SPENT FUEL DATA BASE

LAWRENCE LIVERMORE LABORATORY

LOWER TIE PLATE

FUEL CLADDING

FUEL CLADDING

FUEL CHANNEL

LOWER TIE PLATE

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S/C-9101903

TERA ADVANCED SERVICES CORPORATION

**SPENT FUEL DATA BASE:
COMMERCIAL
LIGHT WATER REACTORS**

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TERA CORPORATION

EXECUTIVE SUMMARY

As a consequence of this country's non-proliferation policy, the reprocessing of spent nuclear fuel has been delayed indefinitely. This has resulted in spent light water reactor (LWR) fuel being considered as a potential waste form for disposal. Since the Nuclear Regulatory Commission (NRC) is currently developing methodologies for use in the regulation of the management and disposal of high-level and transuranic wastes, a comprehensive data base describing LWR fuel technology must be compiled. This document provides that technology baseline and, as such, will support the development of those evaluation standards and criteria applicable to spent nuclear fuel.

The most likely scenario for the spent fuel waste management program includes the following:

- Fuel is discharged from the reactor and is retained at the site in a spent fuel pool for a short period of time (less than one year). This allows for decay of the short lived radioactive fission products.
- The "cooled" fuel is then shipped to an off-site interim storage facility where it is repackaged as necessary to meet the criteria of the final disposal site. This interim facility also uses pools for spent fuel storage but in this case, for periods of up to twenty years.
- Following interim storage, the repackaged fuel is transported to a federal repository where it is stored in preparation for retrievable underground disposal in deep geologic formations.

In order to adequately develop licensing methodologies for each of these waste management program steps, four categories of information must be included in the spent fuel data base. These are:

- Physical characteristics of the spent fuel
- Composition of the spent fuel and fuel bundles in the spent fuel pool

- Spent fuel transportation and shipping cask descriptions
- Accident considerations and potential radioactive releases

Sections 2.0 through 5.0 of this report contain the specific data for each of the above categories. Because of the nature of a data base, this executive summary provides a guide to the types of information to be found in each section rather than a condensed listing of the information itself.

Physical Characteristics

Section 2.0 of the report describes the physical, chemical, thermal, and radiological characteristics of spent nuclear fuel resulting from the operations of reactors manufactured by General Electric (BWR), Westinghouse (PWR), Combustion Engineering (PWR), and Babcock and Wilcox (PWR). Also included are projections of the future quantities of fuel to be discharged expressed in both number of assemblies and metric tons of uranium.

Composition

Section 3.0 consists primarily of the inventories of fission products contained in the fuel as a function of time after discharge from the reactor. Description of the activation products deposited on the fuel assemblies and the fuel bundle materials are also provided.

Transportation

In Section 4.0, transportation practices are discussed and regulatory requirements applicable to the shipping of spent nuclear fuel are summarized. Following this is a detailed description of each of the spent fuel shipping casks in use in the United States. Both truck and rail casks are included.

Accident Considerations

Section 5.0 is concerned with a description of typical postulated accidents for LWR fuel during storage or transportation including the potential radioactive

released associated with such accidents. The initial section covers the characteristics of the most biologically significant radionuclides present as a function of time after discharge from the reactor. Alternate sources of radioactivity (such as the pool water purification system) and possible release mechanisms are also discussed. The final sections analyze the probabilities and consequences of specific fuel pool and transportation accidents.

1.0 INTRODUCTION

The purpose of this document is to establish a detailed and comprehensive base of physical, chemical, thermal and radiological data which will serve to describe the specific characteristics of spent nuclear reactor fuel, the typical plant fuel storage environment, the mechanisms of fuel handling and transportation, and postulated modes of accidental fuel failure. These data have been accumulated to provide a common basis from which to perform evaluations and analyses in support of the Nuclear Regulatory Commission's waste management program which is under the control and auspices of the Lawrence Livermore Laboratory (LLL).

The Nuclear Regulatory Commission is currently developing standards and licensing review methodologies with which it can effectively and efficiently regulate the management and disposal of high-level and transuranic wastes (HLTW). A major aspect of the HLTW program is the development of an information base and standards in the areas of:

- Waste form performance criteria
- HLTW repository site suitability criteria
- HLTW repository design/performance criteria
- HLTW management radiological performance objectives

The spent fuel waste management program encompasses the handling of spent LWR fuel in the following scenario. The spent fuel is stored at the reactor for short periods of time before it is transported to an off-site interim storage pool (either privately or federally owned). At this interim facility, the spent fuel will be repackaged as necessary to meet the criteria of the federal repository to which it will be sent next. It is understood that total interim storage could be for periods approaching 20 years. Upon the completion of storage and repackaging, either by the removal of the fuel material and separation of cladding hull from the spent reactor fuel or by any other potential packaging

technique, the repackaged spent fuel will then be transported to a federal repository where it will be stored in preparation for underground retrievable disposal in a deep geologic formation.

The purpose of the LLL program is to develop potential criteria for evaluating the regulatory decisions necessary to allow the implementation of this or a similar spent fuel waste management program.

In order to achieve the regulatory program for the waste management activities dealing with spent LWR fuel, criteria and methods which encompass the technology presently utilized in the nuclear industry must be developed. The spent fuel data base document has been prepared to provide this technology baseline.

2.0 SPENT FUEL PHYSICAL CHARACTERISTICS

The following material is provided to define the physical, chemical, thermal and radiological characteristics of the spent nuclear fuel resulting from operation of reactors designed by the following reactor manufacturers:

- General Electric Company (BWR)
- Westinghouse (PWR)
- Combustion Engineering (PWR)
- Babcock & Wilcox Company (PWR)

Emphasis has been placed on BWR and PWR fuel types, since only one HTGR facility is in operation in the United States and since General Atomic Company has ceased manufacturing operations. Further, due to their more exotic characteristics and very limited numbers, research and experimental reactor fuels and Pu-recycle elements have not been included in the data base at this time. This information will be provided if it is deemed necessary. The bulk of the data presented will be in a tabular or graphical form.

2.1 GENERAL FUEL DESCRIPTIONS AND DATA

This section summarizes data applicable to all spent fuel types and provides typical fuel configurations and data.

2.1.1 ENERGY CAPACITY AND SPENT FUEL DISCHARGED

The inventory of nuclear fuel discharged to spent fuel pools is summarized (and projected) in Figures 2-1 and 2-2, and Table 2-1.

Figure 2-1 shows the cumulative discharge of spent fuel assemblies through the year 1986. Two projections are shown. The lower curve represents the results of

FIGURE 2-1
ACCUMULATION OF LWR FUEL ASSEMBLIES
SOURCE: REFERENCE 1

FIGURE 2-2
CUMULATIVE MTU DISCHARGED
REFERENCE I

TABLE 2-1
CUMULATIVE MTU DISCHARGED

Year	Low Case	ERDA 77-25
1970	54	
1971	142	
1972	287	
1973	489	
1974	769	
1975	1197	
1976	1814	2342
1977	2635	3376
1978	3614	4733
1979	4690	6258
1980	5864	8121
1981	7126	10017
1982	8541	12490
1983	10190	15366
1984	12080	18606
1985	14257	22587
1986	16791	26903
1987	19673	
1988	22847	
1989	26292	
1990	30015	
1991	34033	
1992	38365	
1993	43024	
1994	48020	
1995	53743	
1996	59111	
1997	65042	
1998	71762	
1999	78662	
2000	85937	

Assumptions: In Column 2 a ratio of 0.176 MTU/Assembly for a BWR and 0.412 MTU/Assembly for a PWR were used. These were the calculated averages from ERDA-25. ⁽³⁾

ERDA's* planning projection based on ERDA long range goals. The upper curve is based on a recent survey completed for ERDA of both existing plants and those under construction. Over the near term, i.e., to 1986, the upper curve is considered to be the more accurate projection because it is based on actual industry data.

Figure 2-2 uses the number of PWR and BWR bundles discharged to plot the cumulative metric tons of uranium discharged. This information is extended to the year 2000 in Table 2-1. Using the industry projection, there will be 26,000 MTU in 1986. The ERDA projection for the year 2000 shows that 86,000 MTU will have been discharged. While numerous projections appear nearly weekly, the exact magnitude of the cumulative inventory is not presently critical and data are only provided to indicate the future magnitude of the spent fuel disposal problem.

Fuel in U.S. pools includes zircaloy as the principal cladding alloy, but also includes fuel with stainless steel cladding from both boiling water reactor (BWR) and pressurized water reactor (PWR) electric generating plants. Approximately 90 percent of the fuel bundles now stored in U.S. pools have zircaloy-2 or zircaloy-4 cladding. The nominal compositions for the two alloys are: zircaloy-2, 1.5 Sn, 0.20 Fe, 0.15 Cr, 0.05 Ni; zircaloy-4, 1.5 Sn, 0.24 Fe, 0.13 Cr, 0.005 Ni. Zircaloy-2 is the principal BWR cladding and zircaloy-4 is the principal PWR cladding. The behavior of the two alloys is expected to be similar under pool storage conditions. Only three U.S. power reactors currently operate with stainless steel cladding: Connecticut Yankee (PWR, 600 MWe), San Onofre I (PWR, 450 MWe) and La Crosse (BWR, 56 MWe). Stainless steel fuel cladding materials are alloys 304 and 348H.

2.1.2 MAXIMUM FUEL BURNUPS

Table 2-2 summarizes maximum burnups on fuel now in storage, reported by surveyed U.S. utilities.⁽⁴⁾

* ERDA has been replaced by the Department of Energy (DOE).

TABLE 2-2
MAXIMUM FUEL BURNUPS ON STORED
COMMERCIAL FUEL

<u>Cladding</u>	<u>Reactor</u>	<u>Burnup* MWd/MTU Maximum</u>	<u>Reactor Discharge Date</u>
Zircaloy-2	BWR	25,000	1974
Zircaloy-4	PWR	33,160	1976
Stainless Steel	PWR	33,200	1973
Stainless Steel	BWR	22,000	1975

* Applies to burnup on peak bundle, i.e., fuel bundle subjected to highest neutron fluence.

