.07E-03	
CS137	1.02E-06	6.21E-08	4.59E-08	3.18E-07	2.39E-07	1.79E-06	2.47E-08	8.73E-06	1.22E-05	
I 129	8.66E-09	2.02E-07	1.55E-06	1.08E-05	8.60E-06	2.03E-05	7.53E-06	3.88E-04	4.37E-04	
KR85	2.20E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.20E-07	
ZR95	6.28E-05	9.90E-05	1.05E-06	1.10E-05	8.29E-06	2.32E-09	3.59E-10	2.05E-08	1.82E-04	
SR89	3.11E-09	5.27E-06	5.02E-08	1.50E-05	1.02E-05	8.83E-04	7.07E-09	1.43E-04	1.06E-03	
									604.5759295	
2. ADULTS										
	External Dose	Inhalation Dose	Human Soil Ingestion	Leafy Veg.	Other Veg. & Fruit	Fresh Meat	Fresh Eggs	Regime 1 Milk Dose	Totals	REM/YR
I 131	8.85E-02	2.00E+00	7.79E-03	5.83E+00	3.34E+00	4.71E+00	1.03E+01	2.48E+01	5.11E+01	
RU106	9.76E-07	1.53E-04	3.23E-08	6.39E-06	3.68E-06	4.07E-06	1.66E-08	2.80E-09	1.68E-04	
RU103	7.29E-06	1.72E-05	9.50E-09	3.11E-06	1.77E-06	1.74E-06	8.85E-09	1.13E-09	3.12E-05	
CO60	7.33E-08	3.43E-07	2.83E-12	5.21E-10	2.95E-10	3.33E-09	2.22E-11	3.89E-11	4.20E-07	
I 132	8.45E-05	5.66E-06	4.08E-10	5.67E-07	3.21E-07	1.10E-53	8.78E-07	2.32E-06	9.43E-05	
XE133	1.94E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.94E-05	
CE144	1.73E-06	9.23E-04	2.21E-07	4.48E-05	2.52E-05	2.84E-05	9.74E-08	1.94E-08	1.20E-03	
PU239	1.56E-11	3.03E-03	8.77E-08	1.58E-05	8.83E-06	1.01E-08	5.38E-08	1.19E-09	3.06E-03	
SR90	5.01E-09	3.25E-05	6.61E-08	1.22E-05	8.94E-06	7.88E-04	5.23E-09	1.37E-04	9.79E-04	
CS137	1.02E-06	4.54E-07	2.39E-09	4.32E-07	2.42E-07	4.14E-06	9.00E-08	2.27E-06	8.65E-06	
I 129	8.66E-09	1.90E-06	1.03E-07	1.87E-05	1.11E-05	5.99E-05	3.50E-05	1.29E-04	2.55E-04	
KR85	2.20E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.20E-07	
ZR95	6.28E-05	2.26E-04	3.20E-08	8.76E-06	4.92E-06	3.15E-09	7.67E-10	3.13E-09	3.02E-04	
SR89	3.11E-09	5.27E-06	5.02E-08	1.50E-05	1.02E-05	8.83E-04	7.07E-09	1.43E-04	1.06E-03	

**TABLE 9. Percent of 1945 Effective Doses for Infants and Adults by Radionuclide and Pathway**

1. INFANTS									
	External Dose	Inhalation Dose	Human Soil Ingestion	Leafy Veg.	Other Veg. & Fruit	Fresh Meat	Fresh Eggs	Regim 1 Milk Dose	Totals
I 131	0.5327%	0.4070%	0.1373%	3.9407%	3.0285%	1.8449%	2.5909%	87.4919%	99.9958%
RU106	0.0000%	0.0001%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0001%
RU103	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0001%
CO60	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%
I 132	0.0005%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0003%	0.0009%
XE133	0.0001%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0001%
CE144	0.0000%	0.0004%	0.0000%	0.0001%	0.0001%	0.0000%	0.0000%	0.0000%	0.0007%
PU239	0.0000%	0.0001%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0001%
SR90	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0003%	0.0000%	0.0005%	0.0008%
CS137	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0001%
I 129	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0001%	0.0001%
KR85	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%
ZR95	0.0004%	0.0001%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0005%
SR89	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0006%	0.0000%	0.0001%	0.0007%
									100.0000%
2. ADULTS									
	External Dose	Inhalation Dose	Human Soil Ingestion	Leafy Veg.	Other Veg. & Fruit	Fresh Meat	Fresh Eggs	Regim 1 Milk Dose	Totals
I 131	5.5644%	3.6575%	0.0144%	10.8010%	6.1795%	8.7179%	19.0531%	45.9629%	99.9549%
RU106	0.0001%	0.0011%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0013%
RU103	0.0005%	0.0001%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0006%
CO60	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%
I 132	0.0053%	0.0003%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0001%	0.0058%
XE133	0.0012%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0012%
CE144	0.0001%	0.0070%	0.0000%	0.0002%	0.0001%	0.0001%	0.0000%	0.0000%	0.0076%
PU239	0.0000%	0.0105%	0.0000%	0.0001%	0.0000%	0.0000%	0.0000%	0.0000%	0.0105%
SR90	0.0000%	0.0002%	0.0000%	0.0001%	0.0000%	0.0040%	0.0000%	0.0007%	0.0050%
CS137	0.0001%	0.0000%	0.0000%	0.0000%	0.0000%	0.0003%	0.0000%	0.0000%	0.0005%
I 129	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0001%	0.0001%	0.0002%	0.0005%
KR85	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%
ZR95	0.0039%	0.0007%	0.0000%	0.0001%	0.0001%	0.0000%	0.0000%	0.0000%	0.0048%
SR89	0.0000%	0.0002%	0.0000%	0.0001%	0.0001%	0.0058%	0.0000%	0.0009%	0.0071%
									100.0000%

REN/YR

**TABLE 10. Percent of 1945 Critical-Organ Doses for Infants and Adults by Radionuclide and Pathway**

1. INFANTS									
	External Dose	Inhalation Dose	Human Soil Ingestion	Leafy Veg.	Other Veg. & Fruit	Fresh Meat	Fresh Eggs	Regim 1 Milk Dose	Totals
I 131	0.0144%	0.3457%	0.1381%	3.9631%	3.0457%	1.8775%	2.6054%	87.9888%	99.9990%
RU106	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%
RU103	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%
CO60	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%
I 132	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0002%	0.0003%
XE133	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%
CE144	0.0000%	0.0001%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0002%
PU239	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%
SR90	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0001%	0.0000%	0.0001%	0.0002%
CS137	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%
I 129	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0001%	0.0001%
KR85	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%
ZR95	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%
SR89	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0001%	0.0000%	0.0000%	0.0002%
									100.0000%
2. ADULTS									
	External Dose	Inhalation Dose	Human Soil Ingestion	Leafy Veg.	Other Veg. & Fruit	Fresh Meat	Fresh Eggs	Regim 1 Milk Dose	Totals
I 131	0.1732%	3.9129%	0.0152%	11.4164%	6.5315%	9.2146%	20.1408%	48.5817%	99.9863%
RU106	0.0000%	0.0003%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0003%
RU103	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0001%
CO60	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%
I 132	0.0002%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0002%
XE133	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%
CE144	0.0000%	0.0018%	0.0000%	0.0001%	0.0000%	0.0001%	0.0000%	0.0000%	0.0020%
PU239	0.0000%	0.0059%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0060%
SR90	0.0000%	0.0001%	0.0000%	0.0000%	0.0000%	0.0015%	0.0000%	0.0003%	0.0019%
CS137	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%
I 129	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0001%	0.0001%	0.0003%	0.0005%
KR85	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%
ZR95	0.0001%	0.0004%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0006%
SR89	0.0000%	0.0000%	0.0000%	0.0000%	0.0000%	0.0017%	0.0000%	0.0003%	0.0021%

REN/YR

REN/YR

## 4.0 RECOMMENDATIONS

Scoping calculations were performed for that portion of Franklin County considered to be the most exposed area in the HEDR study region. Based on the results of this scoping study, and the companion study on cumulative dose, the following recommendations are made regarding exposure pathways, calculational methods, and included radionuclides for the calculation of individual doses for the HEDR project:

### EXPOSURE PATHWAYS

Although external dose, inhalation dose, and dose from ingestion of soil by humans all contribute less than one percent of the total dose, each individually has the potential to contribute a sizable fraction of the TSP's dose decision level. Each of these pathways also shares the characteristic of being simple to calculate from information that will be available. For each of these reasons, and because their inclusion would enhance the validity of the estimated doses, it is recommended that they be retained in the model. The remaining pathways evaluated each have the potential to contribute some multiples of the TSP dose decision level, even if only for a very limited geographical area or for a limited target population. Thus, they should also be retained.

### CALCULATIONAL METHODS

A term noted in the development of this spreadsheet scoping study for which there are currently only very limited data available is the holdup time from slaughter to consumption of meat. The distribution of holdups (all consumed relatively fresh, or long holdups in freezers or lockers) will have a significant impact on the magnitude of this value. Additional information is required from the Demography and Food Habits Task to help better define this value. A study of the secondary literature will be requested of Task 06.

## INCLUDED RADIONUCLIDES

The results indicate very plainly that the radionuclide of greatest interest is iodine-131. The doses, either to adults or children, from any pathway, are four to seven orders-of-magnitude smaller for any other radionuclide than they are from iodine-131. This calls into question the need to investigate these other radionuclides in great detail. A driving force for retaining the capability for estimating doses from other nuclides was the possibility that they could contribute significantly to the dose. It is apparent from this analysis that this will not be the case.

It is recommended to the TSP that the detailed analysis be limited to the doses from iodine-131 from the air pathways. If the TSP wishes to continue to evaluate doses from other radionuclides, such analyses should be performed in a greatly circumscribed fashion. Options include additional spreadsheets such as the one used for this analysis, deterministic calculations with the larger dose code (i.e., using the same code but with only one realization of source, dispersion, uptake, and dose), or scaling from the more completely calculated iodine doses. Any of these options would greatly reduce the computational complexity required of the main dose code, and also reduce the effort required to obtain adequate data to support the main dose code.

## 5.0 QUALITY ASSURANCE

Quality assurance was undertaken in accordance with PNL-MA-70, Volume 1, Procedures for Quality Assurance Program, under PNL administrative procedure PAP-70-301, "Hand Calculations, General." Complete documentation of the calculation was prepared by the senior author, who independently prepared the calculational spreadsheets and performed the spreadsheet calculations. A thorough independent review was conducted by the developer of the milk dose spreadsheet. Spreadsheet documentation is on file and available for review.



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APPENDIX A

CALCULATION OF MONTHLY RELEASE RATES AND ENVIRONMENTAL  
CONCENTRATIONS OF SELECTED RADIONUCLIDES

CALCULATION OF APPROXIMATE MONTHLY RELEASE RATES OF RADIONUCLIDES  
 BASED ON PNWD-2033 VOL. 1 TABLE 5.2 TONS AND COOLING TIMES  
 FUEL CONTENTS BASED ON ORIGEN2 RUN AT 200 MW/D/T, 1 MW/T POWER (9/3/92)

1. MONTHLY TOTAL TONS AND COOLING (1945)

MONTH	J	F	M	A	M	J	J	A	S	O	N	D	total
TONS	3.7	6.9	6.7	35.3	49.8	33.9	39.8	61.2	70.8	116.5	99.9	92.9	617
DAYS	30	53	52	42	36	35	40	30	30	44	52	47	
I 131 Air Conc. (Ci*sec/m <sup>3</sup> )	1.80E-05	1.40E-05	2.90E-05	1.50E-04	6.90E-04	2.50E-04	5.80E-04	5.50E-04	2.70E-03	1.70E-03	1.90E-04	9.90E-04	
Cell's releases (Ci/mo)	1221	2128	2002	28746	74482	46466	47036	72090	80682	92066	37752	82340	555089
Derived X/Q (sec/m <sup>3</sup> )	1.474E-08	6.585E-08	1.393E-08	5.218E-08	9.264E-08	5.38E-09	1.191E-08	7.829E-09	3.045E-08	1.847E-08	5.033E-09	1.586E-08	

2. CURIES/TON OF 200 MW/D/T FUEL AT 30,40, OR 50 DAYS COOLING

NUCLIDE	LAMDA R ( DEP. VEL.	30 DAYS	40 DAYS	50 DAYS
I 131	0.086	0.01	1894	838
RU/RH106	0.00186	0.001	2011	1974
RU/RH103	0.0176	0.001	17310	14510
CO60	0.000361	0.001	12.6	12.5
Te/I 132	7.23	0.01	65	7.7
XE133	0.132	0	1328	354
CE/PR144	0.00244	0.001	15600	14860
PU239	7.87E-08	0.001	15.5	15.5
SR/Y90	6.96E-05	0.001	573	573
CS/BAm13	6.3E-05	0.001	636	636
I 129	1.21E-10	0.01	0.00017	0.00017
KR85	0.000177	0	74	74
ZR/NB95	0.0108	0.001	33240	29830
SR99	0.0137	0.001	22910	19970

3. RELEASE FRACTIONS

MOBILE GASES	1 FROM PHYSICS
COINES	0.9 FROM C. HEEB PNWD-2033 VOL. 1
RUTHEINIUMS	1E-05 FROM MONITORING DATA
ALL OTHERS	1E-05 FROM MONITORING DATA

4. CORRECTION FOR POWER PEAKING FACTOR FOR SHORT-LIVED PRODUCTS

APPLIED TO I 131, I-132, AND XE133  
 (THIS ALSO ACCOUNTS FOR THE FACT THAT DECAY IS EXPONENTIAL, NOT LINEAR)  
 ARBITRARILY SET TO 1.4 (BIGGER THAN CAL'S 1.2) TO MAKE ANNUAL TOTALS AGREE

1.433531

5. AMOUNTS RELEASED

CALCULATED AS LOG INTERPOLATION OF CONTENTS BASED ON COOLING DAYS

NUCLIDE	J	F	M	A	M	J	J	A	S	O	N	D
I131	4.4E+03	2.4E+03	2.6E+03	3.2E+04	7.6E+04	5.6E+04	4.3E+04	7.2E+04	8.3E+04	9.8E+04	3.8E+04	5.5E+04
RU106	7.3E-02	1.3E-01	1.3E-01	9.9E-01	9.9E-01	9.9E-01	7.9E-01	1.2E+00	1.4E+00	2.3E+00	1.9E+00	1.8E+00
RU103	5.5E-01	6.0E-01	7.9E-01	4.9E+00	7.8E+00	5.4E+00	9.0E+00	9.0E+00	1.0E+01	1.9E+01	1.2E+01	1.2E+01
CO60	4.8E-04	8.6E-04	8.4E-04	4.4E-03	6.3E-03	4.3E-03	5.0E-03	7.7E-03	8.9E-03	1.8E-02	1.2E-02	1.2E-02
I132	4.5E+01	4.2E+00	5.1E+00	2.3E+02	1.2E+03	9.8E+02	3.9E+02	7.5E+02	8.7E+02	4.9E+02	7.6E+01	2.0E+02
XE133	2.1E+03	6.3E+02	7.0E+02	1.4E+04	4.3E+04	3.3E+04	2.0E+04	3.6E+04	4.1E+04	1.0E+04	1.9E+04	1.9E+04
CE144	5.6E-01	1.0E+00	9.9E-01	6.3E-01	7.7E-03	5.3E-03	6.1E+00	9.3E+00	1.1E-02	1.8E-02	1.5E+01	1.4E+01
PU239	5.7E-04	1.1E-03	1.0E-03	5.9E-03	7.7E-03	5.3E-03	6.2E-03	9.5E-03	1.1E-02	1.8E-02	1.4E-02	1.4E-02
SR90	2.1E-02	3.9E-02	3.9E-02	2.0E-01	2.9E-01	1.9E-01	2.3E-01	3.9E-01	4.1E-01	6.7E-01	6.7E-01	5.3E-01
CS137	2.4E-02	4.4E-02	4.0E-02	2.2E-01	3.2E-01	2.5E-01	3.9E-01	3.9E-01	4.5E-01	7.4E-01	9.3E-01	5.9E-01
I129	5.7E-04	1.1E-03	1.0E-03	5.4E-03	7.8E-03	5.2E-03	6.1E-03	9.4E-03	1.1E-02	1.8E-02	1.5E-02	1.4E-02
KR85	2.7E+02	5.1E+02	5.0E+02	2.6E+03	3.7E+03	2.5E+03	2.9E+03	4.5E+03	5.2E+03	6.8E+03	7.4E+03	6.9E+03
ZR85	1.1E+00	1.8E+00	1.8E+00	1.0E+01	1.6E+01	1.1E+01	1.2E+01	1.8E+01	2.1E+01	3.3E+01	2.6E+01	2.6E+01
SR89	7.5E-01	1.2E+00	1.1E+00	6.9E+00	1.1E+01	7.3E+00	7.9E+00	1.2E+01	1.4E+01	2.2E+01	1.7E+01	1.7E+01

6. MONTHLY INTEGRATED AIR CONCENTRATIONS, CI\*SEC/M3

NUCLIDE	J	F	M	A	M	J	J	A	S	O	N	D
I131	6.43E-05	1.65E-05	3.59E-05	1.80E-04	7.04E-04	3.03E-04	5.12E-04	5.50E-04	2.54E-03	1.85E-03	1.93E-04	8.73E-04
RU106	1.06E-09	8.75E-10	1.80E-09	3.62E-09	9.17E-09	3.63E-09	9.35E-09	9.23E-09	4.29E-08	4.21E-08	6.70E-09	2.67E-08
RU103	6.05E-09	5.24E-09	1.10E-08	2.50E-08	7.18E-08	2.89E-08	6.87E-08	6.89E-08	3.19E-07	2.91E-07	5.90E-08	1.89E-07
CO60	8.85E-12	5.67E-12	1.17E-11	2.31E-11	5.80E-11	2.29E-11	5.95E-11	5.86E-11	2.71E-10	2.70E-10	8.29E-11	1.85E-10
I132	6.67E-07	2.76E-06	7.06E-06	1.18E-06	1.07E-05	5.25E-06	4.68E-06	5.71E-06	2.63E-05	9.02E-06	3.81E-07	3.29E-06
XE133	3.17E-05	4.17E-06	9.79E-06	7.20E-06	3.98E-04	1.80E-04	2.41E-04	2.71E-04	1.25E-03	9.48E-04	5.28E-05	2.88E-04
CE144	8.33E-09	6.70E-09	1.36E-08	2.79E-08	7.09E-08	2.81E-08	7.21E-08	7.13E-08	3.29E-07	3.24E-07	7.44E-08	2.21E-07
PU239	4.45E-12	7.04E-12	1.45E-11	2.86E-11	7.15E-11	2.93E-11	7.34E-11	7.24E-11	3.34E-10	3.33E-10	7.79E-11	2.29E-10
SR90	3.12E-10	2.89E-10	5.34E-10	1.05E-09	2.64E-09	1.04E-09	2.71E-09	2.87E-09	1.29E-08	1.23E-08	2.86E-09	8.44E-09
CS137	3.47E-10	2.88E-10	5.99E-10	1.17E-09	2.93E-09	1.19E-09	3.01E-09	2.97E-09	1.37E-08	1.37E-08	3.19E-09	9.37E-09
I129	6.35E-12	6.95E-12	1.43E-11	2.82E-11	7.08E-11	2.79E-11	7.25E-11	7.14E-11	3.30E-10	3.29E-10	7.69E-11	2.29E-10
KR85	4.04E-06	3.36E-06	6.91E-06	1.36E-05	3.41E-05	1.35E-05	3.51E-05	3.46E-05	1.69E-04	1.59E-04	3.72E-05	1.09E-04
ZR85	1.64E-06	1.18E-06	2.44E-06	5.30E-06	1.44E-05	5.74E-06	1.41E-05	1.41E-05	6.59E-07	6.15E-07	1.32E-07	4.09E-07
SR89	1.10E-08	7.59E-09	1.58E-08	3.50E-08	9.73E-08	3.90E-08	9.46E-08	9.45E-08	4.36E-07	4.07E-07	8.52E-08	2.69E-07

