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INTERIM REPORT

A Comparison of the ICRP2 and ICRP30
Internal Dosimetry Models

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INTERNAL REPORT

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Introduction

The Nuclear Fuel Cycle Risk Analysis Division of Sandia National Laboratories was provided funding by the Nuclear Regulatory Commission under the short term technical assistance task of FIN A-1165 to compare the dose conversion factors calculated with the ICRP2 dosimetry model with the dose factors calculated with the ICRP30 dosimetry model. This comparison study addresses the assumptions concerning the chemical forms of the nuclides considered by each model and applies each set of dose factors to several scenario analyses previously performed under the Risk Methodology for Geologic Disposal of Radioactive Waste Program currently underway at Sandia.

The International Commission on Radiological Protection (ICRP) developed an internal dosimetry model in 1959 to estimate the permissible dose from internal radiation in the working environment. This internal dosimetry model is described in Publication 2 of Committee 2 of the ICRP (ICRP, 1959) and is most often referred to as ICRP2. The model has been used in establishing permissible levels of radiation in the work place, in performing risk assessments and in developing dose conversion factors to estimate the dose commitment to body tissues and organ from the intake of radioactive material.

The ICRP2 modeling concepts and data were used by Hoenes and Soldat (1977) to produce a set of dose conversion factors for estimating dose commitments from inhaled and ingested radionuclides. NUREG-0172 is currently the "official" (commonly used) set of dose factors utilized by the Nuclear Regulatory Commission (NRC) for risk assessments (e.g., NUREG 1.109).

Since 1959, the Task Group on Lung Dynamics for Committee 2 of the ICRP has developed a more complex lung model than the lung model used in ICRP2 to estimate the deposition patterns and clearance of inhaled particulates from the respiratory tract (ICRP, 1966). This lung model was incorporated in the INREM internal dosimetry model developed at Oak Ridge National Laboratory (Killough, et al., 1978).

More recently, Committee 2 of the ICRP has published an updated internal dosimetry model and associated dose conversion factors that incorporate the model of the Task Group on Lung Dynamics, revised metabolic data and considers the irradiation of surrounding body organs (target organs) from radioactive material deposited in source organs. The ICRP Publication 30 (ICRP30) for the Limits for Intakes of Radionuclides by Workers (ICRP, 1979a; 1979b; 1980) has been recommended by ICRP to supersede Publication 2.

The study described in this report is designed to compare the dose conversion factors that are calculated using the ICRP2 and the ICRP30 internal dosimetry models. To compare the two models, a CRPC index (cancer risk per curie intake) was calculated by multiplying the dose factor for designated organs from each model by a cancer risk estimator for the designated organ. The risk estimates of latent cancer deaths were taken from BEIR (1972) for the ICRP2 dose estimates and from ICRP26 (ICRP, 1977) for the ICRP30 dose estimates. These risk estimators are consistent with the dosimetric calculations of the respective models. The ICRP26 risk estimators are similar to those proposed by the BEIR Committee (1980). Overall there are small differences noted in the various risk estimators. Also two scenario analyses were performed to illustrate the effect that the use of the ICRP2 and the ICRP30 dosimetry models have on the results from a repository site analysis. In the scenario analysis performed with the Risk Methodology for Geologic Disposal of Radioactive Waste Program, the radionuclide intake is determined by the ingestion of contaminated food sources and inhalation of contaminated air. These intake levels are dependent upon the groundwater and environmental transport parameters. The dose commitment calculations and the estimates of adverse health effects that may result from these dose levels are a linear function

of intake. Therefore, it is possible to execute the Dosimetry and Health Effects Model (Runkle, et al., 1981) for a given scenario with the ICRP2 dose factors and with the ICRP30 dose factors and compare the results. The cancer risk estimators described above for the CRPC index were associated with the respective dose factors for the scenario analysis.

Chapter 2 of this report contains a brief description of each of the ICRP models. It is recommended that the reader refer to the reference documents for a thorough description of the models (ICRP, 1959; 1979a; 1979b; 1980). Chapter 3 describes the methods, assumptions, conversion factors and risk estimators for latent cancer deaths used in the comparison. The results of the comparison of the dose factors and the cancer risks per curie intake for each radionuclide are presented in Chapter 4. Also the results of an analysis of a U-tube scenario and a U-tube scenario with well withdrawal using the ICRP2 and the ICRP30 dose conversion factors and their associated risk estimators of adverse health effects are presented.

Chapter 2

Description of the ICRP2 and ICRP30 Internal Dosimetry Models

A brief summary of the ICRP2 and the ICRP30 internal dosimetry models is given in this chapter. However, the reader should refer to ICRP (1959, 1979a, 1979b, 1980) for the detailed descriptions of each model.

The ICRP2 model is a relatively simple representation of a complex biological system. Publication 2 was designed to protect the radiation worker by establishing the maximum permissible concentration for various radionuclides in the occupational environment. The basic equations used to calculate dose commitments, the absorbed energy data, fractions to distribute the radionuclide to various body organs, biological half-lives and quality factors are presented in Publication 2 (ICRP, 1959). These parameters and modeling concepts have been used to define dose conversion factors for the body organs for various radionuclides. Two solubility classes (soluble and insoluble) were established by ICRP2 to represent the most probable chemical form of a radionuclide that may be inhaled or ingested. Each of these chemical classes will be discussed with the ingestion and inhalation intakes.

Hoenes and Soldat (1977) used the basic equations and the data base presented in ICRP2 (1959) to derive

equations for calculating internal dose commitment factors that predict a 50 year dose commitment from a 1 year intake by ingestion or inhalation. These dose factors presented in NUREG-0172 (Hoenes and Soldat, 1977), have been used for the ICRP2 dose factors for this comparison study.

The flow diagram of the ICRP2 model is given in Figure 2.1. For the ingestion pathway, a radionuclide enters the mouth and is swallowed, reaching the stomach and intestine where it is absorbed across the gut lining. The fraction absorbed into the bloodstream is taken to be f_1 , and thus, $1-f_1$ represents the amount reaching the lower large intestine (LLI). The fraction reaching the LLI is assumed to determine the dose commitment to the gastrointestinal (GI) tract since the ingested material is retained in this region of the GI tract for the longest period. This retention period was assumed by ICRP2 to be 18 hours. If a completely soluble material is ingested, the $f_1 = 1.0$ would result in zero dose to the lower large intestine. However, by convention for GI tract dosimetry only, 5% is assumed to escape absorption. An insoluble compound has degrees of solubility in the GI tract defined by the value of f_1 . Thus, a completely insoluble compound would have an $f_1 = 0$ and represents

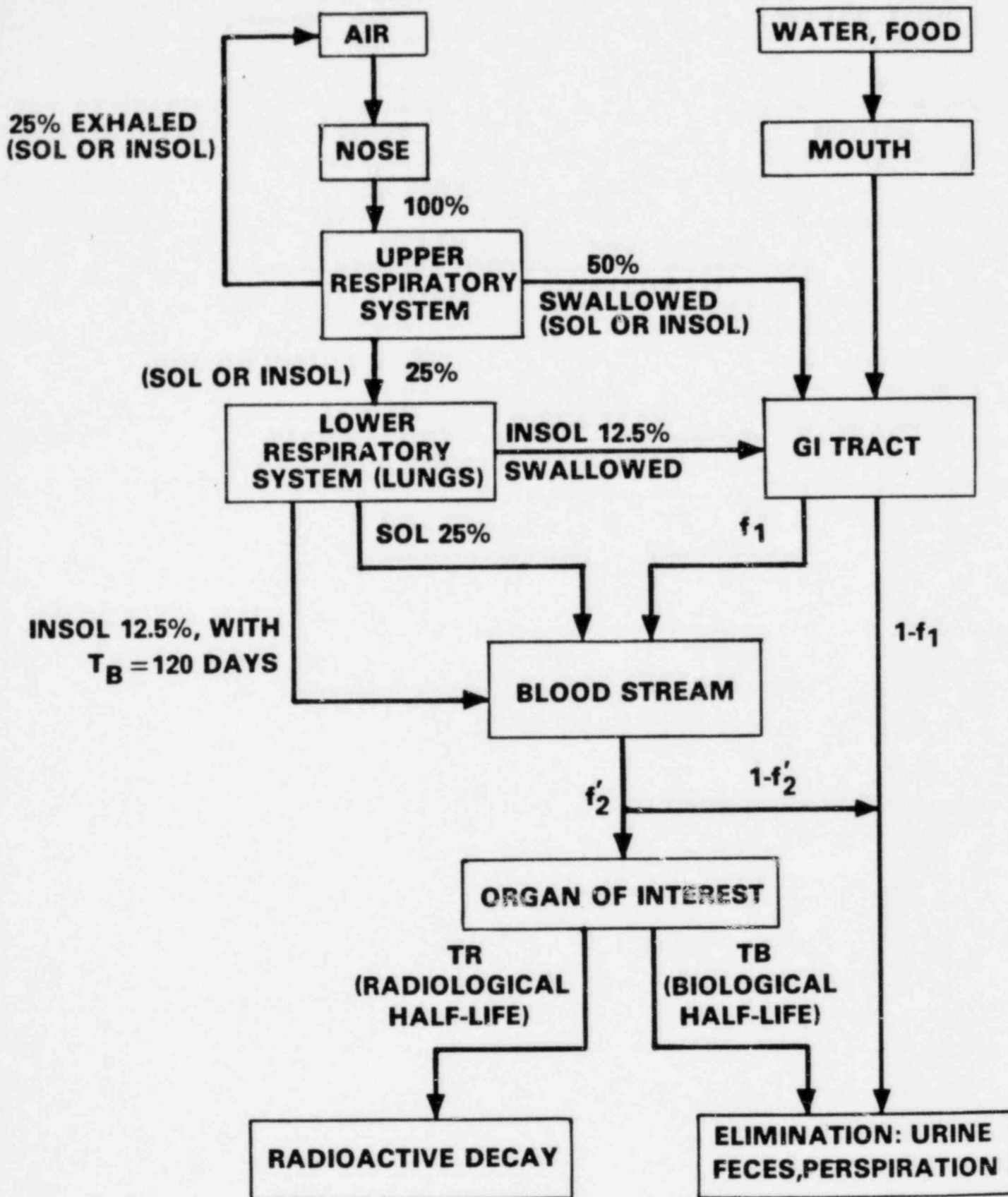


Figure 2.1

a dose commitment to only the GI tract. Most insoluble radionuclides have some absorption from the gut. A soluble form of the radionuclide was assumed for all the ingestion dose factor calculations in NUREG-0172.

The fraction that is transferred from the blood to the organ of interest is defined by f_2' and $1 - f_2'$ is eliminated from the body. The product of f_1 and f_2' defines the constant f_w , where f_w represents the fraction of the ingested radionuclide that reaches the organ of interest. A radionuclide is eliminated from the organ of interest by radioactive decay and excretion represented by T_R and T_B , respectively.

For the inhalation pathway, 25% of the inhaled radionuclide is assumed to be immediately exhaled. Of the remaining radionuclide deposited in the respiratory tract, 50% is carried up the trachea by ciliary action and swallowed into the GI tract for subsequent uptake from the gut. The distribution of the remaining 25%, deposited in the deep pulmonary region, is determined by the solubility of the inhaled material. If a soluble compound is inhaled the entire 25% deposited in the deep lung is absorbed into the bloodstream and distributed to the body organs according to the values of the constant, f_a (inhaled fraction reaching the reference organ). There is no lung dose from inhaled soluble material in the

ICRP2 model. If an insoluble material is inhaled, one-half of 25% deposited in the deep lung is retained in the lung. The remaining 12.5% is cleared by ciliary action and swallowed into the GI tract. The 12.5% retained in the lung is cleared with an assumed biological half-life of 120 days for all radionuclides except plutonium and thorium, which have assumed biological half-lives of 1 year and 4 years, respectively.

In the ICRP2 model, the bone is considered a homogeneous organ for the calculation of dose commitments. There is no distinction between cortical bone and red bone marrow in the model. The dose calculated by ICRP2 for bone is for cortical (calcified) bone. ICRP2 applies a "relative damage factor" for bone seekers (other than radium) which increases the calculated dose by a factor of approximately 5. This factor accounts for a tendency toward non-homogeneous distribution in the bones. ICRP Publication 11 (ICRP, 1968) describes the distribution of dose for various classes of radionuclides to the calcified, the bone forming and the hematopoietic portions of the bone. Based on these data, use of the bone dose calculated by ICRP2 to estimate leukemia (usually based on the dose to bone marrow) will over estimate the leukemia risk by 2-7 for specified radionuclides (ICRP, 1968).

In contrast to the ICRP2 model, the ICRP30 is a much more complex internal dosimetry model. It not only considers the dose commitment to an organ from the radionuclide

deposited in the organ (source organ S), but also considers the effect that the energy from radioactive decay within a source organ will have upon surrounding organs (target organs T).

In ICRP30, the gastrointestinal tract is considered as four separate organs (stomach, small intestine, upper large intestine and lower large intestine) as defined by the gastrointestinal model of Eve (1966) for estimating dose commitments. The ICRP2 model considers only the dose to the lower large intestine to represent the GI tract. Both models define the constant, f_1 , as the fraction of the radionuclide absorbed across the gut wall. However, ICRP30 defines several f_1 values for various chemical forms of the radionuclide.

The lung model in ICRP30 considers three clearance classes (Class D, W and Y) of inhaled compounds defined by the Task Group on Lung Dynamics (ICRP, 1966). The soluble/insoluble classification of ICRP2 is no longer used. A Class D material is retained in the lung for less than 1 day and is comparable to the ICRP2 classification of soluble. A Class W compound is retained within the lung for several weeks and most closely approximates the 120 day model (insoluble) used by ICRP2. A Class Y compound is retained within the lung for a year or

more and simulates biological retention times consistent with the actinides and transuranic elements.

The calculation of bone dose in ICRP30 is significantly modified and improved from ICRP2 and is detailed in Section 7 of Part 1 of Publication 30 (ICRP, 1979a). ICRP30 considers dose commitments to the hematopoietic cells of the bone marrow, the osteogenic cells (bone forming cells) on the endosteal surfaces and to epithelial cells close to the bone surfaces in contrast to the homogeneous bone dose calculated by ICRP2. The bone dose from radionuclides that are bone surface seekers is distinguished from other bone seeking radionuclides where possible.

This brief description of the models is not adequate to present all of the concepts included in the ICRP2 and the ICRP30 internal dosimetry models. However, this background will help to clarify some of the assumptions and methods used in this comparison study.

Chapter 3

Methods

This comparison study included three basic objectives. The first objective involved the collection of the ICRP2 and ICRP30 dose conversion factors and input of the data base into the computer. Secondly, risk estimators were associated with the dose commitments to designated organs to estimate the cancer risk. Finally, two scenario analyses were performed to illustrate the effect that the use of the ICRP2 and the ICRP30 dose conversion factors have on the results of a repository site analysis. These objectives are detailed in subsections 3.1 - 3.4.

3.1 ICRP2 Dose Conversion Factors

The 50 year dose commitment factors from Hoenes and Soldat (1977) were used as the source of the ICRP2 dose conversion factors. Dose factors for seven organs (including the total body) and 186 radionuclides are included in this data base. These dose factors are expressed in units of millirem/50 years per picocurie intake in the first year. The units were converted to rem/curie by multiplying by 10^9 for the comparison with ICRP30.

3.2 ICRP30 Dose Conversion Factors

The 50 year committed dose equivalent per intake

of unit activity were taken from ICRP (1979) and are expressed as Sv/Bq (sievert per becquerel). The dose factors for a limited number of target organs for each radionuclide are presented in ICRP, 1979a; 1979b. A more extensive publication of the data base for ICRP30 that includes 20 organs and 85 radionuclides (Eckerman, et al., 1981) was used as the source of the dose factors for this comparison study. These 85 radionuclides did not include all the radionuclides considered in the inventory of the reference waste repository. Therefore, the dose factors for the additional radionuclides (^{126}Sn , ^{210}Bi , ^{223}Ra , ^{225}Ra , ^{225}Ac , ^{227}Ac , ^{227}Th , ^{229}Th , ^{231}Pa , ^{236}U , ^{242}Pu , ^{243}Am , ^{245}Cm , ^{246}Cm , ^{14}C and ^{135}Cs) were obtained from computer listings provided by K. Eckerman, Oak Ridge National Laboratory.

The sievert/becquerel units were converted to rem/curie to compare to the ICRP2 dose factors by the conversion factors listed in Table 3.1.

In the ICRP30 data base, dose factors for some radionuclides include several clearance classes for the inhalation pathway and several f_1 values for the ingestion pathway, while the ICRP2 model considers only one type of chemical compound for each radionuclide. A set of

Table 3.1

Table to Convert SI* Units to Previous Units

<u>Quantity</u>	<u>SI Units</u>	<u>Previous Units</u>	<u>Conversion Factors</u>
Dose Equivalent	sievert (Sv)	rem (rem)	1 Sv = 100 rem
Activity	becquerel (Bq)	curie (Ci)	1 Bq = 2.7E-11 Ci
Dose per Unit Intake	Sv/Bq	rem/Ci	3.7E12**

*SI = International System of Units

**Multiply SI units by conversion factor to convert to previous units.

criteria was established to select one of the inhalation classes and one f_1 value for the comparison with the ICRP2. The criteria are:

- (1) If one value is listed in the ICRP30 data base for the inhalation and/or the oral intakes, this value was used for the comparison with ICRP2.
- (2) If several clearance classes are listed in ICRP30 for inhalation, the clearance class that most closely simulates the solubility class considered in ICRP2 (based on the biological half-life) was selected. A class W compound is similar to the 120 day half-life of ICRP2.

Class

D = biological half-life of less than one day
W = biological half-life of weeks and less than one year
Y = biological half-life of 365 days or greater.

- (3) If two f_1 values are listed in ICRP30 for the ingestion pathway, the f_1 most closely related to the f_1 value in ICRP2 was selected.

Table 3.2 lists the elements, the inhalation clearance classes and f_1 values for the ICRP30 dosimetry model (from Eckerman, et al., 1981) and the ICRP2

Table 3.2

ICRP30-ICRP2 Selection/Comparison Table

ELEMENT	INHALATION		INGESTION	
	ICRP30 Class-Compound	ICRP2 Biological Half Life (Days)/Solubility	ICRP30 f_1 - Compound	ICRP2 f_1 (Soluble for all compounds)
H	---	---	1.0 - Tritiated water	1.0
Na	All compounds	0.0 - Soluble	1.0 - All compounds	1.0
P	All compounds* - Insoluble phosphates	0.0 - Soluble	0.8 - All compounds	0.75
Ca	All compounds	120 - Insoluble	0.3 - All compounds	0.6
Cr	D - All other compounds W - Halides and nitrates* Y - Oxides and hydroxides	120 - Insoluble	0.01 - Trivalent compounds* 0.1 - Hexavalent compounds	0.005
Mn	D - All other compounds W - Oxides, hydroxides,* halides & nitrates	120 - Insoluble	0.1 - All compounds	0.1
Fe	D - All other compounds W - Oxides, hydroxides,* and halides	120 - Insoluble	0.1 - All compounds	0.1
Co	W - All other compounds* Y - Oxides, hydroxides, halides, and nitrates	120 - Insoluble	0.3 - Organically complexed* and inorganic compounds, except oxides and hydrox- ides in the presence of carrier material. 0.05 - Oxides and hydroxides and all other inorganic compounds ingested in tracer quantities.	0.3

*Selected for Comparison

Table 3.2 (continued)

ICRP30-ICRP2 Selection/Comparison Table

ELEMENT	INHALATION		INGESTION	
	ICRP30 Class-Compound	ICRP2 Biological Half Life (Days)/Solubility	ICRP30 f_1 - Compound	ICRP2 f_1 (Soluble for all compounds)
Cu	D - All other inorganic compounds		0.5 - All compounds	0.28
	W - Sulfides, halides,* and nitrates	120 - Insoluble		
	Y - Oxides and hydroxides			
Zn	Y - Most compounds	120 - Insoluble	0.5 - All compounds	0.1
Sr	D - All soluble compounds		0.3 - All soluble compounds*	0.3
	Y - Titanates*	120 - Insoluble	0.01 - Titanates	
Y	W - All other compounds*	120 - Insoluble	10^{-4} - All compounds	10^{-4}
	Y - Oxides and hydroxides			
Zr	D - All other compounds		0.002 - All compounds	10^{-4}
	W - Oxides, hydroxides,* halides, and nitrates	120 - Insoluble		
	Y - Carbides			
Nb	W - All other compounds*	120 - Insoluble	0.01 - All compounds	10^{-4}
	Y - Oxides and hydroxides			
Mo	D - All other compounds		0.8 - All other compounds*	0.8
	Y - Oxides, hydroxides,* and disulfides	120 - Insoluble	0.05 - Disulfides	
Tc	D - All other compounds		0.8 - All compounds	0.5
	W - Oxides, hydroxides,* halides, and nitrates	120 - Insoluble		
Ru	D - All other compounds		0.05 - Most compounds	0.03
	W - Halides*	120 - Insoluble		
	Y - Oxides and hydroxides			
Te	D - All other compounds		0.2 - All compounds	0.25
	W - Oxides, hydroxides* and nitrates	120 - Insoluble		

*Selected for Comparison

Table 3.2 (continued)

ICRP30-ICRP2 Selection/Comparison Table

ELEMENT	INHALATION		INGESTION	
	ICRP30 Class-Compound	ICRP2 Biological Half Life (Days)/Solubility	ICRP30 f_1 - Compound	ICRP2 f_1 (Soluble for all compounds)
I	D - All compounds	0.0 - Soluble	1.0 - Most compounds	1.0
Cs	D - All compounds	140 - Insoluble	1.0 - All compounds	1.0
Ce	W - All other compounds* Y - Oxides, hydroxides, and fluorides	120 - Insoluble	3×10^{-4} - All compounds	10^{-4}
Pb	D - Most compounds	120 - Insoluble	0.2 - All compounds	0.08
Po	D - All other compounds W - Oxides, hydroxides,* and nitrates	120 - Insoluble	0.1 - All compounds	0.06
Ra	W - Most compounds	120 - Insoluble	0.2 - All compounds	0.3
Th	W - All other compounds Y - Oxides and hydroxides*	1460 - Insoluble	2×10^{-4} - All compounds	10^{-4}
U	D - Soluble compounds [UF ₆ , UO ₂ F ₂ , and UO ₂ (NO ₃) ₂] W - Less soluble compounds* [UO ₃ , UF ₄ , and UCL ₄] Y - Highly insoluble oxides [UO ₂ and U ₃ O ₈]	120 - Insoluble	0.05 - Water-soluble* inorganic compounds (hexavalent) 0.002 - Insoluble compounds [UF ₄ , UO ₂ , and U ₃ O ₈] (usually tetravalent)	0.01
Np	W - All compounds	120 - Insoluble	0.01 - All compounds	10^{-4}
Pu	W - Most other compounds Y - Dioxides*	365 - Insoluble	10^{-4} - Most other compounds* 10^{-5} - Oxides and hydroxides	3×10^{-5}
Am	W - All compounds	120 - Insoluble	5×10^{-4} - All compounds	10^{-4}
Cm	W - All compounds	120 - Insoluble	5×10^{-4} - Most all compounds	10^{-4}
Cf	W - All other compounds* Y - Oxides and hydroxides	120 - Insoluble	5×10^{-4} - All compounds	3×10^{-5}

*Selected for Comparison

biological half-life in the lung and f_1 value for the same elements (from Hoenes and Soldat, 1977). The inhalation clearance class and the f_1 value for ICRP30 that were selected for comparison with ICRP2 are given in the table.

3.3 Risk Estimators

The risk estimators for estimating the potential cancer deaths that may result from the dose commitments from the ICRP2 dosimetry model were based on BEIR (1972) and are given in Table 3.3 with the body organ associated with the particular cancer type. These risk estimators are based on a lifetime risk. The BEIR (1972) risk estimates are consistent with the dosimetric assumptions of the ICRP2 model.

The risk estimators for ICRP30 are given in Table 3.4 with the associated organ for each cancer type. These estimators were taken from ICRP26 (ICRP, 1977) and are consistent with the revised bone dose calculation and the other dosimetric assumptions of ICRP30.

The risk estimators for the various cancers were multiplied by the dose conversion factors for the appropriate body organs for each of the internal

Table 3.3

Risk Estimators From BEIR-1972*
for Use With ICRP2

<u>Type of Cancer</u>	<u>Risk per rem**</u>	<u>ICRP2 Organ Dose Commitment With Associated Cancer Type</u>
Lung	2.5E-5	Lung
Leukemia	2.9E-5	Bone
GI tract	1.9E-5	GI tract
Breast	2.9E-5	Total Body
Bone	9.8E-6	Bone
Other	3.6E-5	Total Body

*BEIR (1972)

**Based on lifetime risk

Table 3.4

Risk Estimators From ICRP26*
for Use With ICRP30

<u>Type of Cancer</u>	<u>Risk per rem**</u>	<u>ICRP30 Organ Dose Commitment Associated With Cancer Type</u>
Lung	2.0E-5	Lung
Leukemia	2.0E-5	Red bone marrow
Breast	2.5E-5	Breast
Bone surfaces	5.0E-6	Bone surface
Thyroid	5.0E-6	Thyroid
Remainder	5.0E-5	***

*ICRP (1977).

**Converted from Risk/Sv using Table 3.1.

***Remainder represents cancer risk to unspecified tissues of the body. The five highest dose commitments for the remaining tissues (excluding lung, red bone marrow, breast, bone surface, thyroid and skin) are summed to represent the organ dose. No tissue represents a risk greater than 1.0E-5.

dosimetry models. The cancer risk was summed over all organs considered. This calculation resulted in the estimate of the cancer risk per curie intake (CRPC) for the ingestion and the inhalation pathways. This CRPC index is a reasonable measure to compare the various radionuclides considered by the ICRP2 and the ICRP30 models. The results of this comparison are presented in Chapter 4.

3.4 Scenario Analysis

The final step of this comparison study is to examine the effect that the use of the ICRP2 or ICRP30 dosimetry models will have on the results from a repository site analysis. Since the dosimetry and health effects estimates are a linear function with respect to the rate of radionuclide intake, it is possible to use each of the dose factor data bases and their associated risk estimators to calculate the cancer risk from a scenario analysis and compare the results. A U-tube scenario and a U-tube scenario with well withdrawal were chosen for this comparison.

A U-tube effect could result from exploratory drill holes or mining shafts present at the time of closure or emplaced at some future time (Figure 3.1). In this scenario, radionuclides reaching the middle aquifer are discharged to the surface at river L approximately 20 miles from the repository (Campbell, et al., 1978). In the analysis of a scenario, we consider four decay chains and one chain composed of single elements from fission and

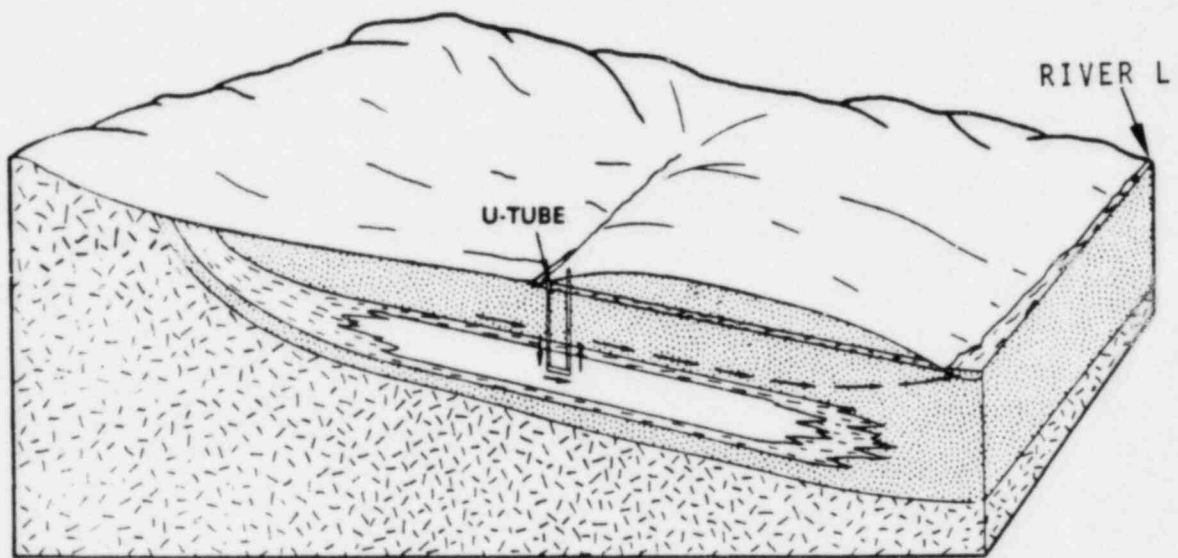


Figure 3.1

The reference repository site illustrating a U-tube connecting the subsurface facility with the middle sandstone aquifer.

activation products as the radionuclide inventory of the subsurface facility. The four decay chains begin with ^{252}Cf , ^{249}Cf , ^{250}Cf , and ^{251}Cf , respectively, and the radionuclides considered in each chain are given below:

Chain 1 -- ^{240}Pu , ^{236}U , ^{232}Th , ^{228}Ra , ^{224}Ra ;

Chain 2 -- ^{245}Cm , ^{241}Pu , ^{241}Am , ^{237}Np , ^{233}U , ^{229}Th ,
 ^{225}Ra , ^{225}Ac ;

Chain 3 -- ^{246}Cm , ^{242}Pu , ^{238}U , ^{238}Pu , ^{234}U , ^{230}Th ,
 ^{226}Ra , ^{210}Pb , ^{210}Bi , ^{210}Po ;

Chain 4 -- ^{243}Am , ^{239}Pu , ^{235}U , ^{231}Pa , ^{227}Ac , ^{227}Th ,
 ^{223}Ra ;

Chain 5 -- ^{126}Sn , ^{137}Cs , ^{99}Tc .

In the scenario analysis, the time span considered is 100,000 years after closure of the depository. During this time, factors such as leaching, retardation, chemical changes and other physical/chemical properties all affect the amount of radioactive material that may potentially be released from the subsurface facility and may ultimately reach the biosphere. To account for the uncertainty in the input parameters to the groundwater flow and transport models, these parameters are treated as random variables with assumed distributions. Table 3.5 lists the variable ranges and the assumed distribution used in this analysis for the contaminant transport through geologic media. A set of input values is referred to as a vector, where the components of the vector are

Table 3.5

Range and Distribution of Independent Variables
for Contaminant Transport for U-Tube Scenario

Variable	Range/Parameters	Distribution	Description
1	1.6×10^{-4} - 1.6×10^3 ($.01$ - 10^5)	Log _e normal	KD for Cm/Am ft ³ /lb (cm ³ /g)
2	1.6×10^{-4} - 1.6×10^2 ($.01$ - 10^4)	Log _e normal	KD for Pu " "
3	1.6×10^{-4} - 1.6×10^2 ($.01$ - 10^4)	Log _e normal	KD for U " "
4	1.6×10^{-4} - 1.6×10^2 ($.01$ - 10^4)	Log _e normal	KD for Th " "
5	1.6×10^{-4} - 8.0×10^1 ($.01$ - 500)	Log _e normal	KD for Ra " "
6	1.6×10^{-4} - 8.0×10^{-1} ($.01$ - 50)	Log _e normal	KD for Np " "
7	1.6×10^{-4} - 1.6×10^2 ($.01$ - 10^4)	Log _e normal	KD for Pb " "
8	1.6×10^{-4} - 1.6×10^2 ($.01$ - 10^4)	Log _e normal	KD for Pa " "
9	1.6×10^{-4} - 1.6×10^2 ($.01$ - 10^4)	Log _e normal	KD for Ac " "
10	1.6×10^{-4} - 1.6×10^2 ($.01$ - 10^4)	Log _e normal	KD for Cs " "
11	1.6×10^{-4} - 8.0×10^1 ($.01$ - 500)	Log _e normal	KD for Sn " "
12	1.6×10^{-4} - 8.0×10^1 ($.01$ - 500)	Log _e normal	KD for Tc " "
13	mean = -7.1, deviation = 2.	Log ₁₀ normal	Solubility limit of Pu lb/lb (g/g)
14	mean = -5.7, deviation = 1.	Log ₁₀ normal	Solubility limit of U " "
15	mean = -7.1, deviation = .6	Log ₁₀ normal	Solubility limit of Th " "
16	mean = -8.0, deviation = 1.	Log ₁₀ normal	Solubility limit of Ra " "
17	mean = -14.4, deviation = 3.	Log ₁₀ normal	Solubility limit of Np " "
18	mean = -7.5, deviation = 1.	Log ₁₀ normal	Solubility limit of Pb " "
19	mean = -5.0, deviation = .6	Log ₁₀ normal	Solubility limit of Pa " "
20	mean = -8.0, deviation = 2.	Log ₁₀ normal	Solubility limit of Sn " "
21	mean = -6.5, deviation = .8	Log ₁₀ normal	Solubility limit of Tc " "
22	.01 - 50 (3.5×10^{-6} - 1.8×10^{-2})	Log _e normal	Middle sandstone conductivity ft/day (cm)
23	.01 - 40 (3.5×10^{-6} - 1.4×10^{-2})	Log _e normal	Lower sandstone conductivity ft/day (cm)
24	.05 - .3	Normal	Middle sandstone porosity
25	.05 - .3	Normal	Lower sandstone porosity
26	50-500 (1.5×10^3 - 1.5×10^4)	Uniform	Dispersivity ft (cm)
27	10^3 - 10^7 (3.15×10^{10} - 3.15×10^{14})	Log _e uniform	Leach duration y (s)
28	.05 - 25	Log _e uniform	Shaft conductivity (ft/day)
29	.05 - .3	Normal	Shaft Porosity
30	-	-	Not used
31	-	-	Not used
32	10^2 - 10^5	Uniform*	Time of Occurrence (years)
33	1 - 1100	Uniform	Number of Rooms Accessed

- * 5 values between 100 and 1000 (uniform)
 10 values between 1000 and 10000 (uniform)
 20 values between 10000 and 100000 (uniform)

the specific values of the input parameters obtained during one statistical sampling procedure. For this comparison study, 35 input vectors were selected. The same set of input parameters were used for both the ICRP2 and the ICRP30 analysis.