Fuel burnup expressed as MWd/MTU is a measure of the power generated by the fuel. On the other hand, radiation damage phenomena generally are correlated in terms of neutron fluence (neutrons/cm²). A rigorous conversion from burnup (e.g., MWd/MTU) to fluence must account for the physics of the specific fuel and reactor in question. However, the following expression approximates the conversion for a pressurized water reactor (based on data in WCAP-8837 by H. H. Crain, T. E. Caye, and P. J. Sipush, Tables 2-4 and 2-5):

$$1 \text{ MWd/MTU} \approx 1.7 \times 10^{17} \text{ n/cm}^2, > 1 \text{ MeV.}$$

Thus, the estimated neutron fluence corresponding to 33,000 MWd/MTU is $5.6 \times 10^{21} \text{ n/cm}^2$, > 1 MeV. Values for BWRs would generally be lower due to lower power densities. Changes in cladding properties, such as increased strength, decreased ductility and metal growth have been reported for zircaloy⁽⁵⁾ and stainless steel.⁽⁶⁾ The residual radioactivity in the cladding⁽⁷⁾ and the fission product inventories⁽⁸⁾ and heat generation rate are relateable to fuel burnup, but they decrease with time after discharge, due to radioactive decay.

2.1.3 FUEL CONFIGURATIONS

Figures 2-3, 2-4 and 2-5 show a typical LWR fuel element, typical BWR fuel assembly and typical PWR fuel assembly, respectively. Table 2-3 summarizes the range of materials in stainless- and zircaloy-clad fuel bundles.

2.1.4 COMPOSITION*

Typical characteristics of spent fuel, as listed in Appendix C, are based on operation of a typical large PWR with fuel exposed to 25,000 megawatt-days thermal per metric ton of uranium (MWd/MTU) at a specific power of 35 megawatts per metric ton (MW/MTU). Composition of BWR spent fuel would be

* Extracted from Reference 9.

FIGURE 2-3

CUTAWAY OF TYPICAL OXIDE FUEL ROD FOR
COMMERCIAL LWR POWER PLANT

FIGURE 2-4
TYPICAL BWR FUEL ASSEMBLY

FIGURE 2-5

TYPICAL PWR FUEL ASSEMBLY

TABLE 2-3
FUEL BUNDLE MATERIALS^(a)

<u>Component</u>	<u>Sub-Components</u>	<u>Material</u>	<u>Alloy</u>
Fuel Rods:	—	Zircaloy:	Zry-2 (BWR)
			Zry-4 (PWR)
		Stainless Steel:	304
			348H
Fuel Spacers:	Grid:	Stainless Steel	304
		Inconel	718
		Zircaloy	Zry-4
	Springs:	Inconel	718
Upper Tie Plates:	Bail/Tie Plate	Stainless Steel	304
	Bolts/Nuts	Stainless Steel	304
		Inconel	600
	Springs	Inconel	718
Lower Tie Plates:	Tie Plate/Nozzle	Stainless Steel	304
Tie Rods:		Zircaloy	--
		Stainless Steel	

(a) Some variations on material and alloy specifications may occur.

similar, but its fresh-fuel U-235 content would be from 1 to 10 percent lower. The values shown in the tables represent anticipated maximum burnup of 25,000 MWd/MTU under current operating conditions, although an expectancy of 33,000 MWd/MTU has been indicated by the suppliers.* With operation at this higher burnup, the activity of a number of the long-lived fission products and transuranics would be increased, but by no more than about 30 percent. However, due to periodic reactor shutdowns as necessary for partial refueling of the core and for plant maintenance at least annually, the actual time of fuel residence in the reactor will always be longer than that implied by the specific power and burnup values stated above. Therefore, the activity of intermediate-lived fission products and transuranics (half-life of one to five years) is expected to be reduced from the indicated values. (Appendices A, B and D present composition data for other specific powers and burnups.) The composition data were extracted from output of the ORIGEN computer code at the Oak Ridge National Laboratory.**

2.1.4.1 FISSION PRODUCTS

During its service in a reactor, nuclear fuel undergoes fission. A portion of the initial uranium and some of the plutonium generated in situ is fragmented or fissioned, with a release of heat and the production of fragments, or fission products. These fission products consist of two groups of elements: one group has atomic weights somewhat less than half that of uranium; the other group has atomic weights somewhat more than half that of uranium. Some of these fission product elements are stable and indistinguishable from elements found in nature, while some are unstable (radioactive) and seek a stable state by radioactive decay. A measure of their instability is the half-life of each radionuclide. These half-lives vary from a small fraction of a second to millions of years. Specific

* Nuclear Fuel, September 4, 1978 reports that several nuclear utilities are moving to an 18 month refueling schedule, with somewhat higher uranium enrichments and expected burnups in the 40,000 MWd/MTU range.

** ORIGEN-Oak Ridge National Laboratory model for spent fuel.

activity, a function of decay time, and biological effects of the emitted radiation are the predominant factors in evaluating the human risk of exposure to the radioactive constituents in spent fuels.

Table C-7 (Appendix C) lists the fission product radionuclides present in spent fuel in concentrations that produce more than 0.001 curie per metric ton of uranium contained in the spent fuel after a decay time of 120 days following reactor shutdown (the decay time normally stipulated as a minimum for storage prior to spent fuel reprocessing). This table characterizes each nuclide by its half-life, mode of decay, specific activity, energy (MEV) of the principal modes of decay, and the primary daughter element produced by radioactive decay. Table C-1 (Appendix C) is a tabulation of the radioactivity generated by these nuclides as a function of decay time. The times were chosen to represent the conditions at reactor shutdown (0 days), short storage times (30 and 90 days), release for shipping to a reprocessing plant (normally about 120 days), the maximum average age (365 days) for the fuel in a large spent fuel storage installation, and after 10 years (3,653 days) to show decay characteristics of individual nuclides over a relatively long time period in storage. Table C-2 (Appendix C) shows the quantities of these same radionuclides in units of grams per metric ton of uranium in the fuels, again as a function of decay times over a range of 0 to 3,653 days.

2.1.4.2 TRANSURANICS

During its service in a reactor, a portion of the uranium present also undergoes nuclear transmutation by the absorption of neutrons. Elements formed from uranium, or from further transmutation of uranium absorption products, constitute a group of heavy nuclides known as transuranics.

Table C-8 (Appendix C) lists the transuranics and their daughter products present in spent fuels in concentrations which produce more than 0.0001 curie per metric ton of uranium in the fuel after a decay time of 180 days following reactor shutdown. The nuclides are characterized in the same manner as shown in Table C-7. Similarly, Tables C-3 and C-4 (Appendix C) show the radioactivity and grams per metric ton of uranium, respectively.

2.1.4.3 LIGHT ELEMENTS AND MATERIALS OF CONSTRUCTION

The metallic structural components of reactor fuels also undergo transmutation while in service in a reactor. Table C-8 identifies those radionuclides from this source present in concentrations which produce more than 0.001 curie per metric ton of uranium in the spent fuel. Table C-9 provides the equivalent quantities of light elements. The contribution to total radioactivity of the fuel assembly from this source is minor, being at least two orders of magnitude less than that of the fission products in the fuel.

2.1.5 HEAT GENERATION*

Radioactive decay is a mechanism by which an unstable nuclide reaches a more stable energy state by the ejection of alpha and beta or beta particles from its nucleus and the release of energy in the form of gamma rays. The ejection and absorption by matter of such particles and energy rays produce heat. The radionuclides present in spent fuel produce heat in the fuel by this mechanism. The rate of heat generation reflects the total radioactive decay processes going on at any specific time after reactor shutdown and is a complex function of the quantities of radionuclides present and their decay rates. Figure 2-6 is a plot of heat generation for spent fuel that has been exposed to 25,000 MWd/MTU of reactor operation at a specific power of 35 MW/MTU. Heat decay rate declines from a thermal power of almost 100 KW/MTU at 10 days to less than 1 KW/MTU as delay times approach 10^4 days.

2.2 GENERAL ELECTRIC (BWR) FUEL¹⁰

Tables 2-4 and 2-5 and Figures 2-7 through 2-9 provide specific, detailed fuel assembly design parameters and drawings for General Electric fuel assemblies.

* Extracted from Reference 9.

FIGURE 2-6
SPENT FUEL HEAT GENERATION RATE

TABLE 2-4
GENERAL ELECTRIC FUEL ASSEMBLY DESIGNS

Parameter	1	2
Overall assembly length (cm)	435	435
Active fuel length (cm)	366	366
Nominal envelope	$(13.8 \text{ cm})^2$	$(13.9 \text{ cm})^2$
Avg wt U per assembly (kg)	195	210
Total weight per assembly (kg)	310	275
Fuel rod array	7 x 7	8 x 8
Fuel rod O. D. (cm)	1.45	1.25
Fuel rod clad material	Zirc-2	Zirc-2
Burnable poison material	Gd ₂ O ₃	Gd ₂ O ₃

TABLE 2-5
FUEL PARAMETERS
GENERAL ELECTRIC
BWR 6 (8 x 8)

WEIGHT	275 Kg *		
CLADDING			
Material	Zircaloy-2		
Thickness	0.086 cm		
FUEL COMPOSITION			
UO ₂	210 Kg		
Zircaloy-2	53 Kg		
Zircaloy-4	2 Kg		
Type 304SS	4 Kg		
ACTIVITY PER ASSEMBLY (Ci)	<u>160 days</u>	<u>1 yr</u>	<u>10 yrs</u>
Cladding & Structural	---	---	---
Actinides	---	---	---
Fission Products	1.5×10^3	7.8×10^4	1.1×10^4
HEAT GENERATION (WATTS)			
Actinides	---	---	---
Fission Products	7.0×10^2	3.8×10^2	4.0×10^1

* Total Weight

FIGURE 2-7

BWR-6
(8 x 8) FUEL ASSEMBLY - ISOMETRIC
GENERAL ELECTRIC COMPANY

FIGURE 2-8
BWR-6
8 x 8 FUEL ASSEMBLY
GENERAL ELECTRIC COMPANY

DIM. IDENTIFICATION	A	B	C	D	E	F	G	H	I	J
DIM. INCHES	12.0	5.278	0.241	0.260	0.120	0.147	0.1525	0.640		

DIM. IDENTIFICATION	K	L	M	N	O	P	Q	R	S	
DIM. INCHES	4.875	0.241	1.563						0.400	

FIGURE 2-9
BWR-6
TYPICAL CORE CELL
GENERAL ELECTRIC COMPANY

2.3 WESTINGHOUSE (PWR) FUEL¹¹

Tables 2-6 and 2-7 and Figures 2-10 and 2-17 provide specific, detailed fuel assembly design parameters and drawings for Westinghouse fuel assemblies.

2.4 COMBUSTION ENGINEERING (PWR) FUEL¹²

Tables 2-8 and 2-9 and Figures 2-11 through 2-14 provide specific, detailed fuel assembly design parameters and drawings for Combustion Engineering fuel assemblies.