7. MONTH-END DEPOSITIONS, CI/M2

NUCLIDE	J	F	M	A	M	J	J	A	S	O	N	D
I131	2.30E-07	5.74E-06	1.25E-07	6.00E-07	2.52E-06	1.07E-06	1.83E-06	1.97E-06	9.10E-06	5.90E-06	6.92E-07	3.128E-06
RU106	1.04E-12	8.51E-13	1.75E-12	3.82E-12	8.92E-12	3.53E-12	9.09E-12	8.97E-12	4.144E-11	4.007E-11	9.434E-12	2.794E-11
RU103	6.25E-12	4.07E-12	8.51E-12	2.00E-11	5.81E-11	2.24E-11	5.34E-11	5.357E-11	2.473E-10	2.259E-10	4.565E-11	1.47E-10
CO60	6.81E-15	5.64E-15	1.159E-14	2.297E-14	5.788E-14	2.281E-14	5.915E-14	5.83E-14	2.692E-13	2.681E-13	6.246E-14	1.836E-13
I132	3.074E-11	1.28E-12	3.257E-12	5.482E-11	4.94E-10	2.419E-10	2.156E-10	2.631E-10	1.215E-09	4.155E-10	1.754E-11	1.501E-10
XE133	0	0	0	0	0	0	0	0	0	0	0	0
CE144	6.029E-12	6.464E-12	1.331E-11	2.691E-11	6.839E-11	2.711E-11	6.957E-11	6.872E-11	3.172E-10	3.126E-10	7.17E-11	2.129E-10
PU239	6.455E-15	7.043E-15	1.447E-14	2.855E-14	7.151E-14	2.827E-14	7.345E-14	7.237E-14	3.341E-13	3.334E-13	7.793E-14	2.287E-13
SR90	3.12E-13	2.596E-13	5.332E-13	1.053E-12	2.639E-12	1.041E-12	2.71E-12	2.671E-12	1.233E-11	1.23E-11	2.873E-12	8.433E-12
CS137	3.463E-13	2.862E-13	5.92E-13	1.169E-12	2.93E-12	1.159E-12	3.008E-12	2.965E-12	1.369E-11	1.365E-11	3.169E-12	9.362E-12
I129	6.345E-14	6.952E-14	1.428E-13	2.818E-13	7.059E-13	2.791E-13	7.25E-13	7.144E-13	3.298E-12	3.291E-12	7.693E-13	2.257E-12
KR85	0	0	0	0	0	0	0	0	0	0	0	0
ZR85	1.405E-11	1.006E-11	2.068E-11	4.593E-11	1.228E-10	4.908E-11	1.207E-10	1.203E-10	5.552E-10	5.249E-10	1.125E-10	3.465E-10
SR89	6.056E-12	6.225E-12	1.298E-11	2.935E-11	7.962E-11	3.199E-11	7.76E-11	7.752E-11	3.579E-10	3.335E-10	6.983E-11	2.195E-10

**APPENDIX B**

**DETAILS OF DOSE ESTIMATES FOR SELECTED RADIONUCLIDES**

RADIONUCLIDE/PATHWAY SCOPING STUDY

SCREENING CALCULATIONS: I 131 ADULT  
 DOSES FROM VARIOUS PATHWAYS

ALLDOSIA

VARIABLE	description	SINGLE REALIZATION OF RATC			
		Decay Corrected	18,25	18,25	TOTAL ON
0.5	kg/m <sup>2</sup> dry, Y other veg & fruit	1.8E-05	4.4E-08	4.4E-08	4.4E-08
0.3	kg/m <sup>2</sup> dry, Y pasture	1.4E-05	8.1E-08	8.43E-08	8.43E-08
0.3	kg/m <sup>2</sup> dry, Y silage	2.9E-05	1.8E-07	1.86E-07	1.86E-07
0.2	kg/m <sup>2</sup> dry, Y alfalfa & Leafy veg.	1.5E-04	6.3E-07	6.44E-07	6.44E-07
2.9	m <sup>2</sup> /kg, alpha	6.9E-04	5.0E-06	5.05E-06	5.05E-06
0.0092	df/l, TFmilk	2.5E-04	1.3E-06	1.68E-06	1.68E-06
0.5	l/d, IR ADULT	5.6E-04	2.1E-06	2.23E-06	2.23E-06
1.40E+06	Ingestion dose factor, rad/Ci, ADULT	5.5E-04	1.7E-06	1.87E-06	1.87E-06
30	days/month	2.7E-03	5.3E-06	5.44E-06	5.44E-06
0.086	d-1, lambda rad	1.7E-03	3.1E-06	3.51E-06	3.51E-06
10.74	d, consumption integral, 30 days	1.9E-04	7.3E-07	9.96E-07	9.96E-07
0.01	day/kg, beef transfer factor	9.9E-04	2.3E-06	2.38E-06	2.38E-06
0.62	m <sup>2</sup> , surface area of bale				
30	kg, mass of bale				
9	kg/d dry, IR of hay, cow, FR 3 & 4				
13	kg/m <sup>2</sup> , RHO usl (1 cm depth)				
4.4	d/kg, egg transfer factor				
0.0017	cow m <sup>3</sup> /s, cow inhalation rate				
0.48	unitless, adjustment factor* (Zack 85)				
0.0495	d-1, lambda dba weathering				
0.635	weathering correction factor, unitless				
3650	rad/month per Ci/m <sup>2</sup> , External DF				
1000000	Inhalation dose factor, rad Ci, ADULT				
0.0001	Soil Consumption Rate, kg/day, ADULT				
0.000255	Breathing Rate, m <sup>3</sup> /sec, ADULT				
0.006	Leafy Veg. Consumption, kg/d DRY, ADULT (20 kg/yr wet*12MO/8MO FOR SEASONALITY)				
0.067	Other veg. & fruit consumption, kg/d DRY, ADULT (81.5 kg/yr wet*12/8 MO)				
0.066	rad/sec per Ci/m <sup>3</sup> , Submersion DF				
0.05	translocation factor, unitless				
0.2	kg/day, meat consumption rate ADULT				
0.035	kg/day, egg consumption rate, ADULT				
0.05	kg/day, fresh stuff consumption by chickens				
0.001	kg/day, soil consumption by chickens				
0.4	SOIL-TO-PLANT TRANSFER				
224	KG/M <sup>2</sup> , SOIL SURFACE DENSITY				



DOSE FROM FEEDING REGIME 1 PLUS OTHER PATHWAYS, 1 131 ADULT

month/ year	External Dose		Inhalation Dose		Human Soil Leafy Veg. Ingestion		Other Veg & Fruit		15 day meat		fresh eggs		Regime 1 Milk dose	
	rem/mo	rem/mo	rem/mo	rem/mo	rem/mo	rem/mo	rem/mo	rem/mo	rem/mo	rem/mo	rem/mo	rem/mo	rem/mo	rem/mo
1/45	1.62E-04	4.59E-03	1.42E-05		1.8E+00	1.0E+00	6.3E-01	3.3E-01	5.5E-01	2.9E+00	1.4E-02	2.5E-02	3.1E-03	J
2/45	3.09E-04	3.57E-03	2.72E-05		4.7E-01	2.7E-01	3.3E-01	5.3E-01	8.8E-01	4.4E+00	2.6E-02	4.7E-02	5.7E-03	F
3/45	6.82E-04	7.40E-03	6.02E-05		7.6E-01	4.3E-01	5.3E-01	8.8E-01	7.1E-01	3.6E+00	5.6E-02	1.0E-01	1.3E-02	M
4/45	2.36E-03	3.83E-02	2.08E-04		6.2E-01	3.5E-01	4.3E-01	6.9E-01	2.3E+00	6.1E+00	1.7E-01	3.1E-01	4.4E-02	A
5/45	1.85E-02	1.76E-01	1.63E-03		2.0E+00	1.1E+00	6.9E-01	8.6E-01	1.5E+00	2.0E+00	6.3E-01	2.1E+00	5.4E+00	M
6/45	6.16E-03	6.38E-02	5.44E-04		4.7E-01	2.7E-01	3.3E-01	5.5E-01	2.9E+00	1.4E-02	2.6E-02	4.7E-02	5.7E-03	J
7/45	8.17E-03	1.43E-01	7.20E-04		7.6E-01	4.3E-01	5.3E-01	8.8E-01	4.4E+00	2.6E-02	5.6E-02	1.0E-01	1.3E-02	J
8/45	6.86E-03	1.40E-01	6.04E-04		6.2E-01	3.5E-01	4.3E-01	7.1E-01	3.6E+00	1.7E-01	1.7E-01	3.1E-01	4.4E-02	A
9/45	2.00E-02	6.89E-01	1.76E-03		2.0E+00	1.1E+00	6.9E-01	8.6E-01	1.5E+00	2.0E+00	6.3E-01	2.1E+00	5.4E+00	S
10/45	1.29E-02	4.34E-01	1.13E-03		1.9E-01	1.1E-01	8.6E-01	1.5E+00	2.0E+00	6.1E+00	1.29E-02	4.34E-01	1.13E-03	O
11/45	3.65E-03	4.85E-02	3.22E-04		1.5E-02	8.4E-03	2.3E-01	4.1E-01	1.8E-01	1.8E-01	3.65E-03	4.85E-02	3.22E-04	N
12/45	8.74E-03	2.52E-01	7.67E-04		1.1E-03	6.4E-04	7.5E-01	1.3E+00	1.3E+00	1.3E+00	8.74E-03	2.52E-01	7.67E-04	D

Pathway dose, r 8.85E-02 2.00E+00 7.79E-03 5.83E+00 3.34E+00 4.71E+00 1.03E+01 2.48E+01  
 % Contribution 0.17% 3.91% 0.02% 11.42% 6.53% 9.22% 20.14% 48.59%  
 Cumulative 8.85E-02 2.09E+00 2.10E+00 7.93E+00 1.13E+01 1.60E+01 2.63E+01 5.11E+01

5.11E+01 rem

RADIONUCLIDE/PATHWAY SCOPING STUDY

INFANT

ALLDOS#1

SCREENING CALCULATIONS: I 131  
DOSES FROM VARIOUS PATHWAYS

VARIABLE description

0.5 kg/m2 dry, Y other veg & fruit  
 0.3 kg/m2 dry, Y pasture  
 0.3 kg/m2 dry, Y silage  
 0.2 kg/m2 dry, Y alfalfa & Leafy veg.  
 2.9 m2/kg, alpha  
 0.0092 d/l, TFmilk  
 1.0 l/d, IR INFANT  
 1.50E+07 Ingestion dose factor, rad/Ci, INFANT  
 30 days/month  
 0.086 d-1, lambda rad  
 10.74 d, consumption integral, 30 days  
 0.01 day/kg, beef transfer factor  
 0.62 m2, surface area of bale  
 30 kg, mass of bale  
 9 kg/d dry, IR of hay,cow, FR,3 & 4  
 13 kg/m2, RHO wal (1 cm depth)  
 4.4 d/kg, egg transfer factor  
 0.0017 cow m3/s, cow inhalation rate  
 0.48 unitless, adjustment factor\* (Zack 85)  
 0.0495 d-1, lambda weathering  
 0.635 weathering correction factor, unitless  
 3650 rad/month per Ci/m2, External DF  
 15000000 Inhalation dose factor, rad Ci, INFANT  
 0.001 Soil Consumption Rate, kg/day, INFANT  
 1.88E-05 Breathing Rate, m3/sec, INFANT  
 0.0023 Leafy Veg. Consumption, kg/d DRY, INFANT(5.5 kg/yr wet\*12/8 MO FOR SEASONALITY)  
 0.0345 Other veg. & fruit consumption, kg/d DRY, INFANT(42 kg/yr wet\*12/8 MO)  
 0.066 rad/sec per Ci/m3, Submersion DF  
 0.05 translocation factor, unitless  
 0.045 kg/day, meat consumption rate INFANT  
 0.005 kg/day, egg consumption rate, INFANT  
 0.05 kg/day, fresh stuff consumption by chickens  
 0.001 kg/day, soil consumption by chickens  
 0.4 SOIL-TO-PLANT TRANSFER  
 224 KG/M2, SOIL SURFACE DENSITY

SINGLE REALIZATION OF RATC  
Decay Corrected RUNNING  
18,25 18,25 TOTAL ON

X	D(END)	GROUND
1/45	1.8E-05	4.4E-08
2/45	1.4E-05	8.49E-08
3/45	2.9E-05	1.86E-07
4/45	1.5E-04	6.44E-07
5/45	6.9E-04	5.0E-06
6/45	2.5E-04	1.3E-06
7/45	5.6E-04	2.1E-06
8/45	5.5E-04	1.7E-06
9/45	2.7E-03	5.3E-06
10/45	1.7E-03	3.1E-06
11/45	1.9E-04	7.3E-07
12/45	9.9E-04	2.3E-06

Air conc Surf con

DOSE FROM FEEDING REGIME 1 PLUS OTHER PATHWAYS, I 131 INFANT

month/ year	External Dose rem/mo	Inhalation Dose rem/mo	Human Soi Leafy Ingestion Veg. rem/mo	Other Veg & Fruit rem/mo	15 day meat rem/mo	fresh eggs rem/mo	Regime 1	
							Milk dose rem/mo	1945 rem/mo
1/45	1.62E-04	5.08E-03	1.52E-03		3.5E-02	3.9E-02	6.6E-02	J
2/45	3.09E-04	3.95E-03	2.92E-03		6.4E-02	7.2E-02	1.2E-01	F
3/45	6.82E-04	8.18E-03	6.45E-03		1.4E-01	1.5E-01	2.7E-01	M
4/45	2.36E-03	4.23E-02	2.23E-02		4.2E-01	4.7E-01	9.4E-01	A
5/45	1.85E-02	1.95E-01	1.75E-01	7.4E+00	1.5E+00	3.2E+00	1.2E+02	M
6/45	6.16E-03	7.05E-02	5.82E-02	1.9E+00	7.9E-01	8.4E-01	6.2E+01	J
7/45	8.17E-03	1.58E-01	7.71E-02	3.1E+00	1.3E+00	1.4E+00	9.5E+01	J
8/45	6.86E-03	1.55E-01	6.47E-02	2.5E+00	1.9E+00	1.1E+00	7.8E+01	A
9/45	2.00E-02	7.61E-01	1.88E-01	8.1E+00	6.2E+00	3.5E+00	1.3E+02	S
10/45	1.29E-02	4.79E-01	1.22E-01	8.0E-01	2.1E+00	2.3E+00	4.2E+01	O
11/45	3.65E-03	5.36E-02	3.45E-02	6.0E-02	5.5E-01	6.2E-01	3.9E+00	N
12/45	8.74E-03	2.79E-01	8.22E-02	4.6E-03	1.8E+00	2.0E+00	2.9E+00	D
Pathway dose, r	8.85E-02	2.21E+00	8.35E-01	2.40E+01	1.14E+01	1.58E+01	5.32E+02	
% Contribution	0.01%	0.37%	0.14%	3.96%	3.05%	1.88%	2.61%	87.99%
Cumulative	8.85E-02	2.30E+00	3.13E+00	2.71E+01	4.55E+01	5.69E+01	7.26E+01	6.05E+02

6.05E+02 rem

RADIONUCLIDE/PATHWAY SCOPING STUDY

SCREENING CALCULATIONS: RU/RH106 ADULT  
DOSES FROM VARIOUS PATHWAYS

ALLOS2A

FROM "NUCREL1.WG1"

VARIABLE	description	Decay Corrected		RUNNING	
		18,25	18,25	TOTAL ON	GROUND
0.5	kg/m2 dry, Y other veg & fruit	1.08E-09	1.05E-12	1.05E-12	1.05E-12
0.3	kg/m2 dry, Y pasture	8.75E-10	8.51E-13	1.84E-12	1.84E-12
0.3	kg/m2 dry, Y silage	1.80E-09	1.75E-12	3.49E-12	3.49E-12
0.2	kg/m2 dry, Y alfalfa & Leafy veg.	3.62E-09	3.52E-12	6.82E-12	6.82E-12
2.9	m2/kg, alpha	9.17E-09	8.92E-12	1.54E-11	1.54E-11
6E-07	d/l, Tfr milk	3.63E-09	3.53E-12	1.81E-11	1.81E-11
0.5	l/d, IR ADULT	9.35E-09	9.09E-12	2.62E-11	2.62E-11
2.10E+04	Ingestion dose factor, rad/Ci, ADULT	9.23E-09	8.98E-12	3.37E-11	3.37E-11
30	days/month	4.26E-08	4.14E-11	7.33E-11	7.33E-11
0.00188	d-1, lambda da rad	4.21E-08	4.1E-11	1.1E-10	1.1E-10
10.74	d, consumption integral, 30 days	9.70E-09	9.43E-12	1.14E-10	1.14E-10
0.002	day/kg, beef transfer factor	2.87E-08	2.79E-11	1.35E-10	1.35E-10
0.62	m2, surface area of bale				
30	kg, mass of bale				
9	kg/d dry, IR of hay, cow, FR 3 & 4				
13	kg/m2, RHO usl (1 cm depth)				
0.006	d/kg, egg transfer factor				
0.0017	cow m3/s, cow inhalation rate				
0.48	unitless, adjustment factor* (Zack 85)				
0.0495	d-1, lambda dba weathering				
0.524	weathering correction factor, unitless				
1800	rad/month per Ci/m2, External DF				
440000	Inhalation dose factor, rad Ci, ADULT				
0.0001	Soil Consumption Rate, kg/day, ADULT				
0.000255	Breathing Rate, m3/sec, ADULT				
0.006	Leafy Veg. Consumption, kg/d DRY, ADULT (20 kg/yr wet*12MO/6MO for seasonality)				
0.067	Other veg. & fruit consumption, kg/d DRY, ADULT (81.5 kg/yr wet)				
0.033	rad/sec per Ci/m3, Submersion DF				
0.05	translocation factor, unitless				
0.2	kg/day, meat consumption rate ADULT				
0.035	kg/day, egg consumption rate, ADULT				
0.05	kg/day, fresh stuff consumption by chickens				
0.001	kg/day, soil consumption by chickens				
0.2	SOIL-TO-PLANT TRANSFER				
224	KG/M2, SOIL SURFACE DENSITY				

DOSE FROM FEEDING REGIME 1 PLUS OTHER PATHWAYS, RU/RU106 ADULT

month/ year	External	Inhalation	Human Soi Leafy	Other Veg	15 day	fresh	Regime 1	1945
	Dose	Dose	Ingestion	& Fruit	meat	eggs	Milk dose	
	rem/mo	rem/mo	rem/mo	rem/mo	rem/mo	rem/mo	rem/mo	
1/45	1.92E-09	1.21E-07	5.08E-12		3.0E-09	1.0E-11	7.5E-14	J
2/45	3.34E-09	9.82E-08	8.93E-12		2.4E-09	8.5E-12	9.0E-14	F
3/45	6.35E-09	2.02E-07	1.69E-11		4.8E-09	1.7E-11	1.8E-13	M
4/45	1.24E-08	4.06E-07	3.31E-11		8.5E-09	3.0E-11	3.5E-13	A
5/45	2.80E-08	1.03E-06	7.45E-11	4.0E-08	9.8E-09	6.4E-11	8.0E-12	M
6/45	3.26E-08	4.08E-07	8.75E-11	1.6E-08	7.8E-09	2.7E-11	6.9E-12	J
7/45	4.74E-08	1.05E-06	1.27E-10	4.1E-08	2.0E-08	6.7E-11	1.6E-11	J
8/45	6.10E-08	1.04E-06	1.63E-10	4.0E-08	2.0E-08	6.7E-11	1.6E-11	A
9/45	1.33E-07	4.78E-06	3.55E-10	1.9E-07	4.7E-08	3.1E-10	4.2E-11	S
10/45	2.00E-07	4.73E-06	5.34E-10	6.6E-08	9.9E-08	3.5E-10	4.8E-11	O
11/45	2.05E-07	1.09E-06	5.51E-10	6.3E-08	2.6E-08	1.0E-10	4.4E-11	N
12/45	2.45E-07	3.22E-06	6.56E-10	5.9E-06	8.0E-08	2.9E-10	4.3E-11	D
Pathway dose, r	9.76E-07	1.82E-05	2.61E-09	5.16E-07	3.29E-07	1.34E-09	2.26E-10	
% Contribution	4.81%	89.55%	0.01%	2.54%	1.46%	1.62%	0.01%	0.00%
Cumulative	9.76E-07	1.91E-05	1.92E-05	1.97E-05	2.03E-05	2.03E-05	2.03E-05	2.03E-05

RADIONUCLIDE/PATHWAY SCOPING STUDY

SCREENING CALCULATIONS: RU/RH106 INFANT  
DOSES FROM VARIOUS PATHWAYS

ALLDOS2I

FROM "NUCREL1.WQ1"

Decay Corrected	18,25	18,25	RUNNING
X	D(END)	GROUND	TOTAL ON
Air conc	Surf con		
1/45	1.08E-09	1.05E-12	1.05E-12
2/45	8.75E-10	8.51E-13	1.84E-12
3/45	1.80E-09	1.75E-12	3.49E-12
4/45	3.62E-09	3.52E-12	6.82E-12
5/45	9.17E-09	8.92E-12	1.54E-11
6/45	3.63E-09	3.53E-12	1.81E-11
7/45	9.35E-09	9.09E-12	2.62E-11
8/45	9.23E-09	8.98E-12	3.37E-11
9/45	4.26E-08	4.14E-11	7.33E-11
10/45	4.21E-08	4.1E-11	1.1E-10
11/45	9.70E-09	9.43E-12	1.14E-10
12/45	2.87E-08	2.79E-11	1.35E-10