Input data to the Pathways Model (Helton and Kaestner, 1981) are derived from output from the geologic transport model at each time step. The Pathways Model calculates the concentration for each radionuclide in the soil, water and sediment. To account for uncertainty and variability in the input parameters to the Pathways Model, a set of 18 variables with assumed distributions were used in the analysis. These variables are defined in Tables 3.6 and 3.7. Two zones, Zone 1 and Zone 2, are defined for use by the Pathways Model. Zone 1 describes an area 4 km by 40 km from a point above the subsurface facility to the junction with river L. This zone is designed to display the effects of discharges to the surface environment other than at the river (e.g., well withdrawal and faults). If the scenario includes a well all the drinking water for the individual is assumed to come from the well discharge and irrigation water is obtained from the river. If the scenario does not include a well, the drinking water in addition to the irrigation water for the other food pathways is obtained from River L. Zone 2 is downstream from Zone 1 and takes into account environmental dilution and retardation, resuspension from soil and irrigation

Table 3.6

Variables Which Affect the Physical Description of
the Surface Environment

-
- V_1 : scale factor used to introduce variation in hydrologic properties. New values for water flow from soil subzones to groundwater subzones, river discharge at head of zone 1, upper sand and gravel aquifer discharge and middle sandstone aquifer discharge are obtained by multiplication with this factor. As the reference site was defined with an annual rainfall of 1m, use of V_1 amounts in a crude way to varying the rainfall from .25m to 2m. This is only approximate as the indicated notes do not move in a strictly linear manner with rainfall; however, it is felt that this provides a way of varying the Reference Site between wet and dry conditions. (Units: Unitless; Range: .25, 2.; Sampling Dist.: Uniform.)
-
- V_2 : scale factor used to introduce variation in water movement between soil subzones and surface water subzones. New values for such movements are obtained by multiplication of the pore volume of a soil subzone by V_2 . This variable is introduced to allow for variation in water movements which might result from runoff, irrigation or overbank flooding. (Units: yr^{-1} ; Range: 10^{-2} , 10^1 ; Sampling Dist.: Log Uniform.)
-
- V_3 : scale factor used to introduce variation in solid movement between soil subzones and surface water subzones. New values for such movements are obtained by multiplication of the mass of solids contained in a soil subzone by V_3 . This variable is introduced to allow for variation in solid movements which might result from runoff, irrigation or overbank flooding. (Units: yr^{-1} ; Range: 10^{-4} , 10^{-2} ; Sampling Dist.: Log Uniform.)
-
- V_4 : regional erosion rate (Units: cm/1000 yrs; Range: 3., 15.; Sampling Dist.: Uniform.)

Table 3.7

Radionuclides and Associated Distribution Coefficients
(Units: cm^3/g) for Surface Environment

Variable	Element	Range	Distribution
V ₅	Cm	.01-10 ⁵	Log _e normal
"	Am	"	" "
V ₆	Pu	.01-10 ⁴	Log _e normal
V ₇	Np	.01-50	Log _e normal
V ₈	U	.01-10 ⁴	Log _e normal
V ₉	Pa	.01-10 ⁴	Log _e normal
V ₁₀	Th	.01-10 ⁴	Log _e normal
V ₁₁	Ac	.01-10 ⁴	Log _e normal
V ₁₂	Ra	.01-500	Log _e normal
V ₁₃	Po	.01-200	Log _e normal
V ₁₄	Bi	.01-200	Log _e normal
V ₁₅	Pb	.01-10 ⁴	Log _e normal
V ₁₆	Tc	.01-500	Log _e normal
V ₁₇	Sn	.01-500	Log _e normal
V ₁₈	Cs	.01-10 ⁴	Log _e normal

with river water. In Zone 2, the drinking water and irrigation water are always obtained from River L. The Pathways Model separates the exposure pathways into ingestion, inhalation and external. However, for this comparison study the external exposure pathway is not considered. The 50 year dose conversion factors (expressed as rem/Ci) from the ICRP2 and the ICRP30 models for the radionuclides considered in the inventory, were each multiplied by the radionuclide dependent intakes (expressed as curies per year) for the ingestion and inhalation pathways to estimate the dose commitment to the individual body organs (rem). These rem values are summed over all radionuclides for the individual body organs to calculate the total dose commitment from the potential releases from the subsurface facility. The cancer risk estimators, associated with each model (ICRP2 -- BEIR-1972; ICRP30 -- ICRP26) for the various organs, are multiplied by the organ dose commitments to estimate the cancer risk that may result from exposure to the releases from the subsurface facility at a given time step. These cancer risk estimates are based on a 50 year dose commitment. The results from the Dosimetry and Health Effects Model are expressed as cancer risk for the ingestion and inhalation pathways for each vector analyzed at a given time step.

The mean of the 35 vectors is output for each of the exposure pathways and will reflect changes in the groundwater discharge rates with time post closure.

The U-tube scenario with well withdrawal scenario is nearly the same as the U-tube scenario, except that a field of withdrawal wells completed into the middle sandstone aquifer is located downdip from the subsurface facility (Figure 3.2). These wells represent sources of water for individuals or municipal water supplies and the discharge from these wells is used as a source of drinking water for the scenario analysis in Zone 1. The wells are located approximately 1 mile downdip from the subsurface facility and represent a potential shortened path to the surface environment for radionuclides released into the middle sandstone aquifer through the U-tube.

In this scenario, we again consider 35 vectors and 5 decay chains. The same set of input variables listed in Table 3.5 for contaminant transport and in Tables 3.6 & 3.7 for the surface transport were used in the U-tube with well withdrawal scenario. The results of the 35 vectors at each time step represent the cancer risk for the radionuclides considered in the inventory. The effects of the well discharge are presented for Zone 1 where the well is used as the source of drinking water. The results of these scenario analyses are presented in Chapter 4.

Chapter 4

Results

The ICRP2 and the ICRP30 dose conversion factors (expressed as rem/Ci) are given in Appendix A for the radionuclides that were common to both data bases. The ICRP30 dose factors were selected according to the criteria detailed in Chapter 3 and in Table 3.2 for those radionuclides with multiple clearance classes and f_1 values.

The cancer risk per curie intake (CRPC) indices were calculated using the ICRP2 dose factors with the BEIR I cancer risk estimators and the ICRP30 dose factors with the ICRP26 cancer risk estimators. These CRPC values are given in Table 4.1 for the ingestion and inhalation pathways. Differences between the CRPC indices for the ICRP2 and the ICRP30 models for the ingestion intakes range from approximately 2 to 20 for most radionuclides. Of particular note, is the index for ^{237}Np that is approximately 200 times greater for the ICRP30 model. This difference can be explained by the increased gut uptake (defined by f_1) used in the ICRP30 model. Generally, there is much closer agreement of the CRPC indices for most radionuclides for inhalation intakes.

The ICRP2 and ICRP30 CRPC index for each of the 33 radionuclides considered in the scenario analysis are plotted in Figure 4.1 and 4.2 for the ingestion and inhalation pathways, respectively. Points near the solid line indicate close agreement between the two models. Points significantly

TABLE 4.1
 CANCER RISK PER CURIE (CRPC)

	ICRP2	ICRP30
H3		
INGESTION	1.14E-02	2.08E-02
INHALATION	1.14E-02	2.08E-02
NA22		
INGESTION	2.56E+00	3.83E+00
INHALATION	1.91E+00	2.48E+00
NA24		
INGESTION	2.50E-01	5.79E-01
INHALATION	1.88E-01	3.48E-01
P32		
INGESTION	8.27E+00	3.34E+00
INHALATION	6.92E+00	1.52E+00
CR51		
INGESTION	1.31E-02	9.06E-02
INHALATION	5.38E-02	9.14E-02
MN54		
INGESTION	3.25E-01	1.29E+00
INHALATION	4.61E+00	2.28E+00
MN56		
INGESTION	7.18E-02	7.34E-01
INHALATION	7.81E-02	1.02E-01
FE55		
INGESTION	1.81E-01	3.07E-01
INHALATION	3.89E-01	5.18E-01
FE59		
INGESTION	1.14E+00	3.52E+00
INHALATION	3.77E+00	4.01E+00
CO57		
INGESTION	1.04E-01	5.60E-01
INHALATION	1.24E+00	7.14E-01

TABLE 4.1 (CONTINUED)
 CANCER RISK PER CURIE (CRPC)

	ICRP2	ICRP30
C058		
INGESTION	3.98E-01	1.71E+00
INHALATION	3.17E+00	1.96E+00
C060		
INGESTION	1.08E+00	1.12E+01
INHALATION	1.95E+01	1.05E+01
ZN65		
INGESTION	8.22E-01	5.26E+00
INHALATION	3.36E+00	6.53E+00
ZN69		
INGESTION	5.39E-04	7.33E-02
INHALATION	2.91E-03	8.90E-03
SR89		
INGESTION	1.33E+01	6.02E+00
INHALATION	6.74E+00	9.86E+00
SR90		
INGESTION	4.14E+02	2.81E+01
INHALATION	5.55E+02	2.21E+02
SR91		
INGESTION	7.50E-01	1.87E+00
INHALATION	5.73E-01	7.02E-01
SR92		
INGESTION	9.06E-01	1.28E+00
INHALATION	1.55E-01	3.47E-01
Y90		
INGESTION	1.96E+00	8.96E+00
INHALATION	1.75E+00	3.83E+00
Y91		
INGESTION	1.50E+00	7.92E+00
INHALATION	8.56E+00	9.16E+00

TABLE 4.1 (CONTINUED)
 CANCER RISK PER CURIE (CRPC)

	ICRP2	ICRP30
Y91M		
INGESTION	8.83E-06	2.74E-02
INHALATION	6.00E-03	7.38E-03
ZR95		
INGESTION	5.95E-01	2.47E+00
INHALATION	6.55E+00	4.09E+00
ZR97		
INGESTION	2.02E+00	6.54E+00
INHALATION	1.50E+00	1.91E+00
NB95		
INGESTION	4.04E-01	1.49E+00
INHALATION	1.93E+00	1.45E+00
MO99		
INGESTION	2.45E-01	2.01E+00
INHALATION	8.80E-01	1.02E+00
TC99		
INGESTION	1.25E-01	9.89E-01
INHALATION	2.67E+00	1.85E+00
TC99M		
INGESTION	8.52E-03	3.36E-02
INHALATION	1.24E-02	8.88E-03
RU103		
INGESTION	4.27E-01	2.03E+00
INHALATION	1.86E+00	1.90E+00
RU106		
INGESTION	3.55E+00	2.00E+01
INHALATION	3.18E+01	2.92E+01
SN126		
INGESTION	3.85E+00	1.29E+01
INHALATION	3.60E+01	2.48E+01

TABLE 4.1 (CONTINUED)
 CANCER RISK PER CURIE (CRPC)

	ICRP2	ICRP30
TE127		
INGESTION	1.72E-01	5.69E-01
INHALATION	1.58E-01	1.35E-01
TE127M		
INGESTION	7.48E-01	3.56E+00
INHALATION	3.43E+00	4.79E+00
TE129		
INGESTION	2.15E-03	1.66E-01
INHALATION	6.43E-03	1.82E-02
TE129M		
INGESTION	1.67E+00	7.00E+00
INHALATION	4.60E+00	6.38E+00
TE131		
INGESTION	1.21E-03	4.25E-01
INHALATION	4.35E-03	9.22E-02
TE131M		
INGESTION	1.72E+00	3.75E+00
INHALATION	1.79E+00	1.75E+00
TE132		
INGESTION	1.68E+00	2.60E+00
INHALATION	2.13E+00	2.09E+00
I129		
INGESTION	7.30E-01	4.61E+01
INHALATION	5.47E-01	2.91E+01
I131		
INGESTION	4.10E-01	8.58E+00
INHALATION	3.01E-01	5.54E+00
I132		
INGESTION	2.22E-02	2.31E-01
INHALATION	1.59E-02	8.98E-02

TABLE 4.1 (CONTINUED)
 CANCER RISK PER CURIE (CRPC)

	ICRP2	ICRP30
I133		
INGESTION	1.46E-01	1.83E+00
INHALATION	9.92E-02	1.01E+00
I134		
INGESTION	1.07E-02	1.38E-01
INHALATION	8.06E-03	3.80E-02
I135		
INGESTION	6.98E-02	4.84E-01
INHALATION	4.52E-02	2.37E-01
CS134		
INGESTION	1.07E+01	2.54E+01
INHALATION	8.01E+00	1.61E+01
CS134M		
INGESTION	2.70E-03	2.86E-02
INHALATION	1.95E-03	1.18E-02
CS136		
INGESTION	1.55E+00	4.01E+00
INHALATION	1.15E+00	2.56E+00
CS137		
INGESTION	8.02E+00	1.69E+01
INHALATION	6.01E+00	1.07E+01
CE141		
INGESTION	4.65E-01	2.32E+00
INHALATION	1.53E+00	3.12E+00
CE143		
INGESTION	8.76E-01	3.63E+00
INHALATION	7.94E-01	1.53E+00
CE144		
INGESTION	3.19E+00	1.74E+01
INHALATION	4.41E+01	1.12E+02

TABLE 4.1 (CONTINUED)
 CANCER RISK PER CURIE (CRPC)

	ICRP2	ICRP30
PB210		
INGESTION	6.21E+02	2.25E+03
INHALATION	1.72E+03	5.69E+03
BI210		
INGESTION	9.32E-01	5.30E+00
INHALATION	2.83E+01	3.67E+01
PO210		
INGESTION	2.04E+01	1.43E+03
INHALATION	8.07E+02	3.12E+03
RA223		
INGESTION	2.60E+02	1.85E+02
INHALATION	6.52E+02	1.35E+03
RA224		
INGESTION	8.90E+01	1.11E+02
INHALATION	2.26E+02	5.49E+02
RA225		
INGESTION	3.41E+02	8.94E+01
INHALATION	7.51E+02	1.32E+03
RA226		
INGESTION	2.58E+04	2.82E+02
INHALATION	1.36E+04	1.49E+03
RA228		
INGESTION	1.21E+04	3.36E+02
INHALATION	8.81E+03	9.02E+02
AC225		
INGESTION	8.00E+00	8.17E+01
INHALATION	5.75E+02	1.79E+03
AC227		
INGESTION	8.02E+01	4.81E+03
INHALATION	1.03E+05	5.82E+05

TABLE 4.1 (CONTINUED)
 CANCER RISK PER CURIE (CRPC)

	ICRP2	ICRP30
TH227		
INGESTION	1.09E+01	2.45E+01
INHALATION	9.58E+02	2.71E+03
TH228		
INGESTION	3.08E+01	9.42E+01
INHALATION	3.33E+04	5.73E+04
TH229		
INGESTION	3.40E+02	6.08E+02
INHALATION	4.55E+05	2.90E+05
TH230		
INGESTION	8.35E+01	1.02E+02
INHALATION	1.07E+05	4.39E+04
TH232		
INGESTION	7.91E+01	4.66E+02
INHALATION	9.58E+04	1.93E+05
TH234		
INGESTION	2.17E+00	1.13E+01
INHALATION	6.14E+00	1.01E+01
PA231		
INGESTION	1.68E+02	1.78E+03
INHALATION	2.08E+05	2.14E+05
U233		
INGESTION	3.79E+01	1.29E+02
INHALATION	1.79E+03	1.55E+03
U234		
INGESTION	3.65E+01	1.28E+02
INHALATION	1.74E+03	1.52E+03
U235		
INGESTION	3.52E+01	1.20E+02
INHALATION	1.65E+03	1.42E+03

TABLE 4.1 (CONTINUED)

CANCER RISK PER CURIE (CRPC)

	ICRP2	ICRP30
U236		
INGESTION	3.49E+01	1.21E+02
INHALATION	1.67E+03	1.44E+03
U238		
INGESTION	3.33E+01	1.14E+02
INHALATION	1.55E+03	1.35E+03
NP237		
INGESTION	5.74E+01	1.32E+04
INHALATION	7.03E+04	1.65E+05
NP239		
INGESTION	4.61E-01	2.57E+00
INHALATION	4.05E-01	1.14E+00
PU238		
INGESTION	2.85E+01	1.41E+02
INHALATION	1.14E+05	8.19E+04
PU239		
INGESTION	3.26E+01	1.55E+02
INHALATION	1.31E+05	9.00E+04
PU240		
INGESTION	3.25E+01	1.55E+02
INHALATION	1.31E+05	9.00E+04
PU241		
INGESTION	6.79E-01	2.90E+00
INHALATION	2.54E+03	1.68E+03
PU242		
INGESTION	3.03E+01	1.47E+02
INHALATION	1.22E+05	8.55E+04
AM241		
INGESTION	3.62E+01	7.43E+02
INHALATION	4.44E+04	1.76E+05

TABLE 4.1 (CONTINUED)
 CANCER RISK PER CURIE (CRPC)

	ICRP2	ICRP30
AM243		
INGESTION	3.64E+01	7.40E+02
INHALATION	4.43E+04	1.76E+05
CM242		
INGESTION	2.40E+00	3.31E+01
INHALATION	1.61E+03	5.00E+03
CM244		
INGESTION	2.18E+01	4.05E+02
INHALATION	2.63E+04	9.49E+04
CM245		
INGESTION	4.40E+01	7.64E+02
INHALATION	5.42E+04	1.81E+05
CM246		
INGESTION	4.36E+01	7.58E+02
INHALATION	5.39E+04	1.80E+05
CF252		
INGESTION	1.60E+01	1.99E+02
INHALATION	4.38E+04	4.01E+04
C14		
INGESTION	1.72E-01	2.59E-01
INHALATION	1.35E-01	2.96E-03
CS135		
INGESTION	1.33E+00	8.87E-01
INHALATION	9.99E-01	5.71E-01

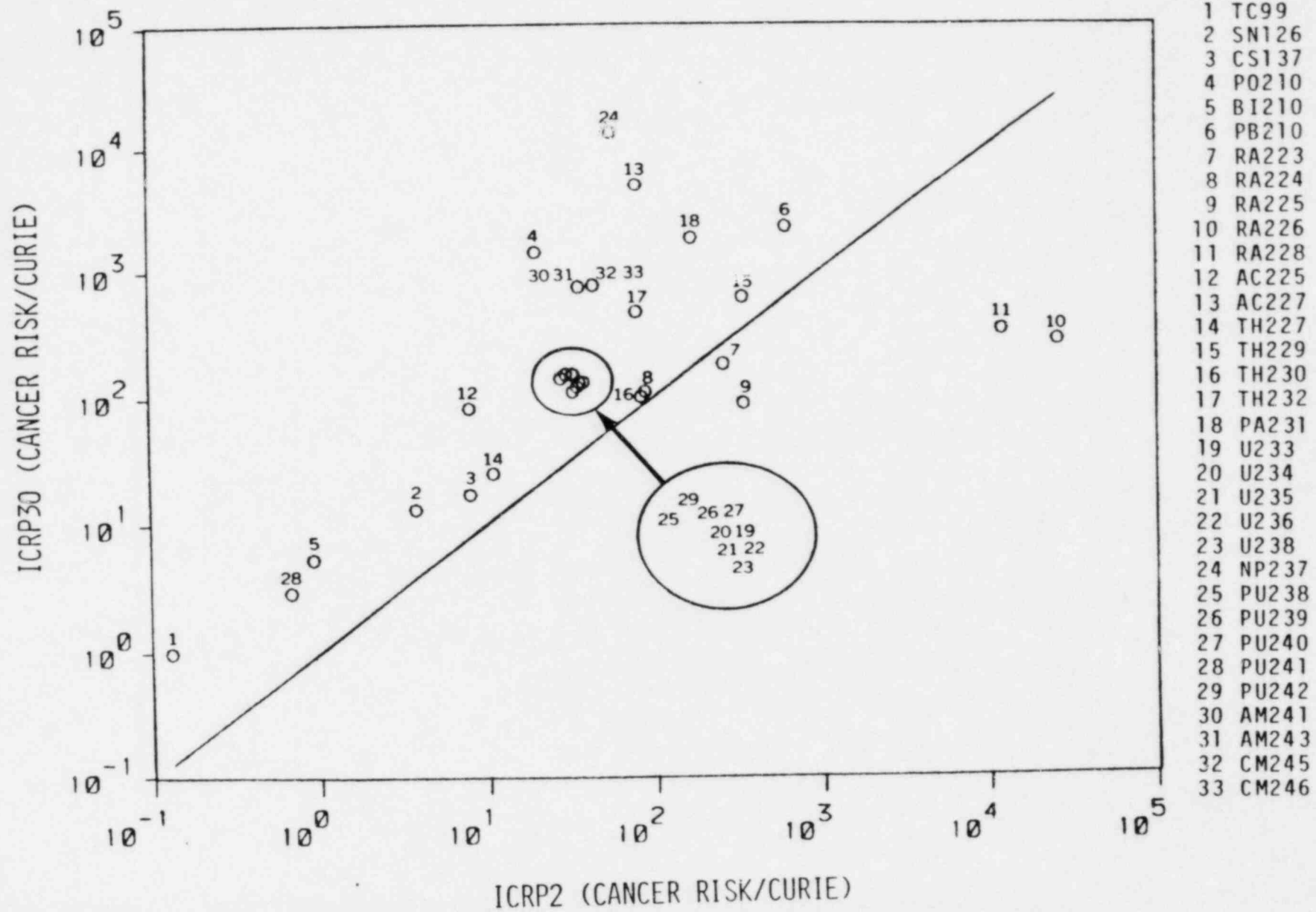


Figure 4.1
Cancer risk per curie for the ingestion pathway.

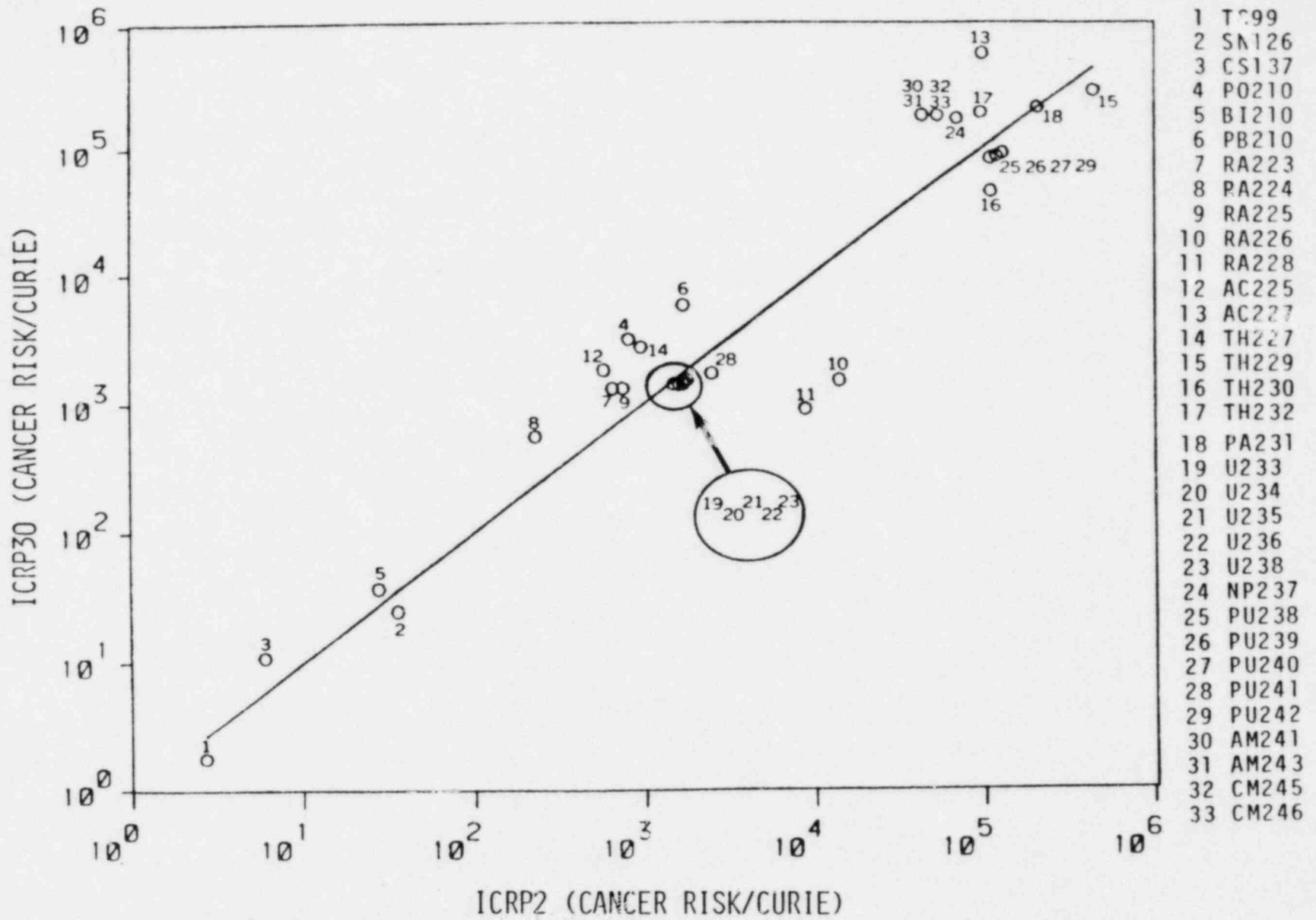


Figure 4.2
Cancer risk per curie for the inhalation pathway.

above or below the line indicate dominance of the ICRP30 or the ICRP2 CRPC index, respectively.

The results of the U-tube scenario analysis are given in Figure 4.3 for Zone 2. As mentioned before, Zone 1 is designed to display the effects of discharge to the surface environment other than at the river. The plotted curves represent the mean value of the 35 vectors considered in the analysis for the ICRP2 and ICRP30 ingestion pathways. The inhalation risk is below the 10^{-9} cutoff. The ICRP30 risks are higher by approximately 20 at 10,000 years post closure. However, the ICRP2 risks are higher by a factor of approximately 2 at times greater than 50,000 years. The mean risk values for the ingestion and inhalation pathways are given in Table 4.2 for this scenario. A comparison of these risk values, with respect to time, and the mean discharge curves from the transport analysis (Figure 4.4) for this scenario, suggests that certain radionuclides dominate the risk. At each point in time the Ci/day discharge value is found by averaging over all 35 vectors. The multi-peaked behavior in the average discharge curve is due to one or a few vectors dominating the mean at different times. At approximately 10,000 years post closure, ^{245}Cm , ^{246}Cm , ^{241}Am and ^{243}Am appear to be the radionuclides with the greatest discharge rates. The cancer risk per curie indices for these radionuclides are approximately 17-20 times higher for the ICRP30 model and probably account for the differences noted in the

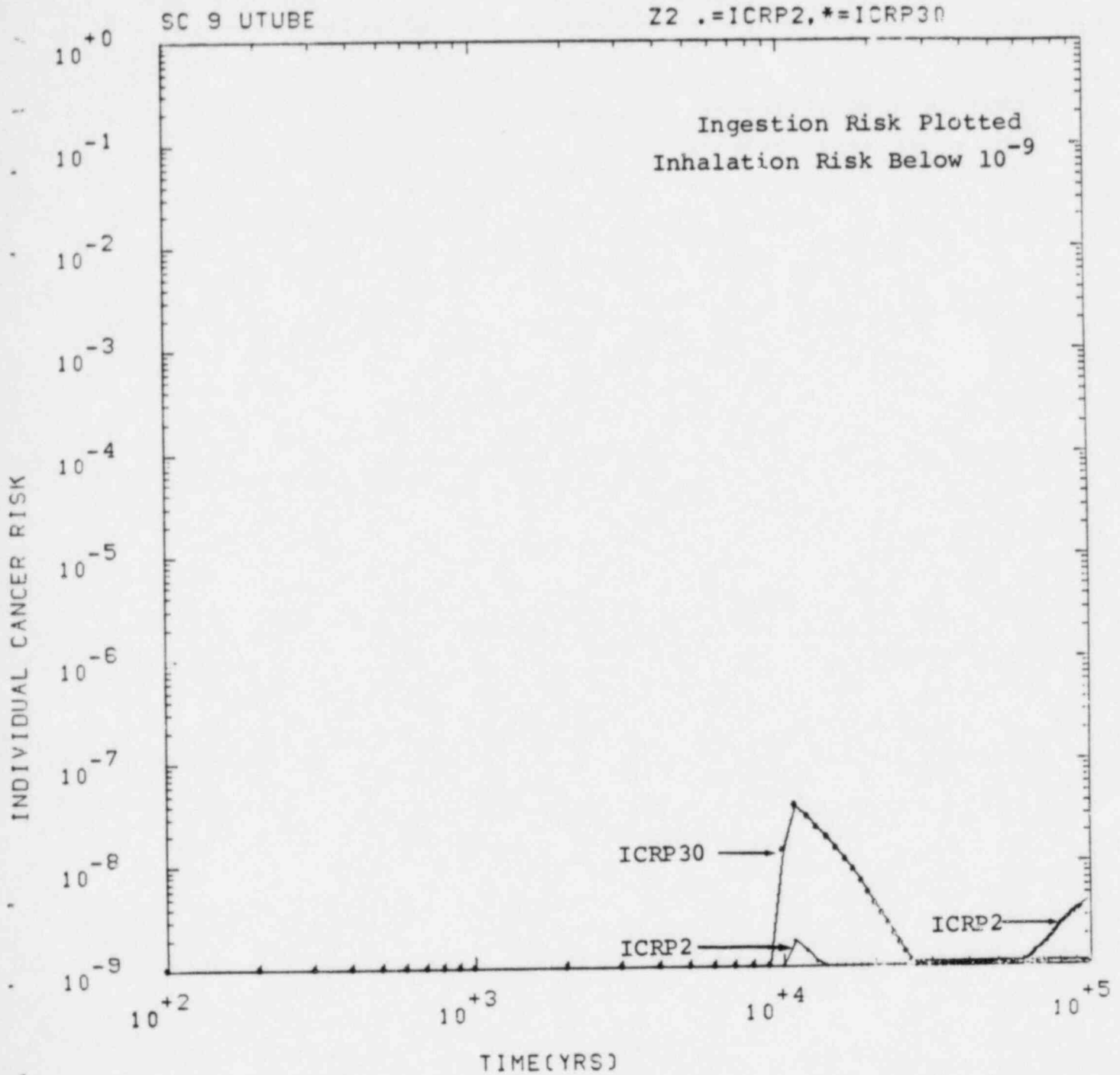


Figure 4.3

Risk Estimates for the U-tube Scenario in Zone 2
Using the ICRP2 and ICRP30 Dosimetry Models