2.5 BABCOCK & WILCOX (PWR) FUEL^{13, 14}

Tables 2-10 and 2-11 and Figures 2-15 through 2-16 provide specific, detailed fuel assembly design parameters and drawings for Babcock & Wilcox fuel assemblies.

Overall assembly length (cm)	283	352	352	410	410	415	418	418	410
Active fuel length (cm)	231	309	305	366	366	366	366	366	366
Nominal envelope	(18.2 cm) ²	(21.4 cm) ²	(19.7 cm) ²	(21.4 cm) ²	(19.7 cm) ²	(21.4 cm) ²	(21.4 cm) ²	(21.4 cm) ²	(21.4 cm) ²
Avg wt U per assembly (kg)	255	410	340	445	390	445	450	445	521
Total weight per assembly (kg)	-	600	485	650	570	650	650	640	656
Fuel rod array	18 x 18	15 x 15	14 x 14	15 x 15	14 x 14	15 x 15	15 x 15	15 x 15	17 x 17
Fuel rod O. D. (cm)	0.86	1.07	1.07	1.07	1.07	1.07	1.07	1.07	0.95
Fuel rod clad material	SS	SS	SS	Zirc-4	Zirc-4	Zirc-4	Zirc-4	Zirc-4	Zirc-4
Burnable poison material	-	-	-	Boro-silicate glass	Borated pyrex	Boro-silicate glass	Borated pyrex	Boro-silicate glass	Boro-silicate glass

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TABLE 2-7
FUEL PARAMETERS
WESTINGHOUSE
17 x 17 FUEL ASSEMBLY¹¹

WEIGHT 656 Kg

CLADDING

Material Zircaloy-4
Thickness .057 cm
Conductivity ---

FUEL COMPOSITION

UO₂ 521 Kg
Zircaloy-4 129 Kg
Inconel 625 ?
Type 304SS ?

ACTIVITY PER ASSEMBLY (Ci)	<u>160 days</u> ⁽¹⁾	<u>1 yr</u>	<u>10 yrs</u>
Cladding & Structural	1.1×10^4	4.0×10^2	9.6×10^2
Actinides	5.1×10^4	4.6×10^4	2.9×10^3
Fission Products	1.7×10^6	8.9×10^5	1.3×10^5

(1) time after discharge

DECAY HEAT PER ASSEMBLY
(WATTS)

	<u>160 days</u>	<u>1 yr</u>	<u>10 yrs</u>
Actinides	3.4×10^2	1.9×10^2	9.0×10
Fission Products	7.7×10^3	4.2×10^3	4.3×10^2

CORROSION PRODUCTS ON STRUCTURAL
MEMBERS OF FUEL ASSEMBLIES

<u>RADIONUCLIDE</u>	<u>CI/ASSEMBLY</u>	<u>ELEMENT</u>	<u>MASS (gms)</u>
Cr-51	0.21	Cr	0.23
Mn-54	0.05	Fe	1.86
Co-58	0.70	Co	7.0×10^{-3}
Fe-59	0.03	Ni	2.56
Co-60	0.11	Zr	0.40
Zr-95	0.01

TABLE 2-8
COMBUSTION ENGINEERING FUEL ASSEMBLY DESIGNS

Parameter	1	2	3	4	5	6
Overall assembly length (cm)	378	426	399	464	464	449*
Active fuel length (cm)	335.3	344.7	347.2	348	381	381
Nominal envelope	(20.6 cm) ²	(20.8 cm) ²	(20.8 cm) ²	(20.8 cm) ²	(20.8 cm) ²	(20.2 cm) ²
Avg wt U per assembly (kg)	415	375	375	375	450	485
Total weight per assembly (kg)	615	590	570	570	650	652
Fuel rod array	15 x 15	14 x 14	14 x 14	14 x 14	14 x 14	16 x 16
Fuel rod O. D. (cm)	1.05	1.12	1.12	1.12	1.12	0.97
Fuel rod clad material	Zirc-4	Zirc-4	Zirc-4	Zirc-4	Zirc-4	Zirc-4
Burnable poison material	B ₄ C	B ₄ C	B ₄ C	B ₄ C	-	B ₄ C

* This value applies to the 16 x 16 core array used at Arkansas Nuclear 1. The later CE "System 80" plants are currently designed with a 16 x 16 array; of the parameters listed in this table, only the overall assembly length differs in the "System 80" design, and it is 453 cm. The weight may be greater by a small amount, of course, with the additional assembly length.

TABLE 2-9
FUEL PARAMETERS
COMBUSTION ENGINEERING
SYSTEM 80 ASSEMBLY
(16 x 16)

WEIGHT 652 Kg
CLADDING

Material Zircaloy-4
Thickness 0.089 cm

FUEL COMPOSITION

UO₂ 485 Kg
Zircaloy-4 134 Kg
Inconel 625 1.0 Kg
Type 304SS 3.3 Kg

ACTIVITY PER ASSEMBLY (Ci)	<u>160 days</u>	<u>1 yr</u>	<u>10 yrs</u>
Cladding & Structural	7.1×10^3	2.7×10^3	6.5×10^2
Actinides	3.4×10^4	3.1×10^4	2.0×10^4
Fission Products	1.1×10^6	6.0×10^5	8.6×10^4

HEAT GENERATION (WATTS)

Actinides	2.3×10^2	1.3×10^2	6.1×10
Fission Products	5.2×10^3	2.8×10^3	2.9×10^2

CORROSION PRODUCTS ON STRUCTURAL MEMBERS
OF FUEL ASSEMBLIES

<u>ISOTOPE</u>	<u>Ci/ASSEMBLY</u>	<u>ELEMENT</u>	<u>MASS (gms)</u>
Cr-51	0.17	Cr	0.19
Mn-54	0.04	Fe	1.55
Co-58	0.58	Co	0.006
Fe-59	0.02	Ni	2.13
Co-60	0.09	Zr	0.33
Zr-95	0.01

FIGURE 2-11

SYSTEM 80 FUEL ROD
COMBUSTION ENGINEERING

FIGURE 2-12

SYSTEM 80 FUEL ASSEMBLY
COMBUSTION ENGINEERING

FIGURE 2-13

SYSTEM 80 FUEL SPACER GRID
COMBUSTION ENGINEERING

FIGURE 2-14

SYSTEM 80 FUEL ASSEMBLY HOLD DOWN
COMBUSTION ENGINEERING

TABLE 2-10
BABCOCK & WILCOX FUEL ASSEMBLY DESIGNS^{13, 14}

<u>PARAMETER</u>	<u>1</u>	<u>2</u>
Overall assembly length (cm)	421	421
Active fuel length (cm)	366	363
Nominal envelope	$(21.7 \text{ cm})^2$	$(21.7 \text{ cm})^2$
Avg wt U per assembly (kg)	465	520
Total weight per assembly (kg)	700	746
Fuel rod array	15 x 15	17 x 17
Fuel rod O. D. (cm)	1.09	0.96
Fuel rod clad material	Zirc-4	Zirc-4

TABLE 2-11

FUEL PARAMETERS
 BABCOCK & WILCOX
 MARK C ASSEMBLY^{13, 14}
 (17 x 17)

WEIGHT 746 Kg

CLADDING

Material Zircaloy-4
 Thickness 0.119 cm

FUEL COMPOSITION

UO₂ 520 Kg
 Zircaloy-4 228 Kg

ACTIVITY PER ASSEMBLY (Ci)	<u>160 days</u>	<u>1 yr</u>	<u>10 yrs</u>
Cladding & Structural	8.8×10^3	3.4×10^3	8.1×10
Actinides	4.3×10^4	3.8×10^3	2.4×10^4
Fission Products	1.4×10^6	7.0×10^5	10.0×10^4

HEAT GENERATION PER
ASSEMBLY

	<u>160 days</u>	<u>1 yr</u>	<u>10 yrs</u>
Actinides	2.8×10^2	1.6×10^2	7.6×10
Fission Products	6.5×10^3	3.5×10^3	3.6×10^2

EXTERNAL CORROSION PRODUCTS

<u>ISOTOPE</u>	<u>Ci/ASSEMBLY</u>	<u>ELEMENT</u>	<u>MASS (gms)</u>
Cr-51	0.18	Cr	0.20
Mn-54	0.04	Fe	0.16
Co-58	0.60	Co	0.006
Fe-59	0.02	Ni	2.22
Co-60	0.09	Zr	0.34
Zr-95	0.01

FIGURE 2-15

MARK C FUEL ASSEMBLY
BABCOCK & WILCOX

FIGURE 2-16

MARK C PRESSURIZED FUEL ROD ASSEMBLY
BABCOCK & WILCOX

SPECIFIC DIMENSIONS DEPEND ON DESIGN VARIABLES SUCH AS
PRE-PRESSURIZATION, POWER HISTORY, AND DISCHARGE BURNUP

FIGURE 2-17

FUEL ROD SCHEMATIC
WESTINGHOUSE

3.0 COMPOSITION OF SPENT FUEL AND FUEL BUNDLES IN THE SPENT FUEL STORAGE POOL

Spent fuel is stored in the spent fuel storage pool for a period of at least 120 days following reactor shutdown.

Appendix E describes the design of the spent fuel pool for both commercial light water reactor types and the operations associated with refueling.

3.1 COMPOSITION OF SPENT FUEL

Appendices A, B, C and D give inventories of fission products in fuel rods as a function of time after reactor discharge.

3.2 COMPOSITION OF THE MATERIAL DEPOSITED EXTERNALLY TO THE SPENT FUEL

The activation products on the cladding of the spent fuel come principally from corrosion products from the reactor primary circuits which deposit as crud layers on fuel bundle surfaces (Fe_2O_3 , Fe_3O_4 , spinels, sometimes oxides of nickel and copper). Crud layers may be 25 to 50 μm thick, particularly on BWR fuel rods. The layers generally are thinner and sometimes are almost absent on PWR fuel rods. The crud layers are quite insoluble at fuel temperatures, but do release some particulates to the pool water, together with traces of soluble species. The corrosion products on zircaloy rods (ZrO_2) also have low solubilities and generally resist spallation. As described in Appendix E, some of the fission products escape to the spent fuel storage pool.

3.3 FUEL BUNDLE MATERIALS

Table 3-1 describes the materials contained in stainless- and zircaloy-clad fuel bundles.