VARIABLE	description
0.5	kg/m <sup>2</sup> dry, Y other veg & fruit
0.3	kg/m <sup>2</sup> dry, Y pasture
0.3	kg/m <sup>2</sup> dry, Y silage
0.2	kg/m <sup>2</sup> dry, Y alfalfa & Leafy veg.
2.9	m <sup>2</sup> /kg, alpha
6E-07	d/l, TFmilk
1.0	l/d, IR ADULT
3.30E+05	Ingestion dose factor, rad/Ci, INFANT
30	days/month
0.00188	d-1, lambda rad
10.74	d, consumption integral, 30 days
0.002	day/kg, beef transfer factor
0.62	m <sup>2</sup> , surface area of bale
30	kg, mass of bale
9	kg/d dry, IR of hay,cow, FR 3 & 4
13	kg/m <sup>2</sup> , RHO usl (1 cm depth)
0.006	d/kg, egg transfer factor
0.0017	cow m <sup>3</sup> /s, cow inhalation rate
0.48	unitless, adjustment factor* (Zack 85)
0.0495	d-1, lambda d's weathering
0.524	weathering correction factor, unitless
1800	rad/month per Ci/m <sup>2</sup> , External DF
3600000	Inhalation dose factor, rad Ci, INFANT
0.001	Soil Consumption Rate, kg/day, INFANT
1.88E-05	Breathing Rate, m <sup>3</sup> /sec, INFANT
0.00226	Leafy Veg. Consumption, kg/d DRY, INFANT (5.5 kg/yr wet*12MO/8MO for seasonality)
0.0345	Other veg. & fruit consumption, kg/d DRY, INFANT (42 kg/yr wet*12/8)
0.033	rad/sec per Ci/m <sup>3</sup> , Submersion DF
0.05	translocation factor, unitless
0.045	kg/day, meat consumption rate INFANT
0.005	kg/day, egg consumption rate, INFANT
0.05	kg/day, fresh stuff consumption by chickens
0.001	kg/day, soil consumption by chickens
0.2	SOIL-TO-PLANT TRANSFER
224	KG/M <sup>2</sup> , SOIL SURFACE DENSITY

DOSE FROM FEEDING REGIME 1 PLUS OTHER PATHWAYS, RU/RU106 INFANT

month/ year	External Dose rem/mo	Inhalation Dose rem/mo	Human Soil Ingestion rem/mo	Human Soil Leafy Veg. rem/mo	Other Veg & Fruit rem/mc	15 day meat rem/mo	fresh eggs rem/mo	Regime 1 Milk dose rem/mo	1945
1/45	1.92E-09	7.30E-08	7.99E-10			1.1E-08	2.3E-11	2.4E-12	J
2/45	3.34E-09	5.92E-08	1.40E-09			8.6E-09	1.9E-11	2.8E-12	F
3/45	6.35E-09	1.22E-07	2.66E-09			1.7E-08	3.7E-11	5.5E-12	M
4/45	1.24E-08	2.45E-07	5.20E-09			3.0E-08	6.7E-11	1.1E-11	A
5/45	2.80E-08	6.21E-07	1.17E-08	2.4E-07	1.9E-07	3.5E-08	1.4E-10	2.5E-10	M
6/45	3.26E-08	2.46E-07	1.38E-08	9.4E-08	7.7E-08	2.8E-08	6.1E-11	2.2E-10	J
7/45	4.74E-08	6.33E-07	1.99E-08	2.4E-07	1.9E-07	7.1E-08	1.5E-10	5.2E-10	J
8/45	6.10E-08	6.25E-07	2.57E-08	2.4E-07	1.9E-07	7.0E-08	1.5E-10	5.1E-10	A
9/45	1.33E-07	2.88E-06	5.58E-08	1.1E-06	8.8E-07	1.7E-07	7.0E-10	1.3E-09	S
10/45	2.00E-07	2.85E-06	8.40E-08	3.9E-07	3.1E-07	3.5E-07	7.8E-10	1.5E-09	O
11/45	2.05E-07	6.57E-07	8.65E-08	3.7E-07	2.9E-07	9.2E-08	2.3E-10	1.4E-09	N
12/45	2.45E-07	1.94E-06	1.03E-07	3.5E-07	2.7E-07	2.8E-07	6.5E-10	1.4E-09	D

Pathway dose, r	9.76E-07	1.10E-05	4.11E-07	3.06E-06	2.40E-06	1.16E-06	3.01E-09	7.10E-09
% Contribution	5.14%	57.76%	2.16%	16.10%	12.66%	6.12%	0.02%	0.04%
Cumulative	9.76E-07	1.19E-05	1.23E-05	1.54E-05	1.78E-05	1.90E-05	1.90E-05	1.90E-05

1.90E-05 rem

RADIONUCLIDE/PATHWAY SCOPING STUDY

SCREENING CALCULATIONS: RU/RH103 ADULT  
 DOSES FROM VARIOUS PATHWAYS

ALLDOS3A

FROM "NUCREL1.WQ1"

Decay Corrected	18.25	18.25	RUNNING
X	D(END)	TOTAL ON	GROUND
Air conc	Surf con		
1/45	8.05E-09	6.26E-12	6.26E-12
2/45	5.24E-09	4.07E-12	7.76E-12
3/45	1.10E-08	8.51E-12	1.31E-11
4/45	2.58E-08	2E-11	2.78E-11
5/45	7.18E-08	5.58E-11	7.22E-11
6/45	2.89E-08	2.25E-11	6.5E-11
7/45	6.87E-08	5.34E-11	9.18E-11
8/45	6.89E-08	5.36E-11	1.08E-10
9/45	3.18E-07	2.47E-10	3.11E-10
10/45	2.91E-07	2.26E-10	4.09E-10
11/45	5.90E-08	4.59E-11	2.87E-10
12/45	1.89E-07	1.47E-10	3.16E-10

VARIABLE	description
0.5	kg/m2 dry, Y other veg & fruit
0.3	kg/m2 dry, Y pasture
0.3	kg/m2 dry, Y silage
0.2	kg/m2 dry, Y alfalfa & Leafy veg.
2.9	m2/kg, alpha
6E-07	d/l, TFmilk
0.5	l/d, IR ADULT
2.70E+03	Ingestion dose factor, rad/Ci, ADULT
30	days/month
0.0176	d-1, lambda rad
10.74	d, consumption integral, 30 days
0.002	day/kg, beef transfer factor
0.62	m2, surface area of bale
30	kg, mass of bale
9	kg/d dry, IR of hay, cow, FR 3 & 4
13	kg/m2, RHO usl (1 cm depth)
0.006	d/kg, egg transfer factor
0.0017	cow m3/s, cow inhalation rate
0.48	unitless, adjustment factor* (Zack 85)
0.0495	d-1, lambda dbda weathering
0.554	weathering correction factor, unitless
4200	rad/month per Ci/m2, External DF
7800	Inhalation dose factor, rad Ci, ADULT
0.0001	Soil Consumption Rate, kg/day, ADULT
0.000255	Breathing Rate, m3/sec, ADULT
0.006	Leafy Veg. Consumption, kg/d DRY, ADULT (20 kg/yr wet*12MO/8MO for seasonality)
0.067	Other veg. & fruit consumption, kg/d DRY, ADULT (81.5 kg/yr wet)
0.077	rad/sec per Ci/m3, Submersion DF
0.05	translocation factor, unitless
0.2	kg/day, meal consumption rate ADULT
0.035	kg/day, egg consumption rate, ADULT
0.05	kg/day, fresh stuff consumption by chickens
0.001	kg/day, soil consumption by chickens
0.2	SOIL-TO-PLANT TRANSFER
224	KG/M2, SOIL SURFACE DENSITY



DOSE FROM FEEDING REGIME 1 PLUS OTHER PATHWAYS. RU/RH103 ADULT

month/ year	External Dose		Inhalation Dose		Human Soil Leafy Veg. Ingestion		Other Veg & Fruit		15 day meat		fresh eggs		Regime 1 Milk dose		1945
	rem/mo	rem/mo	rem/mo	rem/mo	rem/mo	rem/mo	rem/mo	rem/mo	rem/mo	rem/mo	rem/mo	rem/mo	rem/mo	rem/mo	
1/45	2.69E-08	1.60E-08	3.90E-12						1.9E-09	8.3E-12	5.9E-14	J			
2/45	3.30E-08	1.04E-08	4.84E-12						1.2E-09	5.5E-12	5.2E-14	F			
3/45	5.58E-08	2.18E-08	8.16E-12						2.5E-09	1.1E-11	9.7E-14	M			
4/45	1.19E-07	5.13E-08	1.73E-11						5.2E-09	2.3E-11	2.2E-13	A			
5/45	3.09E-07	1.43E-07	4.50E-11	3.4E-08	1.9E-08				6.6E-09	5.4E-11	6.8E-12	M			
6/45	2.75E-07	5.75E-08	4.05E-11	1.4E-08	7.9E-09				5.3E-09	2.2E-11	5.8E-12	J			
7/45	3.91E-07	1.37E-07	5.72E-11	3.3E-08	1.9E-08				1.3E-08	5.2E-11	1.3E-11	J			
8/45	4.58E-07	1.37E-07	6.71E-11	3.3E-08	1.9E-08				1.3E-08	5.3E-11	1.3E-11	A			
9/45	1.33E-06	6.33E-07	1.94E-10	1.5E-07	8.8E-08				3.0E-08	2.5E-10	3.2E-11	S			
10/45	1.74E-06	5.78E-07	2.55E-10	4.3E-08	2.4E-08				5.9E-08	2.6E-10	2.9E-11	O			
11/45	1.21E-06	1.17E-07	1.79E-10	2.5E-08	1.4E-08				1.4E-08	6.3E-11	1.7E-11	N			
12/45	1.34E-06	3.76E-07	1.97E-10	1.5E-08	8.4E-09				4.5E-08	2.0E-10	1.1E-11	D			
Pathway dose, r	7.29E-06	2.28E-06	1.07E-09	3.50E-07	1.99E-07				1.96E-07	9.96E-10	1.27E-10				
% Contribution	70.68%	22.09%	0.01%	3.39%	1.93%				1.90%	0.01%	0.00%				
Cumulative	7.29E-06	9.57E-06	9.57E-06	9.92E-06	1.01E-05				1.03E-05	1.03E-05	1.03E-05				

1.03E-05 rem

RADIONUCLIDE/PATHWAY SCOPING STUDY

SCREENING CALCULATIONS: RU/RH103 INFANT  
DOSES FROM VARIOUS PATHWAYS

ALLDOS31

FROM "NUCREL1.WQ1"

Decay Corrected	18,25	18,25	D(END)	TOTAL ON
X	18,25	18,25	D(END)	TOTAL ON
Air conc	Surf con			GROUND
1/45	8.05E-09	6.26E-12	6.26E-12	6.26E-12
2/45	5.24E-09	4.07E-12	7.76E-12	7.76E-12
3/45	1.10E-08	8.51E-12	1.31E-11	1.31E-11
4/45	2.58E-08	2E-11	2.78E-11	2.78E-11
5/45	7.18E-08	5.58E-11	7.22E-11	7.22E-11
6/45	2.89E-08	2.25E-11	6.5E-11	6.5E-11
7/45	6.87E-08	5.34E-11	9.18E-11	9.18E-11
8/45	6.89E-08	5.36E-11	1.08E-10	1.08E-10
9/45	3.18E-07	2.47E-10	3.11E-10	3.11E-10
10/45	2.91E-07	2.26E-10	4.09E-10	4.09E-10
11/45	5.90E-08	4.59E-11	2.87E-10	2.87E-10
12/45	1.89E-07	1.47E-10	3.16E-10	3.16E-10

VARIABLE	description
0.5	kg/m2 dry, Y other veg & fruit
0.3	kg/m2 dry, Y pasture
0.3	kg/m2 dry, Y silage
0.2	kg/m2 dry, Y alfalfa & Leafy veg.
2.9	m2/kg, alpha
6E-07	d/l, TFmilk
1.0	l/d, IR INFNAT
2.80E+04	Ingestion dose factor, rad/Ci, INFANT
30	days/month
0.0176	d-1, lambda rad
10.74	d, consumption integral, 30 days
0.002	day/kg, beef transfer factor
0.62	m2, surface area of bale
30	kg, mass of bale
9	kg/d dry, IR of hay, cow, FR 3 & 4
13	kg/m2, RHO usl (1 cm depth)
0.006	d/kg, egg transfer factor
0.0017	cow m3/s, cow Inhalation rate
0.48	unitless, adjustment factor* (Zack 85)
0.0495	d-1, lambda da weathering
0.554	weathering correction factor, unitless
4200	rad/month per Ci/m2, External DF
81000	Inhalation dose factor, rad Ci, INFANT
0.001	Soil Consumption Rate, kg/day, INFANT
1.88E-05	Breathing Rate, m3/sec, INFANT
0.0023	Leafy Veg. Consumption, kg/d DRY, INFANT (5.5 kg/yr wet*12MO/BMO for seasonality)
0.0345	Other veg. & fruit consumption, kg/d DRY, INFANT (42 kg/yr wet)
0.077	rad/sec per Ci/m3, Submersion DF
0.05	translocation factor, unitless
0.045	kg/day, meat consumption rate INFANT
0.005	kg/day, egg consumption rate, INFANT
0.05	kg/day, fresh stuff consumption by chickens
0.001	kg/day, soil consumption by chickens
0.2	SOIL-TO-PLANT TRANSFER
224	KG/M2, SOIL SURFACE DENSITY

DOSE FROM FEEDING REGIME 1 PLUS OTHER PATHWAYS, RU/RH103 INFANT

month/ year	External Dose rem/mo	Inhalation Dose rem/mo	Human Soi Leafy Ingestir Veg. rem/mo	Other Veg & Fruit rem/mo	15 day meat rem/mo	fresh eggs rem/mo	Regime 1	
							Milk dose rem/mo	1945 rem/mo
1/45	2.69E-08	1.23E-08	4.04E-10		4.5E-09	1.2E-11	1.2E-12	J
2/45	3.30E-08	7.98E-09	5.02E-10		2.9E-09	8.1E-12	1.1E-12	F
3/45	5.58E-08	1.67E-08	8.46E-10		5.8E-09	1.6E-11	2.0E-12	M
4/45	1.19E-07	3.93E-08	1.79E-09		1.2E-08	3.4E-11	4.5E-12	A
5/45	3.09E-07	1.09E-07	4.66E-09	1.4E-07	1.5E-08	8.0E-11	1.4E-10	M
6/45	2.75E-07	4.40E-08	4.20E-09	5.4E-08	1.2E-08	3.3E-11	1.2E-10	J
7/45	3.91E-07	1.05E-07	5.93E-09	1.3E-07	2.9E-08	7.7E-11	2.6E-10	J
8/45	4.58E-07	1.05E-07	6.96E-09	1.3E-07	2.9E-08	7.8E-11	2.7E-10	A
9/45	1.33E-06	4.85E-07	2.01E-08	6.1E-07	7.1E-08	3.7E-10	6.7E-10	S
10/45	1.74E-06	4.43E-07	2.64E-08	1.7E-07	1.4E-07	3.8E-10	6.0E-10	O
11/45	1.21E-06	8.99E-08	1.86E-08	1.0E-07	3.2E-08	9.3E-11	3.5E-10	N
12/45	1.34E-06	2.88E-07	2.04E-08	5.9E-08	1.1E-07	2.9E-10	2.3E-10	D
Pathway dose, r	7.29E-06	1.74E-06	1.11E-07	1.39E-06	4.56E-07	1.48E-09	2.64E-09	
% Contribution	60.46%	14.47%	0.92%	11.53%	3.78%	0.01%	0.02%	
Cumulative	7.29E-06	9.04E-06	9.15E-06	1.05E-05	1.21E-05	1.21E-05	1.21E-05	

1.21E-05 rem

SCREENING CALCULATION ZR/NB 95 INFANT  
DOSES FROM VARIOUS PATHWAYS

ALLDO121

VARIAB	description	FROM "NUCREL1.WQ1"
0.5	kg/m2 dry, Y other veg & fruit	Decay Correcte 18,25
0.3	kg/m2 dry, Y pasture	18,25 TOTAL
0.3	kg/m2 dry, Y silage	X D(END) GROUN
0.2	kg/m2 dry, Y alfalfa & Leafy veg.	Air conc Surf con
2.9	m2/kg, alpha	1/45 1.64E-08 1.4E-11 1.4E-11
5.5E-07	d/l, TFmilk	2/45 1.18E-08 1.01E-11 2E-11
1.0	l/d, IR INFANT	3/45 2.44E-08 2.09E-11 3.6E-11
6E+04	Ingestion dose factor, rad/Ci, INFANT	4/45 5.38E-08 4.59E-11 7.2E-11
30	days/month	5/45 1.44E-07 1.23E-10 1.7E-10
0.0108	d-1, lambda rad	6/45 5.74E-08 4.91E-11 1.8E-10
10.74	d, consumption integral, 30 days	7/45 1.41E-07 1.21E-10 2.5E-10
1.2E-06	day/kg, beef transfer factor	8/45 1.41E-07 1.2E-10 3E-10
0.62	m2, surface area of bale	9/45 6.50E-07 5.55E-10 7.7E-10
30	kg, mass of bale	10/45 6.15E-07 5.25E-10 1.1E-09
9	kg/d dry, IR of hay, cow, FR 3 & 4	11/45 1.32E-07 1.13E-10 9E-10
13	kg/m2, RHO usl (1 cm depth)	12/45 4.08E-07 3.48E-10 1E-09
0.0002	d/kg, egg transfer factor	
0.0017	cow m3/s, cow inhalation rate	
0.48	unitless, adjustment factor* (Zack 85)	
0.0495	d-1, lambda weathering	
0.541	weathering correction factor, unitless	
13000	rad/month per Ci/m2, External DF	
230000	inhalation dose factor, rad Ci, INFANT	
0.001	Soil Consumption Rate, kg/day, INFANT	
1.66E-05	Breathing Rate, m3/sec, INFANT	
0.0023	Leafy Veg. Consumption, kg/d DRY, INFANT (5.5 kg/yr wet*12MO/BMO for seasonality)	
0.0345	Other veg. & fruit consumption, kg/d DRY, INFANT (20 kg/yr wet)	
0.25	rad/sec per Ci/m3, Submersion DF	
0.05	translocation factor, unitless	
0.045	kg/day, meat consumption rate INFANT	
0.005	kg/day, egg consumption rate, INFANT	
0.05	kg/day, fresh stuff consumption by chickens	
0.001	kg/day, soil consumption by chickens	
0.04	SOIL-TO-PLANT TRANSFER	
224	KG/M2, SOIL SURFACE DENSITY	

SCREENING CALCULATIONS: CO60 ADULT  
 DOSES FROM VARIOUS PATHWAYS

ALLDOS4A

FROM "NUCRELI.WQI"

Decay Corrected	RUNNING
18.25	TOTAL ON
X	D(END) GROUND
Air conc	Surf con
1/45 6.85E-12	6.81E-15 6.81E-15
2/45 5.67E-12	5.64E-15 1.24E-14
3/45 1.17E-11	1.16E-14 2.38E-14
4/45 2.31E-11	2.3E-14 4.66E-14
5/45 5.80E-11	5.77E-14 1.04E-13
6/45 2.29E-11	2.28E-14 1.25E-13
7/45 5.95E-11	5.91E-14 1.83E-13
8/45 5.86E-11	5.83E-14 2.4E-13
9/45 2.71E-10	2.69E-13 5.06E-13
10/45 2.70E-10	2.68E-13 7.69E-13
11/45 6.28E-11	6.25E-14 8.23E-13
12/45 1.85E-10	1.84E-13 9.98E-13

VARIABLE	description
0.5	kg/m2 dry, Y other veg & fruit
0.3	kg/m2 dry, Y pasture
0.3	kg/m2 dry, Y silage
0.2	kg/m2 dry, Y alfalfa & Leafy veg.
2.9	m2/kg, alpha
0.0001	dA, TFmilk
0.5	I/d, IR ADULT
1.00E+04	Ingestion dose factor, rad/Ci, ADULT
30	days/month
0.000361	d-1, lambda rad
10.74	d, consumption integral, 30 days
0.02	day/kg, beef transfer factor
0.62	m2, surface area of bale
30	kg, mass of bale
9	kg/d dry, IR of hay,cow, FR 3 & 4
13	kg/m2, RHO usd (1 cm depth)
0.1	d/kg, egg transfer factor
0.0017	cow m3/s, cow inhalation rate
0.48	unitless, adjustment factor* (Zack 65)
0.0495	d-1, lambda weathering
0.522	weathering correction factor, unitless
19000	rad/month per Ci/m2, External DF
150000	Inhalation dose factor, rad Ci, ADULT
0.0001	Soil Consumption Rate, kg/day, ADULT
0.000255	Breathing Rate, m3/sec, ADULT
0.006	Leafy Veg. Consumption, kg/d DRY, INFANT (20 kg/yr wet*12MO/8MO for seasonality)
0.067	Other veg. & fruit consumption, kg/d DRY, ADULT (81.5 kg/yr wet)
0.41	rad/sec per Ci/m3, Submersion DF
0.05	translocation factor, unitless
0.2	kg/day, meat consumption rate ADULT
0.035	kg/day, egg consumption rate, ADULT
0.05	kg/day, fresh stuff consumption by chickens
0.001	kg/day, soil consumption by chickens
0.1	SOIL-TO-PLANT TRANSFER
224	KG/M2, SOIL SURFACE DENSITY