TIME(YRS)	RISK ING ICRP2	RISK ING ICRP30	RISK INH ICRP2	RISK INH ICRP30	TOT RISK ICRP2	TOT RISK ICRP30
1.000E+02	0.	0.	0.	0.	0.	0.
2.000E+02	0.	0.	0.	0.	0.	0.
3.000E+02	0.	0.	0.	0.	0.	0.
4.000E+02	0.	0.	0.	0.	0.	0.
5.000E+02	0.	0.	0.	0.	0.	0.
6.000E+02	0.	0.	0.	0.	0.	0.
7.000E+02	0.	0.	0.	0.	0.	0.
8.000E+02	0.	0.	0.	0.	0.	0.
9.000E+02	0.	0.	0.	0.	0.	0.
1.000E+03	0.	0.	0.	0.	0.	0.
2.000E+03	0.	0.	0.	0.	0.	0.
3.000E+03	0.	0.	0.	0.	0.	0.
4.000E+03	0.	0.	0.	0.	0.	0.
5.000E+03	1.190E-14	1.161E-14	1.184E-18	6.347E-19	1.190E-14	1.161E-14
6.000E+03	5.928E-14	5.707E-14	5.618E-18	3.085E-18	5.929E-14	5.708E-14
7.000E+03	1.758E-13	1.123E-12	1.653E-17	1.237E-17	1.758E-13	1.123E-12
8.000E+03	1.071E-12	8.610E-12	4.522E-17	5.367E-17	1.071E-12	8.610E-12
9.000E+03	2.597E-12	2.344E-11	8.799E-16	3.236E-15	2.598E-12	2.344E-11
1.000E+04	6.562E-10	1.315E-08	7.513E-13	2.947E-12	6.569E-10	1.315E-08
1.100E+04	1.809E-09	3.635E-08	2.075E-12	8.141E-12	1.811E-09	3.635E-08
1.200E+04	1.426E-09	2.860E-08	1.631E-12	6.397E-12	1.427E-09	2.860E-08
1.300E+04	1.122E-09	2.236E-08	1.274E-12	4.999E-12	1.123E-09	2.236E-08
1.400E+04	8.861E-10	1.748E-08	9.961E-13	3.907E-12	8.871E-10	1.748E-08
1.500E+04	7.054E-10	1.367E-08	7.786E-13	3.053E-12	7.062E-10	1.367E-08
1.600E+04	5.676E-10	1.069E-08	6.087E-13	2.386E-12	5.682E-10	1.069E-08
1.700E+04	4.632E-10	8.365E-09	4.759E-13	1.865E-12	4.637E-10	8.367E-09
1.800E+04	3.851E-10	6.550E-09	3.722E-13	1.457E-12	3.855E-10	6.552E-09
1.900E+04	3.273E-10	5.134E-09	2.911E-13	1.139E-12	3.276E-10	5.136E-09
2.000E+04	2.926E-10	4.054E-09	2.277E-13	8.904E-13	2.928E-10	4.055E-09
2.100E+04	2.705E-10	3.216E-09	1.782E-13	6.960E-13	2.707E-10	3.217E-09
2.200E+04	2.583E-10	2.569E-09	1.395E-13	5.441E-13	2.585E-10	2.570E-09
2.300E+04	2.534E-10	2.071E-09	1.093E-13	4.254E-13	2.535E-10	2.071E-09
2.400E+04	2.482E-10	1.662E-09	8.572E-14	3.326E-13	2.483E-10	1.663E-09
2.500E+04	2.469E-10	1.343E-09	6.726E-14	2.601E-13	2.469E-10	1.343E-09
2.600E+04	2.481E-10	1.096E-09	5.294E-14	2.035E-13	2.481E-10	1.096E-09
2.700E+04	2.613E-10	9.362E-10	4.250E-14	1.598E-13	2.614E-10	9.363E-10
2.800E+04	2.741E-10	8.044E-10	3.418E-14	1.256E-13	2.742E-10	8.045E-10
2.900E+04	2.873E-10	6.991E-10	2.764E-14	9.877E-14	2.874E-10	6.992E-10
3.000E+04	3.019E-10	6.174E-10	2.253E-14	7.783E-14	3.019E-10	6.175E-10
3.100E+04	3.168E-10	5.531E-10	1.852E-14	6.146E-14	3.168E-10	5.531E-10
3.200E+04	3.327E-10	5.014E-10	1.536E-14	4.864E-14	3.327E-10	5.015E-10
3.300E+04	3.485E-10	4.595E-10	1.287E-14	3.861E-14	3.485E-10	4.596E-10
3.400E+04	3.648E-10	4.261E-10	1.087E-14	3.073E-14	3.648E-10	4.261E-10
3.500E+04	3.808E-10	3.994E-10	9.343E-15	2.458E-14	3.808E-10	3.994E-10
3.600E+04	3.983E-10	3.798E-10	8.166E-15	1.980E-14	3.983E-10	3.798E-10
3.700E+04	4.140E-10	3.588E-10	7.092E-15	1.595E-14	4.140E-10	3.589E-10
3.800E+04	4.315E-10	3.465E-10	6.355E-15	1.301E-14	4.315E-10	3.465E-10
3.900E+04	4.384E-10	3.338E-10	5.707E-15	1.066E-14	4.384E-10	3.338E-10
4.000E+04	4.621E-10	3.249E-10	5.207E-15	8.833E-15	4.621E-10	3.249E-10
4.100E+04	4.872E-10	3.172E-10	4.769E-15	7.374E-15	4.872E-10	3.172E-10
4.200E+04	4.953E-10	3.208E-10	4.472E-15	6.260E-15	4.953E-10	3.208E-10
4.300E+04	5.194E-10	3.270E-10	4.167E-15	5.345E-15	5.194E-10	3.270E-10
4.400E+04	5.479E-10	3.346E-10	3.963E-15	4.648E-15	5.479E-10	3.347E-10
4.500E+04	5.580E-10	3.420E-10	3.772E-15	4.084E-15	5.580E-10	3.420E-10
4.600E+04	5.829E-10	3.573E-10	3.669E-15	3.675E-15	5.829E-10	3.573E-10

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TIME(YRS)	RISK ING ICRP2	RISK ING ICRP30	RISK INH ICRF2	RISK INH ICRP30	TOT RISK ICRP2	TOT RISK ICRP30
4.700E+04	6.118E-10	3.808E-10	3.545E-15	3.327E-15	6.118E-10	3.809E-10
4.800E+04	6.257E-10	4.045E-10	3.693E-15	3.086E-15	6.257E-10	4.045E-10
4.900E+04	6.506E-10	4.263E-10	3.233E-15	2.249E-15	6.506E-10	4.263E-10
5.000E+04	6.836E-10	4.549E-10	3.288E-15	2.270E-15	6.836E-10	4.549E-10
5.100E+04	6.952E-10	4.719E-10	3.226E-15	2.215E-15	6.952E-10	4.719E-10
5.200E+04	7.351E-10	4.929E-10	3.233E-15	2.210E-15	7.351E-10	4.929E-10
5.300E+04	7.514E-10	5.151E-10	3.243E-15	2.208E-15	7.514E-10	5.151E-10
5.400E+04	7.940E-10	5.409E-10	3.228E-15	2.193E-15	7.940E-10	5.409E-10
5.500E+04	8.127E-10	5.664E-10	3.314E-15	2.244E-15	8.127E-10	5.664E-10
5.600E+04	8.585E-10	5.903E-10	3.313E-15	2.240E-15	8.585E-10	5.903E-10
5.700E+04	8.802E-10	6.142E-10	3.310E-15	2.230E-15	8.802E-10	6.142E-10
5.800E+04	9.300E-10	6.410E-10	3.307E-15	2.222E-15	9.300E-10	6.410E-10
5.900E+04	9.549E-10	6.649E-10	3.315E-15	2.228E-15	9.549E-10	6.649E-10
6.000E+04	1.013E-09	6.836E-10	3.435E-15	2.305E-15	1.013E-09	6.836E-10
6.100E+04	1.046E-09	6.950E-10	3.455E-15	2.316E-15	1.046E-09	6.950E-10
6.200E+04	1.112E-09	7.086E-10	3.478E-15	2.331E-15	1.112E-09	7.086E-10
6.300E+04	1.150E-09	7.170E-10	3.503E-15	2.345E-15	1.150E-09	7.170E-10
6.400E+04	1.217E-09	7.272E-10	3.658E-15	2.445E-15	1.217E-09	7.272E-10
6.500E+04	1.255E-09	7.250E-10	3.684E-15	2.460E-15	1.255E-09	7.250E-10
6.600E+04	1.322E-09	7.255E-10	3.713E-15	2.479E-15	1.322E-09	7.255E-10
6.700E+04	1.364E-09	7.237E-10	3.754E-15	2.506E-15	1.364E-09	7.237E-10
6.800E+04	1.433E-09	7.257E-10	3.805E-15	2.548E-15	1.433E-09	7.257E-10
6.900E+04	1.493E-09	7.262E-10	3.961E-15	2.654E-15	1.493E-09	7.262E-10
7.000E+04	1.543E-09	7.240E-10	3.995E-15	2.682E-15	1.543E-09	7.240E-10
7.100E+04	1.638E-09	7.235E-10	4.052E-15	2.727E-15	1.638E-09	7.235E-10
7.200E+04	1.694E-09	7.186E-10	4.090E-15	2.757E-15	1.694E-09	7.186E-10
7.300E+04	1.788E-09	7.175E-10	4.145E-15	2.800E-15	1.788E-09	7.175E-10
7.400E+04	1.858E-09	7.150E-10	4.305E-15	2.907E-15	1.858E-09	7.150E-10
7.500E+04	1.925E-09	7.121E-10	4.364E-15	2.951E-15	1.925E-09	7.121E-10
7.600E+04	2.036E-09	7.125E-10	4.410E-15	2.987E-15	2.036E-09	7.125E-10
7.700E+04	2.108E-09	7.106E-10	4.476E-15	3.034E-15	2.108E-09	7.106E-10
7.800E+04	2.225E-09	7.146E-10	4.541E-15	3.079E-15	2.225E-09	7.146E-10
7.900E+04	2.303E-09	7.165E-10	4.727E-15	3.201E-15	2.303E-09	7.165E-10
8.000E+04	2.382E-09	7.173E-10	4.798E-15	3.248E-15	2.382E-09	7.173E-10
8.100E+04	2.503E-09	7.219E-10	4.876E-15	3.300E-15	2.503E-09	7.219E-10
8.200E+04	2.582E-09	7.220E-10	4.937E-15	3.330E-15	2.582E-09	7.220E-10
8.300E+04	2.665E-09	7.248E-10	5.020E-15	3.372E-15	2.665E-09	7.248E-10
8.400E+04	2.792E-09	7.316E-10	5.144E-15	3.442E-15	2.792E-09	7.316E-10
8.500E+04	2.870E-09	7.344E-10	5.308E-15	3.537E-15	2.870E-09	7.344E-10
8.600E+04	2.954E-09	7.370E-10	5.388E-15	3.577E-15	2.954E-09	7.370E-10
8.700E+04	3.076E-09	7.444E-10	5.463E-15	3.615E-15	3.076E-09	7.444E-10
8.800E+04	3.133E-09	7.464E-10	5.534E-15	3.650E-15	3.133E-09	7.464E-10
8.900E+04	3.148E-09	7.416E-10	5.591E-15	3.671E-15	3.148E-09	7.416E-10
9.000E+04	3.313E-09	7.559E-10	5.806E-15	3.794E-15	3.313E-09	7.559E-10
9.100E+04	3.377E-09	7.584E-10	5.867E-15	3.818E-15	3.377E-09	7.584E-10
9.200E+04	3.422E-09	7.588E-10	5.916E-15	3.833E-15	3.422E-09	7.588E-10
9.300E+04	3.590E-09	7.737E-10	5.970E-15	3.855E-15	3.590E-09	7.737E-10
9.400E+04	3.613E-09	7.718E-10	6.013E-15	3.867E-15	3.613E-09	7.718E-10
9.500E+04	3.701E-09	7.769E-10	6.050E-15	3.876E-15	3.701E-09	7.769E-10
9.600E+04	3.841E-09	7.911E-10	6.251E-15	3.993E-15	3.841E-09	7.911E-10
9.700E+04	3.842E-09	7.880E-10	6.291E-15	4.004E-15	3.842E-09	7.880E-10
9.800E+04	3.970E-09	7.995E-10	6.336E-15	4.021E-15	3.970E-09	7.995E-10
9.900E+04	4.064E-09	8.066E-10	6.361E-15	4.029E-15	4.064E-09	8.066E-10
1.000E+05	4.081E-09	8.058E-10	6.387E-15	4.036E-15	4.081E-09	8.058E-10

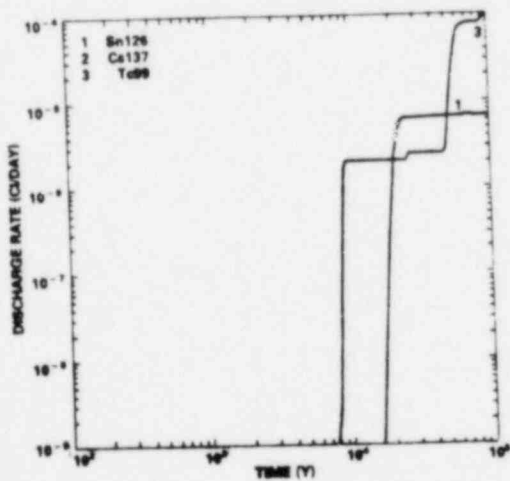
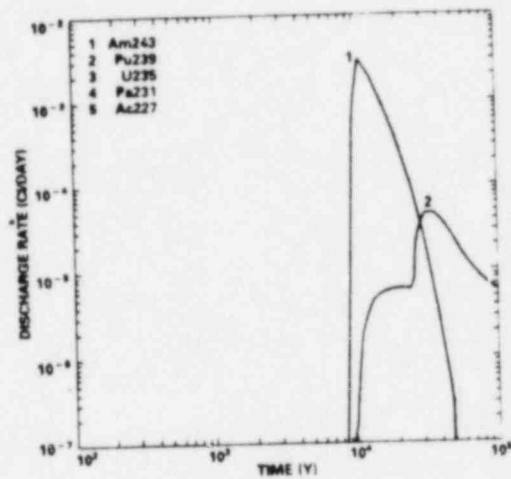
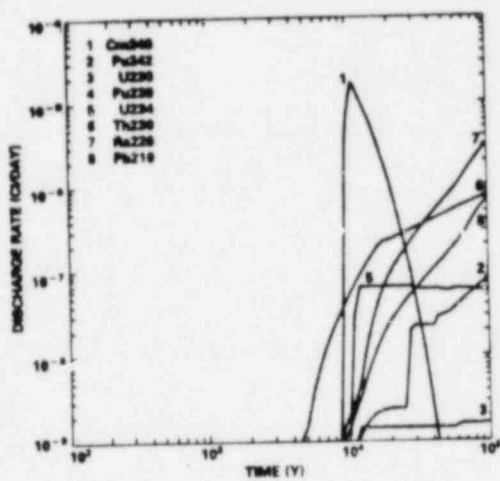
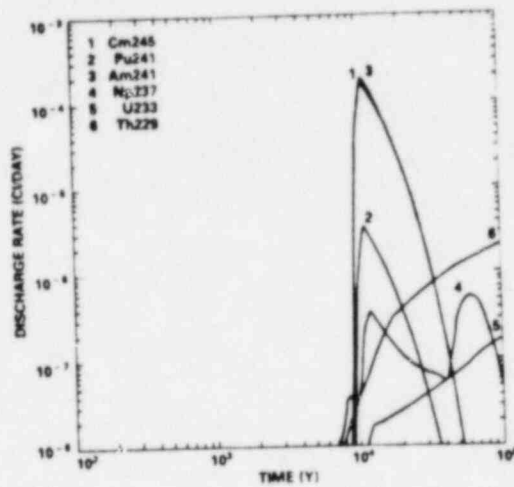
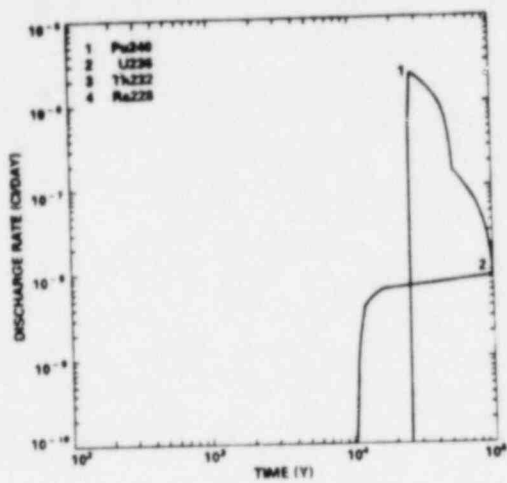


Figure 4.4

Mean Groundwater Discharge Curves
for the U-tube Scenario

two risk curves (Figure 4.3). At 50,000 to 100,000 years, ^{99}Tc , ^{229}Th , ^{239}Pu and ^{226}Ra appear to be the main radionuclides discharged, with the ^{226}Ra discharge determining the shape of the risk curve. After 50,000 years the difference between the ICRP2 and ICRP30 risk curves is due to the fact that the ^{226}Ra CRPC index is 90 times higher for ICRP2, while the CRPC indices for the other radionuclides are higher for ICRP30. Changes in gut uptakes and in retention times within the body account for this variability.

The ICRP2 and ICRP30 results of the U-tube scenario with well withdrawal are plotted in Figure 4.5 and 4.6 and the mean risk values for the ingestion and inhalation pathways are given in Tables 4.3 and 4.4 for Zones 1 and 2. The mean discharge curves for the five chains considered in the analysis are shown in Figures 4.7. The discharge rate represents the activity expressed in Ci/day taken out via the well. In Zone 1 the cancer risk is much higher than the risk in Zone 2 due to the consumption of contaminated drinking water from the well discharge. The ICRP30 risk dominates the ICRP2 risk for early times (<20,000 years post closure) and again the radionuclides that are discharged include ^{245}Cm , ^{246}Cm , ^{241}Am and ^{243}Am . At times >50,000 years the ICRP2 risk results dominate the ICRP30 risks. Technetium-99, ^{239}Pu and ^{226}Ra appear to have the greatest radionuclide discharge rates and the difference in their cancer risk per curie indices probably accounts for the difference noted in the risk curves.

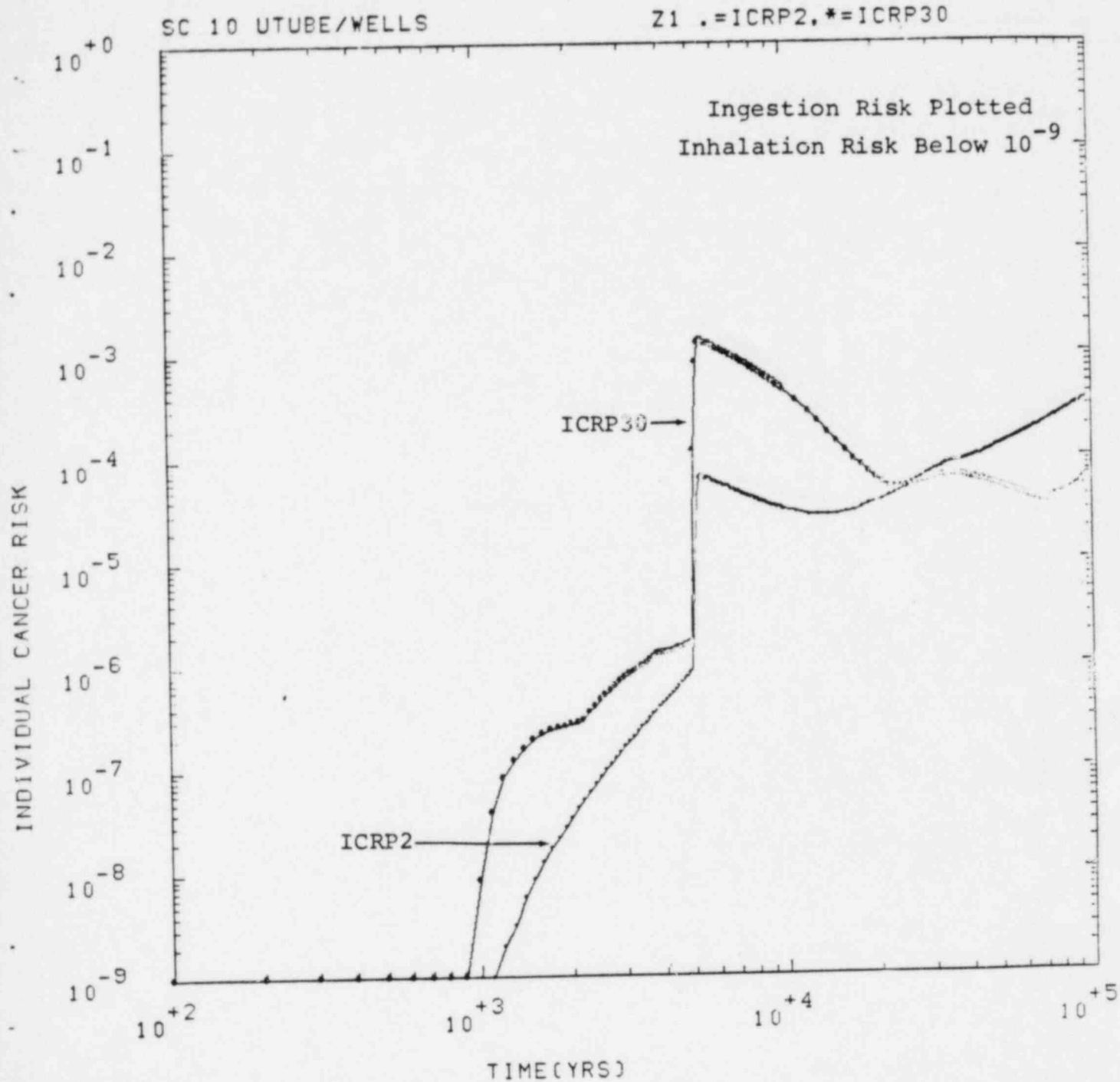


Figure 4.5

Risk estimates for the U-tube Scenario with Well Withdrawal for Zone 1 Using the ICRP2 and ICRP30 Dosimetry Models

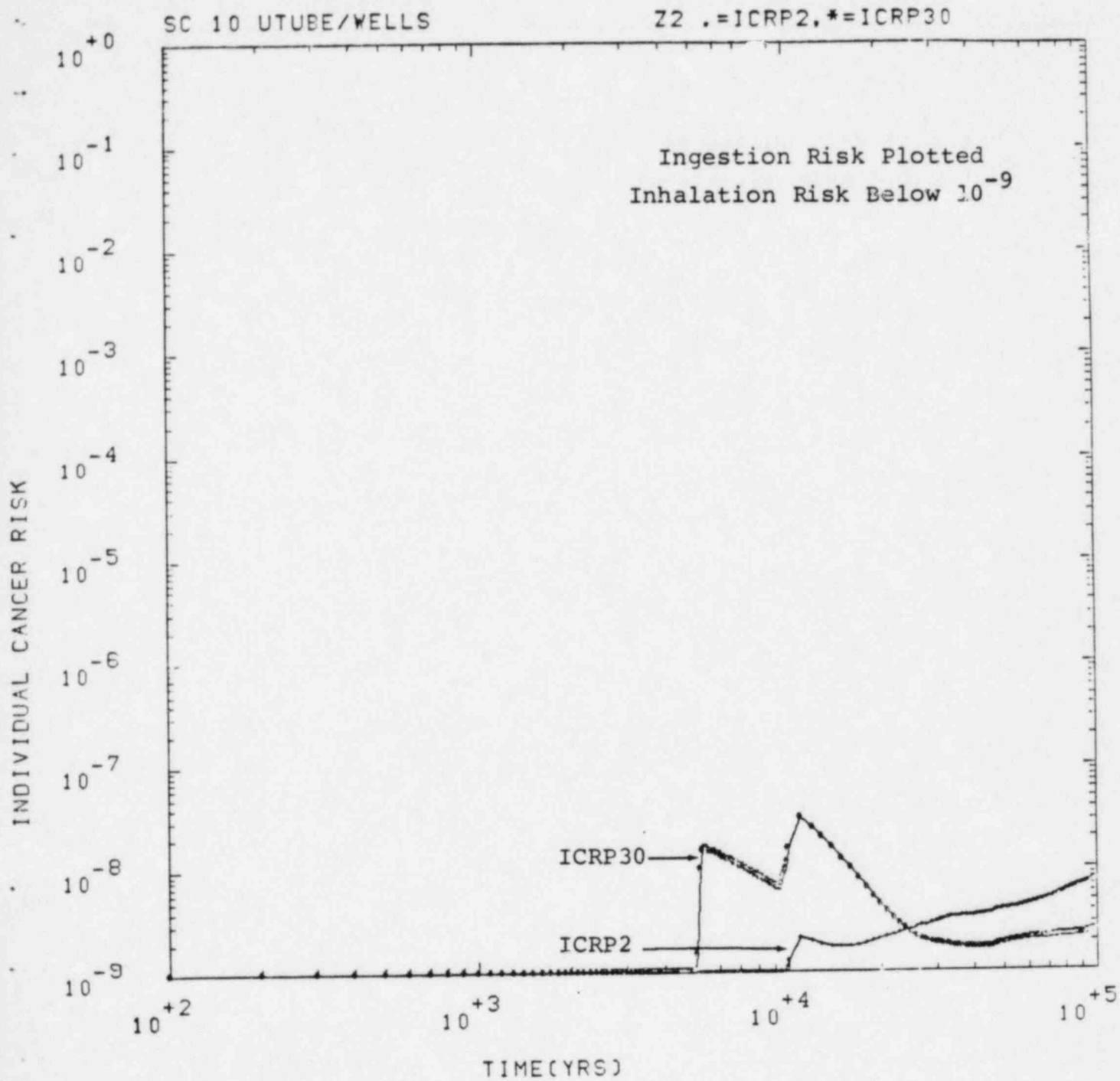


Figure 4.6

Risk Estimates for the U-tube Scenario with Well Withdrawal
for Zone 2 Using the ICRP2 and ICRP30 Dosimetry Models

Table 4.3 Risk Estimates for the U-tube Scenario With Withdrawal Wells for Zone SC 10 UTUBE/WELLS ZONE 1 PAGE 1

TIME(YRS)	RISK ING ICRP2	RISK ING ICRP30	RISK INF ICRP2	RISK INF ICRP30	TOT RISK ICRP2	TOT RISK ICRP30
1.000E+02	0.	0.	0.	0.	0.	0.
2.000E+02	0.	0.	0.	0.	0.	0.
3.000E+02	0.	0.	0.	0.	0.	0.
4.000E+02	0.	0.	0.	0.	0.	0.
5.000E+02	0.	0.	0.	0.	0.	0.
6.000E+02	0.	0.	0.	0.	0.	0.
7.000E+02	1.972E-13	4.522E-11	3.559E-21	8.619E-21	1.972E-13	4.522E-11
8.000E+02	5.551E-13	1.273E-10	1.030E-20	2.427E-20	5.551E-13	1.273E-10
9.000E+02	5.859E-12	7.354E-10	2.562E-19	3.363E-19	5.859E-12	7.354E-10
1.000E+03	2.405E-10	8.759E-09	4.411E-18	7.717E-18	2.405E-10	8.759E-09
1.100E+03	9.926E-10	3.970E-08	1.816E-17	3.732E-17	9.926E-10	3.970E-08
1.200E+03	2.071E-09	8.492E-08	3.762E-17	8.052E-17	2.071E-09	8.492E-08
1.300E+03	3.271E-09	1.246E-07	5.504E-17	1.185E-16	3.271E-09	1.246E-07
1.400E+03	6.112E-09	1.595E-07	7.068E-17	1.504E-16	6.112E-09	1.595E-07
1.500E+03	8.952E-09	1.929E-07	8.529E-17	1.794E-16	8.952E-09	1.929E-07
1.600E+03	1.302E-08	2.177E-07	9.697E-17	2.007E-16	1.302E-08	2.177E-07
1.700E+03	1.751E-08	2.376E-07	1.073E-16	2.182E-16	1.751E-08	2.376E-07
1.800E+03	2.207E-08	2.510E-07	1.164E-16	2.324E-16	2.207E-08	2.510E-07
1.900E+03	2.852E-08	2.597E-07	1.244E-16	2.436E-16	2.852E-08	2.597E-07
2.000E+03	3.498E-08	2.685E-07	1.327E-16	2.549E-16	3.498E-08	2.685E-07
2.100E+03	4.333E-08	2.772E-07	1.450E-16	2.692E-16	4.333E-08	2.772E-07
2.200E+03	5.219E-08	2.876E-07	1.610E-16	2.871E-16	5.219E-08	2.876E-07
2.300E+03	6.210E-08	3.521E-07	2.049E-16	3.505E-16	6.210E-08	3.521E-07
2.400E+03	7.361E-08	4.070E-07	2.487E-16	4.228E-16	7.361E-08	4.070E-07
2.500E+03	8.664E-08	4.675E-07	3.035E-16	5.148E-16	8.664E-08	4.675E-07
2.600E+03	1.007E-07	5.253E-07	3.722E-16	6.133E-16	1.007E-07	5.253E-07
2.700E+03	1.151E-07	5.813E-07	4.549E-16	7.200E-16	1.151E-07	5.813E-07
2.800E+03	1.306E-07	6.431E-07	5.747E-16	8.546E-16	1.306E-07	6.431E-07
2.900E+03	1.477E-07	7.047E-07	7.503E-16	1.026E-15	1.477E-07	7.047E-07
3.000E+03	1.650E-07	7.634E-07	1.033E-15	1.295E-15	1.650E-07	7.634E-07
3.100E+03	1.850E-07	8.123E-07	1.592E-15	1.755E-15	1.850E-07	8.123E-07
3.200E+03	2.063E-07	8.671E-07	3.186E-15	2.925E-15	2.063E-07	8.671E-07
3.300E+03	2.293E-07	9.209E-07	5.102E-15	4.311E-15	2.293E-07	9.209E-07
3.400E+03	2.539E-07	9.764E-07	7.417E-15	5.966E-15	2.539E-07	9.764E-07
3.500E+03	2.795E-07	1.042E-06	1.023E-14	8.004E-15	2.795E-07	1.042E-06
3.600E+03	3.078E-07	1.103E-06	1.372E-14	1.044E-14	3.078E-07	1.103E-06
3.700E+03	3.372E-07	1.175E-06	1.794E-14	1.341E-14	3.372E-07	1.175E-06
3.800E+03	3.689E-07	1.248E-06	2.289E-14	1.688E-14	3.689E-07	1.248E-06
3.900E+03	4.022E-07	1.284E-06	2.881E-14	2.099E-14	4.022E-07	1.284E-06
4.000E+03	4.370E-07	1.297E-06	3.566E-14	2.572E-14	4.370E-07	1.297E-06
4.100E+03	4.745E-07	1.314E-06	4.338E-14	3.105E-14	4.745E-07	1.314E-06
4.200E+03	5.130E-07	1.332E-06	5.199E-14	3.698E-14	5.130E-07	1.332E-06
4.300E+03	5.542E-07	1.359E-06	6.135E-14	4.343E-14	5.542E-07	1.359E-06
4.400E+03	5.968E-07	1.391E-06	7.153E-14	5.044E-14	5.968E-07	1.391E-06
4.500E+03	6.408E-07	1.427E-06	8.229E-14	5.785E-14	6.408E-07	1.427E-06
4.600E+03	6.871E-07	1.466E-06	9.363E-14	6.566E-14	6.871E-07	1.466E-06
4.700E+03	7.339E-07	1.507E-06	1.054E-13	7.379E-14	7.339E-07	1.507E-06
4.800E+03	7.827E-07	1.549E-06	1.177E-13	8.218E-14	7.827E-07	1.549E-06
4.900E+03	8.323E-07	1.593E-06	1.301E-13	9.069E-14	8.323E-07	1.593E-06
5.000E+03	8.830E-07	1.637E-06	1.425E-13	9.923E-14	8.830E-07	1.637E-06
5.100E+03	6.592E-06	1.155E-04	2.934E-12	1.101E-11	6.592E-06	1.155E-04
5.200E+03	4.163E-05	8.181E-04	2.009E-11	7.831E-11	4.163E-05	8.181E-04
5.300E+03	6.350E-05	1.253E-03	3.072E-11	1.200E-10	6.350E-05	1.253E-03
5.400E+03	6.595E-05	1.299E-03	3.184E-11	1.243E-10	6.595E-05	1.299E-03
5.500E+03	6.606E-05	1.299E-03	3.185E-11	1.243E-10	6.606E-05	1.299E-03

Table 4.3 (continued)