TABLE 3-1
FUEL BUNDLE MATERIALS

<u>Component</u>	<u>Sub-Components</u>	<u>Material</u>	<u>Alloy</u>
Fuel Rods:	—	Zircaloy:	Zry-2 (BWR) Zry-4 (PWR)
		Stainless Steel:	304 348H
Fuel Spacers:	Grid:	Stainless Steel Inconel Zircaloy	304 718 Zry-4
	Springs:	Inconel	718
Upper Tie Plates:	Bail/Tie Plate	Stainless Steel	304
	Bolts/Nuts	Stainless Steel Inconel	304 600
	Springs	Inconel	718
Lower Tie Plates:	Tie Plate/Nozzle	Stainless Steel	304
Tie Rods:		Zircaloy Stainless Steel	—

4.0 SPENT FUEL TRANSPORTATION/SHIPPING CASKS

The following section provides a summary of current spent fuel transportation practices and a detailed description of fuel shipping casks now being designed or used by the nuclear industry.

4.1 TRANSPORTATION PRACTICES*

Irradiated nuclear fuel has been transported in the United States since the mid-1940's, with numerous shipping cask designs developed because of the variety of AEC (ERDA), military, research, and commercial nuclear reactors in service. Experience gained in the design and use of these casks, plus stringent NRC and Department of Transportation (DOT) regulations, have led to the present generation of LWR shipping casks.

All spent LWR fuel transported in the United States currently is shipped in heavily shielded casks by truck or rail. Truck casks weigh 25-35 tons when fully loaded and will normally accommodate one to three PWR or two to seven BWR fuel assemblies. Rail casks can weigh in excess of 100 tons fully loaded and can take seven to 12 PWR or 18 to 32 BWR fuel assemblies. Barge shipment remains unexploited. Since air shipment of plutonium in any form is presently precluded by law, spent fuel cannot be transported by air.

The primary reliance for safety in transport of irradiated nuclear fuels is based on the shipping cask design. Cask design and operation are influenced by regulations imposed by the NRC, DOT, and the individual states. These regulations are described below.

* Summary extracted in part from Reference 9.

4.1.1 REGULATORY AND STATE REQUIREMENTS

Strict criteria regarding allowable radiation levels, criticality safety, heat dissipation, and release of radioactive materials have been established for spent fuel shipping casks. Cask design must prevent loss or dispersal of spent fuel under normal operating and severe design base accident conditions.

Primary responsibility for overseeing the transportation of radioactive materials in the United States rests with the DOT and NRC. State requirements are normally auxiliary regulations that pertain to transportation routes in highway weight limits, or require additional safety measures.

Some degree of overlap does exist between the NRC and DOT, but a memorandum of understanding signed in 1966 and revised in March of 1973 generally delineates the authority of the DOT as setting standards for marking, labeling, safety in shipment (radiation levels, temperature, etc.), regulating shippers and carriers, and approving various packages as suitable for transport of radioactive materials. The authority of the NRC (then AEC) was set forth as reviewing and approving shipping containers for fissile, Type B, and large quantities of radioactive materials as defined by Title 49 CFR 173.389. This represents almost all radioactive materials.

FEDERAL

NRC regulations for the transport of radioactive materials are set forth in "Standards for Protection Against Radiation" (10 CFR Part 20), and "Packaging of Radioactive Materials for Transport and Transportation of Radioactive Material Under Certain Conditions" (10 CFR Part 71).

The packaging and shipping requirements for transport of radioactive materials are a function of the quantity, type, and fissile characteristics of the isotopes being shipped. The "transport group" of an isotope refers to any one of seven

groups into which radioactive materials in normal form are classified according to toxicity and potential hazard in transport as defined by Title 49 CFR Part 173.389. Because of the presence of plutonium and other highly toxic isotopes, irradiated nuclear fuel is classified as Transport Group I, the most restrictive grouping.

The quantities of isotopes which can be shipped as Type A, Type B, or large quantities vary with the transport group. Spent nuclear fuel is shipped under a large-quantity designation.

Shipments of fissile material are classified as either Fissile Class I, II, or III, as defined by Title 49 CFR Part 173.389. Spent fuel shipments are rated as the most restrictive class, Fissile Class III, which requires special arrangements between the shipper and carrier to ensure nuclear criticality safety for shipment.

The general NRC criteria for packaging and shipment of radioactive materials are given in 10 CFR Part 71, Subparts B, C, and D. Because of the large-quantity designation for irradiated fuel shipments, spent fuel casks must also be designed to meet hypothetical accident conditions when applied sequentially. The hypothetical accident conditions and the resultant cask condition, as set forth, represent what are considered reasonably conservative estimates of what a transportation accident might involve.

NRC regulations for transportation of radioactive materials are also included in 10 CFR Part 20, and require a receiver to check any package (cask) for smearable contamination within three hours after receipt and to notify the carrier and the NRC immediately if contamination levels above 22,000 dpm/100 cm² are found. Records must be kept of all such cask surveys and monitorings. Licensees must also maintain and follow established procedures for opening or handling any shipping cask.

Security requirements for protection of special nuclear materials given in 10 CFR Part 73, "Physical Protection of Plants and Materials," paragraphs 73.30-73.36, 73.60, and 73.70, do not apply for spent fuel shipments because of the exemption granted for special nuclear material (SNM) that is not readily separable from other radioactive material and that has a dose rate greater than 100 rem per hour at a distance of three feet when there is no intervening shielding.

DOT regulations for transportation of radioactive materials are given in 49 CFR ("Transportation") Parts 170-179. These regulations set the criteria for radiation levels, surface temperatures, surface contamination levels, bill of lading information, labeling, placarding, shipper certification, accident response, and general packaging.

In 1974 the DOT proposed a new labeling system for hazardous materials called the DOT HI system. If adopted, this system will alter the information given below and would require additional emergency response information to be carried with the shipment.

Spent fuel casks are transported in exclusive-use vehicles and must be filled only by the consignor and opened only by the consignee. Allowable radiation limits for exclusive-use vehicles are:

- 1000 mR/hr at three feet from the external surface of the package (cask)
- 200 mR/hr at any point from the external surface of the vehicle (truck or rail car)
- 10 mR/hr at six feet from the external surface of the vehicle
- 2 mR/hr in any normally occupied position in the vehicle

Because of the large size of the packages used for shipping irradiated fuel, the limiting factor will be the radiation level at either three feet from the surface of the package or six feet from the vehicle. Therefore, the radiation levels at the package surface will be considerably below those allowed by the regulation.

Based on actual experience, radiation levels around some irradiated fuel casks may exceed 200 mrem/hr at the surface of the cask, but will meet the limitations of 1,000 mrem/hr for closed vehicle shipments. In order to meet the limitation of 10 mrem/hr at six feet from the vehicle surface, the level will rarely exceed about 50 or 60 mrem/hr at the vehicle surface, or 25 mrem/hr at three feet from the truck or rail car.

Although a radiation level of 2 mrem/hr is permitted in a truck cab, the level based on actual experience is unlikely to exceed 0.2 mrem/hr, because of the distance from the cask and shielding provided by intervening material.

Surface contamination levels must be 2,200 dpm/100 cm² or less for beta-gamma (β - γ) radiation, and less than or equal to 220 dpm/100 cm² for alpha (α) radiation.

Heat generated within shipping casks must be dissipated so as not to affect the efficiency of the cask or to damage the contents. Maximum accessible external surface temperature of a package (cask) transported as an exclusive use shipment must be 180°F or less.

STATE AND LOCAL

State and local regulations on the transport of nuclear materials are normally limited to those requirements for any type of vehicle traffic, such as gross vehicle weight and dimensions. Overweight shipments are sometimes subject to limitations on routing and time of operation. In addition, some states have adopted or are considering regulations to cover the following:

- Routing restrictions, speed limits, or blanket prohibitions on shipments
- Advance notification of shipments and approval by states
- Inspection of shipments
- Pilot vehicles or escorts
- Special training of drivers, additional monitoring personnel, and emergency plans
- Requiring drivers to carry copies of state regulations
- Special-use trains
- Classifying drivers as radiation workers
- Emergency preparedness by state officials

The effect each of the above can have on transportation of spent fuel will vary from state to state and will have to be evaluated on an individual basis.

4.2 DESCRIPTION OF CASKS

At present, all spent fuel shipments in the United States are by truck or rail casks. Truck casks are more mobile and much lighter than rail casks. Truck casks are limited to a loaded weight of about 25 tons because of the maximum 73,280-pound load limit (tractor-trailer included) for most highways. Weights up to 35 tons are usually acceptable on an overweight basis, although most states will require certain restrictions, such as routings, time of travel, or early notification of shipment. Rail casks weigh about 100 tons fully loaded, and have a much larger fuel assembly capacity. (It would take six trips with a truck cask to carry the same amount of fuel that could be transported in a fully loaded rail cask.)

One advantage to truck casks is the faster turn-around time, about three to four days being necessary for a 3,200-kilometer round trip with a truck cask, compared with nine days for a rail cask. Experience at one reprocessing plant showed two round trips of 177 kilometers each were possible in slightly more than four hours with a truck cask. Truck casks will still be needed for those reactors without rail facilities. Of the 89 reactors scheduled for operation by 1980, 56 percent have rail spurs at the site. Table 4-1 summarizes those casks in the United States that are either presently licensed or known to be in the planning/fabrication stage and that are capable of transporting spent LWR fuel.

The majority of those casks presently licensed or known to be in the planning/fabrication stage in the United States are discussed in more detail below.

4.2.1 TRUCK CASKS

NFS-4—The Nuclear Fuel Services NFS-4 is a water-filled 1 PWR/2 BWR truck cask. The license application was submitted in January 1972, with final AEC approval in November 1972. The first two casks were completed in 1973. The cask has an internal cavity 452 cm long by 34 cm in diameter, with interchangeable baskets for either PWR or BWR fuel assemblies. Surrounding the cavity for gamma shielding and structural strength is 16.8 cm of lead and about 4 cm of stainless steel (in several layers). Neutron shielding is provided around the body by 11.4 cm of borated water-antifreeze solution. The cask lid is held down with high-strength bolts and sealed with Teflon O-rings. Stainless-steel-encased balsa wood impact limiters are provided around the side and ends of the cask. (See Figure 4-1.)