DOSE FROM FEEDING REGIME 1 PLUS OTHER PATHWAYS, CO60 ADULT

month/ year	External Dose rem/mo	Inhalation Dose rem/mo	Human Soi Leafy Ingestion rem/mo	Other Veg & Fruit rem/mo	15 day meat rem/mo	fresh eggs rem/mo	Regime 1 Milk dose rem/mo	1945
1/45	1.32E-10	2.62E-10	1.57E-14		9.4E-11	5.3E-13	3.9E-14	J
2/45	2.38E-10	2.17E-10	2.86E-14		7.8E-11	4.4E-13	4.8E-14	F
3/45	4.58E-10	4.46E-10	5.50E-14		1.5E-10	8.7E-13	9.4E-14	M
4/45	8.94E-10	8.84E-10	1.07E-13		2.7E-10	1.5E-12	1.8E-13	A
5/45	1.99E-09	2.22E-09	2.39E-13	1.2E-10	3.1E-10	3.3E-12	4.1E-12	M
6/45	2.39E-09	8.77E-10	2.89E-13	4.8E-11	2.4E-10	1.4E-12	3.5E-12	J
7/45	3.51E-09	2.27E-09	4.23E-13	1.3E-10	6.3E-10	3.5E-12	8.4E-12	J
8/45	4.58E-09	2.24E-09	5.53E-13	1.2E-10	6.2E-10	3.5E-12	8.4E-12	A
9/45	9.73E-09	1.04E-08	1.17E-12	5.9E-10	1.5E-09	1.6E-11	2.2E-11	S
10/45	1.47E-08	1.03E-08	1.77E-12	2.1E-10	3.1E-09	1.8E-11	2.5E-11	O
11/45	1.57E-08	2.40E-09	1.90E-12	2.1E-10	8.3E-10	5.4E-12	2.5E-11	N
12/45	1.90E-08	7.06E-09	2.30E-12	2.0E-10	2.5E-09	1.5E-11	2.5E-11	D
Pathway dose, r	7.33E-08	3.95E-08	8.85E-12	1.63E-09	1.04E-08	6.95E-11	1.22E-10	
% Contribution	58.18%	31.38%	0.01%	1.29%	8.26%	0.06%	0.10%	
Cumulative	7.33E-08	1.13E-07	1.13E-07	1.15E-07	1.26E-07	1.26E-07	1.26E-07	

1.26E-07 rem

RADIONUCLIDE/PATHWAY SCOPING STUDY

ADULT

ALLDOSSA

SCREENING CALCULATIONS: XE133  
DOSES FROM VARIOUS PATHWAYS

FROM "NUCREL1.WQ1"

VARIABLE	description	Decay Corrected		TOTAL ON
		18,25	18,25	
		X	D(END)	GROUND
		Air conc	Surf con	
0.5	kg/m2 dry, Y other veg & fruit	1/45	3.17E-05	0
0.3	kg/m2 dry, Y pasture	2/45	4.17E-06	0
0.3	kg/m2 dry, Y silage	3/45	9.76E-06	0
0.2	kg/m2 dry, Y alfalfa & Leafy veg.	4/45	7.20E-05	0
2.9	m2/kg, alpha	5/45	3.98E-04	0
0	d/l, TFmilk	6/45	1.80E-04	0
0.5	l/d, IR ADULT	7/45	2.41E-04	0
0.00E+00	Ingestion dose factor, rad/Ci, ADULT	8/45	2.71E-04	0
30	days/month	9/45	1.25E-03	0
0.132	d-1, lambda rad	10/45	6.46E-04	0
10.74	d, consumption integral, 30 days	11/45	5.26E-05	0
0	day/kg, beef transfer factor	12/45	2.88E-04	0
0.62	m2, surface area of bale			
30	kg, mass of bale			
9	kg/d dry, IR of hay,cow, FR 3 & 4			
13	kg/m2, RHO usl (1 cm depth)			
0	d/kg, egg transfer factor			
0.0017	cow m3/s, cow inhalation rate			
0.48	unitless, adjustment factor* (Zack 85)			
0.0495	d-1, lambda weathering			
0.738	weathering correction factor, unitless			
0	rad/month per Ci/m2, External DF			
0	Inhalation dose factor, rad Ci, ADULT			
0.0001	Soil Consumption Rate, kg/day, ADULT			
0.000255	Breathing Rate, m3/sec, ADULT			
0.006	Leafy Veg. Consumption, kg/d DRY, INFANT (20 kg/yr wet*12MO/8MO for seasonality)			
0.067	Other veg. & fruit consumption, kg/d DRY, ADULT (81.5 kg/yr wet)			
0.0056	rad/sec per Ci/m3, Submersion DF			
0.05	translocation factor, unitless			
0.2	kg/day, meat consumption rate ADULT			
0.035	kg/day, egg consumption rate, ADULT			
0.05	kg/day, fresh stuff consumption by chickens			
0.001	kg/day, soil consumption by chickens			
0	SOIL-TO-PLANT TRANSFER			
224	KG/M2, SOIL SURFACE DENSITY			

DOSE FROM FEEDING REGIME 1 PLUS OTHER PATHWAYS, XE133 ADULT

month/ year	External Dose rem/mo	Inhalation Dose rem/mo	Human Soi Ingestion rem/mo	Leafy Veg. rem/mo	Other Veg & Fruit rem/mo	15 day meat rem/mo	fresh eggs rem/mo	Regime 1 Milk dose rem/mo	1945
1/45	1.77E-07	0.00E+00	0.00E+00			0.0E+00	0.0E+00	0.0E+00	J
2/45	2.33E-08	0.00E+00	0.00E+00			0.0E+00	0.0E+00	0.0E+00	F
3/45	5.47E-08	0.00E+00	0.00E+00			0.0E+00	0.0E+00	0.0E+00	M
4/45	4.03E-07	0.00E+00	0.00E+00			0.0E+00	0.0E+00	0.0E+00	A
5/45	2.23E-06	0.00E+00	0.00E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	M
6/45	1.01E-06	0.00E+00	0.00E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	J
7/45	1.35E-06	0.00E+00	0.00E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	J
8/45	1.52E-06	0.00E+00	0.00E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	A
9/45	7.01E-06	0.00E+00	0.00E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	S
10/45	3.62E-06	0.00E+00	0.00E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	O
11/45	2.95E-07	0.00E+00	0.00E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	N
12/45	1.67E-06	0.00E+00	0.00E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	D

Pathway dose, r 1.94E-05 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00  
 % Contribution 100.00% 0.00% 0.00% 0.00% 0.00% 0.00% 0.00% 0.00% 0.00%  
 Cumulative 1.94E-05 1.94E-05 1.94E-05 1.94E-05 1.94E-05 1.94E-05 1.94E-05 1.94E-05 1.94E-05

1.94E-05 rem



DOSES FROM VARIOUS PATHWAYS

FROM "NUCREL1.WG1"

VARIABLE	description	Decay Corrected		RUNNING
		18,25	18,25	
		X	D(ENL)	GROUND
		Air conc	Surf con	
0.5	kg/m2 dry, Y other veg & fruit	1/45	4.04E-06	0
0.3	kg/m2 dry, Y pasture	2/45	3.36E-06	0
0.3	kg/m2 dry, Y silage	3/45	6.91E-06	0
0.2	kg/m2 dry, Y alfalfa & Leafy veg.	4/45	1.36E-05	0
2.9	m2/kg, alpha	5/45	3.41E-05	0
0	d/l, TFmilk	6/45	1.35E-05	0
0.5	l/d, IR ADULT	7/45	3.51E-05	0
0.00E+00	ingestion dose factor, rad/Ci, ADULT	8/45	3.46E-05	0
30	days/month	9/45	1.60E-04	0
0.000177	d-1, lambda da rad	10/45	1.59E-04	0
10.74	d, consumption integral, 30 days	11/45	3.72E-05	0
0	day/kg, beef transfer factor	12/45	1.09E-04	0
0.62	m2, surface area of bale			
30	kg, mass of bale			
9	kg/d dry, IR of hay,cow, FR 3 & 4			
13	kg/m2, RHO usl (1 cm depth)			
0	d/kg, egg transfer factor			
0.0017	cow m3/s, cow inhalation rate			
0.48	unitless, adjustment factor* (Zack 85)			
0.0495	d-1, lambda dba weathering			
0.521	weathering correction factor, unitless			
0	rad/month per Ci/m2, External DF			
0	Inhalation dose factor, rad Ci, ADULT			
0.0001	Soil Consumption Rate, kg/day, ADULT			
0.000255	Breathing Rate, m3/sec, ADULT			
0.006	Leafy Veg. Consumption, kg/d DRY, INFANT (20 kg/yr wet*12MO/BMO for seasonality)			
0.067	Other veg. & fruit consumption, kg/d DRY, ADULT (61.5 kg/yr wet)			
0.00036	rad/sec per Ci/m3, Submersion DF			
0.05	translocation factor, unitless			
0.2	kg/day, meat consumption rate ADULT			
0.035	kg/day, egg consumption rate, ADULT			
0.05	kg/day, fresh stuff consumption by chickens			
0.001	kg/day, soil consumption by chickens			
0	SOIL-TO-PLANT TRANSFER			
224	KG/M2, SOIL SURFACE DENSITY			

DOSE FROM FEEDING REGIME 1 PLUS OTHER PATHWAYS, KR85 ADULT

month/ year	External Dose rem/mo	Inhalation Dose rem/mo	Human Soi Ingestion rem/mo	Leafy Veg. rem/mo	Other Veg & Fruit rem/mo	15 day meat rem/mo	fresh eggs rem/mo	Regime 1 Milk dose rem/mo	1945
1/45	1.45E-09	0.00E+00	0.00E+00			0.0E+00	0.0E+00	0.0E+00	J
2/45	1.21E-09	0.00E+00	0.00E+00			0.0E+00	0.0E+00	0.0E+00	F
3/45	2.49E-09	0.00E+00	0.00E+00			0.0E+00	0.0E+00	0.0E+00	M
4/45	4.91E-09	0.00E+00	0.00E+00			0.0E+00	0.0E+00	0.0E+00	A
5/45	1.23E-08	0.00E+00	0.00E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	M
6/45	4.86E-09	0.00E+00	0.00E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	J
7/45	1.26E-08	0.00E+00	0.00E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	J
8/45	1.24E-08	0.00E+00	0.00E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	A
9/45	5.74E-08	0.00E+00	0.00E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	S
10/45	5.73E-08	0.00E+00	0.00E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	O
11/45	1.34E-08	0.00E+00	0.00E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	N
12/45	3.93E-08	0.00E+00	0.00E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	D

Pathway dose, r 2.20E-07 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00 0.00E+00

% Contribution 100.00% 0.00% 0.00% 0.00% 0.00% 0.00% 0.00% 0.00% 0.00%

Cumulative 2.20E-07 2.20E-07 2.20E-07 2.20E-07 2.20E-07 2.20E-07 2.20E-07 2.20E-07 2.20E-07

2.20E-07 rem

SCREENING CALCULATIONS: CE/PR144 ADULT  
 DOSES FROM VARIOUS PATHWAYS

ALLDOS7A

FROM "NUCRELI.WG01"

Decay Corrected	18,25	18,25	TOTAL ON
RUNNING	X	D(END)	GROUND
Air conc	Surf con		
1/45	6.33E-09	8.03E-12	8.03E-12
2/45	6.70E-09	6.46E-12	1.39E-11
3/45	1.38E-08	1.33E-11	2.62E-11
4/45	2.79E-08	2.69E-11	5.13E-11
5/45	7.09E-08	6.84E-11	1.16E-10
6/45	2.81E-08	2.71E-11	1.35E-10
7/45	7.21E-08	6.96E-11	1.95E-10
8/45	7.13E-08	6.87E-11	2.5E-10
9/45	3.29E-07	3.17E-10	5.5E-10
10/45	3.24E-07	3.13E-10	8.24E-10
11/45	7.44E-08	7.17E-11	8.37E-10
12/45	2.21E-07	2.13E-10	9.91E-10

VARIABLE	description
0.5	kg/m2 dry, Y other veg & fruit
0.3	kg/m2 dry, Y pasture
0.3	kg/m2 dry, Y silage
0.2	kg/m2 dry, Y alfalfa & Leaty veg.
2.9	m2/kg, alpha
6E-07	d/l, Tfmilk
0.5	l/d, IR ADULT
2.00E+04	Ingestion dose factor, rad/Ci, ADULT
30	days/month
0.00244	d-1, lambda da rad
10.74	d, consumption integral, 30 days
0.002	day/kg, beef transfer factor
0.62	m2, surface area of bale
30	kg, mass of bale
9	kg/d dry, IR of hay, cow, FR 3 & 4
13	kg/m2, RHO usl (1 cm depth)
0.005	d/kg, egg transfer factor
0.0017	cow m3/s, cow inhalation rate
0.48	unitless, adjustment factor* (Zack 85)
0.0495	d-1, lambda da weathering
0.525	weathering correction factor, unitless
430	rad/month per Ci/m2, External DF
350000	Inhalation dose factor, rad Ci, ADULT
0.0001	Soil Consumption Rate, kg/day, ADULT
0.00255	Breathing Rate, m3/sec, ADULT
0.006	Leafy Veg. Consumption, kg/d DRY, ADULT (20 kg/yr wet*12MO/6MO for seasonality)
0.067	Other veg. & fruit consumption, kg/d DRY, ADULT (81.5 kg/yr wet)
0.0086	rad/sec per Ci/m3, Submersion DF
0.05	translocation factor, unitless
0.2	kg/day, meat consumption rate ADULT
0.035	kg/day, egg consumption rate, ADULT
0.05	kg/day, fresh stuff consumption by chickens
0.001	kg/day, soil consumption by chickens
0.04	SOIL-TO-PLANT TRANSFER
224	KG/M2, SOIL SURFACE DENSITY

DOSE FROM FEEDING REGIME 1 PLUS OTHER PATHWAYS, CE/PR144 ADULT

month/ year	External Dose rem/mo	Inhalation Dose rem/mo	Human Soi Ingestion rem/mo	Leafy Veg. rem/mo	Other Veg & Fruit rem/mo	15 day meat rem/mo	fresh eggs rem/mo	Regime 1 Milk dose rem/mo	1945
1/45	3.52E-09	7.43E-07	3.71E-11			2.2E-08	6.2E-11	5.5E-13	J
2/45	6.05E-09	5.98E-07	6.43E-11			1.7E-08	5.1E-11	6.5E-13	F
3/45	1.14E-08	1.23E-06	1.21E-10			3.4E-08	1.0E-10	1.3E-12	M
4/45	2.23E-08	2.49E-06	2.37E-10			6.2E-08	1.8E-10	2.5E-12	A
5/45	5.05E-08	6.33E-06	5.36E-10	2.9E-07	1.6E-07	7.1E-08	3.9E-10	5.9E-11	M
6/45	5.83E-08	2.51E-06	6.23E-10	1.2E-07	6.6E-08	5.6E-08	1.6E-10	5.0E-11	J
7/45	8.45E-08	6.44E-06	9.00E-10	3.0E-07	1.7E-07	1.4E-07	4.1E-10	1.2E-10	J
8/45	1.08E-07	6.36E-06	1.15E-09	2.9E-07	1.7E-07	1.4E-07	4.1E-10	1.2E-10	A
9/45	2.39E-07	2.94E-05	2.54E-09	1.4E-06	7.8E-07	3.4E-07	1.9E-09	3.1E-10	S
10/45	3.57E-07	2.89E-05	3.80E-09	4.8E-07	2.7E-07	7.2E-07	2.1E-09	3.4E-10	O
11/45	3.61E-07	6.64E-06	3.86E-09	4.5E-07	2.5E-07	1.9E-07	6.2E-10	3.2E-10	N
12/45	4.28E-07	1.97E-05	4.57E-09	4.2E-07	2.3E-07	5.8E-07	1.7E-09	3.0E-10	D

Pathway dose, r 1.73E-06 1.11E-04 1.84E-08 3.73E-06 2.10E-06 2.37E-06 8.12E-09 1.62E-09

% Contribution 1.43% 91.79% 0.02% 3.08% 1.73% 1.95% 0.01% 0.00%

Cumulative 1.73E-06 1.13E-04 1.13E-04 1.17E-04 1.19E-04 1.21E-04 1.21E-04 1.21E-04

1.21E-04 rem

SCREENING CALCULATIONS: CE/PRI44 INFANT  
DOSES FROM VARIOUS PATHWAYS

ALLDOS7I

FROM "NUCRELI.WQI"

Decay Corrected	RUNNING		
18,25	18,25		
TOTAL ON	TOTAL ON		
X	D(END) GROUND		
Air conc	Surf con		
1/45	8.33E-09	8.03E-12	8.03E-12
2/45	6.70E-09	6.46E-12	1.39E-11
3/45	1.38E-08	1.33E-11	2.62E-11
4/45	2.79E-08	2.69E-11	5.13E-11
5/45	7.09E-08	6.84E-11	1.16E-10
6/45	2.81E-08	2.71E-11	1.35E-10
7/45	7.21E-08	6.96E-11	1.95E-10
8/45	7.13E-08	6.87E-11	2.5E-10
9/45	3.29E-07	3.17E-10	5.5E-10
10/45	3.24E-07	3.13E-10	8.24E-10
11/45	7.44E-08	7.17E-11	8.37E-10
12/45	2.21E-07	2.13E-10	9.91E-10

VARIABLE	description
0.5	kg/m2 dry, Y other veg & fruit
0.3	kg/m2 dry, Y pasture
0.3	kg/m2 dry, Y silage
0.2	kg/m2 dry, Y alfalfa & Leafy veg.
2.9	m2/kg, alpha
6E-07	d/l, TFmilk
1.0	l/d, IR INFANT
3.00E+05	Ingestion dose factor, rad/Ci, INFANT
30	days/month
0.00244	d-1, lambda da rad
10.74	d, consumption integral, 30 days
0.002	day/kg, beef transfer factor
0.62	m2, surface area of bale
30	kg, mass of bale
9	kg/d dry, IR of hay,cow, FR 3 & 4
13	kg/m2, RHO usl (1 cm depth)
0.005	d/kg, egg transfer factor
0.0017	cow m3/s, cow inhalation rate
0.48	unitless, adjustment factor* (Zack 85)
0.0495	d-1, lambda da weathering
0.525	weathering correction factor, unitless
430	rad/month per Ci/m2, External DF
2900000	Inhalation dose factor, rad Ci, INFANT
0.001	Soil Consumption Rate, kg/day, INFANT
1.88E-05	Breathing Rate, m3/sec, INFANT
0.0023	Leafy Veg. Consumption, kg/d DRY, INFANT (5.5 kg/yr wet*12MO/8MO for seasonality)
0.0345	Other veg. & fruit consumption, kg/d DRY, INFANT (20 kg/yr wet)
0.0086	rad/sec per Ci/m3, Submersion DF
0.05	translocation factor, unitless
0.045	kg/day, meat consumption rate INFANT
0.005	kg/day, egg consumption rate, INFANT
0.05	kg/day, fresh stuff consumption by chickens
0.001	kg/day, soil consumption by chickens
0.04	SOIL-TO-PLANT TRANSFER
224	KG/M2, SOIL SURFACE DENSITY