SC 10 UTUBE/WELLS

ZONE 1

PAGE 2

TIME(YRS)	RISK ING ICRP2	RISK IVG ICRP30	RISK INH ICRP2	RISK INH ICRP30	TOT RISK ICRP2	TOT RISK ICRP30
5.600E+03	6.251E-05	1.225E-03	3.007E-11	1.173E-10	6.251E-05	1.225E-03
5.700E+03	6.260E-05	1.225E-03	3.007E-11	1.172E-10	6.260E-05	1.225E-03
5.800E+03	6.172E-05	1.204E-03	2.959E-11	1.153E-10	6.172E-05	1.204E-03
5.900E+03	5.896E-05	1.147E-03	2.819E-11	1.098E-10	5.896E-05	1.147E-03
6.000E+03	5.899E-05	1.145E-03	2.815E-11	1.096E-10	5.899E-05	1.145E-03
6.100E+03	5.737E-05	1.109E-03	2.730E-11	1.062E-10	5.737E-05	1.109E-03
6.200E+03	5.564E-05	1.072E-03	2.640E-11	1.026E-10	5.564E-05	1.072E-03
6.300E+03	5.564E-05	1.069E-03	2.635E-11	1.024E-10	5.564E-05	1.069E-03
6.400E+03	5.342E-05	1.022E-03	2.519E-11	9.780E-11	5.342E-05	1.022E-03
6.500E+03	5.260E-05	1.002E-03	2.473E-11	9.594E-11	5.260E-05	1.002E-03
6.600E+03	5.259E-05	9.989E-04	2.466E-11	9.564E-11	5.259E-05	9.989E-04
6.700E+03	4.984E-05	9.406E-04	2.324E-11	9.005E-11	4.984E-05	9.406E-04
6.800E+03	4.983E-05	9.371E-04	2.316E-11	8.971E-11	4.983E-05	9.371E-04
6.900E+03	4.952E-05	9.277E-04	2.294E-11	8.881E-11	4.952E-05	9.277E-04
7.000E+03	4.714E-05	8.765E-04	2.169E-11	8.391E-11	4.714E-05	8.765E-04
7.100E+03	4.726E-05	8.755E-04	2.166E-11	8.381E-11	4.726E-05	8.755E-04
7.200E+03	4.642E-05	8.550E-04	2.119E-11	8.185E-11	4.642E-05	8.550E-04
7.300E+03	4.484E-05	8.198E-04	2.033E-11	7.847E-11	4.484E-05	8.198E-04
7.400E+03	4.494E-05	8.183E-04	2.030E-11	7.833E-11	4.494E-05	8.183E-04
7.500E+03	4.361E-05	7.878E-04	1.957E-11	7.541E-11	4.361E-05	7.878E-04
7.600E+03	4.268E-05	7.668E-04	1.906E-11	7.340E-11	4.268E-05	7.668E-04
7.700E+03	4.281E-05	7.648E-04	1.902E-11	7.321E-11	4.281E-05	7.648E-04
7.800E+03	4.100E-05	7.257E-04	1.807E-11	6.946E-11	4.100E-05	7.257E-04
7.900E+03	4.086E-05	7.174E-04	1.787E-11	6.866E-11	4.086E-05	7.174E-04
8.000E+03	4.083E-05	7.148E-04	1.782E-11	6.842E-11	4.083E-05	7.148E-04
8.100E+03	3.897E-05	6.712E-04	1.677E-11	6.424E-11	3.897E-05	6.712E-04
8.200E+03	3.907E-05	6.708E-04	1.676E-11	6.420E-11	3.907E-05	6.708E-04
8.300E+03	3.881E-05	6.599E-04	1.651E-11	6.316E-11	3.881E-05	6.599E-04
8.400E+03	3.737E-05	6.280E-04	1.574E-11	6.010E-11	3.737E-05	6.280E-04
8.500E+03	3.759E-05	6.272E-04	1.573E-11	6.002E-11	3.759E-05	6.272E-04
8.600E+03	3.684E-05	6.083E-04	1.527E-11	5.821E-11	3.684E-05	6.083E-04
8.700E+03	3.602E-05	5.876E-04	1.477E-11	5.623E-11	3.602E-05	5.876E-04
8.800E+03	3.621E-05	5.864E-04	1.475E-11	5.611E-11	3.621E-05	5.864E-04
8.900E+03	3.511E-05	5.608E-04	1.413E-11	5.365E-11	3.511E-05	5.608E-04
9.000E+03	3.487E-05	5.500E-04	1.388E-11	5.262E-11	3.487E-05	5.500E-04
9.100E+03	3.493E-05	5.483E-04	1.384E-11	5.246E-11	3.493E-05	5.483E-04
9.200E+03	3.371E-05	5.169E-04	1.308E-11	4.945E-11	3.371E-05	5.169E-04
9.300E+03	3.369E-05	5.146E-04	1.303E-11	4.923E-11	3.369E-05	5.146E-04
9.400E+03	3.382E-05	5.100E-04	1.293E-11	4.879E-11	3.382E-05	5.100E-04
9.500E+03	3.255E-05	4.818E-04	1.225E-11	4.608E-11	3.255E-05	4.818E-04
9.600E+03	3.285E-05	4.814E-04	1.225E-11	4.604E-11	3.285E-05	4.814E-04
9.700E+03	3.250E-05	4.704E-04	1.199E-11	4.499E-11	3.250E-05	4.704E-04
9.800E+03	3.179E-05	4.510E-04	1.151E-11	4.313E-11	3.179E-05	4.510E-04
9.900E+03	3.199E-05	4.502E-04	1.150E-11	4.306E-11	3.199E-05	4.502E-04
1.000E+04	3.140E-05	4.338E-04	1.111E-11	4.149E-11	3.140E-05	4.338E-04
1.100E+04	2.941E-05	3.463E-04	9.054E-12	3.310E-11	2.941E-05	3.463E-04
1.200E+04	2.779E-05	2.673E-04	7.200E-12	2.552E-11	2.779E-05	2.673E-04
1.300E+04	2.748E-05	2.199E-04	6.115E-12	2.097E-11	2.748E-05	2.199E-04
1.400E+04	2.727E-05	1.715E-04	5.000E-12	1.634E-11	2.727E-05	1.715E-04
1.500E+04	2.748E-05	1.382E-04	4.256E-12	1.314E-11	2.748E-05	1.382E-04
1.600E+04	2.865E-05	1.132E-04	3.704E-12	1.074E-11	2.865E-05	1.132E-04
1.700E+04	2.973E-05	9.167E-05	3.243E-12	8.626E-12	2.973E-05	9.167E-05
1.800E+04	3.182E-05	7.971E-05	2.988E-12	7.397E-12	3.182E-05	7.971E-05
1.900E+04	3.424E-05	6.770E-05	2.732E-12	6.155E-12	3.424E-05	6.770E-05
2.000E+04	3.598E-05	5.975E-05	2.554E-12	5.299E-12	3.598E-05	5.975E-05

Table 4.3 (continued)

SC 10 UTUBE/WELLS

ZONE 1

PAGE 3

TIME(YRS)	RISK ING ICRP2	RISK IVG ICRP30	RISK INH ICRP2	RISK INH ICRP30	TOT RISK ICRP2	TOT RISK ICRP30
2.100E+04	3.868E-05	5.396E-05	2.415E-12	4.646E-12	3.868E-05	5.396E-05
2.200E+04	4.112E-05	4.898E-05	2.293E-12	4.059E-12	4.112E-05	4.898E-05
2.300E+04	4.359E-05	4.754E-05	2.257E-12	3.732E-12	4.359E-05	4.754E-05
2.400E+04	4.692E-05	4.801E-05	2.284E-12	3.434E-12	4.692E-05	4.801E-05
2.500E+04	4.967E-05	4.945E-05	2.306E-12	3.213E-12	4.967E-05	4.945E-05
2.600E+04	5.349E-05	5.122E-05	2.346E-12	3.054E-12	5.349E-05	5.122E-05
2.700E+04	5.798E-05	5.321E-05	2.386E-12	2.941E-12	5.798E-05	5.321E-05
2.800E+04	6.067E-05	5.498E-05	2.452E-12	2.908E-12	6.067E-05	5.498E-05
2.900E+04	6.463E-05	5.645E-05	2.507E-12	2.846E-12	6.463E-05	5.645E-05
3.000E+04	6.779E-05	5.791E-05	2.513E-12	2.769E-12	6.779E-05	5.791E-05
3.100E+04	7.118E-05	5.902E-05	2.522E-12	2.687E-12	7.118E-05	5.902E-05
3.200E+04	7.451E-05	6.046E-05	2.562E-12	2.633E-12	7.451E-05	6.046E-05
3.300E+04	7.794E-05	6.145E-05	2.594E-12	2.591E-12	7.794E-05	6.145E-05
3.400E+04	8.062E-05	6.209E-05	2.614E-12	2.539E-12	8.062E-05	6.209E-05
3.500E+04	8.320E-05	6.272E-05	2.624E-12	2.494E-12	8.320E-05	6.272E-05
3.600E+04	8.577E-05	6.345E-05	2.650E-12	2.468E-12	8.577E-05	6.345E-05
3.700E+04	8.840E-05	6.395E-05	2.660E-12	2.431E-12	8.840E-05	6.395E-05
3.800E+04	9.058E-05	6.283E-05	2.617E-12	2.360E-12	9.058E-05	6.283E-05
3.900E+04	9.274E-05	6.158E-05	2.577E-12	2.291E-12	9.274E-05	6.158E-05
4.000E+04	9.493E-05	6.037E-05	2.530E-12	2.220E-12	9.493E-05	6.037E-05
4.100E+04	9.705E-05	5.922E-05	2.485E-12	2.152E-12	9.705E-05	5.922E-05
4.200E+04	9.910E-05	5.828E-05	2.451E-12	2.093E-12	9.910E-05	5.828E-05
4.300E+04	1.013E-04	5.734E-05	2.406E-12	2.030E-12	1.013E-04	5.734E-05
4.400E+04	1.037E-04	5.647E-05	2.379E-12	1.982E-12	1.037E-04	5.647E-05
4.500E+04	1.066E-04	5.521E-05	2.318E-12	1.912E-12	1.066E-04	5.521E-05
4.600E+04	1.094E-04	5.403E-05	2.262E-12	1.849E-12	1.094E-04	5.403E-05
4.700E+04	1.137E-04	5.301E-05	2.218E-12	1.795E-12	1.137E-04	5.301E-05
4.800E+04	1.175E-04	5.202E-05	2.157E-12	1.731E-12	1.175E-04	5.202E-05
4.900E+04	1.209E-04	5.117E-05	2.123E-12	1.685E-12	1.209E-04	5.117E-05
5.000E+04	1.246E-04	5.029E-05	2.062E-12	1.622E-12	1.246E-04	5.029E-05
5.100E+04	1.278E-04	4.926E-05	2.018E-12	1.574E-12	1.278E-04	4.926E-05
5.200E+04	1.316E-04	4.818E-05	1.980E-12	1.531E-12	1.316E-04	4.818E-05
5.300E+04	1.354E-04	4.710E-05	1.930E-12	1.482E-12	1.354E-04	4.710E-05
5.400E+04	1.389E-04	4.605E-05	1.884E-12	1.437E-12	1.389E-04	4.605E-05
5.500E+04	1.428E-04	4.512E-05	1.865E-12	1.410E-12	1.428E-04	4.512E-05
5.600E+04	1.470E-04	4.417E-05	1.819E-12	1.366E-12	1.470E-04	4.417E-05
5.700E+04	1.505E-04	4.313E-05	1.774E-12	1.324E-12	1.505E-04	4.313E-05
5.800E+04	1.547E-04	4.229E-05	1.735E-12	1.287E-12	1.547E-04	4.229E-05
5.900E+04	1.591E-04	4.165E-05	1.724E-12	1.268E-12	1.591E-04	4.165E-05
6.000E+04	1.625E-04	4.095E-05	1.691E-12	1.237E-12	1.625E-04	4.095E-05
6.100E+04	1.663E-04	4.018E-05	1.658E-12	1.207E-12	1.663E-04	4.018E-05
6.200E+04	1.703E-04	3.921E-05	1.626E-12	1.181E-12	1.703E-04	3.921E-05
6.300E+04	1.748E-04	3.847E-05	1.630E-12	1.163E-12	1.748E-04	3.847E-05
6.400E+04	1.792E-04	3.775E-05	1.601E-12	1.167E-12	1.792E-04	3.775E-05
6.500E+04	1.833E-04	3.704E-05	1.580E-12	1.158E-12	1.833E-04	3.704E-05
6.600E+04	1.871E-04	3.662E-05	1.566E-12	1.156E-12	1.871E-04	3.662E-05
6.700E+04	1.897E-04	3.618E-05	1.583E-12	1.193E-12	1.897E-04	3.618E-05
6.800E+04	1.933E-04	3.599E-05	1.581E-12	1.223E-12	1.933E-04	3.599E-05
6.900E+04	1.981E-04	3.569E-05	1.570E-12	1.243E-12	1.981E-04	3.569E-05
7.000E+04	2.044E-04	3.561E-05	1.562E-12	1.258E-12	2.044E-04	3.561E-05
7.100E+04	2.098E-04	3.530E-05	1.553E-12	1.271E-12	2.098E-04	3.530E-05
7.200E+04	2.139E-04	3.509E-05	1.580E-12	1.295E-12	2.139E-04	3.509E-05
7.300E+04	2.169E-04	3.490E-05	1.575E-12	1.296E-12	2.169E-04	3.490E-05
7.400E+04	2.215E-04	3.637E-05	1.648E-12	1.403E-12	2.215E-04	3.637E-05
7.500E+04	2.272E-04	3.772E-05	1.702E-12	1.469E-12	2.272E-04	3.772E-05

Table 4.3 (continued)

SC 10 UTUBE/WELLS

ZONE 1

PAGE 4

TIME(YRS)	RISK ING ICRP2	RISK ING ICRP30	RISK INF ICRP2	RISK INH ICRP30	TOT RISK ICRP2	TOT RISK ICRP30
7.600E+04	2.339E-04	3.823E-05	1.703E-12	1.459E-12	2.339E-04	3.823E-05
7.700E+04	2.387E-04	3.826E-05	1.726E-12	1.452E-12	2.387E-04	3.826E-05
7.800E+04	2.412E-04	3.813E-05	1.709E-12	1.419E-12	2.412E-04	3.813E-05
7.900E+04	2.456E-04	3.856E-05	1.705E-12	1.399E-12	2.456E-04	3.856E-05
8.000E+04	2.481E-04	3.898E-05	1.702E-12	1.377E-12	2.481E-04	3.898E-05
8.100E+04	2.549E-04	3.957E-05	1.696E-12	1.356E-12	2.549E-04	3.957E-05
8.200E+04	2.620E-04	3.994E-05	1.721E-12	1.353E-12	2.620E-04	3.994E-05
8.300E+04	2.649E-04	4.081E-05	1.711E-12	1.329E-12	2.649E-04	4.081E-05
8.400E+04	2.717E-04	4.138E-05	1.709E-12	1.311E-12	2.717E-04	4.138E-05
8.500E+04	2.736E-04	4.198E-05	1.706E-12	1.293E-12	2.736E-04	4.198E-05
8.600E+04	2.815E-04	4.299E-05	1.707E-12	1.279E-12	2.815E-04	4.299E-05
8.700E+04	2.882E-04	4.384E-05	1.722E-12	1.278E-12	2.882E-04	4.384E-05
8.800E+04	2.937E-04	4.497E-05	1.755E-12	1.287E-12	2.937E-04	4.497E-05
8.900E+04	3.009E-04	4.602E-05	1.766E-12	1.285E-12	3.009E-04	4.602E-05
9.000E+04	3.021E-04	4.691E-05	1.764E-12	1.272E-12	3.021E-04	4.691E-05
9.100E+04	3.085E-04	4.791E-05	1.777E-12	1.272E-12	3.085E-04	4.791E-05
9.200E+04	3.144E-04	4.889E-05	1.774E-12	1.262E-12	3.144E-04	4.889E-05
9.300E+04	3.201E-04	4.999E-05	1.819E-12	1.265E-12	3.201E-04	4.999E-05
9.400E+04	3.281E-04	5.098E-05	1.849E-12	1.304E-12	3.281E-04	5.098E-05
9.500E+04	3.320E-04	5.608E-05	2.048E-12	1.447E-12	3.320E-04	5.608E-05
9.600E+04	3.360E-04	5.754E-05	2.095E-12	1.473E-12	3.380E-04	5.754E-05
9.700E+04	3.411E-04	5.830E-05	2.112E-12	1.479E-12	3.411E-04	5.830E-05
9.800E+04	3.454E-04	5.878E-05	2.117E-12	1.476E-12	3.454E-04	5.878E-05
9.900E+04	3.519E-04	5.960E-05	2.160E-12	1.499E-12	3.519E-04	5.960E-05
1.000E+05	3.534E-04	5.963E-05	2.164E-12	1.496E-12	3.534E-04	5.963E-05

Table 4.4 Risk Estimates for the U-tube Scenario With Withdrawal Wells for Zone 2

SC 10 UTUBE/WELLS

ZONE 2

PAGE 1

TIME(YRS)	RISK ING ICRP2	RISK ING ICRP30	RISK INH ICRP2	RISK INH ICRP30	TOT RISK ICRP2	TOT RISK ICRP30
1.000E+02	0.	0.	0.	0.	0.	0.
2.000E+02	0.	0.	0.	0.	0.	0.
3.000E+02	0.	0.	0.	0.	0.	0.
4.000E+02	0.	0.	0.	0.	0.	0.
5.000E+02	0.	0.	0.	0.	0.	0.
6.000E+02	0.	0.	0.	0.	0.	0.
7.000E+02	0.	0.	0.	0.	0.	0.
8.000E+02	0.	0.	0.	0.	0.	0.
9.000E+02	0.	0.	0.	0.	0.	0.
1.000E+03	3.397E-13	1.212E-12	1.523E-19	3.510E-19	3.397E-13	1.212E-12
1.100E+03	5.013E-13	3.065E-12	7.929E-19	1.849E-18	8.018E-13	3.085E-12
1.200E+03	1.265E-12	5.115E-12	1.809E-18	4.091E-18	1.265E-12	5.115E-12
1.300E+03	1.747E-12	7.174E-12	2.661E-18	6.036E-18	1.747E-12	7.174E-12
1.400E+03	4.042E-12	1.401E-11	3.359E-18	7.557E-18	4.042E-12	1.401E-11
1.500E+03	6.153E-12	2.126E-11	3.970E-18	8.877E-18	6.153E-12	2.126E-11
1.600E+03	8.406E-12	2.836E-11	4.725E-18	9.960E-18	8.406E-12	2.836E-11
1.700E+03	1.034E-11	3.418E-11	5.141E-18	1.067E-17	1.034E-11	3.418E-11
1.800E+03	1.139E-11	3.690E-11	5.471E-18	1.114E-17	1.139E-11	3.690E-11
1.900E+03	1.264E-11	3.963E-11	5.723E-18	1.139E-17	1.264E-11	3.963E-11
2.000E+03	1.390E-11	4.237E-11	5.986E-18	1.165E-17	1.390E-11	4.237E-11
2.100E+03	1.514E-11	4.476E-11	6.350E-18	1.198E-17	1.514E-11	4.476E-11
2.200E+03	1.625E-11	4.703E-11	6.804E-18	1.240E-17	1.625E-11	4.703E-11
2.300E+03	1.747E-11	5.225E-11	7.684E-18	1.376E-17	1.747E-11	5.225E-11
2.400E+03	1.887E-11	5.747E-11	8.664E-18	1.541E-17	1.887E-11	5.747E-11
2.500E+03	2.042E-11	6.388E-11	1.011E-17	1.729E-17	2.042E-11	6.388E-11
2.600E+03	2.224E-11	7.056E-11	1.189E-17	1.941E-17	2.224E-11	7.056E-11
2.700E+03	2.411E-11	7.727E-11	1.449E-17	2.206E-17	2.411E-11	7.727E-11
2.800E+03	2.611E-11	8.406E-11	1.880E-17	2.602E-17	2.611E-11	8.406E-11
2.900E+03	2.828E-11	9.086E-11	2.585E-17	3.180E-17	2.828E-11	9.086E-11
3.000E+03	3.046E-11	9.765E-11	3.627E-17	4.164E-17	3.046E-11	9.765E-11
3.100E+03	3.299E-11	1.039E-10	6.291E-17	5.990E-17	3.299E-11	1.039E-10
3.200E+03	3.550E-11	1.097E-10	1.424E-16	1.159E-16	3.550E-11	1.097E-10
3.300E+03	3.814E-11	1.150E-10	2.385E-16	1.830E-16	3.814E-11	1.150E-10
3.400E+03	4.095E-11	1.204E-10	3.551E-16	2.642E-16	4.095E-11	1.204E-10
3.500E+03	4.381E-11	1.259E-10	5.006E-16	3.654E-16	4.381E-11	1.259E-10
3.600E+03	4.693E-11	1.308E-10	6.755E-16	4.867E-16	4.693E-11	1.308E-10
3.700E+03	5.002E-11	1.356E-10	8.912E-16	6.363E-16	5.002E-11	1.356E-10
3.800E+03	5.335E-11	1.404E-10	1.145E-15	8.120E-16	5.335E-11	1.404E-10
3.900E+03	5.680E-11	1.429E-10	1.447E-15	1.020E-15	5.680E-11	1.429E-10
4.000E+03	6.022E-11	1.431E-10	1.795E-15	1.260E-15	6.022E-11	1.431E-10
4.100E+03	6.389E-11	1.434E-10	2.189E-15	1.530E-15	6.389E-11	1.434E-10
4.200E+03	6.756E-11	1.437E-10	2.630E-15	1.833E-15	6.756E-11	1.437E-10
4.300E+03	7.144E-11	1.441E-10	3.110E-15	2.163E-15	7.144E-11	1.441E-10
4.400E+03	7.591E-11	1.447E-10	3.633E-15	2.522E-15	7.591E-11	1.447E-10
4.500E+03	7.999E-11	1.452E-10	4.186E-15	2.902E-15	7.999E-11	1.452E-10
4.600E+03	8.423E-11	1.459E-10	4.770E-15	3.304E-15	8.423E-11	1.459E-10
4.700E+03	8.851E-11	1.468E-10	5.377E-15	3.720E-15	8.851E-11	1.468E-10
4.800E+03	9.302E-11	1.480E-10	6.001E-15	4.149E-15	9.302E-11	1.480E-10
4.900E+03	9.756E-11	1.493E-10	6.634E-15	4.584E-15	9.756E-11	1.493E-10
5.000E+03	1.022E-10	1.506E-10	7.270E-15	5.020E-15	1.022E-10	1.506E-10
5.100E+03	1.756E-10	1.524E-09	8.625E-14	3.127E-13	1.757E-10	1.524E-09
5.200E+03	6.056E-10	9.994E-09	5.702E-13	2.208E-12	6.062E-10	9.996E-09
5.300E+03	8.772E-10	1.524E-08	3.697E-13	3.382E-12	8.781E-10	1.524E-08
5.400E+03	9.125E-10	1.579E-08	9.015E-13	3.504E-12	9.134E-10	1.579E-08
5.500E+03	9.188E-10	1.579E-08	9.020E-13	3.505E-12	9.197E-10	1.579E-08

Table 4.4 (continued)

SC 10 UTUBE/WELLS

ZONE 2

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TIME(YRS)	RISK ING ICRP2	RISK ING ICRP30	RISK INH ICRP2	RISK INH ICRP30	TOT RISK ICRP2	TOT RISK ICRP30
5.600E+03	3.807E-10	1.491E-08	8.523E-13	3.307E-12	6.815E-10	1.491E-08
5.700E+03	8.868E-10	1.490E-08	8.529E-13	3.306E-12	8.876E-10	1.491E-08
5.800E+03	8.813E-10	1.467E-08	8.398E-13	3.252E-12	8.822E-10	1.467E-08
5.900E+03	8.529E-10	1.397E-08	8.004E-13	3.090E-12	8.537E-10	1.397E-08
6.000E+03	8.588E-10	1.395E-08	7.997E-13	3.091E-12	8.596E-10	1.395E-08
6.100E+03	8.447E-10	1.353E-08	7.762E-13	2.996E-12	8.454E-10	1.353E-08
6.200E+03	8.291E-10	1.308E-08	7.503E-13	2.895E-12	8.298E-10	1.308E-08
6.300E+03	8.351E-10	1.305E-08	7.498E-13	2.868E-12	8.358E-10	1.305E-08
6.400E+03	8.133E-10	1.248E-08	7.173E-13	2.760E-12	8.146E-10	1.248E-08
6.500E+03	8.098E-10	1.225E-08	7.045E-13	2.707E-12	8.105E-10	1.225E-08
6.600E+03	8.159E-10	1.221E-08	7.030E-13	2.700E-12	8.166E-10	1.222E-08
6.700E+03	7.886E-10	1.151E-08	6.630E-13	2.542E-12	7.893E-10	1.151E-08
6.800E+03	7.947E-10	1.147E-08	6.609E-13	2.532E-12	7.954E-10	1.148E-08
6.900E+03	7.975E-10	1.137E-08	6.549E-13	2.508E-12	7.981E-10	1.137E-08
7.000E+03	7.749E-10	1.075E-08	6.199E-13	2.369E-12	7.756E-10	1.075E-08
7.100E+03	7.831E-10	1.074E-08	6.197E-13	2.367E-12	7.837E-10	1.075E-08
7.200E+03	7.796E-10	1.050E-08	6.064E-13	2.312E-12	7.802E-10	1.050E-08
7.300E+03	7.672E-10	1.008E-08	5.824E-13	2.217E-12	7.678E-10	1.008E-08
7.400E+03	7.754E-10	1.007E-08	5.817E-13	2.213E-12	7.760E-10	1.007E-08
7.500E+03	7.664E-10	9.707E-09	5.610E-13	2.131E-12	7.669E-10	9.709E-09
7.600E+03	7.614E-10	9.450E-09	5.468E-13	2.074E-12	7.619E-10	9.458E-09
7.700E+03	7.707E-10	9.440E-09	5.459E-13	2.069E-12	7.713E-10	9.442E-09
7.800E+03	7.554E-10	8.972E-09	5.193E-13	1.963E-12	7.559E-10	8.974E-09
7.900E+03	7.619E-10	8.878E-09	5.140E-13	1.941E-12	7.624E-10	8.880E-09
8.000E+03	7.682E-10	8.853E-09	5.129E-13	1.935E-12	7.687E-10	8.855E-09
8.100E+03	7.542E-10	8.332E-09	4.833E-13	1.817E-12	7.547E-10	8.334E-09
8.200E+03	7.619E-10	8.331E-09	4.835E-13	1.816E-12	7.623E-10	8.333E-09
8.300E+03	7.668E-10	8.208E-09	4.766E-13	1.767E-12	7.673E-10	8.209E-09
8.400E+03	7.562E-10	7.825E-09	4.550E-13	1.701E-12	7.566E-10	7.827E-09
8.500E+03	7.679E-10	7.822E-09	4.551E-13	1.699E-12	7.684E-10	7.824E-09
8.600E+03	7.674E-10	7.600E-09	4.421E-13	1.648E-12	7.678E-10	7.602E-09
8.700E+03	7.653E-10	7.354E-09	4.281E-13	1.592E-12	7.657E-10	7.356E-09
8.800E+03	7.756E-10	7.346E-09	4.279E-13	1.589E-12	7.760E-10	7.348E-09
8.900E+03	7.700E-10	7.041E-09	4.107E-13	1.520E-12	7.704E-10	7.043E-09
9.000E+03	7.773E-10	6.927E-09	4.044E-13	1.493E-12	7.777E-10	6.929E-09
9.100E+03	7.869E-10	6.923E-09	4.044E-13	1.492E-12	7.873E-10	6.924E-09
9.200E+03	7.818E-10	6.560E-09	3.836E-13	1.409E-12	7.822E-10	6.561E-09
9.300E+03	7.892E-10	6.540E-09	3.827E-13	1.405E-12	7.890E-10	6.547E-09
9.400E+03	8.070E-10	6.628E-09	3.875E-13	1.422E-12	8.074E-10	6.629E-09
9.500E+03	8.535E-10	7.300E-09	4.297E-13	1.525E-12	8.539E-10	7.361E-09
9.600E+03	9.206E-10	8.432E-09	4.912E-13	1.824E-12	9.211E-10	8.434E-09
9.700E+03	9.777E-10	9.375E-09	5.454E-13	2.035E-12	9.783E-10	9.377E-09
9.800E+03	1.031E-09	1.022E-08	5.931E-13	2.222E-12	1.032E-09	1.022E-08
9.900E+03	1.120E-09	1.177E-08	6.822E-13	2.570E-12	1.121E-09	1.177E-08
1.000E+04	1.314E-09	1.543E-08	8.912E-13	3.389E-12	1.315E-09	1.543E-08
1.100E+04	2.239E-09	3.182E-08	1.828E-12	7.049E-12	2.241E-09	3.183E-08
1.200E+04	2.030E-09	2.511E-08	1.444E-12	5.529E-12	2.031E-09	2.512E-08
1.300E+04	1.895E-09	1.991E-08	1.148E-12	4.354E-12	1.896E-09	1.992E-08
1.400E+04	1.818E-09	1.572E-08	9.092E-13	3.404E-12	1.819E-09	1.572E-08
1.500E+04	1.789E-09	1.250E-08	7.264E-13	2.673E-12	1.789E-09	1.251E-08
1.600E+04	1.809E-09	1.002E-08	5.842E-13	2.104E-12	1.810E-09	1.002E-08
1.700E+04	1.858E-09	8.055E-09	4.723E-13	1.653E-12	1.859E-09	8.057E-09
1.800E+04	1.946E-09	6.590E-09	3.873E-13	1.311E-12	1.946E-09	6.591E-09
1.900E+04	2.052E-09	5.414E-09	3.191E-13	1.035E-12	2.053E-09	5.415E-09
2.000E+04	2.142E-09	4.533E-09	2.659E-13	8.216E-13	2.142E-09	4.534E-09

Table 4.4 (continued)