Heat rejection is by convection through the water coolant in the cavity to the inner wall, conduction to the neutron shield, convection to the outer wall, and convection plus radiation to the atmosphere. Maximum heat rejection capacity

TABLE 4-1
SUMMARY TABLE
SPENT FUEL CASKS

Cask ^a	Primary Transport Mode	Weight Loaded, tons ^{**}	Capacity in Elements, PWR/BWR	Fluid in Cavity	Cavity Length/Dia., cm	Design Heat Generation Rate, kW	Major γ Shielding	Neutron Shielding	Casks Available Jan. 1976
NAC-1	Truck	25	1/2	Water	452/34	11.5	Lead and steel	Borated H ₂ O antifreeze	4
NFS-4	Truck	25	1/2	Water	452/34	11.5	Lead and steel	Borated H ₂ O antifreeze	2
NLI-1/2	Truck	24	1/2	Helium	452/32	10.6	Lead and steel	Water	2
NLI-10/24	Rail	97	10/24	Helium	455/114	77	Lead and steel	Water	-
TN-8	Truck/rail	40	3 PWR	Air	427/170	35.5	Lead and steel	Borated solid resin	-
TN-9	Truck/rail	38	7 BWR	Air	452/170	24.5	Lead and steel	Borated solid resin	-
TN-12 ^{***}	Rail	107	12/32	Air	467	135	Steel	Borated solid resin	-
IF-300	Rail	68	7/18	Water	458/95	61.5	Uranium and steel	Water	4

^aCask initials:

NAC = Nuclear Assurance Corporation

NFS = Nuclear Fuel Services, Inc.

NLI = NL Industries (previously National Lead Company)

TN = Trans Nucléaire

IF = "Irradiated Fuel", symbol used by General Electric Corporation.

^{**}Not including auxiliaries.

^{***}Not authorized by U.S. Nuclear Regulatory Commission.

FIGURE 4-1
SCHEMATIC OF NFS-4 SPENT FUEL SHIPPING CASK

is 11.5 kW. Maximum design conditions for the inner cavity during normal transport are 174°C at 150 psig. Normal pressure upon receipt is almost always less than 5 psig, however, so the design is quite conservative. Under the maximum fire accident, the cask will withstand 222°C at 948 psig with no loss of containment.

TN-8—The Transnuclear TN-8 is a 40-ton truck cask designed to transport three PWR assemblies in an air atmosphere. The TN-8 will normally travel under overweight restrictions, although several could be placed together on a rail car. A license was granted by the AEC in 1974. Casks of the same design are presently operated in Europe. The TN-8 has an inner cavity length of 427 cm, with three separate cubicles of 24 x 24 cm for the individual assemblies. Shielding is by 18.5 cm of lead and 6 cm of steel (in several layers). Neutron shielding is provided by 15 cm of borated solid resin. Shock absorbing covers are attached to the top and bottom of the cask. (See Tables 4-2 and 4-3 for detailed characteristics. See also Figures 4-2 and 4-3.)

Maximum design heat generation is based on 35.5 kW. During normal operation the maximum temperature of the inner shell(s) is 115°C. Heat rejection is via conduction through the cask body to the outer wall, with convection and radiation from copper cooling fins on the outside. Pressure is stated to be atmospheric during transport. The cavity design pressure is 110 psig.

A unique feature of the TN-8 is a cylindrical shell which is placed around the outside of the cask before it is lowered into a loading or unloading pool. The annular space is filled with clean water during loading. This, along with other devices to protect the ends of the cask, minimizes contamination of the cask surface and therefore reduces decontamination time and expense.

TN-9—The Transnuclear TN-9 is essentially identical to the TN-8 except the TN-9 is designed for seven BWR assemblies. The inner cask cavities are 25 cm longer, with the cask design heat generation rate equal to 24.5 kW. (See Tables 4-2 and 4-4 and Figures 4-4 and 4-5 for details.)

TABLE 4-2
TN-SPENT FUEL CASK - DETAILED CHARACTERISTICS

PACKAGING	TN 8	TN 9	TN 12
FUEL			
Type of Fuel	PWR	BWR	PWR/BWR
Number of Assemblies	3	7	12/32
Average Burnup, MWD/TU	38,500	36,500	38,500/36,500
Minimum Cooling Time, Days	150	150	150
Maximum Residual Power, KW	35.5	24.5	135
CAVITY			
Fluid During Transport	Air	Air	Air
Pressure During Transport	<-----Atmospheric----->		
Design Pressure, psia	125	125	440
Cavity Length	14'	14'10"	15'3"
SHIELDING			
Gamma Shield Material	Lead	Lead	Steel
Gamma Dose Rate (2 m from surface), mr/hr	6.5	6.5	6.5
Neutron Shield Material	<-----Borated Solid Resin----->		
Neutron Dose Rate (2 m from surface), mr/hr	2	2	2
HEAT REJECTION			
Surface	Nickel Plated Copper Fins		
Mode	Natural Convection & Radiation		
OVERALL DIMENSIONS			
Outside Diameter	5'8"	5'8"	8'2"
Length With Covers	18'1"	18'11"	22'1"
Length Without Covers	16'	16'10"	17'6"
WEIGHT			
Total Weight, Loaded, lb.	78,000	77,600	213,800
Total Weight, Empty, lb.	73,200	73,000	183,000
Weight, Two Covers, lb.	1,820	1,820	5,230
Weight, Lid, lb.	1,870	1,510	7,710

The TN-12 cask is also available with an extension. This cask has the following different data:

Cavity Length: 16'3"
 Length With Covers: 23'7"
 Total Weight, Loaded, lb: 225,000
 Total Weight, Empty, lb: 194,000

TABLE 4-3
TN-8 DATA SHEET

1. AEC Certificate of Compliance Number: SNM-1474 Amendment 71-1.
2. Common Name: Transnuclear, TN-8
3. Date of Most Recent AEC Certificate Revision: May 14, 1974
4. Description of Packaging:

The inner steel lined cavity is divided into three compartments which are surrounded in order, by a lead shield, a secondary steel containment, a solid resin neutron shield. Nickel plated copper fins protrude through the resin and dissipate heat energy to the surrounding air by natural convection and radiation. Balsa wood is located inside removable covers and fixed end drums to provide impact protection. The atmosphere in the cavity is dry air near atmospheric pressure.
5. Interior and Exterior Dimensions: Three compartments 9.1 inches by 9.1 inches by 168 inches, each. Outside diameter 67.5 inches, length with covers 218 inches, without covers 192 inches.
6. Type and Thickness of Shielding: Lead - 7 inches, Resin - 6 inches.
7. Authorized Contents: Three irradiated PWR fuel assemblies.
8. Heat Removal Capacity: 35.5 kw
9. Special Conditions of Use: Truck transport on custom trailer with overweight permit.
10. Number of Packagings Owned: As of January 1975, two in fabrication for use in U.S.A.
11. Identification and Date of Safety Analysis Report:

Transnuclear, Inc. TN-8/9 Safety Analysis Report
Rev. 4, May 6, 1974 - Docket No. 70-1375.
12. IAEA Certified: Yes
13. Other Pertinent Data: Two TN-8's are operational in Europe.

FIGURE 4-2
TN-8 PACKAGING

FIGURE 4-3

TRANS NUCLEAR, INC. MODEL TN-8 PACKAGING CROSS-SECTION

TABLE 4-4
TN-9 DATA SHEET

1. AEC Certificate of Compliance Number: SNM-1474 Amendment 71-2.
2. Common Name: Transnuclear, TN-9
3. Date of Most Recent AEC Certificate Revision: May 14, 1974
4. Description of Packaging:

The inner steel lined cavity is divided into seven compartments which are surrounded in order, by a lead shield, a secondary steel containment, a solid resin neutron shield. Nickel plated copper fins protrude through the resin and dissipate heat energy to the surrounding air by natural convection and radiation. Balsa wood is located inside removable covers and fixed end drums to provide impact protection. The atmosphere in the cavity is dry air near atmospheric pressure.

5. Interior and Exterior Dimensions: Seven compartments 5.9 inches by 5.9 inches by 178 inches, each. Outside diameter 67.5 inches, length with covers 227 inches, without covers 198 inches.
6. Type and Thickness of Shielding: Lead - 7 inches, Resin - 6 inches.
7. Authorized Contents: Seven irradiated PWR fuel assemblies.
8. Heat Removal Capacity: 35.5 kw
9. Special Conditions of Use: Truck transport on custom trailer with overweight permit.
10. Number of Packagings Owned: As of January 1975, two in fabrication for use in U.S.A.
11. Identification and Date of Safety Analysis Report:
Transnuclear, Inc. TN-8/9 Safety Analysis Report
Rev. 4, May 6, 1974
12. IAEA Certified: Yes
13. Other Pertinent Data: Two TN-9's are operational in Europe.

FIGURE 4-4
TN-9 PACKAGING

FIGURE 4-5

TN-3 PACKAGING CROSS-SECTION

NLI ½--The National Lead Industries NLI ½ is a 24-ton helium-filled 1 PWR/2 BWR truck cask. The cask can be used with an optional 600 mm inner container that provides an additional level of confinement. Initial issue of the SAR was in December 1972, with NRC approval granted in March 1975. The cask has a cavity length of 452 cm and a diameter of 34 cm, or 32 cm if the optional inner container is used. Shielding around the body is provided by 7 cm of depleted uranium, 5.4 cm of lead, and 3.8 cm of steel (in several layers). Neutron shielding is provided by 12.7 cm of water. Two lids are used to seal the cask at the top. Depleted uranium and steel are used for shielding on the ends.

Maximum heat generation rate is based on 10.6 kW. Maximum fuel temperature under conditions of normal transport is conservatively estimated at 545°C. Normal maximum design pressure is 120 psig when the inner container is used, or 22.5 psig when it is absent. Maximum fuel temperature during a fire accident condition is 594°C. The cask has a pressure rating of 543 psig at 454°C when the inner container is used, at 264 psig at 454°C when it is absent.

At the present time, there are three NLI-½ casks in the United States, and there are plans to fabricate seven more eventually.

4.2.2 RAIL CASKS

TN-12--The Transnuclear TN-12 is a 107-ton rail cask capable of accommodating 12 PWR or 32 BWR fuel assemblies in an air atmosphere. This cask is undergoing licensing review in Europe, and once a license is obtained there, the company plans to submit its application to the NRC for use in the United States.

The cask has an inner cavity 373 cm long, and has an extension that will allow use of the cask for fuel assemblies up to 502 cm long. Total loaded cask weight is 116 tons with the extension in place. (See Table 4-2 for details.)

Numerous features designed to improve operation and reduce operator dose commitments are said to be included as a result of the company's experience in Europe. The cask uses a solid stainless steel body for gamma shielding and a borated solid resin for neutron attenuation. Maximum heat rejection is based on 135 kW. Design pressure is 425 psig.

NLI 10/24—The National Lead Industries NLI 10/24 authorized by NRC in June 1976, is a 97-ton, helium-filled, 10 PWR/24 BWR rail cask. No casks have been delivered yet, but NLI expects to eventually build a total of 15. Four are under construction.