DOSE FROM FEEDING REGIME 1 PLUS OTHER PATHWAYS, CE/PR144 INFANT

month/ year	External Dose rem/mo	Inhalation Dose rem/mo	Human Soil Ingestion rem/mo	Leafy Veg. rem/mo	Other Veg & Fruit rem/mo	15 day meat rem/mo	fresh eggs rem/mo	Regime 1 Milk dose rem/mo	1945
1/45	3.52E-09	4.54E-07	5.56E-09			7.3E-08	1.3E-10	1.6E-11	J
2/45	6.05E-09	3.65E-07	9.64E-09			5.9E-08	1.1E-10	1.9E-11	F
3/45	1.14E-08	7.52E-07	1.82E-08			1.2E-07	2.2E-10	3.8E-11	M
4/45	2.23E-08	1.52E-06	3.55E-08			2.1E-07	3.9E-10	7.5E-11	A
5/45	5.05E-08	3.87E-06	8.04E-08	1.7E-06	1.3E-06	2.4E-07	8.4E-10	1.8E-09	M
6/45	5.83E-08	1.53E-06	9.35E-08	6.7E-07	5.1E-07	1.9E-07	3.5E-10	1.5E-09	J
7/45	8.45E-08	3.93E-06	1.35E-07	1.7E-06	1.3E-06	4.9E-07	8.7E-10	3.6E-09	J
8/45	1.08E-07	3.89E-06	1.73E-07	1.7E-06	1.3E-06	4.8E-07	8.7E-10	3.6E-09	A
9/45	2.39E-07	1.79E-05	3.80E-07	8.0E-06	6.0E-06	1.2E-06	4.0E-09	9.2E-09	S
10/45	3.57E-07	1.77E-05	5.70E-07	2.8E-06	2.1E-06	2.4E-06	4.5E-09	1.0E-08	O
11/45	3.61E-07	4.05E-06	5.80E-07	2.6E-06	1.9E-06	6.3E-07	1.3E-09	9.5E-09	N
12/45	4.28E-07	1.20E-05	6.86E-07	2.4E-06	1.8E-06	1.9E-06	3.7E-09	9.1E-09	D
Pathway dose, r	1.73E-06	6.80E-05	2.77E-06	2.15E-05	1.62E-05	8.00E-06	1.74E-08	4.86E-08	
% Contribution	1.46%	57.52%	2.34%	18.16%	13.70%	6.76%	0.01%	0.04%	
Cumulative	1.73E-06	6.98E-05	7.25E-05	9.40E-05	1.10E-04	1.18E-04	1.18E-04	1.18E-04	
									1.18E-04 rem

RADIONUCLIDE/PATHWAY SCOPING STUDY

ADULT

SCREENING CALCULATIONS: I132  
DOSES FROM VARIOUS PATHWAYS

ALLDOS8A

FROM "NUCRELI.WGI"

VARIABLE	description	Decay Corrected		RUNNING	
		18,25	18,25	TOTAL ON	GROUND
0.5	kg/m2 dry, Y other veg & fruit	X	D(END)		
0.3	kg/m2 dry, Y pasture	Air conc	Surf con		
0.3	kg/m2 dry, Y silage	1/45	6.67E-07	3.07E-11	3.07E-11
0.2	kg/m2 dry, Y alfalfa & Leafy veg.	2/45	2.78E-08	1.28E-12	1.28E-12
2.9	m2/kg, alpha	3/45	7.06E-08	3.26E-12	3.26E-12
0.0092	d/l, TFmilk	4/45	1.18E-06	5.46E-11	5.46E-11
0.5	l/d, IR ADULT	5/45	1.07E-05	4.94E-10	4.94E-10
5.70E+02	Ingestion dose factor, rad/Ci, ADULT	6/45	5.25E-06	2.42E-10	2.42E-10
30	days/month	7/45	4.68E-06	2.16E-10	2.16E-10
7.23	d-1, lambda rad	8/45	5.71E-06	2.63E-10	2.63E-10
10.74	d, consumption integral, 30 days	9/45	2.63E-05	1.21E-09	1.21E-09
0.01	day/kg, beef transfer factor	10/45	9.02E-06	4.16E-10	4.16E-10
0.62	m2, surface area of bale	11/45	3.81E-07	1.75E-11	1.75E-11
30	kg, mass of bale	12/45	3.26E-06	1.5E-10	1.5E-10
9	kg/d dry, IR of hay,cow, FR 3 & 4				
13	kg/m2, RHO usl (1 cm depth)				
4.4	d/kg, egg transfer factor				
0.0017	cow m3/s, cow inhalation rate				
0.48	unitless, adjustment factor* (Zack 85)				
0.0495	d-1, lambda rad weathering				
0.993	weathering correction factor, unitless				
19000	rad/month per Ci/m2, External DF				
330	Inhalation dose factor, rad Ci, ADULT				
0.0001	Soil Consumption Rate, kg/day, ADULT				
0.000255	Breathing Rate, m3/sec, ADULT				
0.006	Leafy Veg. Consumption, kg/d DRY, ADULT (20 kg/yr wet*12MO/8MO FOR SEASONALITY)				
0.067	Other veg. & fruit consumption, kg/d DRY, ADULT (81.5 kg/yr wet*12/8 MO)				
0.38	rad/sec per Ci/m3, Submersion DF				
0.05	translocation factor, unitless				
0.2	kg/day, meat consumption rate ADULT				
0.035	kg/day, egg consumption rate, ADULT				
0.05	kg/day, fresh stuff consumption by chickens				
0.001	kg/day, soil consumption by chickens				
0.4	SOIL-TO-PLANT TRANSFER				
224	KG/M2, SOIL SURFACE DENSITY				

DOSE FROM FEEDING REGIME 1 PLUS OTHER PATHWAYS, 1 132 ADULT

month/ year	External Dose rem/mo	Inhalation Dose rem/mo	Human Soi Leafy Ingestion rem/mo	Other Veg & Fruit rem/mo	15 day meat rem/mo	fresh eggs rem/mo	Regime 1 Milk dose rem/mo	1945
1/45	8.37E-07	5.61E-08	4.04E-12		1.8E-55	1.1E-08	2.3E-09	J
2/45	3.49E-08	2.34E-09	1.68E-13		7.7E-57	4.7E-10	9.5E-11	F
3/45	8.87E-08	5.94E-09	4.28E-13		1.9E-56	1.1E-09	2.4E-10	M
4/45	1.49E-06	9.97E-08	7.19E-12		2.8E-55	1.7E-08	4.0E-09	A
5/45	1.35E-05	9.02E-07	6.50E-11	1.1E-07	1.1E-54	1.3E-07	3.6E-07	M
6/45	6.59E-06	4.42E-07	3.18E-11	5.6E-08	1.1E-54	6.4E-08	3.4E-07	J
7/45	5.87E-06	3.93E-07	2.84E-11	5.0E-08	1.0E-54	5.7E-08	3.0E-07	J
8/45	7.17E-06	4.80E-07	3.46E-11	6.1E-08	1.2E-54	7.0E-08	3.7E-07	A
9/45	3.31E-05	2.22E-06	1.60E-10	2.9E-07	2.9E-54	3.4E-07	9.2E-07	S
10/45	1.13E-05	7.59E-07	5.47E-11	8.2E-55	2.1E-54	1.3E-07	2.8E-08	O
11/45	4.78E-07	3.20E-08	2.31E-12	5.2E-149	1.0E-55	6.2E-09	1.2E-09	N
12/45	4.09E-06	2.74E-07	1.97E-11	3.3E-243	9.0E-55	5.5E-08	1.0E-08	D
Pathway dose, r	8.45E-05	5.66E-06	4.08E-10	5.67E-07	1.10E-53	8.78E-07	2.32E-06	
% Contribution	89.65%	6.01%	0.00%	0.60%	0.00%	0.93%	2.46%	
Cumulative	8.45E-05	9.02E-05	9.08E-05	9.11E-05	9.11E-05	9.20E-05	9.43E-05	

9.43E-05 rem



SCREENING CALCULATIONS: I 132  
DOSES FROM VARIOUS PATHWAYS

VARIABLE	description
0.5	kg/m2 dry, Y other veg & fruit
0.3	kg/m2 dry, Y pasture
0.3	kg/m2 dry, Y silage
0.2	kg/m2 dry, Y alfalfa & Leaty veg.
2.9	m2/kg, alpha
0.0092	d/l, TFmilk
1.0	l/d, IR INFANT
1.50E+05	ingestion dose factor, rad/Ci, INFANT
30	days/month
7.23	d-1, lambda rad
10.74	d, consumption integral, 30 days
0.01	day/kg, beef transfer factor
0.62	m2, surface area of bale
30	kg, mass of bale
9	kg/d dry, IR of hay,cow, FR 3 & 4
13	kg/m2, RHO us1 (1 cm depth)
4.4	d/kg, egg transfer factor
0.0017	cow m3/s, cow inhalation rate
0.48	unitless, adjustment factor* (Zack 85)
0.0495	d-1, lambda dba weathering
0.993	weathering correction factor, unitless
19000	rad/month per Ci/m2, External DF
67000	Inhalation dose factor, rad Ci, INFANT
0.001	Soil Consumption Rate, kg/day, INFANT
1.88E-05	Breathing Rate, m3/sec, INFANT
0.0023	Leafy Veg. Consumption, kg/d DRY, INFANT(5.5 kg/yr wet*12/8 MO FOR SEASONALITY)
0.0345	Other veg. & fruit consumption, kg/d DRY, INFANT(42 kg/yr wet*12/8 MO)
0.38	rad/sec per Ci/m3, Submersion DF
0.05	translocation factor, unitless
0.045	kg/day, meat consumption rate INFANT
0.005	kg/day, egg consumption rate, INFANT
0.05	kg/day, fresh stuff consumption by chickens
0.001	kg/day, soil consumption by chickens
0.4	SOIL-TO-PLANT TRANSFER
.224	KG/M2, SOIL SURFACE DENSITY

FROM "NUCREL1.WGI"

Decay Corrected	18,25	18,25	RUNNING
X	D(END)	GROUND	TOTAL ON
Air conc	Surf con		
1/45	6.67E-07	3.07E-11	3.07E-11
2/45	2.78E-08	1.28E-12	1.28E-12
3/45	7.06E-08	3.26E-12	3.26E-12
4/45	1.18E-06	5.46E-11	5.46E-11
5/45	1.07E-05	4.94E-10	4.94E-10
6/45	5.25E-06	2.42E-10	2.42E-10
7/45	4.68E-06	2.16E-10	2.16E-10
8/45	5.71E-06	2.63E-10	2.63E-10
9/45	2.63E-05	1.21E-09	1.21E-09
10/45	9.02E-06	4.16E-10	4.16E-10
11/45	3.81E-07	1.75E-11	1.75E-11
12/45	3.26E-06	1.5E-10	1.5E-10

DOSE FROM FEEDING REGIME 1 PLUS OTHER PATHWAYS, I 132 INFANT

month/ year	External Dose rem/mo	Inhalation Dose rem/mo	Human Soil Leafy Ingestion rem/mo	Other Veg & Fruit rem/mo	15 day meat rem/mo	fresh eggs rem/mo	Regime 1 Milk dose rem/mo	1945
1/45	8.37E-07	8.40E-07	1.06E-08		1.1E-53	4.2E-07	1.2E-06	J
2/45	3.49E-08	3.50E-08	4.43E-10		4.6E-55	1.8E-08	5.0E-08	F
3/45	8.87E-08	8.90E-08	1.13E-09		1.1E-54	4.3E-08	1.3E-07	M
4/45	1.49E-06	1.49E-06	1.89E-08		1.6E-53	6.4E-07	2.1E-06	A
5/45	1.35E-05	1.35E-05	1.71E-07	8.7E-06	6.8E-53	4.9E-06	1.9E-04	M
6/45	6.59E-06	6.61E-06	8.37E-08	4.3E-06	6.6E-53	2.4E-06	1.8E-04	J
7/45	5.87E-06	5.89E-06	7.46E-08	3.8E-06	5.9E-53	2.2E-06	1.6E-04	J
8/45	7.17E-06	7.19E-06	9.11E-08	4.7E-06	7.2E-53	2.6E-06	1.9E-04	A
9/45	3.31E-05	3.32E-05	4.20E-07	2.2E-05	1.7E-52	1.3E-05	4.8E-04	S
10/45	1.13E-05	1.14E-05	1.44E-07	6.3E-53	1.3E-52	4.9E-06	1.5E-05	O
11/45	4.78E-07	4.79E-07	6.07E-09	4.0E-147	6.0E-54	2.3E-07	6.2E-07	N
12/45	4.09E-06	4.10E-06	5.20E-08	3.3E-241	5.3E-53	2.1E-06	5.3E-06	D
Pathway dose, r	8.45E-05	8.48E-05	1.07E-06	4.36E-05	6.51E-52	3.30E-05	1.22E-03	
% Contribution	5.54%	5.55%	0.07%	3.75%	0.00%	2.16%	80.08%	
Cumulative	8.45E-05	1.69E-04	1.70E-04	2.71E-04	2.71E-04	3.04E-04	1.53E-03	
							1.53E-03 rem	

SCREENING CALCULATIONS: PU239 ADULT  
 DOSES FROM VARIOUS PATHWAYS

ALLDOS9A

FROM "NUCREL1.WG1"

VARIABLE	description	Decay Corrected		RUNNING	
		18,25	18,25	TOTAL ON	GROUND
0.5	kg/m2 dry, Y other veg & fruit	8.45E-12	8.45E-15	8.45E-15	8.45E-15
0.3	kg/m2 dry, Y pasture	7.04E-12	7.04E-15	1.55E-14	1.55E-14
0.3	kg/m2 dry, Y silage	1.45E-11	1.45E-14	3E-14	3E-14
0.2	kg/m2 dry, Y alfalfa & Leaty veg.	2.66E-11	2.66E-14	5.85E-14	5.85E-14
2.9	m2/kg, alpha	7.15E-11	7.15E-14	1.3E-13	1.3E-13
1E-07	d/l, TFmilk	2.83E-11	2.83E-14	1.58E-13	1.58E-13
0.5	l/d, IR ADULT	7.34E-11	7.34E-14	2.32E-13	2.32E-13
4.30E+06	Ingestion dose factor, rad/Ci, ADULT	7.24E-11	7.24E-14	3.04E-13	3.04E-13
30	days/month	3.34E-10	3.34E-13	6.38E-13	6.38E-13
7.87E-08	d-1, lambda rad	3.33E-10	3.33E-13	9.72E-13	9.72E-13
10.74	d, consumption integral, 30 days	7.79E-11	7.79E-14	1.05E-12	1.05E-12
2E-06	day/kg, beef transfer factor	2.29E-10	2.29E-13	1.28E-12	1.28E-12
0.62	m2, surface area of bale				
30	kg, mass of bale				
9	kg/d dry, IR of hay,cow, FR 3 & 4				
13	kg/m2, RHO usl (1 cm depth)				
0.008	d/kg, egg transfer factor				
0.0017	cow m3/s, cow inhalation rate				
0.48	unitless, adjustment factor* (Zack 85)				
0.0495	d-1, lambda dba weathering				
0.521	weathering correction factor, unitless				
3.2	rad/month per Ci/m2, External DF				
5.1E+08	Inhalation dose factor, rad Ci, ADULT				
0.0001	Soil Consumption Rate, kg/day, ADULT				
0.000255	Breathing Rate, m3/sec, ADULT				
0.006	Leaty Veg. Consumption, kg/d DRY, ADULT (20 kg/yr wet*12MO/8MO for seasonality)				
0.067	Other veg. & fruit consumption, kg/d DRY, ADULT (81.5 kg/yr wet)				
1.3E-05	rad/sec per Ci/m3, Submersion DF				
0.05	translocation factor, unitless				
0.2	kg/day, meat consumption rate ADULT				
0.035	kg/day, egg consumption rate, ADULT				
0.05	kg/day, fresh stuff consumption by chickens				
0.001	kg/day, soil consumption by chickens				
0.0004	SOIL-TO-PLANT TRANSFER				
224	KG/M2, SOIL SURFACE DENSITY				

DOSE FROM FEEDING REGIME 1 PLUS OTHER PATHWAYS, PU239 ADULT

month/ year	External Dose		Inhalation Dose		Human Soil Leafy Veg. Ingestion		Other Veg & Fruit		15 day meat		fresh eggs		Regime 1 Milk dose	
	rem/mo	rem/mo	rem/mo	rem/mo	rem/mo	rem/mo	rem/mo	rem/mo	rem/mo	rem/mo	rem/mo	rem/mo	rem/mo	rem/mo
1/45	2.72E-14	1.10E-06	8.39E-12						5.0E-12	2.2E-11	2.1E-14	J		
2/45	4.97E-14	9.16E-07	1.54E-11						4.2E-12	1.9E-11	2.6E-14	F		
3/45	9.61E-14	1.88E-06	2.97E-11						8.3E-12	3.7E-11	5.1E-14	M		
4/45	1.88E-13	3.71E-06	5.81E-11						1.4E-11	6.5E-11	9.9E-14	A		
5/45	4.17E-13	9.30E-06	1.29E-10	6.5E-08	3.6E-08	1.6E-11	1.4E-10	2.2E-12	1.9E-12	5.9E-11	1.9E-12	J		
6/45	5.07E-13	3.68E-06	1.57E-10	2.6E-08	1.4E-08	1.3E-11	5.9E-11	1.9E-12	4.5E-12	1.5E-10	4.5E-12	J		
7/45	7.43E-13	9.55E-06	2.30E-10	6.7E-08	3.7E-08	3.4E-11	1.5E-10	4.5E-12	4.5E-12	1.5E-10	4.5E-12	A		
8/45	9.74E-13	9.41E-06	3.02E-10	6.6E-08	3.7E-08	3.3E-11	1.5E-10	4.5E-12	8.0E-11	6.8E-10	1.2E-11	S		
9/45	2.05E-12	4.35E-05	6.33E-10	3.1E-07	1.7E-07	8.0E-11	1.7E-10	7.7E-10	1.7E-10	7.7E-10	1.4E-11	O		
10/45	3.11E-12	4.34E-05	9.64E-10	1.1E-07	6.2E-08	1.7E-10	2.3E-10	1.3E-11	4.5E-11	2.3E-10	1.3E-11	N		
11/45	3.36E-12	1.01E-05	1.04E-09	1.1E-07	6.2E-08	4.5E-11	1.4E-10	1.4E-10	1.4E-10	6.4E-10	1.4E-11	D		
12/45	4.09E-12	2.57E-05	1.27E-09	1.1E-07	6.2E-08	1.4E-10	1.4E-10	1.4E-10	5.58E-10	2.97E-09	6.55E-11			
Pathway dose, r	1.56E-11	1.66E-04	4.84E-09	8.72E-07	4.87E-07	5.58E-10	2.97E-09	6.55E-11	0.00%	99.18%	0.00%	0.00%	0.00%	0.00%
% Contribution	0.00%	99.18%	0.00%	0.52%	0.29%	0.00%	0.00%	0.00%	1.68E-04	1.68E-04	1.68E-04	1.68E-04	1.68E-04	1.68E-04
Cumulative	1.56E-11	1.66E-04	1.66E-04	1.67E-04	1.68E-04	1.68E-04	1.68E-04	1.68E-04	1.68E-04	1.68E-04	1.68E-04	1.68E-04	1.68E-04	1.68E-04

RADIONUCLIDE/PATHWAY SCOPING STUDY

SCREENING CALCULATIONS: PU239 INFANT  
DOSES FROM VARIOUS PATHWAYS

ALLDOS91

FROM \*NUCREL1.WQ1\*

Decay Corrected		RUNNING	
18,25	18,25	18,25	TOTAL ON
X	D(END)	GROUND	
Air conc	Surf con		
1/45	8.45E-12	8.45E-15	8.45E-15
2/45	7.04E-12	7.04E-15	1.55E-14
3/45	1.45E-11	1.45E-14	3E-14
4/45	2.86E-11	2.86E-14	5.85E-14
5/45	7.15E-11	7.15E-14	1.3E-13
6/45	2.83E-11	2.83E-14	1.58E-13
7/45	7.34E-11	7.34E-14	2.32E-13
8/45	7.24E-11	7.24E-14	3.04E-13
9/45	3.34E-10	3.34E-13	6.98E-13
10/45	3.33E-10	3.33E-13	9.72E-13
11/45	7.79E-11	7.79E-14	1.05E-12
12/45	2.29E-10	2.29E-13	1.28E-12

VARIABLE description

- 0.5 kg/m<sup>2</sup> dry, Y other veg & fruit
- 0.3 kg/m<sup>2</sup> dry, Y pasture
- 0.3 kg/m<sup>2</sup> dry, Y silage
- 0.2 kg/m<sup>2</sup> dry, Y alfalfa & Leaty veg.
- 2.9 m<sup>2</sup>/kg, alpha
- 1E-07 d/l, TFmilk
- 1.0 l/d, IR INFANT
- 5.20E+07 Ingestion dose factor, rad/Ci, INFANT
- 30 days/month
- 7.87E-08 d-1, lambda da rad
- 10.74 d, consumption integral, 30 days
- 2E-06 day/kg, beef transfer factor
- 0.62 m<sup>2</sup>, surface area of bale
- 30 kg, mass of bale
- 9 kg/d dry, IR of hay,cow, FR 3 & 4
- 13 kg/m<sup>2</sup>, RHO usf (1 cm depth)
- 0.008 d/kg, egg transfer factor
- 0.0017 cow m<sup>3</sup>/s, cow inhalation rate
- 0.48 unitless, adjustment factor\* (Zack 85)
- 0.0495 d-1, lambda dba weathering
- 0.521 weathering correction factor, unitless
- 3.2 rad/month per Ci/m<sup>2</sup>, External DF
- 7E+08 Inhalation dose factor, rad Ci, INFANT
- 0.001 Soil Consumption Rate, kg/day, INFANT
- 1.88E-05 Breathing Rate, m<sup>3</sup>/sec, INFANT
- 0.0023 Leaty Veg. Consumption, kg/d DRY, INFANT (5.5 kg/yr wat\*12MO/BMO for seasonality)
- 0.0345 Other veg. & fruit consumption, kg/d DRY, INFANT (20 kg/yr wat)
- 1.3E-05 rad/sec per Ci/m<sup>3</sup>, Submersion DF
- 0.05 translocation factor, unitless
- 0.045 kg/day, meat consumption rate INFANT
- 0.005 kg/day, egg consumption rate, INFANT
- 0.05 kg/day, fresh stuff consumption by chickens
- 0.001 kg/day, soil consumption by chickens
- 0.0004 SOIL-TO-PLANT TRANSFER
- 224 KG/M<sup>2</sup>, SOIL SURFACE DENSITY