SC 10 LTUBE/WELLS

ZONE 2

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TIME(YRS)	RISK ING ICRP2	RISK ING ICRP30	RISK INH ICRP2	RISK INH ICRP30	TOT RISK ICRP2	TOT RISK ICRP30
2.100E+04	2.296E-09	3.875E-09	2.237E-13	6.549E-13	2.296E-09	3.876E-09
2.200E+04	2.355E-09	3.340E-09	1.903E-13	5.223E-13	2.356E-09	3.341E-09
2.300E+04	2.452E-09	2.952E-09	1.664E-13	4.229E-13	2.452E-09	2.952E-09
2.400E+04	2.561E-09	2.631E-09	1.460E-13	3.431E-13	2.561E-09	2.631E-09
2.500E+04	2.577E-09	2.398E-09	1.327E-13	2.806E-13	2.577E-09	2.398E-09
2.600E+04	2.703E-09	2.228E-09	1.210E-13	2.323E-13	2.703E-09	2.228E-09
2.700E+04	2.845E-09	2.116E-09	1.120E-13	1.937E-13	2.846E-09	2.116E-09
2.800E+04	2.864E-09	2.032E-09	1.052E-13	1.647E-13	2.864E-09	2.032E-09
2.900E+04	3.009E-09	1.967E-09	9.767E-14	1.410E-13	3.009E-09	1.967E-09
3.000E+04	3.070E-09	1.917E-09	9.308E-14	1.212E-13	3.070E-09	1.917E-09
3.100E+04	3.170E-09	1.869E-09	8.763E-14	1.055E-13	3.170E-09	1.889E-09
3.200E+04	3.260E-09	1.852E-09	8.333E-14	9.294E-14	3.261E-09	1.852E-09
3.300E+04	3.350E-09	1.847E-09	8.023E-14	8.350E-14	3.350E-09	1.848E-09
3.400E+04	3.379E-09	1.816E-09	7.727E-14	7.551E-14	3.379E-09	1.816E-09
3.500E+04	3.401E-09	1.783E-09	7.448E-14	6.899E-14	3.401E-09	1.788E-09
3.600E+04	3.425E-09	1.763E-09	7.229E-14	6.388E-14	3.425E-09	1.768E-09
3.700E+04	3.455E-09	1.743E-09	6.994E-14	5.936E-14	3.455E-09	1.748E-09
3.800E+04	3.481E-09	1.734E-09	6.775E-14	5.563E-14	3.481E-09	1.734E-09
3.900E+04	3.498E-09	1.720E-09	6.572E-14	5.240E-14	3.498E-09	1.720E-09
4.000E+04	3.533E-09	1.711E-09	6.368E-14	4.955E-14	3.533E-09	1.711E-09
4.100E+04	3.565E-09	1.701E-09	6.171E-14	4.705E-14	3.565E-09	1.701E-09
4.200E+04	3.583E-09	1.702E-09	6.012E-14	4.500E-14	3.583E-09	1.702E-09
4.300E+04	3.619E-09	1.706E-09	5.830E-14	4.301E-14	3.619E-09	1.706E-09
4.400E+04	3.657E-09	1.712E-09	5.704E-14	4.154E-14	3.657E-09	1.712E-09
4.500E+04	3.683E-09	1.719E-09	5.532E-14	3.969E-14	3.683E-09	1.719E-09
4.600E+04	3.717E-09	1.735E-09	5.390E-14	3.851E-14	3.717E-09	1.735E-09
4.700E+04	3.862E-09	1.776E-09	5.267E-14	3.734E-14	3.862E-09	1.777E-09
4.800E+04	3.918E-09	1.809E-09	5.117E-14	3.606E-14	3.918E-09	1.809E-09
4.900E+04	3.966E-09	1.841E-09	5.019E-14	3.474E-14	3.966E-09	1.841E-09
5.000E+04	4.016E-09	1.873E-09	4.884E-14	3.367E-14	4.016E-09	1.873E-09
5.100E+04	4.036E-09	1.890E-09	4.781E-14	3.288E-14	4.036E-09	1.890E-09
5.200E+04	4.093E-09	1.913E-09	4.686E-14	3.215E-14	4.093E-09	1.914E-09
5.300E+04	4.130E-09	1.935E-09	4.578E-14	3.135E-14	4.130E-09	1.935E-09
5.400E+04	4.176E-09	1.954E-09	4.476E-14	3.060E-14	4.176E-09	1.954E-09
5.500E+04	4.215E-09	1.979E-09	4.443E-14	3.030E-14	4.215E-09	1.979E-09
5.600E+04	4.276E-09	2.002E-09	4.349E-14	2.961E-14	4.276E-09	2.002E-09
5.700E+04	4.301E-09	2.017E-09	4.260E-14	2.896E-14	4.301E-09	2.017E-09
5.800E+04	4.361E-09	2.040E-09	4.189E-14	2.844E-14	4.361E-09	2.040E-09
5.900E+04	4.411E-09	2.064E-09	4.170E-14	2.826E-14	4.411E-09	2.064E-09
6.000E+04	4.455E-09	2.071E-09	4.109E-14	2.783E-14	4.455E-09	2.071E-09
6.100E+04	4.496E-09	2.082E-09	4.045E-14	2.740E-14	4.496E-09	2.082E-09
6.200E+04	4.560E-09	2.082E-09	4.002E-14	2.757E-14	4.560E-09	2.082E-09
6.300E+04	4.617E-09	2.096E-09	4.060E-14	2.953E-14	4.617E-09	2.096E-09
6.400E+04	4.693E-09	2.109E-09	4.072E-14	3.144E-14	4.693E-09	2.109E-09
6.500E+04	4.736E-09	2.106E-09	4.083E-14	3.336E-14	4.736E-09	2.106E-09
6.600E+04	4.821E-09	2.116E-09	4.103E-14	3.535E-14	4.821E-09	2.116E-09
6.700E+04	4.865E-09	2.114E-09	4.226E-14	3.935E-14	4.865E-09	2.114E-09
6.800E+04	4.953E-09	2.125E-09	4.336E-14	4.437E-14	4.953E-09	2.125E-09
6.900E+04	5.007E-09	2.123E-09	4.442E-14	4.935E-14	5.008E-09	2.123E-09
7.000E+04	5.077E-09	2.131E-09	4.546E-14	5.422E-14	5.077E-09	2.131E-09
7.100E+04	5.159E-09	2.129E-09	4.643E-14	5.885E-14	5.159E-09	2.129E-09
7.200E+04	5.243E-09	2.139E-09	4.766E-14	6.182E-14	5.243E-09	2.139E-09
7.300E+04	5.325E-09	2.139E-09	4.795E-14	6.351E-14	5.325E-09	2.139E-09
7.400E+04	5.414E-09	2.176E-09	4.574E-14	6.573E-14	5.414E-09	2.176E-09
7.500E+04	5.478E-09	2.188E-09	4.929E-14	6.742E-14	5.478E-09	2.188E-09

Table 4.4 (continued)

SC 10 UTUBE/WELLS

ZONE 2

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TIME(YRS)	RISK ING ICRP2	RISK ING ICRP30	RISK INH ICRP2	RISK INH ICRP30	TOT RISK ICRP2	TOT RISK ICRP30
7.600E+04	5.604E-09	2.198E-09	4.958E-14	6.864E-14	5.604E-09	2.198E-09
7.700E+04	5.673E-09	2.194E-09	4.982E-14	6.749E-14	5.673E-09	2.194E-09
7.800E+04	5.759E-09	2.190E-09	4.924E-14	6.546E-14	5.759E-09	2.190E-09
7.900E+04	5.853E-09	2.199E-09	4.901E-14	6.369E-14	5.853E-09	2.199E-09
8.000E+04	5.916E-09	2.196E-09	4.873E-14	6.189E-14	5.916E-09	2.196E-09
8.100E+04	6.052E-09	2.206E-09	4.823E-14	5.963E-14	6.052E-09	2.206E-09
8.200E+04	6.132E-09	2.205E-09	4.812E-14	5.754E-14	6.132E-09	2.208E-09
8.300E+04	6.225E-09	2.223E-09	4.733E-14	5.482E-14	6.225E-09	2.223E-09
8.400E+04	6.344E-09	2.228E-09	4.689E-14	5.233E-14	6.344E-09	2.228E-09
8.500E+04	6.415E-09	2.232E-09	4.653E-14	4.993E-14	6.415E-09	2.232E-09
8.600E+04	6.530E-09	2.249E-09	4.593E-14	4.754E-14	6.530E-09	2.249E-09
8.700E+04	6.640E-09	2.257E-09	4.569E-14	4.568E-14	6.641E-09	2.257E-09
8.800E+04	6.723E-09	2.276E-09	4.591E-14	4.414E-14	6.724E-09	2.276E-09
8.900E+04	6.761E-09	2.277E-09	4.574E-14	4.240E-14	6.761E-09	2.277E-09
9.000E+04	6.888E-09	2.291E-09	4.550E-14	4.060E-14	6.888E-09	2.291E-09
9.100E+04	6.957E-09	2.295E-09	4.536E-14	3.921E-14	6.957E-09	2.296E-09
9.200E+04	7.004E-09	2.300E-09	4.503E-14	3.797E-14	7.004E-09	2.300E-09
9.300E+04	7.153E-09	2.319E-09	4.585E-14	3.752E-14	7.153E-09	2.319E-09
9.400E+04	7.207E-09	2.331E-09	4.625E-14	3.678E-14	7.207E-09	2.331E-09
9.500E+04	7.312E-09	2.356E-09	4.665E-14	3.609E-14	7.312E-09	2.356E-09
9.600E+04	7.428E-09	2.417E-09	4.713E-14	3.576E-14	7.428E-09	2.417E-09
9.700E+04	7.441E-09	2.422E-09	4.749E-14	3.547E-14	7.441E-09	2.422E-09
9.800E+04	7.555E-09	2.435E-09	4.766E-14	3.503E-14	7.555E-09	2.435E-09
9.900E+04	7.681E-09	2.456E-09	4.846E-14	3.502E-14	7.681E-09	2.456E-09
1.000E+05	7.699E-09	2.456E-09	4.859E-14	3.467E-14	7.699E-09	2.458E-09

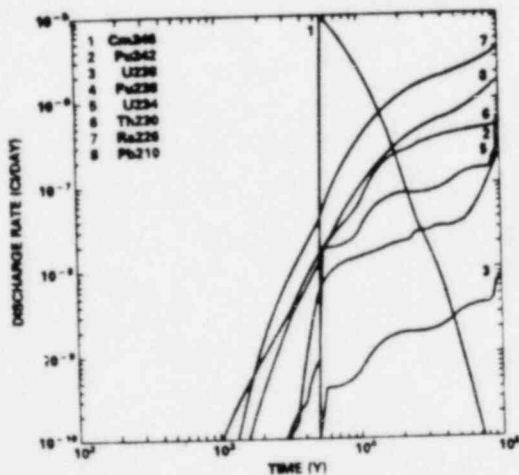
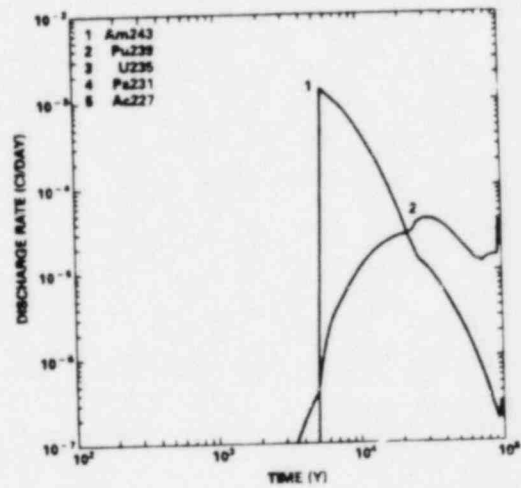
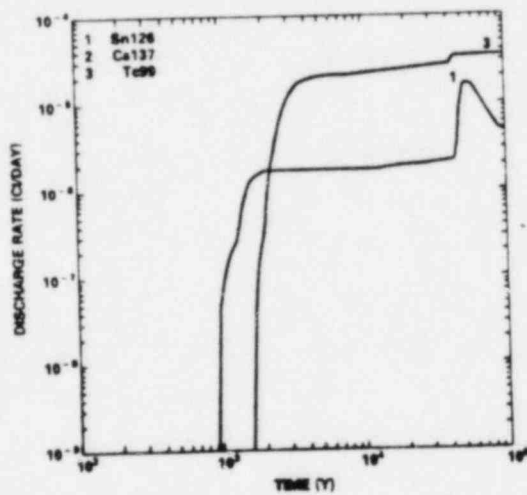
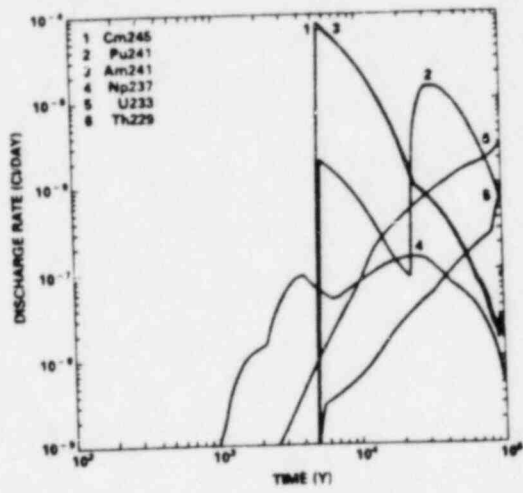
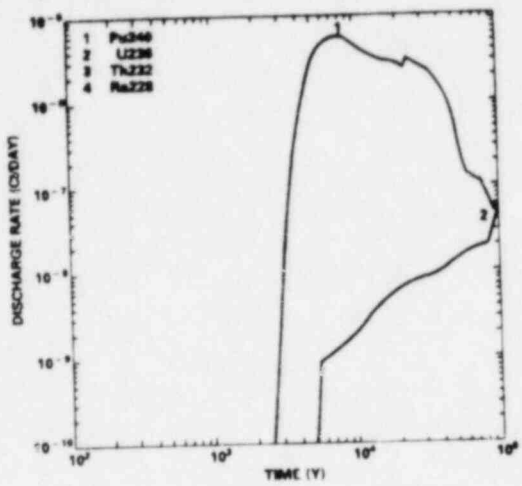


Figure 4.7

Mean Groundwater Discharge Curves
via the Wells for the U-tube Scenario
with Well Withdrawal

Similar results and trends are noted in the results from Zone 2 of the U-tube scenario with well withdrawal.

Summary

In summary, there are differences in the assumptions, modeling techniques and input data between the ICRP2 and the ICRP30 internal dosimetry models. The advanced lung model, modified bone dose calculations and new gut uptakes (e.g., neptunium) and revised retention times used in the ICRP30 dosimetry model have a significant impact on the dose conversion factors calculated with this model. The results from the scenario analyses performed for this comparison study indicate that the risk results vary by factors of approximately 2 to 20. It is very important to note that these results are dependent upon the radionuclides and their discharge rates considered in the analysis. If individual organ doses for the two models are compared, the differences are much greater (e.g., bone dose) due to changes in the modeling approaches between ICRP2 and ICRP30. However, when the calculations are carried to estimates of risk, these differences are somewhat decreased.

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APPENDIX A

TABLE A.1

DOSE CONVERSION FACTORS
(REM/CURIE)

H3	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	1.05E+02	**	1.05E+02	**
BONE	0.	6.40E+01	0.	6.40E+01
R MARROW	**	6.40E+01	**	6.40E+01
LUNGS	1.05E+02	6.40E+01	1.05E+02	6.40E+01
THYROID	1.05E+02	6.40E+01	1.05E+02	6.40E+01
LIVER	1.05E+02	6.40E+01	1.05E+02	6.40E+01
KIDNEYS	1.05E+02	6.40E+01	1.05E+02	6.40E+01
GI LLI	1.05E+02	6.40E+01	1.05E+02	6.40E+01
ULI	**	6.40E+01	**	6.40E+01
SI+CON	**	6.40E+01	**	6.40E+01
S WALL	**	6.40E+01	**	6.40E+01
PANCREAS	**	6.40E+01	**	6.40E+01
BREAST	**	6.40E+01	**	6.40E+01
SPLEEN	**	6.40E+01	**	6.40E+01
THYMUS	**	6.40E+01	**	6.40E+01
ADRENALS	**	6.40E+01	**	6.40E+01
SKIN	**	6.40E+01	**	6.40E+01
BLAD WALL	**	6.40E+01	**	6.40E+01
UTERUS	**	6.40E+01	**	6.40E+01
OVARIES	**	6.40E+01	**	6.40E+01
TESTES	**	6.40E+01	**	6.40E+01

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

C14	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	5.68E+02	**	4.26E+02	**
BONE	2.84E+03	2.07E+03	2.27E+03	2.37E+01
R MARROW	**	2.07E+03	**	2.37E+01
LUNGS	5.68E+02	2.07E+03	4.26E+02	2.37E+01
THYROID	5.68E+02	2.07E+03	4.26E+02	2.37E+01
LIVER	5.68E+02	2.07E+03	4.26E+02	2.37E+01
KIDNEYS	5.68E+02	2.07E+03	4.26E+02	2.37E+01
GI LLI	5.68E+02	2.07E+03	4.26E+02	2.37E+01
ULI	**	2.07E+03	**	2.37E+01
SI+CON	**	2.07E+03	**	2.37E+01
S WALL	**	2.07E+03	**	2.37E+01
PANCREAS	**	2.07E+03	**	2.37E+01
BREAST	**	2.07E+03	**	2.37E+01
SPLEEN	**	2.07E+03	**	2.37E+01
THYMUS	**	2.07E+03	**	2.37E+01
ADRENALS	**	2.07E+03	**	2.37E+01
SKIN	**	2.07E+03	**	2.37E+01
BLAD WALL	**	2.07E+03	**	2.37E+01
UTERUS	**	2.07E+03	**	2.37E+01
OVARIES	**	2.07E+03	**	2.37E+01
TESTES	**	2.07E+03	**	2.37E+01

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

NA22	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	1.74E+04	**	1.30E+04	**
BONE	1.74E+04	2.05E+04	1.30E+04	1.30E+04
R MARROW	**	1.59E+04	**	1.01E+04
LUNGS	1.74E+04	9.29E+03	1.30E+04	9.14E+03
THYROID	1.74E+04	9.25E+03	1.30E+04	5.92E+03
LIVER	1.74E+04	9.99E+03	1.30E+04	6.48E+03
KIDNEYS	1.74E+04	1.05E+04	1.30E+04	6.70E+03
GI LLI	1.74E+04	1.14E+04	1.30E+04	7.18E+03
ULI	**	1.06E+04	**	6.66E+03
SI+CON	**	1.10E+04	**	6.96E+03
S WALL	**	1.08E+04	**	6.22E+03
PANCREAS	**	1.05E+04	**	6.66E+03
BREAST	**	9.55E+03	**	6.11E+03
SPLEEN	**	1.01E+04	**	6.48E+03
THYMUS	**	9.32E+03	**	6.18E+03
ADRENALS	**	1.49E+04	**	9.55E+03
SKIN	**	7.07E+03	**	4.51E+03
BLAD WALL	**	1.05E+04	**	6.59E+03
UTERUS	**	1.06E+04	**	6.70E+03
OVARIES	**	1.04E+04	**	6.55E+03
TESTES	**	9.95E+03	**	6.29E+03

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

NA24	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	1.70E+03	**	1.28E+03	**
BONE	1.70E+03	1.73E+03	1.28E+03	9.55E+02
R MARROW	**	1.38E+03	**	7.88E+02
LUNGS	1.70E+03	9.62E+02	1.28E+03	4.63E+03
THYROID	1.70E+03	9.62E+02	1.28E+03	5.66E+02
LIVER	1.70E+03	1.08E+03	1.28E+03	6.99E+02
KIDNEYS	1.70E+03	1.10E+03	1.28E+03	6.11E+02
GI LLI	1.70E+03	1.25E+03	1.28E+03	6.40E+02
ULI	**	1.15E+03	**	5.99E+02
SI+CON	**	1.19E+03	**	6.18E+02
S WALL	**	4.37E+03	**	1.14E+03
PANCREAS	**	1.62E+03	**	8.55E+02
BREAST	**	1.00E+03	**	5.96E+02
SPLEEN	**	1.16E+03	**	6.66E+02
THYMUS	**	1.12E+03	**	8.47E+02
ADRENALS	**	1.38E+03	**	8.03E+02
SKIN	**	7.81E+02	**	4.44E+02
BLOD WALL	**	1.11E+03	**	5.77E+02
UTERUS	**	1.21E+03	**	6.29E+02
OVARIES	**	1.27E+03	**	6.59E+02
TESTES	**	1.04E+03	**	5.40E+02

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

P32	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	7.46E+03	**	6.26E+03	**
BONE	1.93E+05	2.91E+04	1.65E+05	2.15E+04
R MARROW	**	2.99E+04	**	2.21E+04
LUNGS	0.	2.42E+03	0.	9.25E+03
THYROID	0.	2.42E+03	0.	1.79E+03
LIVER	1.20E+04	2.42E+03	9.64E+03	1.79E+03
KIDNEYS	0.	2.42E+03	0.	1.79E+03
GI LLI	2.17E+04	2.68E+04	1.08E+04	5.55E+03
ULI	**	1.09E+04	**	3.10E+03
SI+CON	**	3.89E+03	**	2.02E+03
S WALL	**	5.37E+03	**	2.24E+03
PANCREAS	**	2.42E+03	**	1.79E+03
BREAST	**	2.42E+03	**	1.79E+03
SPLEEN	**	2.42E+03	**	1.79E+03
THYMUS	**	2.42E+03	**	1.79E+03
ADRENALS	**	2.42E+03	**	1.79E+03
SKIN	**	2.42E+03	**	1.79E+03
BLAD WALL	**	2.42E+03	**	1.79E+03
UTERUS	**	2.42E+03	**	1.79E+03
OVARIES	**	2.42E+03	**	1.79E+03
TESTES	**	2.42E+03	**	1.79E+03

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

CR51	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	2.66E+00	**	1.25E+01	**
BONE	0.	1.18E+01	0.	5.14E+01
R MARROW	**	3.15E+01	**	6.92E+01
LUNGS	3.53E+00	3.50E+00	1.80E+03	1.98E+03
THYROID	1.59E+00	1.58E+00	7.44E+00	4.00E+01
LIVER	0.	1.30E+01	0.	9.51E+01
KIDNEYS	5.86E-01	1.84E+01	2.85E+00	4.74E+01
GI LLI	6.69E+02	9.95E+02	4.15E+02	4.37E+02
ULI	**	4.14E+02	**	1.96E+02
SI+CON	**	1.73E+02	**	9.03E+01
S WALL	**	5.44E+01	**	9.47E+01
PANCREAS	**	1.82E+01	**	1.05E+02
BREAST	**	1.66E+01	**	5.85E+01
SPLEEN	**	1.39E+01	**	8.88E+01
THYMUS	**	2.61E+00	**	1.39E+02
ADRENALS	**	9.14E+00	**	9.55E+01
SKIN	**	6.03E+00	**	2.84E+01
BLAD WALL	**	4.37E+01	**	2.84E+01
UTERUS	**	5.88E+01	**	3.59E+01
OVARIES	**	1.47E+02	**	7.51E+01
TESTES	**	1.39E+01	**	1.31E+01

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

MN54	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	8.72E+02	**	7.87E+02	**
BONE	0.	2.11E+03	0.	4.63E+03
R MARROW	**	1.81E+03	**	4.07E+03
LUNGS	0.	8.47E+02	1.75E+05	2.46E+04
THYROID	0.	4.92E+02	0.	2.74E+03
LIVER	4.57E+03	3.70E+03	4.95E+03	9.14E+03
KIDNEYS	1.36E+03	1.41E+03	1.23E+03	3.29E+03
GI LLI	1.40E+04	8.14E+03	9.67E+03	4.88E+03
ULI	**	5.00E+03	**	3.96E+03
SI+CON	**	3.64E+03	**	3.09E+03
S WALL	**	1.52E+03	**	4.26E+03
PANCREAS	**	1.41E+03	**	5.33E+03
BREAST	**	1.02E+03	**	3.18E+03
SPLEEN	**	9.83E+02	**	4.37E+03
THYMUS	**	5.92E+02	**	6.73E+03
ADRENALS	**	1.53E+03	**	5.74E+03
SKIN	**	5.92E+02	**	1.82E+03
BLAD WALL	**	1.38E+03	**	1.39E+03
UTERUS	**	1.86E+03	**	1.82E+03
OVARIES	**	3.51E+03	**	2.62E+03
TESTES	**	7.81E+02	**	1.01E+03

 ** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

MN56	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	2.04E+01	**	2.29E-02	**
BONE	0.	3.92E+01	0.	3.05E+01
R MARROW	**	8.99E+01	**	3.77E+01
LUNGS	0.	3.26E+01	1.18E+03	1.99E+03
THYROID	0.	8.88E+00	0.	2.29E+01
LIVER	1.15E+02	9.73E+01	1.55E-01	6.44E+01
KIDNEYS	1.46E+02	1.18E+02	1.63E-01	2.96E+01
GI LLI	3.67E+03	2.00E+03	2.53E+03	1.60E+02
ULI	**	5.07E+03	**	3.92E+02
SI+CON	**	3.89E+03	**	3.05E+02
S WALL	**	3.34E+03	**	2.81E+02
PANCREAS	**	2.09E+02	**	5.22E+01
BREAST	**	6.51E+01	**	2.88E+01
SPLEEN	**	1.31E+02	**	4.33E+01
THYMUS	**	1.65E+01	**	5.70E+01
ADRENALS	**	6.51E+01	**	3.77E+01
SKIN	**	2.50E+01	**	1.79E+01
BLAD WALL	**	9.47E+01	**	1.76E+01
UTERUS	**	2.18E+02	**	2.82E+01
OVARIES	**	3.16E+02	**	3.50E+01
TESTES	**	2.85E+01	**	1.17E+01

 ** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

FE55	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	4.43E+02	**	4.93E+02	**
BONE	2.75E+03	3.89E+02	3.07E+03	6.48E+02
R MARROW	**	3.89E+02	**	6.51E+02
LUNGS	1.06E+03	3.77E+02	9.01E+03	3.92E+03
THYROID	0.	4.07E+02	0.	6.85E+02
LIVER	1.90E+03	1.27E+03	2.12E+03	2.13E+03
KIDNEYS	0.	3.81E+02	0.	6.40E+02
GI LLI	1.09E+03	1.12E+03	7.54E+02	1.02E+03
ULI	**	6.36E+02	**	7.73E+02
SI+CON	**	4.23E+02	**	6.66E+02
S WALL	**	4.00E+02	**	6.48E+02
PANCREAS	**	3.85E+02	**	6.48E+02
BREAST	**	3.85E+02	**	6.44E+02
SPLEEN	**	2.09E+03	**	3.50E+03
THYMUS	**	3.81E+02	**	6.36E+02
ADRENALS	**	3.92E+02	**	6.59E+02
SKIN	**	3.70E+02	**	6.18E+02
BLAD WALL	**	3.70E+02	**	6.22E+02
UTERUS	**	3.89E+02	**	6.51E+02
OVARIES	**	3.96E+02	**	6.62E+02
TESTES	**	3.89E+02	**	6.51E+02

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

FE59	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	3.91E+03	**	1.32E+03	**
BONE	4.34E+03	2.45E+03	1.47E+03	4.11E+03
R MARROW	**	3.13E+03	**	4.85E+03
LUNGS	2.85E+03	2.35E+03	1.27E+05	5.11E+04
THYROID	0.	2.23E+03	0.	4.33E+03
LIVER	1.02E+04	5.70E+03	3.47E+03	9.92E+03
KIDNEYS	0.	3.36E+03	0.	5.22E+03
GI LLI	3.40E+04	3.12E+04	2.35E+04	1.67E+04
ULI	**	1.46E+04	**	9.55E+03
SI+CON	**	7.73E+03	**	6.40E+03
S WALL	**	4.11E+03	**	6.25E+03
PA REAS	**	3.34E+03	**	6.51E+03
BREAST	**	2.73E+03	**	4.66E+03
SPLEEN	**	6.73E+03	**	1.09E+04
THYMUS	**	2.34E+03	**	7.70E+03
ADRENALS	**	3.77E+03	**	7.25E+03
SKIN	**	1.86E+03	**	3.12E+03
BLAD WALL	**	4.00E+03	**	4.44E+03
UTERUS	**	4.63E+03	**	5.00E+03
OVARIES	**	6.14E+03	**	5.14E+03
TESTES	**	2.76E+03	**	3.50E+03

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

C057	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	2.91E+02	**	8.39E+01	**
BONE	0.	7.84E+02	0.	7.29E+02
R MARROW	**	9.88E+02	**	9.40E+02
LUNGS	0.	6.03E+02	4.62E+04	1.50E+04
THYROID	0.	4.26E+02	0.	4.18E+02
LIVER	1.75E+02	1.72E+03	8.65E+01	1.36E+03
KIDNEYS	0.	7.29E+02	0.	5.37E+02
GI LLI	4.44E+03	4.00E+03	3.93E+03	2.55E+03
ULI	**	2.08E+03	**	1.28E+03
SI+CON	**	1.26E+03	**	7.33E+02
S WALL	**	8.33E+02	**	8.33E+02
PANCREAS	**	8.03E+02	**	9.88E+02
BREAST	**	5.85E+02	**	5.77E+02
SPLEEN	**	6.66E+02	**	9.51E+02
THYMUS	**	6.14E+02	**	1.32E+03
ADRENALS	**	7.36E+02	**	9.77E+02
SKIN	**	3.85E+02	**	2.98E+02
BLAD WALL	**	7.59E+02	**	3.81E+02
UTERUS	**	9.18E+02	**	4.74E+02
OVARIES	**	1.09E+03	**	6.03E+02
TESTES	**	5.11E+02	**	2.38E+02

 ** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

C058	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	1.67E+03	**	2.59E+02	**
BONE	0.	1.51E+03	0.	1.77E+03
R MARROW	**	2.00E+03	**	2.34E+03
LUNGS	0.	1.50E+03	1.16E+05	2.94E+04
THYROID	0.	1.35E+03	0.	2.04E+03
LIVER	7.45E+02	3.74E+03	1.98E+02	4.26E+03
KIDNEYS	0.	2.12E+03	0.	2.09E+03
GI LLI	1.51E+04	1.23E+04	1.33E+04	7.47E+03
ULI	**	6.88E+03	**	4.40E+03
SI+CON	**	4.63E+03	**	2.86E+03
S WALL	**	2.59E+03	**	3.34E+03
PANCREAS	**	2.09E+03	**	3.74E+03
BREAST	**	1.67E+03	**	2.26E+03
SPLEEN	**	1.89E+03	**	3.28E+03
THYMUS	**	1.31E+03	**	5.03E+03
ADRENALS	**	2.19E+03	**	3.65E+03
SKIN	**	1.02E+03	**	1.22E+03
BLAD WALL	**	2.47E+03	**	1.27E+03
UTERUS	**	2.90E+03	**	1.54E+03
OVARIES	**	4.00E+03	**	2.41E+03
TESTES	**	1.82E+03	**	8.18E+02

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

C060	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	4.72E+03	**	1.85E+03	**
BONE	0.	1.78E+04	0.	1.31E+04
R MARROW	**	2.03E+04	**	1.57E+04
LUNGS	0.	1.84E+04	7.46E+05	1.32E+05
THYROID	0.	1.73E+04	0.	1.38E+04
LIVER	2.14E+03	4.74E+04	1.44E+03	3.39E+04
KIDNEYS	0.	2.37E+04	0.	1.67E+04
GI LLI	4.02E+04	5.00E+04	3.56E+04	3.02E+04
ULI	**	3.54E+04	**	2.18E+04
SI+CON	**	3.03E+04	**	1.75E+04
S WALL	**	2.16E+04	**	1.99E+04
PANCREAS	**	2.31E+04	**	2.21E+04
BREAST	**	1.88E+04	**	1.54E+04
SPLEEN	**	2.06E+04	**	1.93E+04
THYMUS	**	1.95E+04	**	2.96E+04
ADRENALS	**	3.23E+04	**	2.57E+04
SKIN	**	1.31E+04	**	9.73E+03
BLAD WALL	**	2.46E+04	**	1.27E+04
UTERUS	**	2.64E+04	**	1.42E+04
OVARIES	**	2.68E+04	**	1.50E+04
TESTES	**	2.01E+04	**	9.92E+03

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

ZN65	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	6.96E+03	**	5.82E+03	**
BONE	4.84E+03	1.67E+04	4.05E+03	1.24E+04
R MARROW	**	1.67E+04	**	1.34E+04
LUNGS	0.	1.14E+04	1.08E+05	7.77E+04
THYROID	0.	1.19E+04	0.	1.12E+04
LIVER	1.54E+04	1.36E+04	1.29E+04	1.61E+04
KIDNEYS	1.03E+04	1.43E+04	9.62E+03	1.14E+04
GI LLI	9.70E+03	1.84E+04	6.68E+03	9.99E+03
ULI	**	1.57E+04	**	9.84E+03
SI+CON	**	1.58E+04	**	9.58E+03
S WALL	**	1.25E+04	**	1.39E+04
PANCREAS	**	1.32E+04	**	1.54E+04
BREAST	**	1.21E+04	**	1.14E+04
SPLEEN	**	1.34E+04	**	1.50E+04
THYMUS	**	1.12E+04	**	2.18E+04
ADRENALS	**	1.76E+04	**	1.79E+04
SKIN	**	8.47E+03	**	7.14E+03
BLAD WALL	**	1.51E+04	**	8.32E+03
UTERUS	**	1.75E+04	**	9.81E+03
OVARIES	**	1.30E+04	**	7.51E+03
TESTES	**	1.32E+04	**	7.10E+03

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

ZN69	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	1.37E+00	**	5.65E-04	**
BONE	1.03E+01	1.92E+00	4.23E-03	1.27E-01
R MARROW	**	1.98E+00	**	1.32E-01
LUNGS	0.	1.54E+00	1.15E+02	2.96E+02
THYROID	0.	1.54E+00	0.	1.02E-01
LIVER	1.97E+01	1.54E+00	8.14E-03	1.02E-01
KIDNEYS	1.28E+01	1.54E+00	5.27E-03	1.02E-01
GI LLI	2.96E+00	3.85E+01	2.04E+00	1.59E+00
ULI	**	2.28E+02	**	9.25E+00
SI+CON	**	4.03E+02	**	1.64E+01
S WALL	**	7.92E+02	**	3.21E+01
PANCREAS	**	1.54E+00	**	1.02E-01
BREAST	**	1.54E+00	**	1.02E-01
SPLEEN	**	1.54E+00	**	1.02E-01
THYMUS	**	1.54E+00	**	1.02E-01
ADRENALS	**	1.54E+00	**	1.02E-01
SKIN	**	1.54E+00	**	1.02E-01
BLAD WALL	**	1.54E+00	**	1.02E-01
UTERUS	**	1.54E+00	**	1.02E-01
OVARIES	**	1.54E+00	**	1.02E-01
TESTES	**	1.54E+00	**	1.02E-01