The cavity is 455 cm long by 114 cm in diameter. The cask has two interchangeable aluminum baskets for use with PWR or BWR fuel. Gamma shielding is provided by 15 cm of lead plus about 5-8.6 cm of stainless steel (in several layers). Neutron shielding is provided by nine inches of water. Depleted uranium shielding is used on the cask ends and at strategic locations in the cask wall. Impact structures are used to protect the cask ends and sides. Two closure heads are used. (See Table 4-5 and Figures 4-6 and 4-7.)

Maximum heat generation rate is based on 77 kW (including an axial peaking factor of 1.1). Two auxiliary cooling systems are provided to circulate water through channels alongside the inner cavity. Auxiliary cooling is not needed for the cask during fire accident conditions. Without auxiliary cooling and at maximum heat generation rate (including 1.1 axial peaking factor), the average fuel temperature is 348°C. Without the cooling system in operation, heat dissipation is by conduction through the body to the neutron shield, convection to the outer surface, and convection plus radiation from the finned outer surface to the atmosphere. Maximum fuel temperature during fire accident conditions is 533°C. Normal cavity pressure during transport is expected to be about 23 psig, with a maximum internal pressure of 105 psig occurring in the fire accident.

TABLE 4-5

NLI 10/24: RAIL CASK SYSTEM FOR THE TRANSPORTATION
OF IRRADIATED FUEL ELEMENTS - DESCRIPTION

Cask Capacity:	10-PWR Assemblies 24-BWR Assemblies
Basket:	Interchangeable PWR/BWR aluminum
Cask Package Dimensions:	Diameter-88" Length-204.5"
Cask Cavity Dimensions:	Diameter 45" Length-179.5"
Cask Weight:	200,000 pounds, loaded
System Weight:	Cask, rail car and secondary cooling units-335,000 pounds
Rail car:	59' length, with unlimited rail interchange capabilities (6000 lbs./linear foot)
Shielding:	Gammas - Lead and Uranium/steel combination Neutron - Water
Criticality:	Stainless steel clad Ag/In/Cd alloy

FIGURE 4-6
NLI 10/24 RAIL CASK
FOR SPENT FUEL SHIPPING

NLI 10/24 RAIL CASK FOR SPENT FUEL SHIPPING

DESIGN FEATURES

Dry Shipment

Double Containment

Low Pressure 23 psig Helium

Redundant Lifting System
Capability

Passive cooling

Redundant auxiliary cooling without
primary boundary penetration

FIGURE 4-7
NLI 10/24 RAIL CASK CROSS-SECTION

IF-300—The General Electric IF-300 is a 68-ton water-filled rail cask capable of transporting seven PWR or 18 BWR fuel assemblies. Licensing was begun in January 1971 and approval was granted by the AEC in 1973.

The IF-300 is provided with two interchangeable stainless steel baskets, one for each type of fuel. Gamma shielding around the body is provided by a combination of 10 cm depleted uranium clad with stainless steel. Shielding around the cask ends is provided by 7.6 cm of depleted uranium clad in stainless steel. Neutron shielding is provided by the water in the cask plus an annular layer outside the gamma shield. The outer wall and ends of the cask are finned for impact protection. (See Figures 4-8 through 4-11.)

Maximum heat generation is based on 76.7 kW. Cooling is provided by convection to the inner cavity wall, conduction to the outer neutron shield and convection to the corrugated outer wall. Forced air impingement is used to cool the outer shell. During normal operation, the maximum fuel temperature is expected to be 163°C. If the forced air impingement system is lost, the temperature will rise to a maximum of 221°C. If shielding water is lost from the outer compartment, the maximum fuel temperature could reach 788°C, but only after all the inner cavity water has boiled off. It has been conservatively estimated that this would require more than two days.

4-24

FIGURE 4-8

IF 300 SPENT FUEL SHIPPING CASK
SHOWN IN NORMAL RAIL TRANSPORT CONFIGURATION

FIGURE 4-9

IF 300 NINE-AXLE TRUCK SHIPMENT

FIGURE 4-10
IF 300 BWR - CASK

FIGURE 4-11
IF 300 PWR - CASK

5.0 ACCIDENT CONSIDERATIONS/POTENTIAL RADIOACTIVITY RELEASES

The purpose of this section is to provide a description of typical postulated accident failure modes for spent fuel (during pool storage and transportation) and the radioactivity releases which may be associated with incidents of this type. This data may then be used to develop engineered safety features to prevent such incidents and/or to estimate the potential individual and population radiation exposures which could result.

The objective is to give the reader a feeling for the mechanisms and magnitude of such postulated occurrences.

5.1 GENERAL SAFETY AND ACCIDENT CONSIDERATIONS*

To be a potential radiological hazard to the general public, radioactive materials must be released from a facility and dispersed off-site. For this to happen:

- The radioactive materials involved must be available in a dispersable form,
- There must be a mechanism available for the release of such materials from the facility, and
- There must be a mechanism available for off-site dispersion of such released material.

Although the inventory of radioactive materials contained in aged spent fuels may be in the order of a billion curies or more, very little is available in a dispersable form; there is no mechanism available for the release of radioactive materials in significant quantities from the facility; and the only mechanism available for off-site dispersion is atmospheric dispersion. Increased spent fuel storage with AR (at reactor) or AFR (away from reactor) storage normally involves only aged fuel. The underwater storage of aged spent fuels is an operation involving an extremely low risk of a catastrophic release of radioactivity.

* Extracted from Reference 9

The radioactive materials present in a spent fuel storage installation are:

- The spent fuel in storage
- Impurities in the pool water
- The "crud" deposits on the surfaces on the fuel pins and fuel assembly structural components
- Airborne radioactivity, primarily due to entrainment in evaporating pool water
- Impurities removed from the pool waters by filtration and ion exchange treatment
- Wash solutions generated during shipping cask cleanup and miscellaneous decontamination operations
- Dry materials such as contaminated protective clothing, blotting paper, cleaning materials and ventilation system filters.

5.1.1 COMPOSITION OF SPENT FUEL

The spent fuel in storage is highly radioactive, with a total inventory of radionuclides in the order of 10^6 curies per metric ton of contained uranium. The gross radioactivity in curies per metric ton of uranium as a function of time since discharge from a reactor (decay time) is shown in Table 5-1. The decay times were chosen to represent:

<u>Days</u>	<u>Event</u>
0	- At time of discharge from reactor
160	- Probable minimum decay time for receipt at an AFR storage based on I-131 content in spent fuel
365	- Nominal average minimum decay time for an AFR storage inventory-based on logistics of spent fuel transfer
3,652	- Time when only long lived activity remains

TABLE 5-1
 RADIOACTIVITY PRESENT IN SPENT FUELS*
 (Megacuries per Metric Ton of Uranium **)

Decay Time - Days After Discharge	0	160	365	3,653
Fission Product Nuclides***	165	4.25	2.06	0.523
Actinides and Their Daughter Elements***	41	.08	.07	.05
Light Elements & Fuel Element Construc- tion Materials***	0.213	0.060	0.027	0.003

* See Appendices A-D for tabulations of nuclides present

** Based on metric tons of uranium charged to a reactor

*** Source - ORIGEN code

- Reference PWR
- Power - 35 MW/MTU
- Burnup - 25,000 MWd/MTU
- Flux - 3.26×10^{13} n/cm²

Note that from a gross radioactivity standpoint, the fission product nuclides are predominant throughout the life of spent fuels in storage, but that 97.4 percent of this activity decays away in the first 160 days and 98.8 percent is gone in 365 days.

The fission product radionuclides are β , γ emitters, and only those few that enter into biological processes are of major concern. For freshly discharged fuels at a reactor, a principal concern is the 8-day I-131 which is absorbed by plants, animals and humans, particularly in natural iodine deficient inland locations. However, since the quantity of I-131 present in discharged fuel is reduced by a factor of about a million times in the first 160 days of decay, it is not a major concern for the storage of spent fuels in an AFR storage facility.

Those fission product nuclides of primary concern under conditions of long term spent fuel storage are Kr-85, Cs-134, Cs-137 and possibly I-129. These nuclides are present in significant quantities, are soluble in water and biologically mobile. Cesium enters the muscle tissue of animals and man. The isotope, I-129, has a low specific activity (1.4 dpm/g) and hence has a minimal direct radiological effect, i.e., it is physically impossible to absorb enough to give a dose that is more than a small fraction of that from natural radionuclides (e.g., K-40 1780 dpm/g) present in thyroid tissue. However, because of its 17 million year half-life, its release to the environment should be minimized.

Many of the actinides and their daughter elements are also short lived; 99.6 percent decay away in 160 days. Of those present in aged spent fuel stored in an AFR storage facility, the plutonium isotopes present the most significant potential hazard.

Of the materials of fuel element construction and surface crud deposits, the most significant radionuclide is Co-60.

The only way in which the radionuclides in spent fuel could be made available for dispersal is by physical rupturing of fuel pins. As fuel assemblies must be handled under water to provide the necessary protective shielding, a rupture of

fuel pins would allow the escape of free gases, primarily Kr-85, and contact of the fuel material by the pool waters. However, as corrosion rates of ceramic fuel materials are low, the only observable effect might be a slight increase in the Cs-137 content of the pool waters.

5.1.2 KRYPTON 85

The principal radioactive gas which could escape from defective fuel elements in storage is Kr-85. The evidence to date indicates that the free gases present in fuel pin void spaces leak out rather quickly from defective fuel elements in the reactor and upon discharge, but that the gases which are contained within the fuel pellet matrix have an extremely low diffusion rate and hence a low leak rate. Experience at the NFS West Valley reprocessing plant with chopping fuel, in preparation for dissolution, showed that the release of krypton from spent fuel was marginally observable on their krypton stack monitor; almost all of the krypton was retained in the fuel unit until its dissolution. This experience indicates that even the rupture of a number of fuel elements in the storage pool would not cause a release of Kr-85 in sufficient quantities to be measurable off-site.

5.1.3 CESIUM 134/137

Stable cesium is rare geologically and in the biosphere but radioactive cesium from weapons testing fallout is widely distributed throughout the biosphere. Cesium-137 is important as it is readily absorbed from the food intake by both animals and man. However, the cesium in spent fuel is strongly bound within the fuel matrix even when the fuel pellets are exposed to the pool water. The dissolution rate of cesium is very low and decreases sharply with time. The cesium concentration in pool waters is readily controllable by circulation through an ion exchange resin bed.