DOSE FROM FEEDING REGIME 1 PLUS OTHER PATHWAYS, PU239 INFANT

month/ year	External Dose		Inhalation Dose		Human Soil Leafy Veg. Ingestion		Other Veg & Fruit		15 day meat		fresh eggs		Regime 1 Milk dose	
	rem/mo	rem/mo	rem/mo	rem/mo	rem/mo	rem/mo	rem/mo	rem/mo	rem/mo	rem/mo	rem/mo	rem/mo	rem/mo	rem/mo
1/45	2.72E-14	1.11E-07	1.01E-09						1.4E-11	3.9E-11	5.0E-13	J		
2/45	4.97E-14	9.27E-08	1.86E-09						1.1E-11	3.3E-11	6.2E-13	F		
3/45	9.61E-14	1.90E-07	3.60E-09						2.3E-11	6.4E-11	1.2E-12	M		
4/45	1.88E-13	3.76E-07	7.02E-09						3.9E-11	1.1E-10	2.4E-12	A		
5/45	4.17E-13	9.41E-07	1.56E-08	3.0E-07	2.3E-07	4.5E-11	5.3E-11		4.5E-11	2.4E-10	5.3E-11	M		
6/45	5.07E-13	3.72E-07	1.90E-08	1.2E-07	9.0E-08	3.5E-11	4.5E-11		3.5E-11	1.0E-10	4.5E-11	J		
7/45	7.43E-13	9.67E-07	2.78E-08	3.1E-07	2.3E-07	9.2E-11	2.5E-10		9.2E-11	2.5E-10	1.1E-10	J		
8/45	9.74E-13	9.52E-07	3.65E-08	3.1E-07	2.3E-07	9.0E-11	2.6E-10		9.0E-11	2.6E-10	1.1E-10	A		
9/45	2.05E-12	4.40E-06	7.66E-08	1.4E-06	1.1E-06	2.2E-10	1.2E-09		2.2E-10	1.2E-09	2.8E-10	S		
10/45	3.11E-12	4.39E-06	1.17E-07	5.2E-07	3.9E-07	4.6E-10	1.3E-09		4.6E-10	1.3E-09	3.3E-10	O		
11/45	3.36E-12	1.03E-06	1.26E-07	5.2E-07	3.9E-07	1.2E-10	4.0E-10		1.2E-10	4.0E-10	3.2E-10	N		
12/45	4.09E-12	3.01E-06	1.53E-07	5.2E-07	3.9E-07	3.7E-10	1.1E-09		3.7E-10	1.1E-09	3.3E-10	D		
Pathway dose, r	1.56E-11	1.68E-05	5.85E-07	4.04E-06	3.03E-06	1.52E-09	5.13E-09	1.59E-09						
% Contribution	0.00%	68.69%	2.39%	16.50%	12.38%	0.01%	0.02%	0.01%						
Cumulative	1.56E-11	1.68E-05	1.74E-05	2.14E-05	2.45E-05	2.45E-05	2.45E-05	2.45E-05						

2.45E-05 rem

SCREENING CALCULATIONS: SF90 ADULT  
 DOSES FROM VARIOUS PATHWAYS

ALLFO10A

FROM "NUCREL1.WQ1"

VARIABLE	description	Decay Corrected		RUNNING	
		18,25	18,25	TOTAL ON	GROUND
0.5	kg/m2 dry, Y other veg & fruit	X	D(END)		
0.3	kg/m2 dry, Y pasture	Air conc	Surf con		
0.3	kg/m2 dry, Y silage	1/45	3.12E-10	3.12E-13	3.12E-13
0.2	kg/m2 dry, Y alfalfa & Leaty veg.	2/45	2.60E-10	2.6E-13	5.71E-13
2.9	m2/kg, alpha	3/45	5.34E-10	5.33E-13	1.1E-12
0.015	d/l, TFMilk	4/45	1.05E-09	1.05E-12	2.15E-12
0.5	l/d, IR ADULT	5/45	2.64E-09	2.64E-12	4.79E-12
1.30E+05	Ingestion dose factor, rad/Ci, ADULT	6/45	1.04E-09	1.04E-12	5.02E-12
30	days/month	7/45	2.71E-09	2.71E-12	8.52E-12
6.66E-05	d-1, lambda rad	8/45	2.67E-09	2.67E-12	1.12E-11
10.74	d, consumption integral, 30 days	9/45	1.23E-08	1.23E-11	2.35E-11
0.2	day/kg, beef transfer factor	10/45	1.23E-08	1.23E-11	3.57E-11
0.62	m2, surface area of bale	11/45	2.88E-09	2.87E-12	3.85E-11
30	kg, mass of bale	12/45	8.44E-09	8.43E-12	4.69E-11
9	kg/d dry, IR of hay,cow, FR 3 & 4				
13	kg/m2, RHO usl (1 cm depth)				
0.001	d/kg, egg transfer factor				
0.0017	cow m3/s, cow inhalation rate				
0.48	unitless, adjustment factor* (Zack 85)				
0.0495	d-1, lambda dba weathering				
0.521	weathering correction factor, unitless				
28	rad/month per Ci/m2, External DF				
230000	Inhalation dose factor, rad Ci, ADULT				
0.0001	Soil Consumption Rate, kg/day, ADULT				
0.000255	Breathing Rate, m3/sec, ADULT				
0.006	Leafy Veg. Consumption, kg/d DRY, ADULT (20 kg/yr wet*12MO/8MO for seasonality)				
0.067	Other veg. & fruit consumption, kg/d DRY, ADULT (81.5 kg/yr wet)				
0	rad/sec per Ci/m3, Submersion DF				
0.05	translocation factor, unitless				
0.2	kg/day, meat consumption rate ADULT				
0.035	kg/day, egg consumption rate, ADULT				
0.05	kg/day, fresh stuff consumption by chickens				
0.001	kg/day, soil consumption by chickens				
2	SOIL-TO-PLANT TRANSFER				
224	KG/M2, SOIL SURFACE DENSITY				

DOSE FROM FEEDING REGIME 1 PLUS OTHER PATHWAYS, SR90 ADULT

month/ year	External Dose rem/mo	Inhalation Dose rem/mo	Human Soi Ingestion rem/mo	Human Soi Leafy Veg. rem/mo	Other Veg & Fruit rem/mo	15 day meat rem/mo	fresh eggs rem/mo	Regime 1 Milk dose rem/mo	1945
1/45	8.74E-12	1.83E-08	9.36E-12			5.7E-07	3.1E-12	3.4E-09	J
2/45	1.60E-11	1.52E-08	1.71E-11			4.7E-07	2.7E-12	4.3E-09	F
3/45	3.09E-11	3.13E-08	3.31E-11			9.3E-07	5.3E-12	8.5E-09	M
4/45	6.03E-11	6.18E-08	6.46E-11			1.6E-06	9.2E-12	1.7E-08	A
5/45	1.34E-10	1.55E-07	1.44E-10	7.4E-08	5.2E-08	1.9E-06	2.0E-11	3.7E-07	M
6/45	1.63E-10	6.13E-08	1.75E-10	3.0E-08	3.0E-08	1.5E-06	8.6E-12	3.3E-07	J
7/45	2.39E-10	1.59E-07	2.56E-10	7.6E-08	6.2E-08	3.9E-06	2.1E-11	7.7E-07	J
8/45	3.13E-10	1.57E-07	3.35E-10	7.6E-08	6.7E-08	3.8E-06	2.1E-11	7.7E-07	A
9/45	6.58E-10	7.24E-07	7.04E-10	3.5E-07	2.5E-07	9.0E-06	9.6E-11	2.0E-06	S
10/45	1.00E-09	7.22E-07	1.07E-09	1.3E-07	8.9E-08	1.9E-05	1.1E-10	2.3E-06	O
11/45	1.08E-09	1.69E-07	1.16E-09	1.3E-07	8.9E-08	5.4E-06	3.5E-11	2.3E-06	N
12/45	1.31E-09	4.95E-07	1.41E-09	1.3E-07	8.9E-08	1.6E-05	9.3E-11	2.3E-06	D
Pathway dose, r	5.01E-09	2.77E-06	5.37E-09	9.88E-07	7.27E-07	6.40E-05	4.25E-10	1.11E-05	
% Contribution	0.01%	3.48%	0.01%	1.24%	0.91%	80.39%	0.00%	13.97%	
Cumulative	5.01E-09	2.77E-06	2.78E-06	3.77E-06	4.49E-06	6.85E-05	6.85E-05	7.97E-05	

7.97E-05 rem



SCREENING CALCULATIONS: SR90 INFANT  
DOSES FROM VARIOUS PATHWAYS

FROM "NUCRELI.WQ1"

Decay Corrected	18,25	18,25	TOTAL ON
X	D(END)	GROUND	
Air conc	Surf con		
1/45	3.12E-10	3.12E-13	3.12E-13
2/45	2.60E-10	2.6E-13	5.71E-13
3/45	5.34E-10	5.33E-13	1.1E-12
4/45	1.05E-09	1.05E-12	2.15E-12
5/45	2.64E-09	2.64E-12	4.79E-12
6/45	1.04E-09	1.04E-12	5.82E-12
7/45	2.71E-09	2.71E-12	8.52E-12
8/45	2.67E-09	2.67E-12	1.12E-11
9/45	1.23E-08	1.23E-11	2.35E-11
10/45	1.23E-08	1.23E-11	3.57E-11
11/45	2.88E-09	2.87E-12	3.85E-11
12/45	8.44E-09	8.43E-12	4.68E-11

VARIABLE	description
0.5	kg/m <sup>2</sup> dry, Y other veg & fruit
0.3	kg/m <sup>2</sup> dry, Y pasture
0.3	kg/m <sup>2</sup> dry, Y silage
0.2	kg/m <sup>2</sup> dry, Y alfalfa & Leaty veg.
2.9	m <sup>2</sup> /kg, alpha
0.015	d/l, TFmilk
1.0	l/d, IR INFANT
4.80E+05	Ingestion dose factor, rad/Ci, INFANT
30	days/month
6.66E-05	d-1, lambda rad
10.74	d, consumption integral, 30 days
0.2	day/kg, beef transfer factor
0.62	m <sup>2</sup> , surface area of bale
30	kg, mass of bale
9	kg/d dry, IR of hay, cow, FR 3 & 4
13	kg/m <sup>2</sup> , RHO usl (1 cm depth)
0.001	d/kg, egg transfer factor
0.0017	cow m <sup>3</sup> /s, cow inhalation rate
0.48	unitless, adjustment factor* (Zack 85)
0.0495	d-1, lambda weathering
0.521	weathering correction factor, unitless
28	rad/month per Ci/m <sup>2</sup> , External DF
40000	Inhalation dose factor, rad Ci, INFANT
0.001	Soil Consumption Rate, kg/day, INFANT
1.88E-05	Breathing Rate, m <sup>3</sup> /sec, INFANT
0.0023	Leaty Veg. Consumption, kg/d DRY, INFANT (5.5 kg/yr wet*12MO/BMO for seasonality)
0.0345	Other veg. & fruit consumption, kg/d DR INFANT (20 kg/yr wet)
0	rad/sec per Ci/m <sup>3</sup> , Submersion DF
0.05	translocation factor, unitless
0.045	kg/day, meat consumption rate INFANT
0.005	kg/day, egg consumption rate, INFANT
0.05	kg/day, fresh stuff consumption by chickens
0.001	kg/day, soil consumption by chickens
2	SOIL-TO-PLANT TRANSFER
224	KG/M <sup>2</sup> , SOIL SURFACE DENSITY

DOSE FROM FEEDING REGIME 1 PLUS OTHER PATHWAYS, SR90 INFANT

month/ year	External Dose		Inhalation Dose		Human Soi Leafy Veg.		Other Veg & Fruit		15 day meat		fresh eggs		Regime 1 Milk dose 1945	
	rem/mo	rem/mo	rem/mo	rem/mo	rem/mo	rem/mo	rem/mo	rem/mo	rem/mo	rem/mo	rem/mo	rem/mo	rem/mo	rem/mo
1/45	8.74E-12	2.58E-09	3.46E-10						4.7E-07		1.7E-12	2.5E-08	J	
2/45	1.60E-11	2.15E-09	6.32E-10						3.9E-07		1.4E-12	3.2E-08	F	
3/45	3.09E-11	4.41E-09	1.22E-09						7.8E-07		2.8E-12	6.2E-08	M	
4/45	6.03E-11	8.72E-09	2.39E-09						1.4E-06		4.9E-12	1.2E-07	A	
5/45	1.34E-10	2.19E-08	5.31E-09	1.0E-07	9.8E-08	1.5E-06	1.0E-11	2.7E-06	1.3E-06		1.0E-11	2.7E-06	M	
6/45	1.63E-10	8.64E-09	6.45E-09	4.2E-08	5.6E-08	1.3E-06	4.5E-12	2.4E-06	1.3E-06		4.5E-12	2.4E-06	J	
7/45	2.39E-10	2.24E-08	9.44E-09	1.1E-07	1.2E-07	3.2E-06	1.1E-11	5.7E-06	3.2E-06		1.1E-11	5.7E-06	J	
8/45	3.13E-10	2.21E-08	1.24E-08	1.1E-07	1.3E-07	3.2E-06	1.1E-11	5.7E-06	3.2E-06		1.1E-11	5.7E-06	A	
9/45	6.58E-10	1.02E-07	2.60E-08	5.0E-07	4.7E-07	7.5E-06	5.1E-11	1.5E-05	7.5E-06		5.1E-11	1.5E-05	S	
10/45	1.00E-09	1.02E-07	3.96E-08	1.8E-07	1.7E-07	1.6E-05	5.8E-11	1.7E-05	1.6E-05		5.8E-11	1.7E-05	O	
11/45	1.08E-09	2.38E-08	4.27E-08	1.8E-07	1.7E-07	4.5E-06	1.8E-11	1.7E-05	4.5E-06		1.8E-11	1.7E-05	N	
12/45	1.31E-09	6.98E-08	5.19E-08	1.8E-07	1.7E-07	1.3E-05	4.9E-11	1.7E-05	1.3E-05		4.9E-11	1.7E-05	D	
Pathway dose, r	5.01E-09	3.90E-07	1.98E-07	1.40E-06	1.38E-06	5.32E-05	2.24E-10	8.22E-05	5.32E-05		2.24E-10	8.22E-05		
% Contribution	0.00%	0.28%	0.14%	1.01%	1.00%	38.34%	0.00%	59.23%	38.34%		0.00%	59.23%		
Cumulative	5.01E-09	3.95E-07	5.94E-07	1.99E-06	3.37E-06	5.66E-05	5.66E-05	1.39E-04	5.66E-05		5.66E-05	1.39E-04		

1.39E-04 rem

SCREENING CALCULATIONS: 1129 ADULT  
 DOSES FROM VARIOUS PATHWAYS

ALLDO11A

FROM "NUCREL1.WQ1"

Decay Corrected		RUNNING	
18,25	18,25	18,25	TOTAL ON
X	D(END)	GROUND	
Air conc	Surf con		
1/45	8.35E-12	8.35E-14	8.35E-14
2/45	6.95E-12	6.95E-14	1.53E-13
3/45	1.43E-11	1.43E-13	2.96E-13
4/45	2.82E-11	2.82E-13	5.78E-13
5/45	7.06E-11	7.06E-13	1.28E-12
6/45	2.79E-11	2.79E-13	1.56E-12
7/45	7.25E-11	7.25E-13	2.29E-12
8/45	7.14E-11	7.14E-13	3E-12
9/45	3.30E-10	3.3E-12	6.3E-12
10/45	3.29E-10	3.29E-12	9.59E-12
11/45	7.69E-11	7.69E-13	1.04E-11
12/45	2.26E-10	2.26E-12	1.26E-11

VARIABLE	description
0.5	kg/m <sup>2</sup> dry, Y other veg & fruit
0.3	kg/m <sup>2</sup> dry, Y pasture
0.3	kg/m <sup>2</sup> dry, Y silage
0.2	kg/m <sup>2</sup> dry, Y alfalfa & Leafy veg.
2.9	m <sup>2</sup> /kg, alpha
0.0092	d/l, TFmilk
0.5	l/d, IR ADULT
9.30E+06	Ingestion dose factor, rad/Ci, ADULT
30	days/month
1.21E-10	d-1, lambda rad
10.74	d, consumption integral, 30 days
0.01	day/kg, beef transfer factor
0.62	m <sup>2</sup> , surface area of bale
30	kg, mass of bale
9	kg/d dry, IR of hay,cow, FR 3 & 4
13	kg/m <sup>2</sup> , RHO usl (1 cm depth)
4.4	d/kg, egg transfer factor
0.0017	cow m <sup>3</sup> /s, cow inhalation rate
0.48	unitless, adjustment factor* (Zack 85)
0.0495	d-1, lambda weathering
0.521	weathering correction factor, unitless
180	rad/month per Ci/m <sup>2</sup> , External DF
5900000	Inhalation dose factor, rad Ci, ADULT
0.0001	Soil Consumption Rate, kg/day, ADULT
0.000255	Breathing Rate, m <sup>3</sup> /sec, ADULT
9.006	Leafy Veg. Consumption, kg/d DRY, ADULT (20 kg/yr wet*12MO/8MO for seasonality)
0.067	Other veg. & fruit consumption, kg/d DRY, ADULT (81.5 kg/yr wet)
0.0013	rad/sec per Ci/m <sup>3</sup> , Submersion DF
0.05	translocation factor, unitless
0.2	kg/day, meat consumption rate ADULT
0.035	kg/day, egg consumption rate, ADULT
0.05	kg/day, fresh stuff consumption by chickens
0.001	kg/day, soil consumption by chickens
0.4	SOIL-TO-PLANT TRANSFER
224	KG/M <sup>2</sup> , SOIL SURFACE DENSITY

DOSE FROM FEEDING REGIME 1 PLUS OTHER PATHWAYS, I 129 ADULT

month/ year	External Dose rem/mo	Inhalation Dose rem/mo	Human Soi Ingestion rem/mo	Leaty Veg. rem/mo	Other Veg & Fruit rem/mo	15 day meat rem/mo	fresh eggs rem/mo	Regime 1 Milk dose rem/mo	1945
1/45	1.50E-11	1.26E-08	1.79E-10			5.4E-07	2.6E-07	3.8E-08	J
2/45	2.75E-11	1.05E-08	3.28E-10			4.5E-07	2.2E-07	4.8E-08	F
3/45	5.33E-11	2.15E-08	6.35E-10			8.9E-07	4.4E-07	9.5E-08	M
4/45	1.04E-10	4.24E-08	1.24E-09			1.5E-06	7.7E-07	1.9E-07	A
5/45	2.31E-10	1.06E-07	2.75E-09	1.4E-06	8.2E-07	1.8E-06	1.6E-06	4.3E-06	M
6/45	2.81E-10	4.20E-08	3.35E-09	5.5E-07	3.6E-07	1.4E-06	7.0E-07	3.7E-06	J
7/45	4.12E-10	1.09E-07	4.91E-09	1.4E-06	8.7E-07	3.6E-06	1.7E-06	8.9E-06	J
8/45	5.40E-10	1.07E-07	6.44E-09	1.4E-06	8.9E-07	3.6E-06	1.7E-06	8.8E-06	A
9/45	1.13E-09	4.96E-07	1.35E-08	6.7E-06	3.9E-06	8.5E-06	8.0E-06	2.3E-05	S
10/45	1.73E-09	4.95E-07	2.06E-08	2.4E-06	1.4E-06	1.8E-05	9.1E-06	2.7E-05	O
11/45	1.86E-09	1.16E-07	2.22E-08	2.4E-06	1.4E-06	4.8E-06	2.8E-06	2.6E-05	N
12/45	2.27E-09	3.40E-07	2.71E-08	2.4E-06	1.4E-06	1.5E-05	7.6E-06	2.7E-05	D
Pathway dose, r	8.66E-09	1.90E-06	1.03E-07	1.87E-05	1.11E-05	5.99E-05	3.50E-05	1.29E-04	
% Contribution	0.00%	0.74%	0.04%	7.31%	4.35%	23.45%	13.71%	50.40%	
Cumulative	8.66E-09	1.91E-06	2.01E-06	2.07E-05	3.18E-05	9.17E-05	1.27E-04	2.55E-04	