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

SR89	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	8.84E+03	**	1.09E+03	**
BONE	3.08E+05	1.78E+04	3.80E+04	5.88E+02
R MARROW	**	1.20E+04	**	3.96E+02
LUNGS	0.	8.88E+02	1.75E+05	3.09E+05
THYROID	0.	8.88E+02	0.	2.95E+01
LIVER	0.	8.88E+02	0.	2.96E+01
KIDNEYS	0.	8.88E+02	0.	2.94E+01
GI LLI	4.94E+04	7.66E+04	4.37E+04	5.14E+04
ULI	**	2.70E+04	**	1.77E+04
SI+CON	**	5.22E+03	**	2.98E+03
S WALL	**	3.37E+03	**	1.22E+03
PANCREAS	**	8.88E+02	**	2.96E+01
BREAST	**	8.88E+02	**	2.95E+01
SPLEEN	**	8.88E+02	**	2.96E+01
THYMUS	**	8.88E+02	**	2.99E+01
ADRENALS	**	8.88E+02	**	2.96E+01
SKIN	**	8.88E+02	**	2.94E+01
BLAD WALL	**	8.88E+02	**	2.93E+01
UTERUS	**	8.88E+02	**	2.93E+01
OVARIES	**	8.88E+02	**	2.94E+01
TESTES	**	8.88E+02	**	2.93E+01

** = NOT DEFINED BY MODEL

TABLE 4.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

SR90	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	1.86E+06	**	7.62E+05	**
BONE	7.58E+06	1.55E+06	1.24E+07	2.62E+05
R MARROW	**	7.18E+05	**	1.21E+05
LUNGS	0.	5.59E+03	1.20E+06	1.06E+07
THYROID	0.	5.59E+03	0.	9.95E+02
LIVER	0.	5.59E+03	0.	9.95E+02
KIDNEYS	0.	5.59E+03	0.	9.95E+02
GI LLI	2.19E+05	7.29E+04	9.02E+04	7.62E+04
ULI	**	2.12E+04	**	2.25E+04
SI+CON	**	7.33E+03	**	4.07E+03
S WALL	**	6.49E+03	**	2.17E+03
PANCREAS	**	5.59E+03	**	9.95E+02
BREAST	**	5.59E+03	**	9.95E+02
SPLEEN	**	5.59E+03	**	9.95E+02
THYMUS	**	5.59E+03	**	9.95E+02
ADRENALS	**	5.59E+03	**	9.95E+02
SKIN	**	5.59E+03	**	9.95E+02
BLAD WALL	**	5.59E+03	**	9.95E+02
UTERUS	**	5.59E+03	**	9.95E+02
OVARIES	**	5.59E+03	**	9.95E+02
TESTES	**	5.59E+03	**	9.95E+02

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

SR91	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	2.29E+02	**	3.13E-01	**
BONE	5.67E+03	2.92E+02	7.74E+00	4.70E+01
R MARROW	**	4.00E+02	**	8.25E+01
LUNGS	0.	1.13E+02	4.56E+03	7.88E+03
THYROID	0.	8.92E+01	0.	3.57E+01
LIVER	0.	2.01E+02	0.	9.40E+01
KIDNEYS	0.	2.45E+02	0.	7.29E+01
GI LLI	2.70E+04	1.44E+04	2.39E+04	4.33E+03
ULI	**	1.37E+04	**	4.03E+03
SI+CON	**	5.00E+03	**	1.45E+03
S WALL	**	3.17E+03	**	7.66E+02
PANCREAS	**	2.75E+02	**	1.16E+02
BREAST	**	1.84E+02	**	6.44E+01
SPLEEN	**	2.18E+02	**	9.21E+01
THYMUS	**	9.51E+01	**	1.04E+02
ADRENALS	**	1.66E+02	**	8.21E+01
SKIN	**	1.13E+02	**	3.02E+01
BLAD WALL	**	2.83E+02	**	6.03E+01
UTERUS	**	4.48E+02	**	1.09E+02
OVARIES	**	7.77E+02	**	2.09E+02
TESTES	**	1.44E+02	**	1.84E+01

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

SR92	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	9.30E+01	**	3.64E-02	**
BONE	2.15E+03	7.88E+01	8.43E-01	1.61E+01
R MARROW	**	1.43E+02	**	2.58E+01
LUNGS	0.	6.99E+01	2.06E+03	3.89E+03
THYROID	0.	5.00E+01	0.	1.45E+01
LIVER	0.	1.16E+02	0.	3.85E+01
KIDNEYS	0.	1.44E+02	0.	2.72E+01
GI LLI	4.26E+04	7.92E+03	5.38E+03	1.42E+03
ULI	**	1.12E+04	**	2.27E+03
SI+CON	**	4.00E+03	**	1.04E+03
S WALL	**	1.96E+03	**	5.85E+02
PANCREAS	**	2.17E+02	**	5.00E+01
BREAST	**	9.95E+01	**	2.40E+01
SPLEEN	**	1.57E+02	**	3.74E+01
THYMUS	**	5.92E+01	**	5.48E+01
ADRENALS	**	1.08E+02	**	3.34E+01
SKIN	**	6.59E+01	**	1.25E+01
BLAD WALL	**	1.32E+02	**	1.35E+01
UTERUS	**	2.34E+02	**	2.92E+01
OVARIES	**	2.96E+02	**	3.77E+01
TESTES	**	6.81E+01	**	4.26E+00

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

Y90	INGESTION		INHALATION	
	ICRF2	ICRF30	ICRP2	ICRP30
TOTAL BODY	2.58E-01	**	7.01E+00	**
BONE	9.62E+00	1.36E+00	2.61E+02	1.03E+03
R MARROW	**	1.37E+00	**	1.03E+03
LUNGS	0.	4.66E-02	2.12E+04	3.29E+04
THYROID	0.	4.66E-02	0.	3.52E+01
LIVER	0.	1.35E+00	0.	1.02E+03
KIDNEYS	0.	4.66E-02	0.	3.52E+01
GI LLI	1.02E+05	1.17E+05	6.32E+04	4.03E+04
ULI	**	4.88E+04	**	1.69E+04
SI+CON	**	9.44E+03	**	3.29E+03
S WALL	**	3.96E+03	**	1.39E+03
PANCREAS	**	4.66E-02	**	3.52E+01
BREAST	**	4.70E-02	**	3.52E+01
SPLEEN	**	4.66E-02	**	3.52E+01
THYMUS	**	4.66E-02	**	3.52E+01
ADRENALS	**	4.66E-02	**	3.52E+01
SKIN	**	4.66E-02	**	3.52E+01
BLAD WALL	**	4.66E-02	**	3.52E+01
UTERUS	**	4.66E-02	**	3.52E+01
OVARIES	**	5.29E-02	**	3.52E+01
TESTES	**	4.66E-02	**	3.52E+01

 ** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

Y91	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	3.77E+00	**	1.55E+03	**
BONE	1.41E+02	2.27E+01	5.78E+04	2.05E+04
R MARROW	**	2.44E+01	**	2.05E+04
LUNGS	0.	7.47E-01	2.13E+05	1.94E+05
THYROID	0.	4.77E-01	0.	4.07E+02
LIVER	0.	2.28E+01	0.	2.03E+04
KIDNEYS	0.	2.26E+00	0.	4.11E+02
GI LLI	7.76E+04	1.12E+05	4.81E+04	5.18E+04
ULI	**	3.77E+04	**	1.77E+04
SI+CON	**	6.40E+03	**	3.35E+03
S WALL	**	2.57E+03	**	1.59E+03
PANCREAS	**	2.09E+00	**	4.14E+02
BREAST	**	2.05E+00	**	4.11E+02
SPLEEN	**	1.88E+00	**	4.11E+02
THYMUS	**	5.70E-01	**	4.18E+02
ADRENALS	**	1.30E+00	**	4.18E+02
SKIN	**	1.07E+00	**	4.07E+02
BLAD WALL	**	4.55E+00	**	4.03E+02
UTERUS	**	6.03E+00	**	4.07E+02
OVARIES	**	1.31E+01	**	4.11E+02
TESTES	**	1.53E+00	**	4.03E+02

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

Y91M	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	3.52E-03	**	1.27E-03	**
BONE	9.09E-02	3.22E+00	3.26E-02	1.40E+01
R MARROW	**	8.29E+00	**	1.46E+01
LUNGS	0.	4.74E+00	2.40E+02	1.55E+02
THYROID	0.	4.33E-01	0.	2.31E+00
LIVER	0.	9.10E+00	0.	1.61E+01
KIDNEYS	0.	1.45E+01	0.	2.53E+00
GI LLI	2.67E-01	8.84E+01	1.66E-01	3.18E+01
ULI	**	1.14E+02	**	1.40E+01
SI+CON	**	1.14E+02	**	5.96E+00
S WALL	**	1.82E+02	**	8.92E+00
PANCREAS	**	4.14E+01	**	5.55E+00
BREAST	**	6.81E+00	**	2.64E+00
SPLEEN	**	2.36E+01	**	4.26E+00
THYMUS	**	9.88E-01	**	5.70E+00
ADRENALS	**	7.40E+00	**	4.33E+00
SKIN	**	2.62E+00	**	1.50E+00
BLAD WALL	**	8.58E+00	**	1.05E+00
UTERUS	**	2.13E+01	**	1.43E+00
OVARIES	**	2.57E+01	**	1.60E+00
TESTES	**	1.20E+00	**	7.81E-01

 ** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

ZR95	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	6.60E+00	**	2.91E+03	**
BONE	3.04E+01	1.80E+03	1.34E+04	8.03E+04
R MARROW	**	7.92E+02	**	1.20E+04
LUNGS	0.	8.66E+01	2.21E+05	6.88E+04
THYROID	0.	3.06E+01	0.	2.89E+03
LIVER	9.75E+00	2.88E+02	4.30E+03	4.37E+03
KIDNEYS	1.53E+01	4.19E+02	6.77E+03	3.02E+03
GI LL I	3.09E+04	2.89E+04	1.88E+04	1.55E+04
ULI	**	1.13E+04	**	7.10E+03
SI+CON	**	4.14E+03	**	3.64E+03
S WALL	**	1.32E+03	**	4.03E+03
PANCREAS	**	3.89E+02	**	4.85E+03
BREAST	**	3.89E+02	**	3.45E+03
SPLEEN	**	3.27E+02	**	4.29E+03
THYMUS	**	4.85E+01	**	6.40E+03
ADRENALS	**	2.25E+02	**	5.66E+03
SKIN	**	1.55E+02	**	2.15E+03
BLAD WALL	**	8.99E+02	**	1.41E+03
UTERUS	**	1.23E+03	**	1.88E+03
OVARIES	**	3.02E+03	**	3.11E+03
TESTES	**	2.97E+02	**	1.12E+03

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

ZR97	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	1.55E-01	**	1.13E+00	**
BONE	1.68E+00	1.68E+02	1.21E+01	4.55E+02
R MARROW	**	4.81E+02	**	5.29E+02
LUNGS	0.	6.51E+01	9.84E+03	1.46E+04
THYROID	0.	9.84E+00	0.	1.39E+02
LIVER	3.39E-01	2.95E+02	2.45E+00	2.76E+02
KIDNEYS	5.12E-01	4.07E+02	3.71E+00	2.28E+02
GI LLI	1.05E+05	6.62E+04	6.54E+04	1.58E+04
ULI	**	4.48E+04	**	1.08E+04
SI+CON	**	1.25E+04	**	3.28E+03
S WALL	**	4.48E+03	**	1.55E+03
PANCREAS	**	3.96E+02	**	3.22E+02
BREAST	**	3.00E+02	**	2.14E+02
SPLEEN	**	2.97E+02	**	2.69E+02
THYMUS	**	2.79E+01	**	2.97E+02
ADRENALS	**	1.81E+02	**	2.60E+02
SKIN	**	1.12E+02	**	1.23E+02
BLAD WALL	**	6.51E+02	**	2.25E+02
UTERUS	**	1.05E+03	**	3.29E+02
OVARIES	**	2.30E+03	**	6.29E+02
TESTES	**	1.93E+02	**	1.11E+02

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

NB95	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	1.86E+00	**	5.26E+02	**
BONE	6.22E+00	1.09E+03	1.76E+03	8.95E+03
R MARROW	**	7.36E+02	**	2.49E+03
LUNGS	0.	1.01E+02	6.31E+04	2.03E+04
THYROID	0.	4.37E+01	0.	1.16E+03
LIVER	3.46E+00	3.07E+02	9.77E+02	1.97E+03
KIDNEYS	3.42E+00	5.07E+02	9.67E+02	1.89E+03
GI LLI	2.10E+04	1.48E+04	1.30E+04	7.03E+03
ULI	**	6.73E+03	**	3.60E+03
SI+CON	**	3.38E+03	**	2.06E+03
S WALL	**	1.04E+03	**	1.98E+03
PANCREAS	**	4.14E+02	**	2.18E+03
BREAST	**	3.96E+02	**	1.39E+03
SPLEEN	**	4.14E+02	**	2.53E+03
THYMUS	**	6.11E+01	**	2.82E+03
ADRENALS	**	2.51E+02	**	2.26E+03
SKIN	**	1.63E+02	**	7.92E+02
BLAD WALL	**	8.99E+02	**	7.55E+02
UTERUS	**	1.24E+03	**	9.81E+02
OVARIES	**	2.98E+03	**	1.79E+03
TESTES	**	3.57E+02	**	9.36E+02

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

M099	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	8.20E+02	**	2.87E+00	**
BONE	0.	2.85E+03	0.	2.00E+03
R MARROW	**	1.97E+03	**	1.37E+03
LUNGS	0.	7.14E+02	1.14E+04	4.33E+03
THYROID	0.	6.07E+02	0.	4.33E+02
LIVER	4.31E+03	9.84E+03	1.51E+01	6.92E+03
KIDNEYS	9.76E+03	9.21E+03	3.64E+01	6.48E+03
GI LLI	9.99E+03	1.16E+04	3.10E+04	2.15E+03
ULI	**	5.33E+03	**	1.23E+03
SI+CON	**	1.71E+03	**	6.62E+02
S WALL	**	2.47E+03	**	7.88E+02
PANCREAS	**	8.70E+02	**	6.11E+02
BREAST	**	6.77E+02	**	4.77E+02
SPLEEN	**	7.44E+02	**	5.25E+02
THYMUS	**	6.59E+02	**	4.92E+02
ADRENALS	**	8.95E+02	**	6.44E+02
SKIN	**	5.96E+02	**	4.18E+02
BLAD WALL	**	6.99E+02	**	4.66E+02
UTERUS	**	7.51E+02	**	4.92E+02
OVAPIES	**	8.18E+02	**	4.88E+02
TESTES	**	6.33E+02	**	4.37E+02

** = NOT DEFINED BY M099

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

TC99	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	5.02E+01	**	1.25E+01	**
BONE	1.25E+02	2.23E+02	3.13E+01	1.48E+02
R MARROW	**	2.23E+02	**	1.48E+02
LUNGS	1.58E+01	2.23E+02	1.01E+05	6.18E+04
THYROID	0.	5.99E+03	0.	3.96E+03
LIVER	1.86E+02	3.05E+02	4.64E+01	2.01E+02
KIDNEYS	2.34E+03	2.23E+02	5.85E+02	1.48E+02
GI LLI	6.08E+03	4.07E+03	7.54E+03	2.11E+03
ULI	**	1.50E+03	**	7.99E+02
SI+CON	**	4.40E+02	**	2.58E+02
S WALL	**	1.25E+04	**	8.21E+03
PANCREAS	**	2.23E+02	**	1.48E+02
BREAST	**	2.23E+02	**	1.48E+02
SPLEEN	**	2.23E+02	**	1.48E+02
THYMUS	**	2.23E+02	**	1.48E+02
ADRENALS	**	2.23E+02	**	1.48E+02
SKIN	**	2.23E+02	**	1.48E+02
BLAD WALL	**	2.23E+02	**	1.48E+02
UTERUS	**	2.23E+02	**	1.48E+02
OVARIES	**	2.23E+02	**	1.48E+02
TESTES	**	2.23E+02	**	1.48E+02

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

TC99M	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	8.89E+00	**	4.63E-03	**
BONE	2.47E-01	1.50E+01	1.29E-04	6.59E+00
R MARROW	**	2.33E+01	**	8.84E+00
LUNGS	3.42E-01	1.16E+01	9.55E+01	1.14E+02
THYROID	0.	3.13E+02	0.	7.73E+01
LIVER	6.98E-01	1.75E+01	3.64E-04	9.18E+00
KIDNEYS	1.06E+01	1.92E+01	5.52E-03	5.70E+00
GI LLI	4.13E+02	9.40E+01	5.20E+02	1.42E+01
ULI	**	1.37E+02	**	2.06E+01
SI+CON	**	9.21E+01	**	1.30E+01
S WALL	**	2.65E+02	**	5.62E+01
PANCREAS	**	3.96E+01	**	1.33E+01
BREAST	**	1.32E+01	**	5.62E+00
SPLEEN	**	2.60E+01	**	1.02E+01
THYMUS	**	1.14E+01	**	1.25E+01
ADRENALS	**	1.60E+01	**	9.44E+00
SKIN	**	7.07E+00	**	2.77E+00
BLAD WALL	**	1.68E+01	**	3.42E+00
UTERUS	**	2.65E+01	**	5.07E+00
OVARIES	**	3.61E+01	**	6.29E+00
TESTES	**	8.47E+00	**	1.93E+00

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REP/QUIE)

RU103	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	7.97E+01	**	8.23E+01	**
BONE	1.85E+02	3.56E+02	1.91E+02	1.00E+03
R MARROW	**	6.14E+02	**	1.25E+03
LUNGS	0.	2.70E+02	6.31E+04	3.65E+04
THYROID	0.	2.31E+02	0.	1.02E+03
LIVER	0.	4.14E+02	0.	1.65E+03
KIDNEYS	7.06E+02	4.85E+02	7.29E+02	1.12E+03
GI LLI	2.16E+04	2.42E+04	1.38E+04	1.14E+04
ULI	**	9.36E+03	**	4.85E+03
SI+CON	**	3.15E+03	**	2.05E+03
S WALL	**	1.16E+03	**	1.80E+03
PANCREAS	**	4.74E+02	**	1.85E+03
BREAST	**	4.44E+02	**	1.18E+03
SPLEEN	**	4.37E+02	**	1.56E+03
THYMUS	**	2.49E+02	**	2.08E+03
ADRENALS	**	4.11E+02	**	1.76E+03
SKIN	**	2.53E+02	**	7.18E+02
BLAD WALL	**	8.18E+02	**	8.66E+02
UTERUS	**	9.84E+02	**	9.36E+02
OVARIES	**	2.12E+03	**	1.46E+03
TESTES	**	4.51E+02	**	6.88E+02

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

RU106	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	3.48E+02	**	1.09E+03	**
BONE	2.75E+03	5.29E+03	8.64E+03	1.48E+04
R MARROW	**	5.40E+03	**	1.50E+04
LUNGS	0.	5.25E+03	1.17E+06	7.81E+05
THYROID	0.	5.22E+03	0.	1.48E+04
LIVER	0.	5.33E+03	0.	1.54E+04
KIDNEYS	5.31E+03	5.37E+03	1.67E+04	1.49E+04
GI LLI	1.78E+05	2.62E+05	1.14E+05	1.42E+05
ULI	**	9.14E+04	**	5.77E+04
SI+CON	**	2.05E+04	**	2.23E+04
S WALL	**	1.15E+04	**	1.84E+04
PANCREAS	**	5.37E+03	**	1.55E+04
BREAST	**	5.33E+03	**	1.49E+04
SPLEEN	**	5.37E+03	**	1.54E+04
THYMUS	**	5.25E+03	**	1.58E+04
ADRENALS	**	5.40E+03	**	1.57E+04
SKIN	**	5.18E+03	**	1.44E+04
BLAD WALL	**	5.55E+03	**	1.47E+04
UTERUS	**	5.62E+03	**	1.48E+04
OVARIES	**	6.07E+03	**	1.49E+04
TESTES	**	5.37E+03	**	1.46E+04

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

SN126	INGESTION		INHALATION	
	ICRP2	ICRF30	ICRP2	ICRP30
TOTAL BODY	2.40E+03	**	6.00E+03	**
BONE	8.45E+04	1.87E+04	1.58E+05	1.23E+05
R MARROW	**	1.01E+04	**	6.25E+04
LUNGS	0.	2.22E+03	1.17E+06	5.59E+05
THYROID	4.92E+02	2.04E+03	1.23E+03	1.81E+04
LIVER	1.67E+03	2.53E+03	4.18E+03	2.27E+04
KIDNEYS	0.	3.03E+03	0.	1.89E+04
GI LLI	2.43E+04	1.60E+05	1.59E+04	9.66E+04
ULI	**	5.81E+04	**	4.40E+04
SI+CON	**	1.63E+04	**	2.26E+04
S WALL	**	5.92E+03	**	2.22E+04
PANCREAS	**	2.88E+03	**	2.48E+04
BREAST	**	2.95E+03	**	1.99E+04
SPLEEN	**	2.69E+03	**	2.26E+04
THYMUS	**	1.97E+03	**	2.80E+04
ADRENALS	**	3.30E+03	**	2.90E+04
SKIN	**	2.03E+03	**	1.43E+04
BLAD WALL	**	3.92E+03	**	1.38E+04
UTERUS	**	4.70E+03	**	1.51E+04
OVARIES	**	8.92E+03	**	1.83E+04
TESTES	**	2.52E+03	**	1.28E+04

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

TE127	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	2.38E+01	**	3.87E-02	**
BONE	1.10E+02	2.39E+01	1.75E-01	1.51E+01
R MARROW	**	2.43E+01	**	1.51E+01
LUNGS	0.	1.07E+01	8.14E+02	1.58E+03
THYROID	8.15E+01	1.06E+01	1.32E-01	6.81E+00
LIVER	3.95E+01	1.12E+01	8.03E-02	7.10E+00
KIDNEYS	4.48E+02	1.14E+01	6.37E-01	6.99E+00
GI LLI	8.68E+03	4.66E+03	7.17E+03	8.40E+02
ULI	**	4.33E+03	**	7.77E+02
SI+CON	**	1.45E+03	**	2.63E+02
S WALL	**	8.99E+02	**	1.66E+02
PANCREAS	**	1.17E+01	**	7.25E+00
BREAST	**	1.11E+01	**	6.96E+00
SPLEEN	**	1.13E+01	**	7.10E+00
THYMUS	**	1.06E+01	**	7.18E+00
ADRENALS	**	1.10E+01	**	7.07E+00
SKIN	**	1.07E+01	**	6.77E+00
BLAD WALL	**	1.17E+01	**	6.92E+00
UTERUS	**	1.26E+01	**	7.07E+00
OVARIES	**	1.49E+01	**	7.47E+00
TESTES	**	1.08E+01	**	6.77E+00

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

TE127M	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	8.25E+02	**	1.96E+02	**
BONE	6.77E+03	7.66E+04	1.58E+03	7.55E+04
R MARROW	**	2.01E+04	**	1.98E+04
LUNGS	0.	3.56E+02	1.20E+05	1.24E+05
THYROID	1.73E+03	3.49E+02	4.11E+02	3.57E+02
LIVER	2.42E+03	3.51E+02	7.21E+02	4.18E+02
KIDNEYS	2.75E+04	3.52E+02	5.72E+03	3.60E+02
GI LLI	2.27E+04	4.11E+04	1.87E+04	2.12E+04
ULI	**	1.14E+04	**	6.85E+03
SI+CON	**	1.61E+03	**	1.37E+03
S WALL	**	7.84E+02	**	8.55E+02
PANCREAS	**	3.55E+02	**	4.00E+02
BREAST	**	3.60E+02	**	4.07E+02
SPLEEN	**	3.53E+02	**	4.11E+02
THYMUS	**	3.46E+02	**	4.33E+02
ADRENALS	**	3.61E+02	**	4.03E+02
SKIN	**	3.47E+02	**	3.56E+02
BLAD WALL	**	3.57E+02	**	3.49E+02
UTERUS	**	3.65E+02	**	3.54E+02
OVARIES	**	4.63E+02	**	4.07E+02
TESTES	**	3.44E+02	**	3.42E+02

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

TE129	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	7.65E+00	**	1.55E-03	**
BONE	3.14E+01	2.00E+00	6.22E-03	2.30E+00
R MARROW	**	2.83E+00	**	2.29E+00
LUNGS	0.	1.82E+00	2.42E-02	5.66E+02
THYROID	2.41E+01	1.24E+00	4.87E-03	1.88E+00
LIVER	1.18E+01	2.52E+00	2.99E-03	2.23E+00
KIDNEYS	1.32E+02	3.27E+00	2.34E-02	1.95E+00
GI LLI	2.37E+01	1.37E+02	1.96E+01	6.81E+00
ULI	**	6.88E+02	**	2.78E+01
SI+CON	**	1.01E+03	**	4.00E+01
S WALL	**	1.47E+03	**	5.77E+01
PANCREAS	**	7.07E+00	**	2.43E+00
BREAST	**	2.24E+00	**	1.99E+00
SPLEEN	**	4.44E+00	**	2.25E+00
THYMUS	**	1.34E+00	**	2.46E+00
ADRENALS	**	2.25E+00	**	2.22E+00
SKIN	**	1.54E+00	**	1.78E+00
BLAD WALL	**	2.49E+00	**	1.73E+00
UTERUS	**	4.70E+00	**	1.82E+00
OVARIES	**	5.88E+00	**	1.87E+00
TESTES	**	1.39E+00	**	1.68E+00

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

TE129M	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	1.82E+03	**	1.98E+02	**
BONE	1.15E+04	2.96E+04	1.22E+03	2.61E+04
R MARROW	**	1.30E+04	**	1.15E+04
LUNGS	0.	5.88E+02	1.45E+05	1.49E+05
THYROID	3.95E+03	5.81E+02	4.30E+02	5.77E+02
LIVER	4.29E+03	5.99E+02	5.84E+02	6.77E+02
KIDNEYS	4.80E+04	6.14E+02	4.57E+03	5.85E+02
GI LLI	5.79E+04	9.14E+04	4.79E+04	4.07E+04
ULI	**	3.11E+04	**	1.42E+04
SI+CON	**	5.44E+03	**	2.95E+03
S WALL	**	2.32E+03	**	1.78E+03
PANCREAS	**	6.11E+02	**	6.85E+02
BREAST	**	6.14E+02	**	6.25E+02
SPLEEN	**	6.03E+02	**	6.66E+02
THYMUS	**	5.77E+02	**	7.47E+02
ADRENALS	**	6.22E+02	**	6.88E+02
SKIN	**	5.77E+02	**	5.44E+02
BLAD WALL	**	6.48E+02	**	5.44E+02
UTERUS	**	6.77E+02	**	5.59E+02
OVARIES	**	8.92E+02	**	6.59E+02
TESTES	**	5.96E+02	**	5.14E+02

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

TE131	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	6.22E+00	**	4.49E-04	**
BONE	1.97E+01	1.37E+01	1.39E-03	9.66E+00
R MARROW	**	2.44E+01	**	1.09E+01
LUNGS	0.	1.25E+01	1.74E+02	1.11E+03
THYROID	1.62E+01	1.56E+04	1.17E-03	9.84E+03
LIVER	8.23E+00	1.95E+01	7.44E-04	1.10E+01
KIDNEYS	8.63E+01	2.69E+01	5.46E-03	8.21E+00
GI LL I	2.79E+00	5.51E+02	2.30E+00	3.43E+01
ULI	**	1.95E+03	**	1.09E+02
SI+CON	**	2.04E+03	**	1.14E+02
S WALL	**	2.32E+03	**	1.32E+02
PANCREAS	**	5.33E+01	**	1.30E+01
BREAST	**	1.84E+01	**	9.88E+00
SPLEEN	**	3.38E+01	**	1.13E+01
THYMUS	**	1.57E+01	**	1.92E+01
ADRENALS	**	1.65E+01	**	1.12E+01
SKIN	**	1.01E+01	**	7.03E+00
BLAD WALL	**	1.95E+01	**	5.92E+00
UTERUS	**	4.37E+01	**	7.40E+00
OVARIES	**	5.91E+01	**	8.03E+00
TESTES	**	7.81E+00	**	5.00E+00

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

TE131M	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	7.05E+02	**	3.63E+00	**
BONE	1.73E+03	1.20E+03	8.74E+00	8.40E+02
R MARROW	**	8.95E+02	**	5.22E+02
LUNGS	0.	2.32E+02	1.82E+04	8.25E+03
THYROID	1.34E+03	1.59E+05	6.88E+00	1.34E+05
LIVER	8.46E+02	4.59E+02	5.45E+00	4.18E+02
KIDNEYS	8.57E+03	5.85E+02	3.86E+01	3.27E+02
GI LLI	8.40E+04	3.05E+04	6.95E+04	8.92E+03
ULI	**	1.72E+04	**	5.18E+03
SI+CON	**	5.59E+03	**	1.82E+03
S WALL	**	2.22E+03	**	1.01E+03
PANCREAS	**	6.11E+02	**	4.70E+02
BREAST	**	5.00E+02	**	3.42E+02
SPLEEN	**	4.92E+02	**	4.11E+02
THYMUS	**	2.59E+02	**	5.62E+02
ADRENALS	**	3.77E+02	**	4.00E+02
SKIN	**	2.53E+02	**	1.92E+02
BLAD WALL	**	9.10E+02	**	3.35E+02
UTERUS	**	1.33E+03	**	4.66E+02
OVARIES	**	2.73E+03	**	8.66E+02
TESTES	**	3.65E+02	**	1.67E+02

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

TE132	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	1.53E+03	**	2.02E+01	**
BONE	2.52E+03	3.07E+03	3.25E+01	2.63E+03
R MARROW	**	1.64E+03	**	1.58E+03
LUNGS	0.	1.22E+03	3.60E+04	6.18E+03
THYROID	1.80E+03	2.20E+05	2.37E+01	2.32E+05
LIVER	1.63E+03	1.35E+03	2.69E+01	1.45E+03
KIDNEYS	1.57E+04	1.38E+03	1.82E+02	1.40E+03
GI LLI	7.71E+04	1.41E+04	6.37E+04	5.96E+03
ULI	**	6.92E+03	**	3.39E+03
SI+CON	**	2.98E+03	**	2.01E+03
S WALL	**	1.94E+03	**	1.62E+03
PANCREAS	**	1.37E+03	**	1.44E+03
BREAST	**	1.30E+03	**	1.34E+03
SPLEEN	**	1.35E+03	**	1.44E+03
THYMUS	**	1.39E+03	**	1.59E+03
ADRENALS	**	1.50E+03	**	1.62E+03
SKIN	**	9.69E+02	**	1.01E+03
BLAD WALL	**	1.56E+03	**	1.49E+03
UTERUS	**	1.71E+03	**	1.58E+03
OVARIES	**	2.00E+03	**	1.54E+03
TESTES	**	1.34E+03	**	1.37E+03

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

I129	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	9.21E+03	**	6.91E+03	**
BONE	3.27E+03	8.03E+02	2.48E+03	5.11E+02
R MARROW	**	8.18E+02	**	5.18E+02
LUNGS	0.	6.11E+02	0.	1.16E+03
THYROID	7.23E+06	9.18E+06	5.54E+06	5.77E+06
LIVER	2.81E+03	5.11E+02	2.11E+03	3.26E+02
KIDNEYS	6.04E+03	4.96E+02	4.53E+03	3.12E+02
GI LLI	4.44E+02	5.14E+02	2.22E+02	3.24E+02
ULI	**	5.25E+02	**	3.30E+02
SI+CON	**	5.22E+02	**	3.29E+02
S WALL	**	8.10E+02	**	3.67E+02
PANCREAS	**	5.22E+02	**	3.28E+02
BREAST	**	1.22E+03	**	7.73E+02
SPLEEN	**	5.18E+02	**	3.27E+02
THYMUS	**	1.30E+03	**	8.21E+02
ADRENALS	**	4.88E+02	**	3.10E+02
SKIN	**	7.81E+02	**	4.92E+02
BLAD WALL	**	5.00E+02	**	3.16E+02
UTERUS	**	5.11E+02	**	3.23E+02
OVARIES	**	5.11E+02	**	3.22E+02
TESTES	**	4.77E+02	**	3.00E+02

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

I131	INGESTION		INHALATION	
	ICRF2	ICRF30	ICRP2	ICRP30
TOTAL BODY	3.41E+03	**	2.56E+03	**
BONE	4.16E+03	3.23E+02	3.15E+03	2.12E+02
R MARROW	**	3.49E+02	**	2.32E+02
LUNGS	0.	3.77E+02	0.	2.43E+03
THYROID	1.95E+06	1.76E+06	1.49E+06	1.08E+06
LIVER	5.95E+03	1.83E+02	4.47E+03	1.44E+02
KIDNEYS	1.02E+04	1.67E+02	7.66E+03	1.12E+02
GI LLI	1.57E+03	1.57E+02	7.85E+02	9.58E+01
ULI	**	1.64E+02	**	1.01E+02
SI+CON	**	1.65E+02	**	1.01E+02
S WALL	**	1.13E+03	**	2.78E+02
PANCREAS	**	2.21E+02	**	1.49E+02
BREAST	**	4.48E+02	**	2.92E+02
SPLEEN	**	2.05E+02	**	1.44E+02
THYMUS	**	1.14E+03	**	7.55E+02
ADRENALS	**	2.08E+02	**	1.59E+02
SKIN	**	3.07E+02	**	1.97E+02
BLAD WALL	**	1.51E+02	**	9.29E+01
UTERUS	**	1.59E+02	**	9.77E+01
OVARIES	**	1.51E+02	**	9.36E+01
TESTES	**	1.39E+02	**	8.58E+01