5.1.4 POOL WATER ACTIVITY

The fuel pellets are sintered ceramic cylinders which have a very low corrosion rate in water, and the contained radioactivity is tightly bound within the fuel material. In addition, the fuel material is hermetically sealed within highly corrosion resistant zirconium alloy (or stainless steel) cladding tubes with welded end closures. The only mechanism available under normal operating conditions for radionuclides in spent fuel to become available for dispersal is through the corrosion of defective fuel pins by the pool waters. Experience at pools where aged fuel has been stored (G. E. - Morris Operation and NFS - West Valley) has shown that the activity level of the pool water does show an increase when more fuel is added to a pool but that the activity decreases rapidly with time. The apparent explanation is that only the fuel directly exposed by a cladding defect is available for attack and only for a relatively short time.

NFS reported* an experienced pool waters composition of 76 percent Cs; 6 percent Cs-134; 6 percent Sb-124; 6 percent Ce-144 and 1 percent Sr-90. G. E. - Morris Operation has also identified Co-60 as a minor contaminant in pool waters. Because of the direct relationship between pool water activity levels and occupational exposures, there is an incentive to keep pool water activity levels under control at all times; values in the range of 10^{-4} to 10^{-3} $\mu\text{Ci/ml}$ are common.

5.1.5 SURFACE CRUD DEPOSITS

Crud deposits have been observed on the surfaces of fuel pins and fuel assembly hardware, particularly on the inner low nozzle surfaces. The thickness of these crud layers varies from almost nil up to about 150 microns.** Most crud deposits range between 25 to 50 microns. Surface appearance varies from a dense black for PWR fuels to an orange-red for some BWR fuels, depending upon reactor primary coolant circuit characteristics. These crud layers are oxides of iron, nickel, and copper and mixed oxides.

* Safety Analysis Report, Vol. III, NFS Reprocessing Plant, p. X-3-6, Docket 50-201, docketed December 13, 1973.

** BNWL-2256, A. B. Johnson, Jr., "Behavior of Spent Nuclear Fuel in Water Pool Storage."

These crud deposits slough off during shipping and are the principal source of contamination of cask coolants. A small fraction also apparently becomes either dissolved or suspended in the pool waters, e.g., Co-60. However, based on visual observations at the NFS - West Valley plant, most of the crud deposits remained on the fuel assembly until it was chopped up prior to reprocessing.

5.1.6 AIRBORNE RADIOACTIVITY

Airborne radioactivity within a spent fuel storage facility is a function of: the pool water activity, care used in handling fuel, frequency of fuel transfer operations and good housekeeping practices. Based on NFS experience, the airborne activity levels are a factor of 10^{-8} less than the pool water activity and are routinely less than five percent of the occupational exposure limits in 10CFR20, Appendix B, Table I.

5.1.7 POOL WATER PURIFICATION SYSTEM

Spent fuel storage pools are serviced by a pool water cleanup system consisting of filters and ion exchange units, and the necessary pumps, tanks and piping. These systems may contain concentrations of radionuclides as much as 100 times that of the pool waters, enough to require local shielding and carefully controlled operating procedures. However, the inventory of radionuclides available for disposal is limited to that contained in a spent filter or ion exchange unit at the time of replacement. As these are wetted materials, spills could cause a local decontamination and cleanup problem, but the materials involved are readily contained.

5.1.8 DECONTAMINATION SOLUTIONS

Shipping casks represent the major source of contaminated wash solutions. During shipment some of the surface crud on fuel assemblies can become dislodged and become a source of contamination to the cask cavity. On receipt at the storage installation, the water in the cask cavity is sampled for

radioactivity and , if necessary, flushed out before the cask is opened. The wash waters generated are collected in the on-site low level waste system for treatment prior to disposal.

Wash solutions from plant decontamination operations are also collected in the low level waste system for treatment prior to disposal.

5.1.9 DRY WASTE MATERIALS

A spent fuel storage operation also generates dry radioactive waste materials. These consist of contaminated protective clothing, blotting paper, and cleaning mops and plastic sheeting. Such materials are normally collected in plastic bags and packaged in drums prior to disposal. The contained radioactivity in such drums is normally in the order of 200 μ Ci/drum. This activity adheres to the materials involved and is not in a readily dispersable form.

5.1.10 RELEASE MECHANISMS

As underwater storage is a low temperature, low pressure environment, there is no driving force for the sudden release of a major fraction of the radioactive materials contained in the stored spent fuel even under abnormal operating conditions. Small quantities of radioactive materials could be released inside the facility during an inadvertent venting of a shipping cask while it is being prepared for unloading or a spill of low level waste materials in the waste handling and treatment system.

5.1.11 OFF-SITE DISPERSAL MECHANISMS

Again, because of the absence of high temperatures or pressures in an under water spent fuel storage operation, the only mechanism for off-site dispersal of released radioactive materials is atmospheric conditions.

5.2 ACCIDENTS AND NATURAL PHENOMENA EVENTS

For an accident to represent a potential radiological hazard to the general public, the same conditions apply--radioactive materials must be released from the facility and dispersed off-site. For this to happen:

- The radioactive materials involved must be rendered into a dispersable form,
- These must be released from the facility, and
- The conditions must be present for dispersion off-site of such released materials.

A range of potential accidents and natural phenomena events have been postulated in various documents. Appendix F presents the highly conservative assumptions used for evaluating the potential radiological consequences of a fuel handling accident in the fuel handling and storage facility for boiling and pressurized water reactors (Regulatory Guide 1.25). Discussed below are incidents at other fuel storage repositories and during transportation.

5.2.1 ACCIDENTS RESULTING IN RUPTURING OF FUEL PINS

Both NFS and AGNS included in their safety analysis reports (Docket Nos. 50-201 and 70-1729, respectively) an underwater fuel drop accident in which it was assumed that all of the fuel pins in a fuel assembly were ruptured. Because of the age of the spent fuel, very little I-131 would be available for dispersion off-site. The NFS calculated release rates for an assembly exposed for 33,000 MWD/MTU and cooled for a minimum of 120 days were:

Nuclide	Release Rate	-- Ci/Sec
	From Fuel	From Pool
Kr-85	5.5×10^{-4}	5.5×10^{-4}
Xe-131	9.2×10^{-7}	9.2×10^{-7}
I-129	3.7×10^{-10}	3.7×10^{-12}
I-131	2.9×10^{-7}	2.9×10^{-9}

With ground level release dispersion factors in the order of 10^{-4} to 10^{-7} sec/m^3 at most sites, site boundary concentrations would be a small fraction of the 10CFR20, Appendix B, Column II, limits.

5.2.2 LOW PROBABILITY MISSILE ACCIDENT

Analyses have been made of a low probability missile accident at a storage only type of facility containing one year and three year, aged, spent fuel. The accident was defined as the penetration of the building by a tornado generated missile that lands in the storage pool. The activity in the gap between the fuel cladding is released from the fuel pins ruptured by the impact of the missile. The missile evaluated was a 34.3 cm diameter by 10.7 m foot long utility pole, traveling at 232 kph.

Assuming that the missile entered the pool at an optimum angle, a 13.7 m row of fuel assemblies could be impacted if the missile was not deflected from its course of travel. Assuming a uniform storage array of 40 BWR assemblies and 27 PWR assemblies, a total of 20 MT of fuel could be impacted. It was assumed that 10 percent (a high figure) of the contained Kr-85 is in the fuel cladding gap and hence available for release. Similarly, 1 percent of the I-129 is also assumed present in the gap. However, iodine is soluble in water and an underwater release would be subject to a decontamination factor of at least 100. On this basis, the source terms for spent fuel exposed to an average of 28,000 MWd/MTU shown in Table 5-2 were calculated.

Assuming an atmospheric dispersion factor (X/Q) of 10^{-4} sec/m^3 for a ground level release and a site boundary distance of 275 meters, the calculated dose rates are shown in Table 5-3.

The calculated doses shown in Table 5-3 are obviously quite small and are a fraction of the average annual natural background dose of greater than 0.1 rem.

TABLE 5-2
CALCULATED SOURCE TERMS FOR LOW PROBABILITY
MISSILE ACCIDENT ANALYSIS
AWAY-FROM-REACTOR STORAGE POOL

<u>Radio-nuclide</u>	<u>Inventory Ci/MT*</u>		<u>Fraction in Gap</u>	<u>Release Fractions</u>	<u>Ci Released per MTU</u>		<u>Curies Released per 20 MT of Fuel</u>	
	<u>1 yr decay</u>	<u>3 yr decay</u>			<u>1 yr old fuel</u>	<u>3 yr old fuel</u>	<u>1 yr old</u>	<u>3 yr old</u>
Kr-84	9.6×10^3	8.4×10^3	0.1	0.1	9.6×10^2	8.4×10^2	1.9×10^4	1.7×10^4
I-129	3.1×10^{-2}	3.1×10^{-2}	0.01	0.01	3.1×10^{-6}	3.1×10^{-6}	6.2×10^{-5}	6.2×10^{-5}

Bases:

* 28,000 (average) MWd/MTU Burnup, ORIGEN Code Calculation.

** Kr-85 = 10%; I-129 = 1%

*** Kr-85 = 100%; I-129 = 1% of gap activity

TABLE 5-3

CALCULATED SITE BOUNDARY DOSE RATES FOR LOW
PROBABILITY MISSILE ACCIDENT AT
AWAY-FROM-REACTOR STORAGE POOL

<u>Radio-nuclide</u>	<u>Ci Released</u>		<u>Ci/m³ Concentra- tions at Site Boundary</u>		<u>Rem/</u> *	<u>Critical Organ Dose (Rems)</u>	
	<u>1 yr. decay</u>	<u>3 yr decay</u>	<u>1 yr decay</u>	<u>3 yr decay</u>	<u>Rem/Ci-sec/m³</u>	<u>1 yr decay</u>	<u>3 yr decay</u>
Kr-85	1.9×10^4	1.7×10^4	1.9	1.7	3.0×10^{-2}	$5.7 \times 10^{-2**}$	$5.1 \times 10^{-2**}$
I-129	6.2×10^{-5}	6.2×10^{-5}	6×10^{-9}	6×10^{-9}	4.6×10^6	$2.9 \times 10^{-2***}$	$2.9 \times 10^{-2***}$

* 50 year commitment

** Skin

*** Thyroid

5.2.3 FIRES AND EXPLOSIONS

Fires and explosions could be the driving force for the dispersion of radioactive materials in finely divided forms. However, there is no need for the use of explosive materials in an AFR storage facility and normal operating procedures limit the accumulation of combustible materials such as paper. Such materials are used for routine decontamination operations, but as soon as used, these materials must be properly bagged to prevent a further spread of contamination. Serious fires and explosions are not considered credible in an AFR storage facility.