2.55E-04 rem

SCREENING CALCULATIONS:  
DOSES FROM VARIOUS PATHWAYS

FROM "NUGREL1.W01"

VARIABLE	description	Decay Corrected		RUNNING	
		18,25	18,25	TOTAL ON	GROUND
0.5	kg/m2 dry, Y other veg & fruit	X	D(END)		
0.3	kg/m2 dry, Y pasture	Air conc	Surf con		
0.3	kg/m2 dry, Y silage	1/45	8.35E-12	8.35E-14	8.35E-14
0.2	kg/m2 dry, Y alfalfa & Leaty veg.	2/45	6.95E-12	6.95E-14	1.53E-13
2.9	m2/kg, alpha	3/45	1.43E-11	1.43E-13	2.96E-13
0.0082	d/l, TFmilk	4/45	2.82E-11	2.82E-13	5.78E-13
1.0	l/d, IR INFANT	5/45	7.06E-11	7.06E-13	1.28E-12
1.40E+07	Ingestion dose factor, rad/Ci, INFANT	6/45	2.79E-11	2.79E-13	1.56E-12
30	days/month	7/45	7.25E-11	7.25E-13	2.29E-12
1.21E-10	d-1, lambda rad	8/45	7.14E-11	7.14E-13	3E-12
10.74	d, consumption integral, 30 days	9/45	3.30E-10	3.3E-12	6.3E-12
0.01	day/kg, beef transfer factor	10/45	3.29E-10	3.29E-12	9.59E-12
0.62	m2, surface area of bale	11/45	7.69E-11	7.69E-13	1.04E-11
30	kg, mass of bale	12/45	2.26E-10	2.26E-12	1.26E-11
9	kg/d dry, IR of hay,cow, FR 3 & 4				
13	kg/m2, RHO usl (1 cm depth)				
4.4	d/kg, egg transfer factor				
0.0017	cow m3/s, cow inhalation rate				
0.48	unitless, adjustment factor* (Zack 85)				
0.0495	d-1, lambda weathering				
0.521	weathering correction factor, unitless				
180	rad/month per Ci/m2, External DF				
8500000	Inhalation dose factor, rad Ci, INFANT				
0.001	Soil Consumption Rate, kg/day, INFANT				
1.88E-05	Breathing Rate, m3/sec, INFANT				
0.0023	Leaty Veg. Consumption, kg/d DRY, INFANT (5.5 kg/yr wet*12MO/8MO for seasonality)				
0.0345	Other veg. & fruit consumption, kg/d DRY, INFANT (20 kg/yr wet)				
0.0013	rad/sec per Ci/m3, Submersion DF				
0.05	translocation factor, unitless				
0.045	kg/day, meat consumption rate INFANT				
0.005	kg/day, egg consumption rate, INFANT				
0.05	kg/day, fresh stuff consumption by chickens				
0.001	kg/day, soil consumption by chickens				
0.4	SOIL-TO-PLANT TRANSFER				
224	KG/M2, SOIL SURFACE DENSITY				

DOSE FROM FEEDING REGIME 1 PLUS OTHER PATHWAYS, 1 129 INFANT

month/ year	External Dose rem/mo	Inhalation Dose rem/mo	Human Soi Leafy Ingestion rem/mo	Other Veg & Fruit rem/mo	15 day meat rem/mo	fresh eggs rem/mo	Regime 1 Milk dosg rem/mo	1945
1/45	1.50E-11	1.33E-09	2.70E-09		1.8E-07	5.7E-08	1.1E-07	J
2/45	2.75E-11	1.11E-09	4.94E-09		1.5E-07	4.8E-08	1.4E-07	F
3/45	5.32E-11	2.28E-09	9.56E-09		3.0E-07	9.4E-08	2.9E-07	M
4/45	1.04E-10	4.50E-09	1.87E-08		5.2E-07	1.7E-07	5.6E-07	A
5/45	2.31E-10	1.13E-08	4.15E-08	8.0E-07	6.0E-07	3.5E-07	1.3E-05	M
6/45	2.81E-10	4.46E-09	5.05E-08	3.2E-07	4.7E-07	1.5E-07	1.1E-05	J
7/45	4.12E-10	1.16E-08	7.39E-08	8.3E-07	1.2E-06	3.7E-07	2.7E-05	J
8/45	5.40E-10	1.14E-08	9.70E-08	8.2E-07	1.2E-06	3.8E-07	2.6E-05	A
9/45	1.13E-09	5.27E-08	2.04E-07	3.9E-06	2.9E-06	1.7E-06	6.9E-05	S
10/45	1.73E-09	5.26E-08	3.10E-07	1.4E-06	6.1E-06	2.0E-06	8.0E-05	O
11/45	1.86E-09	1.23E-08	3.35E-07	1.4E-06	1.6E-06	6.0E-07	7.9E-05	N
12/45	2.27E-09	3.61E-08	4.08E-07	1.4E-06	5.0E-06	1.6E-06	8.1E-05	D
Pathway dose, r	8.66E-09	2.02E-07	1.55E-06	1.08E-05	2.03E-05	7.53E-06	3.88E-04	
% Contribution	0.00%	0.05%	0.36%	2.47%	1.97%	4.65%	1.73%	88.78%
Cumulative	8.66E-09	2.10E-07	1.76E-06	1.25E-05	2.11E-05	4.14E-05	4.90E-05	4.37E-04

4.37E-04 rem

SCREENING CALCULATIONS: ZR95  
DOSES FROM VARIOUS PATHWAYS

VARIABLE	description
0.5	kg/m <sup>2</sup> dry, Y other veg & fruit
0.3	kg/m <sup>2</sup> dry, Y pasture
0.3	kg/m <sup>2</sup> dry, Y silage
0.2	kg/m <sup>2</sup> dry, Y alfalfa & Leafy veg.
2.9	m <sup>2</sup> /kg, alpha
5.5E-07	d/l, TFnilk
0.5	l/d, IR ADULT
5.60E-03	Ingestion dose factor, rad/Ci, ADULT
30	days/month
0.0108	d-1, lambda rad
10.74	d, consumption integral, 30 days
1.2E-06	day/kg, beef transfer factor
0.62	m <sup>2</sup> , surface area of bale
30	kg, mass of bale
8	kg/d dry, IR of hay,cow, FR3 & 4
13	kg/m <sup>2</sup> , RHO usl (1 cm depth)
0.00019	d/kg, egg transfer factor
0.0017	cow m <sup>3</sup> /s, cow inhalation rate
0.48	unitless, adjustment factor* (Zack 85)
0.0495	d-1, lambda dba weathering
0.541	weathering correction factor, unitless
13000	rad/month per Ci/m <sup>2</sup> , External DF
19000	Inhalation dose factor, rad Ci, ADULT
0.0001	Soil Consumption Rate, kg/day, ADULT
0.000355	Breathing Rate, m <sup>3</sup> /sec, ADULT
0.006	Leafy Veg. Consumption, kg/d DRY, ADULT (20 kg/yr wet*12MO/8MO for seasonality)
0.067	Other veg. & fruit consumption, kg/d DRY, ADULT (81.5 kg/yr wet)
0.25	rad/sec per Ci/m <sup>3</sup> , Submersion DF
0.05	translocation factor, unitless
0.2	kg/day, meat consumption rate ADULT
0.035	kg/day, egg consumption rate, ADULT
0.05	kg/day, fresh stuff consumption by chickens
0.001	kg/day, soil consumption by chickens
0.04	SOIL-TO-PLANT TRANSFER
224	KG/M <sup>2</sup> , SOIL SURFACE DENSITY

FROM "NUCREL1.WQ1"

Decay Corrected	18,25	18,25	RUNNING
X	D(END)	GROUND	TOTAL ON
Air conc	Surf con		
1/45	1.64E-08	1.4E-11	1.4E-11
2/45	1.18E-08	1.01E-11	2.02E-11
3/45	2.44E-08	2.09E-11	3.55E-11
4/45	5.38E-08	4.59E-11	7.16E-11
5/45	1.44E-07	1.23E-10	1.75E-10
6/45	5.74E-08	4.91E-11	1.75E-10
7/45	1.41E-07	1.21E-10	2.48E-10
8/45	1.41E-07	1.2E-10	2.99E-10
9/45	6.50E-07	5.55E-10	7.72E-10
10/45	6.15E-07	5.25E-10	1.08E-09
11/45	1.32E-07	1.13E-10	8.86E-10
12/45	4.08E-07	3.48E-10	9.86E-10

DOSE FROM FEEDING REGIME 1 PLUS OTHER PATHWAYS, ZR/NB95 ADULT

month/ year	External Dose rem/mo	Inhalation Dose rem/mo	Human Soil Ingestion rem/mo	Leafy Veg. rem/mo	Other Veg & Fruit rem/mo	15 day meat rem/mo	fresh eggs rem/mo	Regime 1 Milk dose rem/mo	1945
1/45	1.87E-07	7.97E-08	1.82E-11			5.8E-12	1.2E-12	2.5E-13	J
2/45	2.66E-07	5.70E-08	2.61E-11			4.1E-12	8.7E-13	2.5E-13	F
3/45	4.68E-07	1.18E-07	4.59E-11			8.3E-12	1.7E-12	4.7E-13	M
4/45	9.44E-07	2.61E-07	9.25E-11			1.6E-11	3.3E-12	9.9E-13	A
5/45	2.30E-06	6.96E-07	2.26E-10	1.5E-07	8.5E-08	1.9E-11	7.7E-12	2.8E-11	M
6/45	2.29E-06	2.78E-07	2.27E-10	6.0E-08	3.4E-08	1.6E-11	3.2E-12	2.4E-11	J
7/45	3.25E-06	6.85E-07	3.20E-10	1.5E-07	8.4E-08	3.8E-11	7.6E-12	5.4E-11	J
8/45	3.93E-06	6.82E-07	3.87E-10	1.5E-07	8.3E-08	3.8E-11	7.6E-12	5.4E-11	A
9/45	1.02E-05	3.15E-06	9.97E-10	7.0E-07	3.9E-07	9.2E-11	3.6E-11	1.4E-10	S
10/45	1.42E-05	2.98E-06	1.40E-09	2.1E-07	1.2E-07	1.8E-10	3.9E-11	1.3E-10	O
11/45	1.17E-05	6.38E-07	1.16E-09	1.5E-07	8.7E-08	4.4E-11	1.0E-11	9.7E-11	N
12/45	1.31E-05	1.98E-06	1.29E-09	1.1E-07	6.3E-08	1.4E-10	3.0E-11	7.4E-11	D
Pathway dose, r	6.28E-05	1.16E-05	6.18E-09	1.69E-06	9.49E-07	6.09E-10	1.48E-10	6.04E-10	
% Contribution	81.51%	15.05%	0.01%	2.20%	1.23%	0.00%	0.00%	0.00%	
Cumulative	6.28E-05	7.44E-05	7.44E-05	7.61E-05	7.70E-05	7.70E-05	7.70E-05	7.70E-05	

7.70E-05 rem



RADIONUCLIDES/PATHWAY SCOPING STUDY

ALLODO12I

SCREENING CALCULATION ZR/NB 95 INFANT  
DOSES FROM VARIOUS PATHWAYS

FROM "NUCREL1.WQ1"  
Decay Correcte RUNNI  
18,25 18,25 TOTAL  
X D(END) GROUND  
Air conc Surf con

VARIAB	description	1/45	2/45	3/45	4/45	5/45	6/45	7/45	8/45	9/45	10/45	11/45	12/45
0.5	kg/m <sup>2</sup> dry, Y other veg & fruit	1.64E-08	1.4E-11	1.4E-11									
0.3	kg/m <sup>2</sup> dry, Y pasture	1.18E-08	1.01E-11	2E-11									
0.3	kg/m <sup>2</sup> dry, Y silage	2.44E-08	2.09E-11	3.6E-11									
0.2	kg/m <sup>2</sup> dry, Y alfalfa & Leafy veg.	5.38E-08	4.59E-11	7.2E-11									
2.9	m <sup>2</sup> /kg, alpha	1.44E-07	1.23E-10	1.7E-10									
5.5E-07	d/l, TFmilk	5.74E-08	4.91E-11	1.8E-10									
1.0	l/d, IR INFANT	1.41E-07	1.21E-10	2.5E-10									
6E+04	Ingestion dose factor, rad/Ci, INFANT	1.41E-07	1.2E-10	3E-10									
30	days/month	8.50E-07	5.55E-10	7.7E-10									
0.0108	d-1, lambda ra	6.15E-07	5.25E-10	1.1E-09									
10.74	d, consumption integral, 30 days	1.32E-07	1.13E-10	9E-10									
1.2E-06	day/kg, beef transfer factor	4.08E-07	3.48E-10	1E-09									
0.62	m <sup>2</sup> , surface area of bale												
30	kg, mass of bale												
9	kg/d dry, IR of hay,cow, FR 3 & 4												
13	kg/m <sup>2</sup> , RHO usl (1 cm depth)												
0.0002	d/kg, egg transfer factor												
0.0017	cow m <sup>3</sup> /s, cow inhalation rate												
0.48	unitless, adjustment factor* (Zack 85)												
0.0495	d-1, lambda weathering												
0.541	weathering correction factor, unitless												
13000	rad/month per Ci/m <sup>2</sup> , External DF												
230000	Inhalation dose factor, rad Ci, INFANT												
0.001	Soil Consumption Rate, kg/day, INFANT												
1.88E-05	Breathing Rate, m <sup>3</sup> /sec, INFANT												
0.0023	Leafy Veg. Consumption, kg/d DRY, INFANT (5.5 kg/yr wet*12MO/8MO for seasonality)												
0.0345	Other veg. & fruit consumption, kg/d DRY, INFANT (20 kg/yr wet)												
0.25	rad/sec per Ci/m <sup>3</sup> , Submersion DF												
0.05	translocation factor, unitless												
0.045	kg/day, meat consumption rate INFANT												
0.005	kg/day, egg consumption rate, INFANT												
0.05	kg/day, fresh stuff consumption by chickens												
0.001	kg/day, soil consumption by chickens												
0.04	SOIL-TO-PLANT TRANSFER												
224	KG/M <sup>2</sup> , SOIL SURFACE DENSITY												

DOSE FROM FEEDING REGIME 1 PLUS OTHER PATHWAYS, ZR/NB95 INFANT

month/ year	External Dose rem/mo	Inhalation Dose rem/mo	Human Soi Ingestion rem/mo	Leafy Veg. rem/mo	Other Veg & Fruit rem/mo	15 day meat rem/mo	fresh eggs rem/mo	Regime 1 Milk dose rem/mo	1945
1/45	1.87E-07	7.11E-08	1.82E-09			1.3E-11	1.7E-12	5.0E-12	J
2/45	2.66E-07	5.09E-08	2.61E-09			9.3E-12	1.2E-12	5.0E-12	F
3/45	4.68E-07	1.06E-07	4.59E-09			1.9E-11	2.5E-12	9.5E-12	M
4/45	9.44E-07	2.33E-07	9.25E-09			3.6E-11	4.8E-12	2.0E-11	A
5/45	2.30E-06	6.21E-07	2.26E-08	5.8E-07	4.4E-07	4.4E-11	1.1E-11	5.5E-10	M
6/45	2.29E-06	2.48E-07	2.27E-08	2.3E-07	1.8E-07	3.5E-11	4.5E-12	4.7E-10	J
7/45	3.25E-06	6.11E-07	3.20E-08	5.7E-07	4.3E-07	8.6E-11	1.1E-11	1.1E-09	J
8/45	3.93E-06	6.09E-07	3.87E-08	5.7E-07	4.3E-07	8.6E-11	1.1E-11	1.1E-09	A
9/45	1.02E-05	2.81E-06	9.97E-08	2.7E-06	2.0E-06	2.1E-10	5.1E-11	2.8E-09	S
10/45	1.42E-05	2.66E-06	1.40E-07	8.2E-07	6.2E-07	4.1E-10	5.5E-11	2.7E-09	O
11/45	1.17E-05	5.70E-07	1.16E-07	5.9E-07	4.5E-07	1.0E-10	1.4E-11	1.9E-09	N
12/45	1.31E-05	1.76E-06	1.29E-07	4.3E-07	3.2E-07	3.2E-10	4.3E-11	1.5E-09	D
Pathway dose, r	6.28E-05	1.04E-05	6.18E-07	6.49E-06	4.89E-06	1.37E-09	2.12E-10	1.21E-08	
% Contribution	73.75%	12.16%	0.79%	7.62%	5.74%	0.00%	0.00%	0.01%	
Cumulative	6.28E-05	7.32E-05	7.38E-05	8.03E-05	8.51E-05	8.51E-05	8.51E-05	8.52E-05	

8.52E-05 rem

SCREENING CALCULATIONS: CS/BAm137 ADULT  
DOSES FROM VARIOUS PATHWAYS

ALLDO13A

FROM "NUCREL1.WQ1"

VARIABLE	description	Decay Corrected		RUNNING	
		18,25	X	18,25	TOTAL ON
0.5	kg/m2 dry, Y other veg & fruit				
0.3	kg/m2 dry, Y pasture				
0.3	kg/m2 dry, Y silage				
0.2	kg/m2 dry, Y alfalfa & Leafy veg.				
2.9	m2/kg, alpha				
0.007	d/l, TFmilk				
0.5	l/d, IR ADULT				
5.09E+04	Ingestion dose factor, rad/Ci, ADULT				
30	days/month				
6.3E-05	d-1, lambda da rad				
10.74	d, consumption integral, 30 days				
0.03	day/kg, beef transfer factor				
0.62	m2, surface area of bale				
30	kg, mass of bale				
9	kg/d dry, IR of hay, cow, FR 3 & 4				
13	kg/m2, RHO usl (1 cm depth)				
0.49	d/kg, egg transfer factor				
0.0017	cow m3/s, cow inhalation rate				
0.48	unitless, adjustment factor* (Zack 85)				
0.0495	d-1, lambda da weathering				
0.521	weathering correction factor, unitless				
5100	rad/month per Ci/m2, External DF				
32000	Inhalation dose factor, rad Ci, ADULT				
0.0001	Soil Consumption Rate, kg/day, ADULT				
0.000255	Breathing Rate, m3/sec, ADULT				
0.006	Leafy Veg. Consumption, kg/d DRY, ADULT (20 kg/yr wet*12MO/8MO for seasonality)				
0.067	Other veg. & fruit consumption, kg/d DRY, ADULT (81.5 kg/yr wet)				
0.097	rad/sec per Ci/m3, Submersion DF				
0.05	translocation factor, unitless				
0.2	kg/day, meat consumption rate ADULT				
0.035	kg/day, egg consumption rate, ADULT				
0.05	kg/day, fresh stuff consumption by chickens				
0.001	kg/day, soil consumption by chickens				
0.02	SOIL-TO-PLANT TRANSFER				
224	KG/M2, SOIL SURFACE DENSITY				

DOSE FROM FEEDING REGIME 1 PLUS OTHER PATHWAYS, CS/BAm137

month/ year	External Dose rem/mo	Inhalation Dose rem/mo	Human Soil Leafy Ingestion rem/mo	Other Veg & Fruit rem/mo	15 day meat rem/mo	fresh eggs rem/mo	Regime 1	
							Milk dose rem/mo	1945
1/45	1.80E-09	2.83E-09	4.00E-12		3.6E-08	6.5E-10	5.9E-10	J
2/45	3.26E-09	2.35E-09	7.31E-12		3.0E-08	5.5E-10	8.5E-10	F
3/45	6.30E-09	4.83E-09	1.41E-11		5.9E-08	1.1E-09	1.7E-09	M
4/45	1.23E-08	9.55E-09	2.76E-11		1.0E-07	1.9E-09	3.3E-09	A
5/45	2.74E-08	2.39E-08	6.14E-11	3.1E-08	1.2E-07	4.1E-09	7.3E-08	M
6/45	3.31E-08	9.46E-09	7.46E-11	1.2E-08	9.3E-08	1.7E-09	6.3E-08	J
7/45	4.85E-08	2.46E-08	1.09E-10	3.2E-08	2.4E-07	4.3E-09	1.5E-07	J
8/45	6.36E-08	2.42E-08	1.43E-10	3.1E-08	2.4E-07	4.3E-09	1.5E-07	A
9/45	1.34E-07	1.12E-07	3.01E-10	1.5E-07	5.7E-07	2.0E-08	3.9E-07	S
10/45	2.04E-07	1.12E-07	4.58E-10	5.3E-08	1.2E-06	2.3E-08	4.5E-07	O
11/45	2.19E-07	2.60E-08	4.94E-10	5.3E-08	3.2E-07	6.8E-09	4.5E-07	N
12/45	2.66E-07	7.65E-08	6.01E-10	5.3E-08	9.7E-07	1.9E-08	4.6E-07	D
Pathway dose, r	1.02E-06	4.28E-07	2.29E-09	4.15E-07	3.98E-06	8.66E-08	2.18E-06	
% Contribution	12.21%	5.12%	0.03%	4.97%	2.79%	47.71%	1.04%	26.13%
Cumulative	1.02E-06	1.45E-06	1.45E-06	1.86E-06	6.08E-06	6.17E-06	8.35E-06	