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

I132	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	1.93E+02	**	1.45E+02	**
BONE	2.03E+02	8.10E+01	1.45E+02	4.59E+01
R MARROW	**	9.10E+01	**	5.18E+01
LUNGS	0.	9.77E+01	0.	1.00E+03
THYROID	1.90E+04	1.43E+04	1.43E+04	6.44E+03
LIVER	5.43E+02	1.05E+02	4.07E+02	6.81E+01
KIDNEYS	8.65E+02	1.21E+02	6.48E+02	5.37E+01
GI LLI	1.02E+02	1.02E+02	5.08E+01	4.18E+01
ULI	**	1.23E+02	**	4.77E+01
SI+CON	**	1.17E+02	**	4.63E+01
S WALL	**	2.33E+03	**	3.67E+02
PANCREAS	**	2.86E+02	**	9.36E+01
BREAST	**	9.32E+01	**	5.22E+01
SPLEEN	**	1.96E+02	**	7.73E+01
THYMUS	**	9.32E+01	**	8.73E+01
ADRENALS	**	1.20E+02	**	7.29E+01
SKIN	**	6.62E+01	**	3.57E+01
BLAD WALL	**	9.03E+01	**	3.96E+01
UTERUS	**	9.95E+01	**	4.26E+01
OVARIES	**	8.62E+01	**	3.68E+01
TESTES	**	8.18E+01	**	3.66E+01

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

I133	INGESTION		INHALATION	
	ICRF2	ICRF30	ICRP2	ICRP30
TOTAL BODY	7.53E+02	**	5.65E+02	**
BONE	1.42E+03	1.51E+02	1.08E+03	9.32E+01
R MARROW	**	1.59E+02	**	1.01E+02
LUNGS	0.	1.68E+02	0.	3.03E+03
THYROID	3.63E+05	3.37E+05	2.69E+05	1.80E+05
LIVER	2.47E+03	1.45E+02	1.85E+03	1.07E+02
KIDNEYS	4.31E+03	1.48E+02	3.23E+03	8.91E+01
GI LLI	2.22E+03	1.44E+02	1.11E+03	7.59E+01
ULI	**	1.51E+02	**	8.07E+01
SI+CON	**	1.49E+02	**	7.96E+01
S WALL	**	2.05E+03	**	3.89E+02
PANCREAS	**	2.06E+02	**	1.19E+02
BREAST	**	1.73E+02	**	1.09E+02
SPLEEN	**	1.77E+02	**	1.08E+02
THYMUS	**	2.65E+02	**	1.93E+02
ADRENALS	**	1.62E+02	**	1.16E+02
SKIN	**	1.39E+02	**	8.25E+01
BLAD WALL	**	1.37E+02	**	7.33E+01
UTERUS	**	1.39E+02	**	7.40E+01
OVARIES	**	1.32E+02	**	7.14E+01
TESTES	**	1.34E+02	**	7.22E+01

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

I134	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	1.03E+02	**	7.69E+01	**
BONE	1.06E+02	3.45E+01	8.05E+01	1.96E+01
R MARROW	**	4.03E+01	**	2.25E+01
LUNGS	0.	4.66E+01	0.	5.29E+02
THYROID	4.99E+03	2.30E+03	3.73E+03	1.07E+03
LIVER	2.88E+02	5.18E+01	2.16E+02	3.10E+01
KIDNEYS	4.58E+02	6.48E+01	3.44E+02	2.45E+01
GI LLI	2.51E-01	4.77E+01	1.26E-01	1.78E+01
ULI	**	5.49E+01	**	2.13E+01
SI+CON	**	5.96E+01	**	2.04E+01
S WALL	**	2.03E+03	**	2.62E+02
PANCREAS	**	1.99E+02	**	4.85E+01
BREAST	**	4.33E+01	**	2.28E+01
SPLEEN	**	1.27E+02	**	3.85E+01
THYMUS	**	3.68E+01	**	3.89E+01
ADRENALS	**	5.85E+01	**	3.24E+01
SKIN	**	2.92E+01	**	1.54E+01
BLAD WALL	**	3.85E+01	**	1.67E+01
UTERUS	**	4.59E+01	**	1.85E+01
OVARIES	**	4.07E+01	**	1.57E+01
TESTES	**	3.28E+01	**	1.48E+01

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

I135	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	4.28E+02	**	3.21E+02	**
BONE	4.43E+02	1.24E+02	3.35E+02	7.44E+01
R MARROW	**	1.35E+02	**	8.29E+01
LUNGS	0.	1.39E+02	0.	1.63E+03
THYROID	7.65E+04	6.62E+04	5.60E+04	3.13E+04
LIVER	1.16E+03	1.41E+02	8.73E+02	1.02E+02
KIDNEYS	1.86E+03	1.51E+02	1.39E+03	7.99E+01
GI LLI	1.31E+03	1.45E+02	6.56E+02	6.59E+01
ULI	**	1.55E+02	**	7.10E+01
SI+CON	**	1.52E+02	**	7.03E+01
S WALL	**	2.00E+03	**	3.67E+02
PANCREAS	**	2.81E+02	**	1.24E+02
BREAST	**	1.42E+02	**	8.66E+01
SPLEEN	**	2.05E+02	**	1.04E+02
THYMUS	**	1.89E+02	**	1.62E+02
ADRENALS	**	1.79E+02	**	1.12E+02
SKIN	**	1.09E+02	**	6.22E+01
BLAD WALL	**	1.32E+02	**	6.25E+01
UTERUS	**	1.42E+02	**	6.81E+01
OVARIES	**	1.34E+02	**	6.29E+01
TESTES	**	1.18E+02	**	5.62E+01

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

CS134	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	1.21E+05	**	9.10E+04	**
BONE	6.22E+04	6.44E+04	4.66E+04	4.07E+04
R MARROW	**	6.92E+04	**	4.37E+04
LUNGS	1.59E+04	6.51E+04	1.22E+04	4.37E+04
THYROID	0.	6.51E+04	0.	4.11E+04
LIVER	1.48E+05	7.44E+04	1.06E+05	4.70E+04
KIDNEYS	4.79E+04	7.44E+04	3.59E+04	4.70E+04
GI LIT	2.59E+03	8.10E+04	1.30E+03	5.11E+04
ULI	**	7.92E+04	**	5.00E+04
SI+CON	**	8.07E+04	**	5.07E+04
S WALL	**	7.44E+04	**	4.63E+04
PANCREAS	**	7.18E+04	**	4.51E+04
BREAST	**	6.36E+04	**	4.00E+04
SPLEEN	**	7.44E+04	**	4.70E+04
THYMUS	**	6.29E+04	**	4.00E+04
ADRENALS	**	8.58E+04	**	5.40E+04
SKIN	**	4.59E+04	**	2.90E+04
BLAD WALL	**	7.92E+04	**	5.00E+04
UTERUS	**	8.25E+04	**	5.18E+04
OVARIES	**	6.70E+04	**	4.22E+04
TESTES	**	7.62E+04	**	4.81E+04

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

CS134M	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	2.29E+01	**	1.72E+01	**
BONE	2.13E+01	2.43E+01	1.59E+01	1.31E+01
R MARROW	**	2.56E+01	**	1.39E+01
LUNGS	3.83E+00	2.38E+01	2.93E+00	2.37E+02
THYROID	0.	2.30E+01	0.	1.24E+01
LIVER	4.48E+01	2.53E+01	3.20E+01	1.40E+01
KIDNEYS	2.43E+01	2.55E+01	1.83E+01	1.36E+01
GI LLI	1.58E+01	2.63E+01	7.92E+00	1.41E+01
ULI	**	2.66E+01	**	1.41E+01
SI+CON	**	2.67E+01	**	1.42E+01
S WALL	**	4.26E+02	**	6.99E+01
PANCREAS	**	2.89E+01	**	1.42E+01
BREAST	**	2.32E+01	**	1.25E+01
SPLEEN	**	2.70E+01	**	1.42E+01
THYMUS	**	2.31E+01	**	1.31E+01
ADRENALS	**	2.71E+01	**	1.50E+01
SKIN	**	1.97E+01	**	1.02E+01
BLAD WALL	**	2.59E+01	**	1.39E+01
UTERUS	**	2.66E+01	**	1.43E+01
OVARIES	**	2.40E+01	**	1.27E+01
TESTES	**	2.49E+01	**	1.34E+01

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

CS135	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	7.95E+03	**	5.99E+03	**
BONE	1.95E+04	7.07E+03	1.46E+04	4.44E+03
R MARROW	**	7.07E+03	**	4.44E+03
LUNGS	2.04E+03	7.07E+03	1.57E+03	5.22E+03
THYROID	0.	7.07E+03	0.	4.44E+03
LIVER	1.80E+04	7.07E+03	1.29E+04	4.44E+03
KIDNEYS	6.81E+03	7.07E+03	5.11E+03	4.44E+03
GI LLI	4.21E+02	7.07E+03	2.11E+02	4.44E+03
ULI	**	7.07E+03	**	4.44E+03
SI+CON	**	7.07E+03	**	4.44E+03
S WALL	**	7.36E+03	**	4.48E+03
PANCREAS	**	7.07E+03	**	4.44E+03
BREAST	**	7.07E+03	**	4.44E+03
SPLEEN	**	7.07E+03	**	4.44E+03
THYMUS	**	7.07E+03	**	4.44E+03
ADRENALS	**	7.07E+03	**	4.44E+03
SKIN	**	7.07E+03	**	4.44E+03
BLAD WALL	**	7.07E+03	**	4.44E+03
UTERUS	**	7.07E+03	**	4.44E+03
OVARIES	**	7.07E+03	**	4.44E+03
TESTES	**	7.07E+03	**	4.44E+03

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

CS136	INGESTION		INHALATION	
	ICRP2	ICRF30	ICRP2	ICRP30
TOTAL BODY	1.85E+04	**	1.38E+04	**
BONE	6.51E+03	1.00E+04	4.88E+03	6.29E+03
R MARROW	**	1.09E+04	**	6.88E+03
LUNGS	1.96E+03	9.69E+03	1.50E+03	8.58E+03
THYROID	0.	1.01E+04	0.	6.40E+03
LIVER	2.57E+04	1.17E+04	1.83E+04	7.40E+03
KIDNEYS	1.43E+04	1.17E+04	1.07E+04	7.29E+03
GI LLI	2.92E+03	1.26E+04	1.46E+03	7.81E+03
ULI	**	1.22E+04	**	7.55E+03
SI+CON	**	1.27E+04	**	7.84E+03
S WALL	**	1.25E+04	**	7.25E+03
PANCREAS	**	1.14E+04	**	7.10E+03
BREAST	**	9.81E+03	**	6.18E+03
SPLEEN	**	1.16E+04	**	7.29E+03
THYMUS	**	9.84E+03	**	6.40E+03
ADRENALS	**	1.28E+04	**	9.14E+03
SKIN	**	6.92E+03	**	4.33E+03
BLAD WALL	**	1.28E+04	**	7.96E+03
UTERUS	**	1.42E+04	**	8.81E+03
OVARIES	**	1.00E+04	**	6.22E+03
TESTES	**	1.12E+04	**	6.96E+03

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

CS137	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	7.14E+04	**	5.35E+04	**
BONE	7.97E+04	4.66E+04	5.98E+04	2.94E+04
R MARROW	**	4.88E+04	**	3.07E+04
LUNGS	1.23E+04	4.70E+04	9.40E+03	3.26E+04
THYROID	0.	4.66E+04	0.	2.93E+04
LIVER	1.09E+05	5.03E+04	7.76E+04	3.18E+04
KIDNEYS	3.70E+04	5.07E+04	2.78E+04	3.19E+04
GI LLI	2.11E+03	5.33E+04	1.05E+03	3.36E+04
ULI	**	5.25E+04	**	3.32E+04
SI+CON	**	5.33E+04	**	3.35E+04
S WALL	**	5.14E+04	**	3.19E+04
PANCREAS	**	4.96E+04	**	3.12E+04
BREAST	**	4.59E+04	**	2.90E+04
SPLEEN	**	5.07E+04	**	3.19E+04
THYMUS	**	4.59E+04	**	2.90E+04
ADRENALS	**	5.55E+04	**	3.50E+04
SKIN	**	3.85E+04	**	2.43E+04
BLAD WALL	**	5.22E+04	**	3.29E+04
UTERUS	**	5.33E+04	**	3.34E+04
OVARIES	**	4.77E+04	**	3.00E+04
TESTES	**	5.13E+04	**	3.24E+04

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

CE 141	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	7.18E-01	**	1.91E+02	**
BONE	9.36E+00	8.51E+01	2.49E+03	1.40E+04
R MARROW	**	1.25E+02	**	1.55E+03
LUNGS	0.	5.29E+00	4.52E+04	4.14E+04
THYROID	0.	6.66E-01	0.	1.71E+02
LIVER	6.33E+00	7.25E+01	1.69E+03	1.28E+04
KIDNEYS	2.94E+00	4.40E+01	7.83E+02	3.55E+02
GI LLI	2.42E+04	3.20E+04	1.50E+04	1.42E+04
ULI	**	1.11E+04	**	5.11E+03
SI+CON	**	2.18E+03	**	1.15E+03
S WALL	**	8.25E+02	**	6.96E+02
PANCREAS	**	4.55E+01	**	5.22E+02
BREAST	**	4.11E+01	**	2.63E+02
SPLEEN	**	5.66E+01	**	1.03E+04
THYMUS	**	1.91E+00	**	4.29E+02
ADRENALS	**	1.68E+01	**	4.85E+02
SKIN	**	1.16E+01	**	1.61E+02
BLAD WALL	**	1.22E+02	**	1.72E+02
UTERUS	**	1.67E+02	**	2.08E+02
OVARIES	**	4.00E+02	**	3.12E+02
TESTES	**	2.80E+01	**	1.21E+02

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

CE143	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	1.35E-01	**	1.91E+00	**
BONE	1.65E+00	5.96E+01	2.33E+01	2.92E+02
R MARROW	**	1.88E+02	**	2.87E+02
LUNGS	0.	1.41E+01	9.97E+03	1.31E+04
THYROID	0.	1.61E+00	0.	4.48E+01
LIVER	1.22E+03	8.07E+01	1.72E+01	1.90E+03
KIDNEYS	5.37E-01	1.03E+02	7.60E+00	8.95E+01
GI LLI	4.56E+04	4.33E+04	2.83E+04	1.35E+04
ULI	**	2.11E+04	**	6.59E+03
SI+CON	**	5.07E+03	**	1.58E+03
S WALL	**	2.08E+03	**	7.07E+02
PANCREAS	**	1.10E+02	**	1.31E+02
BREAST	**	8.58E+01	**	8.21E+01
SPLEEN	**	8.32E+01	**	1.55E+03
THYMUS	**	5.29E+00	**	1.10E+02
ADRENALS	**	4.37E+01	**	1.07E+02
SKIN	**	2.77E+01	**	4.51E+01
BLAD WALL	**	2.06E+02	**	8.70E+01
UTERUS	**	3.16E+02	**	1.21E+02
OVARIES	**	7.84E+02	**	2.61E+02
TESTES	**	5.66E+01	**	4.07E+01

 ** = NOT DEFINED BY MCODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

CE144	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	2.62E+01	**	2.30E+04	**
BONE	4.88E+02	4.74E+02	4.29E+05	1.68E+05
R MARROW	**	3.30E+02	**	9.88E+04
LUNGS	0.	2.41E+01	9.72E+05	6.77E+05
THYROID	0.	1.91E+01	0.	6.96E+03
LIVER	2.04E+02	2.56E+03	1.79E+05	9.40E+05
KIDNEYS	1.21E+02	4.81E+01	1.06E+05	8.03E+03
GI LLI	1.65E+05	2.46E+05	1.02E+05	1.28E+05
ULI	**	8.21E+04	**	4.81E+04
SI+CON	**	1.37E+04	**	1.42E+04
S WALL	**	4.11E+03	**	1.04E+04
PANCREAS	**	4.81E+01	**	8.47E+03
BREAST	**	4.51E+01	**	7.29E+03
SPLEEN	**	2.13E+03	**	7.81E+05
THYMUS	**	2.05E+01	**	7.44E+03
ADRENALS	**	3.30E+01	**	8.36E+03
SKIN	**	2.73E+01	**	7.03E+03
BLAD WALL	**	8.99E+01	**	6.96E+03
UTERUS	**	1.14E+02	**	7.07E+03
OVARIES	**	2.58E+02	**	7.14E+03
TESTES	**	3.77E+01	**	6.88E+03

** = NOT DEFINED BY MODEL.

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

PB210	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	5.44E+05	**	8.37E+05	**
BONE	1.53E+07	7.99E+07	2.64E+07	2.02E+08
R MARROW	**	5.48E+06	**	1.39E+07
LUNGS	0.	4.63E+05	2.62E+07	1.18E+06
THYROID	0.	4.63E+05	0.	1.18E+06
LIVER	4.37E+06	2.25E+07	6.73E+06	5.70E+07
KIDNEYS	1.23E+07	1.04E+07	2.12E+07	2.63E+07
GI LLI	5.42E+04	4.81E+05	3.65E+04	1.18E+06
ULI	**	4.66E+05	**	1.18E+06
SI+CON	**	4.63E+05	**	1.18E+06
S WALL	**	4.63E+05	**	1.18E+06
PANCREAS	**	4.63E+05	**	1.18E+06
BREAST	**	4.63E+05	**	1.18E+06
SPLEEN	**	4.63E+05	**	1.18E+06
THYMUS	**	4.63E+05	**	1.18E+06
ADRENALS	**	4.63E+05	**	1.18E+06
SKIN	**	4.63E+05	**	1.18E+06
BLAD WALL	**	4.63E+05	**	1.18E+06
UTERUS	**	4.63E+05	**	1.18E+06
OVARIES	**	4.63E+05	**	1.18E+06
TESTES	**	4.63E+05	**	1.18E+06

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

BI210	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	3.96E+01	**	1.32E+02	**
BONE	4.61E+02	7.29E+01	0.	2.39E+02
R MARROW	**	7.29E+01	**	2.39E+02
LUNGS	0.	7.29E+01	1.11E+06	1.58E+06
THYROID	0.	7.29E+01	0.	2.39E+02
LIVER	3.18E+03	7.29E+01	1.53E+03	2.39E+02
KIDNEYS	3.83E+04	2.18E+04	1.92E+04	7.10E+04
GI LL1	4.75E+04	3.73E+04	2.95E+04	2.25E+04
ULI	**	2.13E+04	**	8.51E+03
SI+CON	**	3.32E+05	**	1.73E+03
S WALL	**	1.72E+05	**	8.81E+02
PANCREAS	**	7.29E+01	**	2.39E+02
BREAST	**	7.29E+01	**	2.39E+02
SPLEEN	**	7.29E+01	**	2.39E+02
THYMUS	**	7.29E+01	**	2.39E+02
ADRENALS	**	7.29E+01	**	2.39E+02
SKIN	**	7.29E+01	**	2.39E+02
BLAD WALL	**	7.29E+01	**	2.39E+02
UTERUS	**	7.29E+01	**	2.39E+02
OVARIES	**	7.29E+01	**	2.39E+02
TESTES	**	7.29E+01	**	2.39E+02

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

P0210	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	8.59E+04	**	9.58E+04	**
BONE	3.56E+05	3.05E+05	3.97E+05	4.66E+05
R MARROW	**	3.05E+05	**	4.66E+05
LUNGS	0.	3.05E+05	3.14E+07	4.81E+07
THYROID	0.	3.05E+05	0.	4.66E+05
LIVER	7.56E+05	1.62E+06	8.60E+05	2.48E+06
KIDNEYS	2.52E+06	9.43E+06	2.95E+06	1.44E+07
GI LLI	6.36E+04	4.85E+05	4.19E+04	5.51E+05
ULI	**	3.63E+05	**	4.92E+05
SI+CON	**	3.15E+05	**	4.70E+05
S WALL	**	3.09E+05	**	4.66E+05
PANCREAS	**	3.05E+05	**	4.66E+05
BREAST	**	3.05E+05	**	4.66E+05
SPLEEN	**	1.62E+07	**	2.48E+07
THYMUS	**	3.05E+05	**	4.66E+05
ADRENALS	**	3.05E+05	**	4.66E+05
SKIN	**	3.05E+05	**	4.66E+05
BLAD WALL	**	3.05E+05	**	4.66E+05
UTERUS	**	3.05E+05	**	4.66E+05
OVARIES	**	3.05E+05	**	4.66E+05
TESTES	**	3.05E+05	**	4.66E+05

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

RA223	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	9.94E+05	**	3.60E+04	**
BONE	4.97E+06	1.08E+07	1.80E+05	8.66E+06
R MARROW	**	1.04E+06	**	8.29E+05
LUNGS	0.	1.57E+05	2.55E+07	6.14E+07
THYROID	0.	1.57E+05	0.	1.25E+05
LIVER	7.65E+03	1.57E+05	2.77E+02	1.25E+05
KIDNEYS	2.17E+05	1.57E+05	7.85E+03	1.25E+05
GI LLI	3.21E+05	1.02E+06	2.84E+05	4.77E+05
ULI	**	4.63E+05	**	2.51E+05
SI+CON	**	2.09E+05	**	1.47E+05
S WALL	**	1.79E+05	**	1.36E+05
PANCREAS	**	1.57E+05	**	1.25E+05
BREAST	**	1.57E+05	**	1.25E+05
SPLEEN	**	1.57E+05	**	1.25E+05
THYMUS	**	1.57E+05	**	1.25E+05
ADRENALS	**	1.57E+05	**	1.25E+05
SKIN	**	1.57E+05	**	1.25E+05
BLAD WALL	**	1.57E+05	**	1.25E+05
UTERUS	**	1.57E+05	**	1.25E+05
OVARIES	**	1.58E+05	**	1.25E+05
TESTES	**	1.57E+05	**	1.25E+05

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

RA224	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	3.23E+05	**	3.96E+03	**
BONE	1.61E+06	5.88E+06	1.98E+04	4.33E+06
R MARROW	**	5.62E+05	**	4.18E+05
LUNGS	0.	7.59E+04	8.77E+06	2.43E+07
THYROID	0.	7.59E+04	0.	5.66E+04
LIVER	3.90E+03	7.62E+04	4.78E+01	5.70E+04
KIDNEYS	1.10E+05	7.62E+04	1.35E+03	5.70E+04
GI LLI	3.40E+05	7.36E+05	3.01E+05	3.09E+05
ULI	**	3.05E+05	**	1.51E+05
SI+CON	**	1.12E+05	**	7.33E+04
S WALL	**	9.21E+04	**	6.48E+04
PANCREAS	**	7.62E+04	**	5.70E+04
BREAST	**	7.62E+04	**	5.70E+04
SPLEEN	**	7.62E+04	**	5.70E+04
THYMUS	**	7.59E+04	**	5.74E+04
ADRENALS	**	7.62E+04	**	5.70E+04
SKIN	**	7.62E+04	**	5.66E+04
BLAD WALL	**	7.70E+04	**	5.70E+04
UTERUS	**	7.70E+04	**	5.70E+04
OVARIES	**	7.84E+04	**	5.77E+04
TESTES	**	7.62E+04	**	5.66E+04

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

RA225	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	1.31E+06	**	5.99E+04	**
BONE	6.56E+06	6.59E+06	3.00E+05	6.22E+06
R MARROW	**	6.22E+05	**	5.85E+05
LUNGS	0.	1.25E+05	2.92E+07	6.18E+07
THYROID	0.	1.25E+05	0.	1.14E+05
LIVER	7.78E+03	1.25E+05	3.56E+02	1.14E+05
KIDNEYS	2.21E+05	1.25E+05	1.01E+04	1.14E+05
GI LLI	3.06E+05	2.36E+05	2.71E+05	1.94E+05
ULI	**	1.45E+05	**	1.34E+05
SI+CON	**	1.25E+05	**	1.16E+05
S WALL	**	1.25E+05	**	1.15E+05
PANCREAS	**	1.25E+05	**	1.14E+05
BREAST	**	1.25E+05	**	1.14E+05
SPLEEN	**	1.25E+05	**	1.14E+05
THYMUS	**	1.25E+05	**	1.14E+05
ADRENALS	**	1.25E+05	**	1.14E+05
SKIN	**	1.25E+05	**	1.14E+05
BLAD WALL	**	1.25E+05	**	1.14E+05
UTERUS	**	1.25E+05	**	1.14E+05
OVARIES	**	1.25E+05	**	1.14E+05
TESTES	**	1.25E+05	**	1.14E+05

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

RA226	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	2.20E+08	**	9.14E+07	**
BONE	3.02E+08	2.53E+07	1.25E+08	2.81E+07
R MARROW	**	2.21E+06	**	2.46E+06
LUNGS	0.	3.39E+05	1.17E+08	5.96E+07
THYROID	0.	3.39E+05	0.	3.77E+05
LIVER	5.74E+03	3.39E+05	2.39E+03	3.77E+05
KIDNEYS	1.63E+05	3.39E+05	6.77E+04	3.77E+05
GI LLI	3.32E+05	4.85E+05	2.94E+05	4.51E+05
ULI	**	3.89E+05	**	4.00E+05
SI+CON	**	3.47E+05	**	3.81E+05
S WALL	**	3.42E+05	**	3.77E+05
PANCREAS	**	3.39E+05	**	3.77E+05
BREAST	**	3.39E+05	**	3.77E+05
SPLEEN	**	3.39E+05	**	3.77E+05
THYMUS	**	3.39E+05	**	3.77E+05
ADRENALS	**	3.40E+05	**	3.77E+05
SKIN	**	3.39E+05	**	3.77E+05
BLAD WALL	**	3.39E+05	**	3.77E+05
UTERUS	**	3.39E+05	**	3.77E+05
OVARIES	**	3.39E+05	**	3.77E+05
TESTES	**	3.39E+05	**	3.77E+05

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

RA228	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	1.21E+08	**	4.78E+07	**
BONE	1.12E+08	2.17E+07	4.41E+07	2.41E+07
R MARROW	**	2.42E+06	**	2.73E+06
LUNGS	0.	5.81E+05	1.61E+08	2.67E+07
THYROID	0.	5.81E+05	0.	6.77E+05
LIVER	3.12E+03	5.81E+05	1.23E+03	6.81E+05
KIDNEYS	8.83E+04	5.81E+05	3.48E+04	6.77E+05
GI LLI	5.64E+04	6.59E+05	5.00E+04	7.25E+05
ULI	**	6.03E+05	**	6.92E+05
SI+CON	**	5.85E+05	**	6.81E+05
S WALL	**	5.81E+05	**	6.81E+05
PANCREAS	**	5.81E+05	**	6.81E+05
BREAST	**	5.81E+05	**	6.81E+05
SPLEEN	**	5.81E+05	**	6.81E+05
THYMUS	**	5.81E+05	**	6.85E+05
ADRENALS	**	5.85E+05	**	6.85E+05
SKIN	**	5.81E+05	**	6.77E+05
BLAD WALL	**	5.81E+05	**	6.77E+05
UTERUS	**	5.81E+05	**	6.77E+05
OVARIES	**	5.85E+05	**	6.77E+05
TESTES	**	5.81E+05	**	6.77E+05

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

AC225	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	2.96E+02	**	2.84E+04	**
BONE	4.40E+03	3.68E+05	4.23E+05	2.87E+07
R MARROW	**	2.96E+04	**	2.29E+06
LUNGS	0.	1.47E+01	2.21E+07	5.74E+07
THYROID	0.	2.03E+00	0.	1.07E+02
LIVER	6.06E+03	9.99E+04	5.82E+05	7.77E+06
KIDNEYS	6.90E+02	1.10E+02	6.63E+04	2.16E+02
GI LLI	4.07E+05	1.04E+05	2.52E+05	4.22E+05
ULI	**	3.61E+05	**	1.47E+05
SI+CON	**	6.18E+04	**	2.65E+04
S WALL	**	1.94E+04	**	1.07E+04
PANCREAS	**	9.62E+01	**	3.58E+02
BREAST	**	1.01E+02	**	1.91E+02
SPLEEN	**	7.73E+01	**	2.38E+02
THYMUS	**	6.22E+00	**	3.47E+02
ADRENALS	**	4.81E+01	**	3.34E+02
SKIN	**	3.49E+01	**	9.29E+01
BLAD WALL	**	2.76E+02	**	1.35E+02
UTERUS	**	3.68E+02	**	1.81E+02
OVARIES	**	5.03E+03	**	3.22E+05
TESTES	**	4.22E+03	**	3.22E+05

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

AC227	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	1.11E+05	**	1.36E+08	**
BONE	1.87E+06	2.49E+08	2.30E+09	3.00E+10
R MARROW	**	2.00E+07	**	2.40E+09
LUNGS	0.	8.14E+02	2.41E+06	2.52E+08
THYROID	0.	2.79E+02	0.	3.41E+04
LIVER	2.48E+05	5.70E+07	3.05E+08	6.85E+09
KIDNEYS	8.00E+04	1.09E+03	9.82E+07	1.32E+05
GI LLI	8.19E+04	2.83E+04	5.08E+04	1.47E+05
ULI	**	5.62E+03	**	1.22E+05
SI+CON	**	1.07E+03	**	7.33E+04
S WALL	**	7.25E+02	**	7.18E+04
PANCREAS	**	1.20E+03	**	1.45E+05
BREAST	**	5.22E+02	**	6.29E+04
SPLEEN	**	3.96E+02	**	4.85E+04
THYMUS	**	3.37E+02	**	4.26E+04
ADRENALS	**	1.44E+03	**	1.74E+05
SKIN	**	3.19E+02	**	3.85E+04
BLAD WALL	**	1.97E+02	**	2.23E+04
UTERUS	**	2.60E+02	**	2.96E+04
OVARIES	**	3.07E+06	**	3.69E+08
TESTES	**	3.07E+06	**	3.69E+08

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

TH227	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	3.95E+02	**	6.25E+03	**
BONE	1.37E+04	2.53E+05	2.17E+05	5.85E+06
R MARROW	**	2.11E+04	**	4.81E+05
LUNGS	0.	4.63E+02	3.77E+07	1.32E+08
THYROID	0.	4.55E+02	0.	1.09E+04
LIVER	2.48E+02	3.92E+03	3.92E+03	9.03E+04
KIDNEYS	1.41E+03	5.22E+02	2.22E+04	1.09E+04
GI LLI	5.40E+05	3.38E+05	3.34E+05	1.94E+05
ULI	**	9.36E+04	**	6.29E+04
SI+CON	**	1.51E+04	**	1.91E+04
S WALL	**	6.03E+03	**	1.44E+04
PANCREAS	**	5.18E+02	**	1.14E+04
BREAST	**	5.18E+02	**	1.10E+04
SPLEEN	**	5.03E+02	**	1.12E+04
THYMUS	**	4.59E+02	**	1.18E+04
ADRENALS	**	4.81E+02	**	1.13E+04
SKIN	**	4.74E+02	**	1.08E+04
BLAD WALL	**	5.40E+02	**	1.07E+04
UTERUS	**	7.03E+02	**	1.07E+04
OVARIES	**	1.09E+03	**	1.10E+04
TESTES	**	5.07E+02	**	1.06E+04

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

TH228	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	1.68E+04	**	6.77E+06	**
BONE	4.96E+05	8.77E+06	2.00E+08	8.47E+08
R MARROW	**	7.14E+05	**	6.92E+07
LUNGS	0.	8.55E+03	1.01E+09	2.56E+09
THYROID	0.	8.51E+03	0.	8.51E+05
LIVER	8.40E+03	7.44E+04	3.39E+06	7.29E+06
KIDNEYS	4.67E+04	4.62E+03	1.89E+07	8.51E+05
GI LLI	5.63E+05	4.88E+05	3.49E+05	1.20E+06
ULI	**	1.15E+05	**	9.36E+05
SI+CON	**	2.25E+04	**	8.55E+05
S WALL	**	1.35E+04	**	8.73E+05
PANCREAS	**	8.58E+03	**	8.77E+05
BREAST	**	8.62E+03	**	8.58E+05
SPLEEN	**	8.58E+03	**	8.73E+05
THYMUS	**	8.55E+03	**	9.03E+05
ADRENALS	**	8.58E+03	**	8.70E+05
SKIN	**	8.55E+03	**	8.44E+05
BLAD WALL	**	8.81E+03	**	8.33E+05
UTERUS	**	8.81E+03	**	8.36E+05
OVARIES	**	9.36E+03	**	8.36E+05
TESTES	**	8.62E+03	**	8.33E+05

 ** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS.
(REM/CURIE)

TH229	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	3.91E+05	**	4.36E+08	**
BONE	7.98E+06	8.81E+07	8.88E+09	2.12E+10
R MARROW	**	7.07E+06	**	1.70E+09
LUNGS	0.	1.69E+04	3.49E+09	7.36E+09
THYROID	0.	1.68E+04	0.	4.37E+06
LIVER	1.19E+05	1.47E+05	1.33E+08	3.81E+07
KIDNEYS	5.75E+05	1.69E+04	6.52E+08	4.37E+06
GI LLI	5.12E+05	2.34E+05	3.17E+05	4.59E+06
ULI	**	8.58E+04	**	4.44E+06
SI+CON	**	2.90E+04	**	4.37E+06
S WALL	**	2.16E+04	**	4.37E+06
PANCREAS	**	1.69E+04	**	4.40E+06
BREAST	**	1.69E+04	**	4.37E+06
SPLEEN	**	1.69E+04	**	4.37E+06
THYMUS	**	1.68E+04	**	4.40E+06
ADRENALS	**	1.69E+04	**	4.40E+06
SKIN	**	1.68E+04	**	4.37E+06
BLAD WALL	**	1.70E+04	**	4.33E+06
UTERUS	**	1.70E+04	**	4.33E+06
OVARIES	**	1.74E+04	**	4.37E+06
TESTES	**	1.69E+04	**	4.33E+06

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

TH230	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	5.70E+04	**	6.36E+07	**
BONE	2.06E+06	1.33E+07	2.29E+09	3.22E+09
R MARROW	**	1.07E+06	**	2.59E+08
LUNGS	0.	2.52E+03	6.21E+08	1.11E+09
THYROID	0.	2.52E+03	0.	6.36E+05
LIVER	1.17E+05	2.20E+04	1.31E+08	5.59E+06
KIDNEYS	5.65E+05	2.52E+03	6.40E+08	6.36E+05
GI LLI	6.02E+04	1.82E+05	3.73E+04	7.40E+05
ULI	**	6.11E+04	**	6.70E+05
SI+CON	**	1.26E+04	**	6.44E+05
S WALL	**	6.55E+03	**	6.40E+05
PANCREAS	**	2.52E+03	**	6.40E+05
BREAST	**	2.52E+03	**	6.36E+05
SPLEEN	**	2.52E+03	**	6.36E+05
THYMUS	**	2.52E+03	**	6.40E+05
ADRENALS	**	2.52E+03	**	6.40E+05
SKIN	**	2.52E+03	**	6.36E+05
BLAD WALL	**	2.52E+03	**	6.36E+05
UTERUS	**	2.52E+03	**	6.36E+05
OVARIES	**	2.52E+03	**	6.36E+05
TESTES	**	2.52E+03	**	6.36E+05

 ** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

TH232	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	1.50E+05	**	9.04E+07	**
BONE	1.75E+06	6.85E+07	1.99E+09	1.85E+10
R MARROW	**	5.48E+06	**	1.48E+09
LUNGS	0.	4.63E+03	5.96E+08	3.48E+09
THYROID	0.	4.48E+03	0.	2.22E+06
LIVER	1.00E+05	3.77E+04	1.12E+08	1.86E+07
KIDNEYS	4.82E+05	4.63E+03	5.47E+09	2.25E+06
GI LLI	5.12E+04	1.58E+05	3.17E+04	2.32E+06
ULI	**	5.44E+04	**	2.24E+06
SI+CON	**	1.32E+04	**	2.21E+06
S WALL	**	7.92E+03	**	2.24E+06
PANCREAS	**	4.63E+03	**	2.30E+06
BREAST	**	4.66E+03	**	2.27E+06
SPLEEN	**	4.55E+03	**	2.26E+06
THYMUS	**	4.55E+03	**	2.33E+06
ADRENALS	**	4.85E+03	**	2.35E+06
SKIN	**	4.59E+03	**	2.22E+06
BLAD WALL	**	4.48E+03	**	2.18E+06
UTERUS	**	4.51E+03	**	2.19E+06
OVARIES	**	4.63E+03	**	2.21E+06
TESTES	**	4.55E+03	**	2.20E+06

 ** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

TH234	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	2.31E+00	**	4.70E+01	**
BONE	8.01E+01	7.70E+01	1.63E+03	2.33E+03
R MARROW	**	6.81E+01	**	9.47E+02
LUNGS	0.	2.61E+00	1.89E+05	2.36E+05
THYROID	0.	1.07E+00	0.	4.70E+01
LIVER	4.71E+00	1.54E+01	9.56E+01	2.19E+02
KIDNEYS	2.67E+01	1.37E+01	5.41E+02	4.85E+01
GI LLI	1.13E+05	1.59E+05	7.03E+04	7.51E+04
ULI	**	5.44E+04	**	2.57E+04
SI+CON	**	9.44E+03	**	4.48E+03
S WALL	**	3.68E+03	**	1.85E+03
PANCREAS	**	1.29E+01	**	8.62E+01
BREAST	**	1.32E+01	**	6.14E+01
SPLEEN	**	1.07E+01	**	7.96E+01
THYMUS	**	1.54E+00	**	1.24E+02
ADRENALS	**	6.07E+00	**	8.29E+01
SKIN	**	4.85E+00	**	3.67E+01
BLAD WALL	**	3.39E+01	**	3.70E+01
UTERUS	**	4.66E+01	**	4.48E+01
OVARIES	**	1.15E+02	**	7.81E+01
TESTES	**	9.36E+00	**	2.43E+01

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

PA231	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	1.59E+05	**	1.98E+08	**
BONE	4.10E+06	2.67E+08	5.08E+09	3.22E+10
R MARROW	**	2.14E+07	**	2.58E+09
LUNGS	0.	2.52E+02	5.75E+07	6.36E+07
THYROID	0.	2.34E+02	0.	2.83E+04
LIVER	1.54E+05	1.61E+04	1.91E+08	1.98E+06
KIDNEYS	8.64E+05	2.51E+04	1.07E+09	3.08E+06
GI LLI	7.17E+04	1.98E+05	4.44E+04	1.33E+05
ULI	**	6.48E+04	**	5.51E+04
SI+CON	**	1.15E+04	**	2.95E+04
S WALL	**	4.63E+03	**	1.98E+04
PANCREAS	**	2.66E+02	**	2.99E+04
BREAST	**	2.89E+02	**	3.25E+04
SPLEEN	**	1.96E+02	**	2.21E+04
THYMUS	**	1.49E+02	**	1.82E+04
ADRENALS	**	3.64E+02	**	4.29E+04
SKIN	**	2.02E+02	**	2.36E+04
BLAD WALL	**	1.87E+02	**	1.61E+04
UTERUS	**	2.25E+02	**	1.84E+04
OVARIES	**	4.48E+02	**	2.55E+04
TESTES	**	1.68E+02	**	1.84E+04

 ** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

U233	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	5.28E+04	**	6.60E+05	**
BONE	8.71E+05	4.29E+06	1.09E+07	1.24E+07
R MARROW	**	2.72E+05	**	7.92E+05
LUNGS	0.	9.69E+03	5.32E+07	5.99E+07
THYROID	0.	9.69E+03	0.	2.82E+04
LIVER	0.	9.69E+03	0.	2.82E+04
KIDNEYS	2.03E+05	1.75E+06	2.54E+06	5.11E+06
GI LLI	6.27E+04	1.84E+05	3.89E+04	1.17E+05
ULI	**	6.66E+04	**	5.74E+04
SI+CON	**	1.95E+04	**	3.32E+04
S WALL	**	1.38E+04	**	3.03E+04
PANCREAS	**	9.69E+03	**	2.82E+04
BREAST	**	9.69E+03	**	2.82E+04
SPLEEN	**	9.69E+03	**	2.82E+04
THYMUS	**	9.69E+03	**	2.82E+04
ADRENALS	**	9.69E+03	**	2.82E+04
SKIN	**	9.69E+03	**	2.82E+04
BLAD WALL	**	9.69E+03	**	2.82E+04
UTERUS	**	9.69E+03	**	2.82E+04
OVARIES	**	9.69E+03	**	2.82E+04
TESTES	**	9.69E+03	**	2.82E+04

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

U234	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	5.17E+04	**	6.46E+05	**
BONE	8.36E+05	4.18E+06	1.04E+07	1.22E+07
R MARROW	**	2.67E+05	**	7.77E+05
LUNGS	0.	9.55E+03	5.22E+07	5.92E+07
THYROID	0.	9.55E+03	0.	2.78E+04
LIVER	0.	9.55E+03	0.	2.78E+04
KIDNEYS	1.99E+05	1.73E+06	2.49E+06	5.03E+06
GI LLI	6.14E+04	1.83E+05	3.81E+04	1.17E+05
ULI	**	6.62E+04	**	5.66E+04
SI+CON	**	1.94E+04	**	3.28E+04
S WALL	**	1.37E+04	**	2.99E+04
PANCREAS	**	9.55E+03	**	2.78E+04
BREAST	**	9.55E+03	**	2.78E+04
SPLEEN	**	9.55E+03	**	2.78E+04
THYMUS	**	9.55E+03	**	2.78E+04
ADRENALS	**	9.55E+03	**	2.78E+04
SKIN	**	9.55E+03	**	2.78E+04
BLAD WALL	**	9.55E+03	**	2.78E+04
UTERUS	**	9.55E+03	**	2.78E+04
OVARIES	**	9.58E+03	**	2.78E+04
TESTES	**	9.55E+03	**	2.78E+04

 ** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

U235	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	4.86E+04	**	6.07E+05	**
BONE	8.01E+05	3.89E+06	1.00E+07	1.13E+07
R MARROW	**	2.52E+05	**	7.33E+05
LUNGS	0.	9.10E+03	4.90E+07	5.48E+07
THYROID	0.	9.06E+03	0.	2.67E+04
LIVER	0.	9.10E+03	0.	2.73E+04
KIDNEYS	1.87E+05	1.60E+06	2.34E+06	4.66E+06
GI LLI	7.81E+04	1.96E+05	4.84E+04	1.25E+05
ULI	**	6.81E+04	**	5.81E+04
SI+CON	**	1.94E+04	**	3.21E+04
S WALL	**	1.32E+04	**	2.92E+04
PANCREAS	**	9.21E+03	**	2.75E+04
BREAST	**	9.21E+03	**	2.71E+04
SPLEEN	**	9.10E+03	**	2.72E+04
THYMUS	**	8.99E+03	**	2.77E+04
ADRENALS	**	9.25E+03	**	2.78E+04
SKIN	**	9.06E+03	**	2.65E+04
BLAD WALL	**	9.21E+03	**	2.63E+04
UTERUS	**	9.32E+03	**	2.64E+04
OVARIES	**	9.88E+03	**	2.68E+04
TESTES	**	9.06E+03	**	2.63E+04

 ** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

U236	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	4.96E+04	**	6.20E+05	**
BONE	8.01E+05	3.96E+06	1.00E+07	1.15E+07
R MARROW	**	2.53E+05	**	7.36E+05
LUNGS	0.	9.06E+03	5.00E+07	5.59E+07
THYROID	0.	9.06E+03	0.	2.63E+04
LIVER	0.	9.06E+03	0.	2.63E+04
KIDNEYS	1.91E+05	1.64E+06	2.39E+06	4.77E+06
GI LLI	5.76E+04	1.73E+05	3.57E+04	1.10E+05
ULI	**	6.25E+04	**	5.37E+04
SI+CON	**	1.83E+04	**	3.10E+04
S WALL	**	1.30E+04	**	2.83E+04
PANCREAS	**	9.06E+03	**	2.63E+04
BREAST	**	9.06E+03	**	2.63E+04
SPLEEN	**	9.06E+03	**	2.63E+04
THYMUS	**	9.06E+03	**	2.63E+04
ADRENALS	**	9.06E+03	**	2.63E+04
SKIN	**	9.06E+03	**	2.63E+04
BLAD WALL	**	9.06E+03	**	2.63E+04
UTERUS	**	9.06E+03	**	2.63E+04
OVARIES	**	9.06E+03	**	2.63E+04
TESTES	**	9.06E+03	**	2.63E+04

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

U238	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	4.54E+04	**	5.67E+05	**
BONE	7.67E+05	3.74E+06	9.58E+06	1.09E+07
R MARROW	**	2.52E+05	**	7.33E+05
LUNGS	0.	3.51E+03	4.58E+07	5.25E+07
THYROID	0.	8.51E+03	0.	2.48E+04
LIVER	0.	8.51E+03	0.	2.49E+04
KIDNEYS	1.75E+05	1.54E+06	2.18E+06	4.48E+06
GI LLI	5.50E+04	1.69E+05	3.41E+04	1.18E+05
ULI	**	5.96E+04	**	5.48E+04
SI+CON	**	1.72E+04	**	2.99E+04
S WALL	**	1.21E+04	**	2.70E+04
PANCREAS	**	8.51E+03	**	2.49E+04
BREAST	**	8.55E+03	**	2.49E+04
SPLEEN	**	8.51E+03	**	2.49E+04
THYMUS	**	3.51E+03	**	2.50E+04
ADRENALS	**	3.55E+03	**	2.50E+04
SKIN	**	3.51E+03	**	2.48E+04
BLAD WALL	**	8.51E+03	**	2.48E+04
UTERUS	**	8.51E+03	**	2.48E+04
OVARIES	**	8.55E+03	**	2.48E+04
TESTES	**	8.51E+03	**	2.48E+04

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

NP237	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	5.54E+04	**	6.87E+07	**
BONE	1.37E+06	7.07E+08	1.69E+09	8.84E+09
R MARROW	**	5.66E+07	**	7.07E+08
LUNGS	0.	8.77E+03	5.22E+07	5.96E+07
THYROID	0.	3.02E+03	0.	3.81E+04
LIVER	1.19E+05	1.52E+08	1.47E+08	1.90E+09
KIDNEYS	4.12E+05	1.14E+04	5.10E+08	1.43E+05
GI LLI	7.94E+04	1.98E+05	4.92E+04	1.47E+05
ULI	**	7.10E+04	**	1.31E+05
SI+CON	**	1.69E+04	**	7.96E+04
S WALL	**	1.04E+04	**	7.70E+04
PANCREAS	**	1.25E+04	**	1.58E+05
BREAST	**	5.62E+03	**	7.03E+04
SPLEEN	**	4.11E+03	**	5.18E+04
THYMUS	**	3.43E+03	**	4.48E+04
ADRENALS	**	1.51E+04	**	1.89E+05
SKIN	**	3.39E+03	**	4.26E+04
BLAD WALL	**	2.05E+03	**	2.50E+04
UTERUS	**	2.63E+03	**	3.21E+04
OVARIES	**	9.10E+06	**	1.14E+08
TESTES	**	9.10E+06	**	1.14E+08

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

NP239	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	6.45E-02	**	1.55E+00	**
BONE	1.19E+00	5.74E+02	2.87E+01	5.11E+03
R MARROW	**	2.12E+02	**	5.44E+02
LUNGS	0.	1.01E+01	4.70E+03	8.73E+03
THYROID	0.	1.05E+00	0.	2.16E+01
LIVER	1.17E-01	2.05E+02	2.82E+00	1.48E+03
KIDNEYS	3.65E-01	7.70E+01	8.75E+00	5.77E+01
GI LLI	2.40E+04	3.20E+04	1.49E+04	1.08E+04
ULI	**	1.41E+04	**	4.77E+03
SI+CON	**	3.22E+03	**	1.09E+03
S WALL	**	1.28E+03	**	4.74E+02
PANCREAS	**	8.14E+01	**	9.40E+01
BREAST	**	6.36E+01	**	5.51E+01
SPLËEN	**	5.59E+01	**	6.85E+01
THYMUS	**	3.37E+00	**	8.70E+01
ADRENALS	**	3.13E+01	**	7.99E+01
SKIN	**	1.89E+01	**	2.09E+01
BLAD WALL	**	1.74E+02	**	6.18E+01
UTERUS	**	2.53E+02	**	8.99E+01
OVARIES	**	5.99E+02	**	2.75E+02
TESTES	**	4.88E+01	**	8.58E+01

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

PU238	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	1.71E+04	**	6.90E+07	**
BONE	6.80E+05	6.77E+06	2.74E+09	3.07E+09
R MARROW	**	5.44E+05	**	2.46E+08
LUNGS	0.	2.70E-01	1.82E+08	1.18E+09
THYROID	0.	1.42E-02	0.	7.36E+00
LIVER	9.58E+04	1.48E+06	3.87E+08	6.81E+08
KIDNEYS	7.32E+04	1.74E-01	2.96E+08	6.81E+01
GI LLI	7.30E+04	2.10E+05	4.52E+04	1.21E+05
ULI	**	6.85E+04	**	3.92E+04
SI+CON	**	1.18E+04	**	6.81E+03
S WALL	**	4.74E+03	**	2.78E+03
PANCREAS	**	2.99E-01	**	7.96E+01
BREAST	**	5.29E-01	**	2.23E+02
SPLEEN	**	9.03E-02	**	7.55E+01
THYMUS	**	2.77E-02	**	4.63E+01
ADRENALS	**	4.33E-01	**	2.39E+02
SKIN	**	1.23E-01	**	4.51E+01
BLAD WALL	**	2.76E-01	**	1.05E+00
UTERUS	**	3.16E-01	**	1.86E+00
OVARIES	**	8.62E+04	**	3.85E+07
TESTES	**	8.62E+04	**	3.85E+07

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REP/CURIE)

PU239	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	1.91E+04	**	7.75E+07	**
BONE	7.87E+05	7.62E+06	3.19E+09	3.52E+09
R MARROW	**	6.11E+05	**	2.81E+08
LUNGS	0.	1.44E-01	1.72E+08	1.20E+09
THYROID	0.	1.36E-02	0.	8.66E+00
LIVER	1.06E+05	1.64E+06	4.31E+08	7.70E+08
KIDNEYS	8.11E+04	1.35E-01	3.30E+08	4.59E+01
GI LLI	6.66E+04	1.96E+05	4.13E+04	1.13E+05
ULI	**	6.40E+04	**	3.69E+04
SI+CON	**	1.11E+04	**	6.40E+03
S WALL	**	4.40E+03	**	2.58E+03
PANCREAS	**	1.85E-01	**	5.66E+01
BREAST	**	2.53E-01	**	1.03E+02
SPLEEN	**	7.14E-02	**	4.18E+01
THYMUS	**	2.20E-02	**	3.28E+01
ADRENALS	**	2.40E-01	**	1.29E+02
SKIN	**	6.88E-02	**	2.53E+01
BLAD WALL	**	1.93E-01	**	2.85E+00
UTERUS	**	2.43E-01	**	3.89E+00
OVARIES	**	9.77E+04	**	4.44E+07
TESTES	**	9.77E+04	**	4.44E+07

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

PU240	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	1.91E+04	**	7.73E+07	**
BONE	7.85E+05	7.62E+06	3.18E+09	3.52E+09
R MARROW	**	6.11E+05	**	2.81E+08
LUNGS	0.	3.07E-01	1.72E+08	1.20E+09
THYROID	0.	1.72E-02	0.	9.14E+00
LIVER	1.06E+05	1.64E+06	4.30E+08	7.70E+08
KIDNEYS	8.10E+04	2.01E-01	3.29E+08	8.07E+01
GI LLI	6.78E+04	1.98E+05	4.21E+04	1.14E+05
ULI	**	6.44E+04	**	3.70E+04
SI+CON	**	1.11E+04	**	6.44E+03
S WALL	**	4.44E+03	**	2.62E+03
PANCREAS	**	3.22E-01	**	9.36E+01
BREAST	**	5.44E-01	**	2.41E+02
SPLEEN	**	1.03E-01	**	8.25E+01
THYMUS	**	3.27E-02	**	5.11E+01
ADRENALS	**	4.96E-01	**	2.73E+02
SKIN	**	1.36E-01	**	5.25E+01
BLAD WALL	**	2.79E-01	**	1.49E+00
UTERUS	**	3.24E-01	**	2.52E+00
OVARIES	**	9.77E+04	**	4.44E+07
TESTES	**	9.77E+04	**	4.44E+07

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

PU241	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	3.32E+02	**	1.29E+06	**
BONE	1.65E+04	1.57E+05	6.41E+07	7.84E+07
R MARROW	**	1.26E+04	**	6.29E+06
LUNGS	0.	2.40E-01	1.52E+05	1.18E+07
THYROID	0.	4.59E-02	0.	2.89E+01
LIVER	8.44E+02	3.17E+04	3.28E+06	1.65E+07
KIDNEYS	1.53E+03	2.71E-01	5.93E+06	1.46E+02
GI LLI	1.40E+03	9.99E+02	8.65E+02	6.66E+02
ULI	**	3.32E+02	**	2.99E+02
SI+CON	**	5.62E+01	**	9.77E+01
S WALL	**	2.26E+01	**	1.01E+02
PANCREAS	**	2.94E-01	**	1.80E+02
BREAST	**	1.29E-01	**	8.66E+01
SPLEEN	**	7.88E-02	**	6.62E+01
THYMUS	**	5.11E-02	**	7.40E+01
ADRENALS	**	3.52E-01	**	2.08E+02
SKIN	**	6.51E-02	**	3.81E+01
BLAD WALL	**	3.08E-02	**	1.41E+01
UTERUS	**	4.18E-02	**	1.96E+01
OVARIES	**	2.09E+03	**	1.02E+06
TESTES	**	2.09E+03	**	1.02E+06

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

PU242	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	1.84E+04	**	7.46E+07	**
BONE	7.29E+05	7.25E+06	2.95E+09	3.34E+09
R MARROW	**	5.81E+05	**	2.68E+08
LUNGS	0.	4.33E-01	1.65E+08	1.14E+09
THYROID	0.	9.36E-02	0.	6.66E+01
LIVER	1.02E+05	1.55E+06	4.15E+08	7.29E+08
KIDNEYS	7.81E+04	8.44E-01	3.17E+08	2.55E+02
GI LLI	6.53E+04	1.87E+05	4.05E+04	1.08E+05
ULI	**	6.11E+04	**	3.53E+04
SI+CON	**	1.05E+04	**	6.18E+03
S WALL	**	4.22E+03	**	2.62E+03
PANCREAS	**	9.07E-01	**	2.81E+02
BREAST	**	9.95E-01	**	3.29E+02
SPLEEN	**	4.55E-01	**	1.75E+02
THYMUS	**	1.41E-01	**	1.80E+02
ADRENALS	**	9.81E-01	**	4.96E+02
SKIN	**	3.56E-01	**	1.19E+02
BLAD WALL	**	1.21E+00	**	2.79E+01
UTERUS	**	1.42E+00	**	3.44E+01
OVARIES	**	9.29E+04	**	4.22E+07
TESTES	**	9.29E+04	**	4.22E+07

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

AM241	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	5.41E+04	**	6.71E+07	**
BONE	8.19E+05	3.92E+07	1.01E+09	9.36E+09
R MARROW	**	3.12E+06	**	7.51E+08
LUNGS	0.	6.36E+01	6.06E+07	6.81E+07
THYROID	0.	1.14E+01	0.	2.78E+03
LIVER	2.88E+05	8.40E+06	3.59E+08	2.02E+09
KIDNEYS	4.07E+05	8.44E+01	5.04E+08	1.71E+04
GI LLI	7.42E+04	2.15E+05	4.60E+04	1.14E+05
ULI	**	7.03E+04	**	4.66E+04
SI+CON	**	1.23E+04	**	1.37E+04
S WALL	**	4.92E+03	**	1.05E+04
PANCREAS	**	9.10E+01	**	1.86E+04
BREAST	**	4.92E+01	**	8.07E+03
SPLEEN	**	3.08E+01	**	4.96E+03
THYMUS	**	1.32E+01	**	3.41E+03
ADRENALS	**	9.55E+01	**	2.22E+04
SKIN	**	2.00E+01	**	4.00E+03
BLAD WALL	**	5.07E+01	**	1.69E+03
UTERUS	**	7.59E+01	**	2.33E+03
OVARIES	**	5.00E+05	**	1.20E+08
TESTES	**	5.00E+05	**	1.20E+08

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

AM243	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	5.30E+04	**	6.57E+07	**
BONE	8.18E+05	3.89E+07	1.01E+09	9.36E+09
R MARROW	**	3.12E+06	**	7.51E+08
LUNGS	0.	4.59E+02	5.75E+07	6.59E+07
THYROID	0.	1.33E+02	0.	3.24E+04
LIVER	2.78E+05	8.36E+06	3.47E+08	2.01E+09
KIDNEYS	3.99E+05	6.44E+02	4.95E+08	1.42E+05
GI LLI	8.70E+04	2.23E+05	5.40E+04	1.62E+05
ULI	**	7.03E+04	**	1.34E+05
SI+CON	**	1.24E+04	**	7.81E+04
S WALL	**	5.00E+03	**	7.55E+04
PANCREAS	**	6.88E+02	**	1.55E+05
BREAST	**	3.34E+02	**	6.70E+04
SPLEEN	**	2.34E+02	**	4.77E+04
THYMUS	**	1.55E+02	**	3.89E+04
ADRENALS	**	7.40E+02	**	1.75E+05
SKIN	**	1.72E+02	**	3.77E+04
BLAD WALL	**	2.78E+02	**	2.22E+04
UTERUS	**	3.69E+02	**	2.97E+04
OVARIES	**	5.00E+05	**	1.20E+08
TESTES	**	5.00E+05	**	1.20E+08

 ** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

CM242	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	1.37E+03	**	9.84E+05	**
BONE	2.06E+04	8.51E+05	1.48E+07	1.86E+08
R MARROW	**	6.81E+04	**	1.49E+07
LUNGS	0.	4.77E-02	3.92E+07	5.74E+07
THYROID	0.	1.97E-03	0.	4.74E-01
LIVER	2.10E+04	2.21E+05	1.51E+07	4.81E+07
KIDNEYS	6.22E+03	6.44E-02	4.48E+06	4.96E+00
GI LLI	7.92E+04	2.31E+05	4.91E+04	1.12E+05
ULI	**	7.59E+04	**	3.67E+04
SI+CON	**	1.31E+04	**	6.36E+03
S WALL	**	5.25E+03	**	2.55E+03
PANCREAS	**	2.01E-01	**	5.51E+00
BREAST	**	4.44E-01	**	1.22E+01
SPLEEN	**	4.85E-02	**	4.22E+00
THYMUS	**	3.89E-03	**	2.69E+00
ADRENALS	**	7.22E-02	**	1.61E+01
SKIN	**	5.44E-02	**	2.79E+00
BLAD WALL	**	3.69E-01	**	2.45E-01
UTERUS	**	4.22E-01	**	3.38E-01
OVARIES	**	9.62E+03	**	2.11E+06
TESTES	**	9.62E+03	**	2.11E+06

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

CM244	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	2.87E+04	**	3.51E+07	**
BONE	4.83E+05	2.02E+07	5.90E+08	4.85E+09
R MARROW	**	1.61E+06	**	3.85E+08
LUNGS	0.	9.55E-01	6.06E+07	7.14E+07
THYROID	0.	9.55E-02	0.	2.31E+01
LIVER	2.07E+05	4.66E+06	2.54E+08	1.11E+09
KIDNEYS	1.34E+05	8.44E-01	1.64E+08	1.72E+02
GI LLI	7.55E+04	2.21E+05	4.68E+04	1.13E+05
ULI	**	7.21E+04	**	3.68E+04
SI+CON	**	1.25E+04	**	6.40E+03
S WALL	**	5.00E+03	**	2.60E+03
PANCREAS	**	9.47E-01	**	1.68E+02
BREAST	**	1.14E+00	**	1.63E+02
SPLEEN	**	3.59E-01	**	6.44E+01
THYMUS	**	1.47E-01	**	3.77E+01
ADRENALS	**	1.73E+00	**	4.07E+02
SKIN	**	4.11E-01	**	8.14E+01
BLAD WALL	**	6.44E-01	**	1.05E+01
UTERUS	**	7.47E-01	**	1.38E+01
OVARIES	**	2.46E+05	**	5.88E+07
TESTES	**	2.46E+05	**	5.88E+07

 ** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

CM245	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	5.76E+04	**	7.14E+07	**
BONE	1.02E+06	4.03E+07	1.26E+09	9.69E+09
R MARROW	**	3.23E+06	**	7.73E+08
LUNGS	0.	1.87E+02	5.85E+07	5.66E+07
THYROID	0.	4.95E+01	0.	1.21E+04
LIVER	2.87E+05	8.62E+06	3.59E+08	2.08E+09
KIDNEYS	2.69E+05	2.30E+02	3.33E+08	5.74E+04
GI LLI	7.04E+04	2.17E+05	4.36E+04	1.28E+05
ULI	**	7.10E+04	**	7.47E+04
SI+CON	**	1.27E+04	**	3.52E+04
S WALL	**	5.11E+03	**	3.14E+04
PANCREAS	**	3.09E+02	**	6.18E+04
BREAST	**	1.59E+02	**	2.69E+04
SPLEEN	**	1.15E+02	**	1.90E+04
THYMUS	**	5.40E+01	**	1.59E+04
ADRENALS	**	2.92E+02	**	6.62E+04
SKIN	**	7.47E+01	**	1.49E+04
BLAD WALL	**	1.87E+02	**	9.36E+03
UTERUS	**	2.51E+02	**	1.23E+04
OVARIES	**	5.18E+05	**	1.24E+08
TESTES	**	5.18E+05	**	1.24E+08

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

CM246	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	5.75E+04	**	7.13E+07	**
BONE	1.01E+06	4.00E+07	1.25E+09	9.62E+09
R MARROW	**	3.20E+06	**	7.70E+08
LUNGS	0.	4.51E+01	5.96E+07	6.73E+07
THYROID	0.	2.39E+01	0.	5.77E+03
LIVER	2.87E+05	8.58E+06	3.59E+08	2.06E+09
KIDNEYS	2.68E+05	1.30E+02	3.33E+08	2.66E+04
GI LLI	6.91E+04	2.08E+05	4.29E+04	1.12E+05
ULI	**	6.77E+04	**	4.88E+04
SI+CON	**	1.19E+04	**	1.74E+04
S WALL	**	4.77E+03	**	1.47E+04
PANCREAS	**	1.20E+02	**	2.42E+04
BREAST	**	8.10E+01	**	1.41E+04
SPLEEN	**	5.18E+01	**	8.92E+03
THYMUS	**	3.05E+01	**	7.36E+03
ADRENALS	**	1.45E+02	**	3.32E+04
SKIN	**	4.59E+01	**	9.29E+03
BLAD WALL	**	7.44E+01	**	4.00E+03
UTERUS	**	8.73E+01	**	4.66E+03
OVARIES	**	5.14E+05	**	1.23E+08
TESTES	**	5.14E+05	**	1.23E+08

** = NOT DEFINED BY MODEL

TABLE A.1 (CONTINUED)

DOSE CONVERSION FACTORS
(REM/CURIE)

CF252	INGESTION		INHALATION	
	ICRP2	ICRP30	ICRP2	ICRP30
TOTAL BODY	6.29E+03	**	2.33E+07	**
BONE	2.64E+05	7.66E+06	9.78E+08	1.80E+09
R MARROW	**	6.22E+05	**	1.44E+08
LUNGS	0.	1.05E+03	1.99E+08	1.38E+08
THYROID	0.	3.70E+02	0.	9.21E+04
LIVER	0.	2.00E+06	0.	4.66E+08
KIDNEYS	0.	5.00E+03	0.	4.37E+05
GI LLI	2.88E+05	5.66E+05	1.78E+05	3.74E+05
ULI	**	1.94E+05	**	3.29E+05
SI+CON	**	5.99E+04	**	2.14E+05
S WALL	**	1.99E+04	**	2.37E+05
PANCREAS	**	4.81E+03	**	4.18E+05
BREAST	**	4.51E+03	**	2.32E+05
SPLEEN	**	3.07E+03	**	1.61E+05
THYMUS	**	5.25E+02	**	1.52E+05
ADRENALS	**	3.51E+03	**	5.55E+05
SKIN	**	1.79E+03	**	1.47E+05
BLAD WALL	**	9.55E+03	**	6.33E+04
UTERUS	**	1.12E+04	**	7.73E+04
OVARIES	**	1.14E+05	**	2.00E+07
TESTES	**	9.32E+04	**	2.00E+07

** = NOT DEFINED BY MODEL