8.35E-06 rem

SCREENING CALCULATIONS: CS137 INFANT  
 DOSES FROM VARIOUS PATHWAYS

ALDD0131

FROM "NUCREL1.WQ1"

VARIABLE	description	Decay Corrected	18,25	18,25	TOTAL ON	RUNNING
		X	D(END)	GROUND		
		Air conc	Surf con			
0.5	kg/m2 dry, Y other veg & fruit	3.47E-10	3.46E-13	3.46E-13		
0.3	kg/m2 dry, Y pasture	2.88E-10	2.88E-13	6.34E-13		
0.3	kg/m2 dry, Y silage	5.93E-10	5.92E-13	1.22E-12		
0.2	kg/m2 dry, Y alfalfa & Leafy veg.	1.17E-09	1.17E-12	2.39E-12		
2.9	m2/kg, alpha	2.93E-09	2.93E-12	5.32E-12		
0.007	d/l, TFmilk	1.16E-09	1.16E-12	6.47E-12		
1.0	l/d, IR INFANT	3.01E-09	3.01E-12	9.46E-12		
7.40E+04	Ingestion dose factor, rad/Ci, INFANT	2.97E-09	2.96E-12	1.24E-11		
30	days/month	1.37E-08	1.37E-11	2.61E-11		
6.3E-05	d-1, lambda rad	1.37E-08	1.37E-11	3.97E-11		
10.74	d, consumption integral, 30 days	3.19E-09	3.19E-12	4.28E-11		
0.03	day/kg, beef transfer factor	9.37E-09	9.36E-12	5.21E-11		
0.62	m2, surface area of bale					
30	kg, mass of bale					
9	kg/d dry, IR of hay,cow, FR 3 & 4					
13	kg/m2, RHO usl (1 cm depth)					
0.49	d/kg, egg transfer factor					
0.0017	cow m3/s, cow inhalation rate					
0.48	unitless, adjustment factor* (Zack 85)					
0.0495	d-1, lambda weathering					
0.521	weathering correction factor, unitless					
5100	rad/month per Ci/m2, External DF					
48000	Inhalation dose factor, rad Ci, INFANT					
0.001	Soil Consumption Rate, kg/day, INFANT					
1.88E-05	Breathing Rate, m3/sec, INFANT					
0.0023	Leafy Veg. Consumption, kg/d DRY, INFANT (5.5 kg/yr wet*12MO/8MO for seasonality)					
0.0345	Other veg. & fruit consumption, kg/d DRY, INFANT (20 kg/yr wet)					
0.097	rad/sec per Ci/m3, Submersion DF					
0.05	translocation factor, unitless					
0.045	kg/day, meat consumption rate INFANT					
0.005	kg/day, egg consumption rate, INFANT					
0.05	kg/day, fresh stuff consumption by chickens					
0.001	kg/day, soil consumption by chickens					
0.02	SOIL-TO-PLANT TRANSFER					
224	KG/M2, SOIL SURFACE DENSITY					

DOSE FROM FEEDING REGIME 1 PLUS OTHER PATHWAYS, CS/BAm137 INFANT

month/ year	External Dose rem/mo	Inhalation Dose rem/mo	Human Soil Ingestion rem/mo	Leafy Veg. rem/mo	Other Veg & Fruit rem/mo	15 day meat rem/mo	fresh eggs rem/mo	Regime 1 Milk dose rem/mo	1945
1/45	1.80E-09	3.13E-10	5.91E-11			1.2E-08	1.4E-10	2.0E-09	J
2/45	3.26E-09	2.60E-10	1.08E-10			1.0E-08	1.2E-10	2.5E-09	F
3/45	6.30E-09	5.35E-10	2.09E-10			2.0E-08	2.3E-10	5.0E-09	M
4/45	1.23E-08	1.06E-09	4.08E-10			3.4E-08	4.0E-10	9.8E-09	A
5/45	2.74E-08	2.65E-09	9.08E-10	1.8E-08	1.3E-08	3.9E-08	8.6E-10	2.2E-07	M
6/45	3.31E-08	1.05E-09	1.10E-09	7.0E-09	5.3E-09	3.1E-08	3.7E-10	1.9E-07	J
7/45	4.85E-08	2.72E-09	1.62E-09	1.8E-08	1.4E-08	8.0E-08	9.1E-10	4.4E-07	J
8/45	6.36E-08	2.68E-09	2.12E-09	1.8E-08	1.3E-08	7.9E-08	9.1E-10	4.4E-07	A
9/45	1.34E-07	1.24E-08	4.45E-09	8.4E-08	6.4E-08	1.9E-07	4.2E-09	1.1E-06	S
10/45	2.04E-07	1.23E-08	6.78E-09	3.0E-08	2.3E-08	4.0E-07	4.8E-09	1.3E-06	O
11/45	2.19E-07	2.88E-09	7.31E-09	3.0E-08	2.3E-08	1.1E-07	1.4E-09	1.3E-06	N
12/45	2.66E-07	8.46E-09	8.89E-09	3.0E-08	2.3E-08	3.2E-07	4.0E-09	1.4E-06	D
Pathway dose, r	1.02E-06	4.73E-08	3.40E-08	2.35E-07	1.77E-07	1.33E-06	1.83E-08	6.46E-06	
% Contribution	10.94%	0.51%	0.36%	2.53%	1.90%	14.24%	0.20%	69.32%	
Cumulative	1.02E-06	1.07E-06	1.10E-06	1.34E-06	1.51E-06	2.84E-06	2.86E-06	9.31E-06	

9.31E-06 rem

RADIONUCLIDE/PATHWAY SCOPING STUDY

SCREENING CALCULATIONS: SR89 ADULT  
DOSES FROM VARIOUS PATHWAYS

ALLDO14A

FROM \*NUCREL1.WQ1\*

Decay Corrected	18,25	18,25	TOTAL ON
X	D(END)	GROUND	
Air conc	Surf con		
1/45	1.10E-08	9.06E-12	9.06E-12
2/45	7.59E-09	6.22E-12	1.22E-11
3/45	1.58E-08	1.3E-11	2.11E-11
4/45	3.58E-08	2.93E-11	4.33E-11
5/45	9.79E-08	7.98E-11	1.09E-10
6/45	3.90E-08	3.2E-11	1.04E-10
7/45	9.46E-08	7.76E-11	1.47E-10
8/45	9.45E-08	7.75E-11	1.75E-10
9/45	4.36E-07	3.58E-10	4.74E-10
10/45	4.07E-07	3.33E-10	6.48E-10
11/45	8.52E-08	6.98E-11	4.89E-10
12/45	2.68E-07	2.19E-10	5.5E-10

VARIABLE	description
0.5	kg/m2 dry, Y other veg & fruit
0.3	kg/m2 dry, Y pasture
0.3	kg/m2 dry, Y silage
0.2	kg/m2 dry, Y alfalfa & Leaty veg.
2.9	m2/kg, alpha
0.015	d/l, TFmilk
0.5	l/d, IR ADULT
8.20E+03	Ingestion dose factor, rad/Ci, ADULT
30	days/month
0.0137	d-1, lambda rad
10.74	d, consumption integral, 30 days
0.2	day/kg, beef transfer factor
0.62	m2, surface area of bale
30	kg, mass of bale
9	kg/d dry, IR of hay,cow, FR 3 & 4
13	kg/m2, RHO usl (1 cm depth)
0.001	d/kg, egg transfer factor
0.0017	cow m3/s, cow inhalation rate
0.48	unitless, adjustment factor* (Zack 85)
0.0495	d-1, lambda dba weathering
0.547	weathering correction factor, unitless
1.1	rad/month per Ci/m2, External DF
5900	Inhalation dose factor, rad Ci, ADULT
0.0001	Soil Consumption Rate, kg/day, ADULT
0.000255	Breathing Rate, m3/sec, ADULT
0.008	Leafy Veg. Consumption, kg/d DRY, ADULT (20 kg/yr wet*12MO/8MO for seasonality)
0.067	Other veg. & fruit consumption, kg/d DRY, ADULT (61.5 kg/yr wet)
2.3E-05	rad/sec per Ci/m3, Submersion DF
0.05	translocation factor, unitless
0.2	kg/day, meat consumption rate ADULT
0.035	kg/day, egg consumption rate, ADULT
0.05	kg/day, fresh stuff consumption by chickens
0.001	kg/day, soil consumption by chickens
2	SOIL-TO-PLANT TRANSFER
224	KG/M2, SOIL SURFACE DENSITY

DOSE FROM FEEDING REGIME 1 PLUS OTHER PATHWAYS, SR89 ADULT

month/ year	External Dose rem/mo	Inhalation Dose rem/mo	Human Soil Leafy Ingestion rem/mo	Other Veg & Fruit rem/mo	15 day meat rem/mo	fresh eggs rem/mo	Regime 1 Milk dose rem/mo	1945
1/45	1.02E-11	1.66E-08	1.71E-11		8.9E-07	6.0E-12	6.4E-09	J
2/45	1.36E-11	1.14E-08	2.31E-11		6.1E-07	4.2E-12	6.1E-09	F
3/45	2.35E-11	2.38E-08	3.99E-11		1.2E-06	8.4E-12	1.1E-08	M
4/45	4.85E-11	5.38E-08	8.20E-11		2.4E-06	1.7E-11	2.5E-08	A
5/45	1.22E-10	1.46E-07	2.05E-10	9.7E-08	3.0E-06	3.9E-11	7.3E-07	M
6/45	1.15E-10	5.87E-08	1.97E-10	4.8E-08	2.5E-06	1.6E-11	6.3E-07	J
7/45	1.63E-10	1.42E-07	2.77E-10	1.0E-07	5.9E-06	3.9E-11	1.4E-06	J
8/45	1.94E-10	1.42E-07	3.31E-10	1.0E-07	5.9E-06	3.9E-11	1.4E-06	A
9/45	5.31E-10	6.57E-07	8.96E-10	4.4E-07	1.4E-05	1.8E-10	3.6E-06	S
10/45	7.22E-10	6.12E-07	1.23E-09	1.3E-07	2.8E-05	1.9E-10	3.4E-06	O
11/45	5.51E-10	1.28E-07	9.44E-10	8.6E-08	6.8E-06	5.0E-11	2.2E-06	N
12/45	6.12E-10	4.03E-07	1.04E-09	5.7E-08	2.2E-05	1.5E-10	1.6E-06	D
Pathway dose, r	3.11E-09	2.39E-06	5.28E-09	1.07E-06	9.28E-05	7.43E-10	1.50E-05	
% Contribution	0.00%	2.12%	0.00%	1.40%	82.26%	0.00%	13.26%	
Cumulative	3.11E-09	2.40E-06	2.40E-06	5.05E-06	9.79E-05	9.79E-05	1.13E-04	
							1.13E-04	rem



**APPENDIX C**

**SUMMARY OF PARAMETERS USED**

APPENDIX C.1

DESCRIPTION OF VARIABLES AND VALUES USED

Parameter Symbol	Description of Parameter and Value Used in Scoping Calculation	Reference
$D_{end\ i}$ $D_{end\ h}$	Surface deposition of iodine-131 on the ground at the end of month $i$ and harvest month $h$ ( $Ci/m^2$ ); varies by month; value used: see Table 3.	Ramsdell Jr., J. V., personal communication, October 1992, and calculation
$Y$	Maximum dry biomass of a plant, $kg/m^2$ dry; value used: 0.3 for pasture and silage; 0.2 for alfalfa; combines the $Y$ and $f_d$ parameters presented in Shindle et al.	Shindle et al. 1992, pages 2.4 and 2.5
$\alpha$	Empirical interception parameter, $m^2/kg$ ; value used: 2.9 for pasture, silage, and alfalfa	Shindle et al. 1992, page 2.6
$f_s$	Fraction of maximum biomass available, unitless; varies monthly for pasture, silage, and alfalfa; value used: see Ikenberry and Napier 1992.	Shindle et al. 1992, page 2.5
$IR_{infant}$	Milk ingestion rate for an infant, L/d; value used: 1.0	Callaway Jr., J. M. 1992, page 19
$IR_{adult}$	Milk ingestion rate for an adult, L/d; value used: 0.5	Callaway Jr., J. M. 1992, page 19
$IR_{cow}$	Ingestion rate by cows of various feed types, kg/d; varies monthly by feed type value used: see Ikenberry and Napier 1992.	Beck et al. 1992, page 54
$\lambda_w$	Weathering removal rate constant, $days^{-1}$ ; value used: 0.0495 (weathering half-time = 14 days)	Snyder et al. 1992, page $\lambda_{weath}$

DESCRIPTION OF VARIABLES AND VALUES USED (cont'd.)

Parameter Symbol	Description of Parameter and Value Used in Scoping Calculation	Reference
$f_{\text{hay}}$	Fraction of total hay consumption from a given hay cutting; value used: 1.0 June, July; 0.5 August; 0.33 September to December	Beck et al. 1992, page 61
$FS_{\text{cow}}$	Soil ingestion rate of dairy cows, kg/d; varies by season (month) and feeding regime type; values used: see Ikenberry and Napier 1992.	Snyder et al. 1992, page $FS_{\text{cow}}$ Darwin 1992, all
$\rho_{\text{cs1}}$	Density of soil layer consumed by cows, kg/m <sup>2</sup> ; value used: 13 (assumed 1-cm depth)	derived from data in: Snyder et al. 1992 page $\rho_{\text{us1}}$ Ikenberry et al. 1992, page 2.15
$SA_{\text{bale}}$	Exposed surface area of stored feed, m <sup>2</sup> ; value used: 0.62 for an individual hay bale	empirically determined
$Mass_{\text{bale}}$	Mass of stored feed, kg; value used: 30 for an individual hay bale	empirically determined
$IHR_{\text{cow}}$	Cow inhalation rate, m <sup>3</sup> /s; value used: 0.0017 (100 l/min)	Black and Barth 1976, page 15,
$ADJ_z$	59-(90)-104 L/min [85-(130)-150 m <sup>3</sup> /d] Adjustment factor to account for differences in transfer to milk between inhalation and ingestion (unitless); value used: 0.48	Zack 1985, page 739 Zack 1985, page 741
BR	Breathing rate, m <sup>3</sup> /s; values used: Infants 0.0000188 Adults 0.000255	Snyder et al. 1992

DESCRIPTION OF VARIABLES AND VALUES USED (cont'd.)

Parameter Symbol	Description of Parameter and Value Used in Scoping Calculation	Reference
$V_d$	Deposition Velocity, m/s: values used: Noble gases 0.0 Iodines 0.01 Particulates 0.001	Napier et al. 1988, page 5.719 Volume 3
$IR_v$	Ingestion rate of fruits and vegetables, kg/d (dry): Infant leafy vegetables 0.0023 Infant other vegetables and fruit 0.0345 Adult leafy vegetables 0.006 Adult other vegetables and fruit 0.067	Marsh et al. 1992. Appendix B
$IR_{meat}$	Human ingestion rate of meat, kg/d: Infant 0.045 Adult 0.2	Nelson and Yang 1987
$IR_{hen}$	Rate of ingestion of pasture grasses by laying hens, kg/d (dry); value used: 0.05	Snyder et al. 1992.
$IR_{cs}$	Rate of ingestion of surface soil by laying hens, kg/d; value used: 0.001	Snyder et al. 1992.
$IR_{egg}$	Human ingestion rate of eggs, kg/d: Infants 0.005 Adult 0.035	Nelson and Yang 1987
$X_i$	the time-integrated air concentration in month i ( $C_i \cdot s/m^3$ ); varies monthly; value used: see Table 3.	Ramsdell Jr., J. V., personal communication, October 1992 and calculation

APPENDIX C.2

TIME-DEPENDENT VARIABLES AND VARIABLE VALUES USED IN THE SCOPING CALCULATION

Parameter Symbol	$f_s$	$f_s$	$f_s$	$f_s$	$f_s$	$FS_{cow}$	$FS_{cow}$	$IR_{cow}$	$IR_{cow}$	$IR_{cow}$	$IR_{cow}$	$IR_{cow}$	$f_{hay}$
Feed Type	Pasture	Silage	Alfalfa	Soil	Soil	Soil	Pasture	Silage	Hay	Hay	Hay	Hay	Hay
Feeding Regime				1 & 2	3 & 4	1 & 2	1 & 2	1 & 2	1 & 2	1 & 2	3 & 4	all	
Units	None	None	None	kg/d	kg/d	kg/d	kg/d	kg/d	kg/d	kg/d	kg/d	kg/d	None
MONTH													
January				2	2						9		
February				2	2						9		
March				2	2						9		
April				2	2						9		
May	0.9		0.75	1	2	4.25					9		
June	0.9		0.75	0.5	2	8.5			1		9	1	
July	0.9		0.75	0.5	2	8.5			1		9	1	
August	0.9		0.75	0.5	2	8.5			1		9	0.5	
September	0.8	0.5	0.75	1	2	4.25			5.25		9	0.33	
October				2	2			4.25	5.25		9	0.33	
November				2	2			4.25	5.25		9	0.33	
December				2	2			4.25	5.25		9	0.33	

APPENDIX C.3

RADIONUCLIDE-DEPENDENT VARIABLES AND VARIABLE VALUES USED IN THE SCOPING CALCULATION

Nuclide	$\lambda_{\alpha-1}$ (d <sup>-1</sup> )	CR (dry)	$F_{milk}$ (d/l)	$F_{meat}$ (d/kg)	$F_{eggs}$ (d/kg)	DF <sub>ex</sub> rem/mo Ci/m <sup>2</sup>	DF <sub>as</sub> rem/s Ci/m <sup>3</sup>	DF <sub>ADULT</sub> rem/Ci	DF <sub>ADULT</sub> rem/Ci	DF <sub>INFANT</sub> rem/Ci	DF <sub>INFANT</sub> rem/Ci
I 131	8.6E-2	0.4	9.2E-3	1.0E-2	4.4E00	3.6E03	6.6E-2	1.1E06	1.8E06	8.5E06	1.5E07
I 132	7.2E00	0.4	9.2E-3	1.0E-2	4.4E00	1.9E04	3.8E-1	3.3E02	5.7E02	6.7E04	1.5E05
Ru106	1.9E-3	0.2	6.0E-7	2.0E-3	6.0E-3	1.8E03	3.3E-2	4.4E05	2.1E04	3.6E06	3.3E05
Ru103	1.8E-2	0.2	6.0E-7	3.0E-3	6.0E-3	4.2E03	7.7E-2	7.8E03	2.7E03	8.1E04	2.8E04
Co60	3.6E-4	0.1	1.0E-4	2.0E-2	1.0E-1	1.9E04	4.1E-1	1.5E05	1.0E04	---	---
Xe133	1.3E-1	0.0	0.0	0.0	0.0	0.0	5.6E-3	0.0	0.0	0.0	0.0
Kr85	1.8E-4	0.0	0.0	0.0	0.0	0.0	3.6E-4	0.0	0.0	0.0	0.0
Ce144	2.4E-3	0.04	4.0E-5	2.0E-3	5.0E-3	4.3E02	8.6E-3	3.5E05	2.0E04	2.9E06	3.0E05
Pu239	7.9E-8	0.0004	1.0E-7	2.0E-6	8.0E-3	3.2E00	1.3E-5	5.1E08	4.3E06	7.0E08	5.2E07
Sr90	6.7E-5	2.0	1.5E-2	2.0E-1	1.0E-3	2.8E01	0.0	2.3E05	1.3E05	4.4E05	4.8E05
Sr89	1.4E-2	2.0	1.5E-2	2.0E-1	1.0E-3	1.1E00	2.3E-5	5.9E03	8.2E03	---	---
Cs137	6.3E-5	0.02	7.0E-3	3.0E-2	4.9E-1	5.1E03	9.7E-2	3.2E04	5.0E04	4.8E04	7.4E04
I 129	1.2-10	0.4	9.2E-2	1.0E-2	4.4E00	1.8E02	1.3E-3	5.9E06	9.3E06	8.5E06	1.4E07
Zr95	1.1E-2	0.04	5.5E-7	1.2E-6	1.9E-4	1.3E04	2.5E-1	1.9E04	5.6E03	2.3E05	5.6E04

**DATE  
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**3 / 26 / 93**