5.2.4 CRITICALITY ACCIDENT

Assuming the fuel storage design was adequate, a criticality accident in a spent fuel pool could conceivably approach the power levels (less than 1,000 Kw) of a "swimming pool" type of research reactor. As proven by the operation of such reactors for many years, conditions did not generate enough energy to disperse any radioactive materials to the atmosphere from under more than 4 m of water.

5.2.5 HIGH POOL WATER ACTIVITY

Based on operating experience at the G. E. Morris Operation and the NFS West Valley Plant, spent fuel storage pool water activity should normally be maintained at less than 5×10^{-3} mCi/ml. At this concentration the dose rate on the bridge crane above the pool is less than 2 mrem/hr.

During a period of high pool water activity, fuel transfer activities would normally be curtailed until the pool water activity is reduced to normal operating levels.

5.2.6 LOWERING OF POOL WATER LEVEL

A 1,000 ton capacity storage pool is estimated to contain 3.7 million liters of water and be 9.5 m deep. The water in a spent fuel storage pool serves the dual functions of heat removal and shielding. Spent fuel storage pools are normally designed with a minimum of 4 m of water over the fuel in storage, enough to reduce the gamma dose rate from the fuel assemblies to less than 0.5 mr/hr at the pool surface.

Fuel transfer mechanisms have limit switches and mechanical stops to prevent raising a fuel assembly or a storage canister to less than 3 meters of the water surface.

- A loss of five percent of the water, about 185,000 liters, would have only a negligible impact on personnel exposures
- A loss of 25 percent of the water, about 925,000 liters, would reduce the shielding over the stored fuel to about 2 meters. Under these conditions the fuel transfer bridge crane work could be carried on within the facility but this may have to be done under "special work permit" conditions.

The fall of the water level to this depth may require an emergency modification of the cooling water circuit inlet and outlet lines, such as connecting emergency supply and cutting off any bleed-off system, but this should be feasible without serious overexposure of personnel.

While the loss of all water is beyond the design basis envelope, it involves only low risks for independent spent fuel storage facilities. The major consequences of such an unlikely event would be a small skyshine dose at a site boundary.

The heat generation rate of spent fuel decreases rapidly with time for a short period following discharge from a reactor. For example, at one year after discharge the spent fuel heat generation rate is less than one percent of its rate when it is discharged from the reactor. At ten years its heat generation rate has decreased by another factor of ten to one-tenth of one percent.

Assuming that the spent fuel stored at an independent spent fuel storage installation is at least one year old, calculations have been performed to show that loss of water should not result in fuel failure due to high temperatures. Cooling by natural convection air currents alone should be adequate.

5.3 CONSIDERATIONS AND ASSUMPTIONS USED FOR OFF-SITE TRANSPORTATION ACCIDENT ANALYSIS

All information in this section is summarized from WASH-1238, "Environment Survey of Transportation of Radioactive Materials To and From Nuclear Power Plants." The consequences of a major release of radioactive material from a spent fuel shipping cask could be severe; however, the low probability of such an occurrence during transportation makes the risk from such accidents extremely small. Spent fuel shipping casks are designed to withstand severe transportation accidents without significant loss of contents or increase in external radiation levels. The casks are protected from the damaging effects of impact, puncture, and fire by thick outer plates, protective crash frames, or other protective features designed to control damage.

Transportation accidents occur in a range of frequencies and severities. Most accidents occur at low vehicle speeds. The severity of accidents is greater at higher speeds, but the frequency decreases as the severity increases. Transportation accidents usually involve some combination of impact, puncture, fire, or submersion in water.

5.3.1 ESTIMATES OF RELEASES IN ACCIDENTS

Estimates of the amount of radioactive material released and the calculated doses in the unlikely event that a shipping cask is breached are summarized below. The consequences in terms of potential doses to humans have been calculated for the estimated releases of Kr-85, I-131, and fission products. Normal distributions of weather and population densities for a release on land were used in the calculations.

Table 5-4 shows the probability of a transportation accident per vehicle mile in each of the five accident severity categories. Tables 5-5 through 5-8 show the probabilities of "N" or more persons receiving doses of "D" or more millirem as a result of a release of 1.1×10^3 Ci of Kr-85, 1×10^{-2} Ci of I-131, and 130 Ci of gross fission products, with all of the krypton and iodine and one percent of the gross fission products being dispersed in the air. It would require an accident of the extra severe category to cause a release of this magnitude. Therefore, the total probability of "N" or more persons receiving doses of "D" or more millirem from the transportation of spent fuel would be the probabilities in Tables 5-5 through 5-8 multiplied by the appropriate probability in Table 5-4 multiplied by the distance traveled.

5.3.2 CONSEQUENCES OF IMPLEMENTING STORAGE ALTERNATIVES FOR OFF-SITE TRANSPORTATION ACCIDENT ANALYSIS

The severity of the consequences of a single transportation accident will not change for any particular storage alternative. However, the probability of occurrence increases in direct proportion of the increase in distance of shipment of spent fuel for those alternatives which involve transportation for off-site storage. Specifically, those storage alternatives which involve off-site transportation are independent storage facilities, trans-shipment, and use of government facilities.

The estimated average distance from a nuclear power plant site to an AFR storage facility over which the irradiated fuel would be transported is 1,000 miles. From Tables 5-6 and Table 5-7, the probability of 100 persons receiving a dose to the skin of 100 millirem from a release of 1,100 curies of Kr-85 as the result of an extra severe transportation accident is 4×10^{-11} . Consequently, the environmental risk due to off-site transportation accidents involving spent fuel casks remains extremely small.

TABLE 5-4

ACCIDENT PROBABILITIES FOR TRUCK OR RAIL TRAVEL
PER VEHICLE MILE FOR THE ACCIDENT SEVERITY CATEGORIES
(FROM WASH-1238)

<u>Minor</u>	<u>Moderate</u>	<u>Severe</u>	<u>Extra Severe</u>	<u>Extreme</u>
2×10^{-6}	3×10^{-7}	8×10^{-9}	2×10^{-11}	1×10^{-13}

TABLE 5-5

PROBABILITY OF "N" OR MORE PERSONS RECEIVING A DOSE
TO THE SKIN OF "D" MILLIREM OR MORE FROM THE
RELEASE OF 1,100 CURIES OF KRYPTON-85
IN AN ACCIDENT (FROM WASH-1238)

<u>Number of People, "N"</u>	<u>Dose (millirem), "D"</u>				
	<u>1</u>	<u>10</u>	<u>100</u>	<u>1000</u>	<u>5000</u>
1	0.9	0.5	0.1	2×10^{-2}	3×10^{-3}
10	0.6	0.2	3×10^{-2}	1×10^{-3}	
10^2	0.2	4×10^{-2}	2×10^{-3}		
10^3	7×10^{-2}	2×10^{-3}			
10^4	1×10^{-2}				
10^5	5×10^{-4}

TABLE 5-6

PROBABILITY OF "N" OR MORE PERSONS RECEIVING A DOSE
TO THE THYROID OF "D" MILLIREM OR MORE FROM
THE RELEASE OF 0.61 CURIES OF IODINE-131
IN AN ACCIDENT (FROM WASH-1238)

<u>Number of People, "N"</u>	<u>Dose (millirem), "D"</u>			
	<u>1</u>	<u>10</u>	<u>100</u>	<u>1000</u>
1	0.5	9×10^{-2}	1×10^{-2}	2×10^{-4}
10	0.1	1×10^{-2}	4×10^{-4}	
10^2	2×10^{-2}	6×10^{-4}		
10^3	1×10^{-3}

TABLE 5-7

PROBABILITY OF "N" OR MORE PERSONS RECEIVING A DOSE
TO THE LUNGS OF "D" MILLIREM OR MORE FROM
1.3 CURIES OF GROSS FISSION PRODUCTS WHICH
BECAME AIRBORNE AS A RESULT
OF AN ACCIDENT
(FROM WASH-1238)

<u>Number of People, "N"</u>	<u>Dose (millirem), "D"</u>					
	<u>1</u>	<u>10</u>	<u>100</u>	<u>1000</u>	<u>5000</u>	<u>10,000</u>
1	1	0.8	0.3	5×10^{-2}	1×10^{-2}	4×10^{-3}
10	0.8	0.3	6×10^{-2}	4×10^{-3}	3×10^{-4}	4×10^{-5}
10^2	0.4	9×10^{-2}	6×10^{-3}	1×10^{-4}		
10^3	0.1	1×10^{-2}	2×10^{-4}			
10^4	4×10^{-2}	5×10^{-4}				
10^5	4×10^{-3}

TABLE 5-8

PROBABILITY OF "N" OR MORE PERSONS RECEIVING A DOSE TO THE WHOLE BODY OF "D" MILLIREM OR MORE OVER A PERIOD OF ONE YEAR FOLLOWING THE RELEASE IN AN ACCIDENT OF 130 CURIES OF GROSS FISSION PRODUCTS WHICH DEPOSIT ON THE GROUND (80% OF THE DOSE IS TO THE SKIN)(FROM WASH-1238)

<u>Number of People, "N"</u>	<u>Dose (millirem), "D"</u>					
	<u>1</u>	<u>10</u>	<u>100</u>	<u>1000</u>	<u>5000</u>	<u>10,000</u>
1	1	1	1	0.9	0.7	0.7
10	1	1	0.9	0.7	0.3	0.2
10^2	1	0.9	0.6	0.3	0.1	6×10^{-2}
10^3	1	0.7	0.4	9×10^{-2}	2×10^{-2}	6×10^{-3}
10^4	0.8	0.5	0.2	3×10^{-2}	9×10^{-4}	2×10^{-4}
10^5	0.7	0.4	8×10^{-2}	2×10^{-3}

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APPENDIX A
ORIGEN CALCULATIONS
Power 35.00 MW/MTU
Burnup 12,000 MWD/MTU

TERA CORPORATION

TABLE A-1

ACTIVITIES OF FISSION PRODUCTS
IN SPENT FUEL VS. DECAY TIMES

NUCLIDE RADIOACTIVITY, CURIES BASIS : 1% OF HEAVY METAL CHARGED TO REACTOR											
	CHARGE	DISCHARGE	0. Y	0. 1	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
M 3	.00	2.33*02	2.33*02	2.31*02	2.28*02	2.12*02	1.39*02	1.35*02	7.67*01	1.42*01	8.45*01
Zn 72	.00	1.47*01	1.52*01	1.52*01	1.50*01	.00	.00	.00	.00	.00	.00
GA 72	.00	1.47*01	2.19*01	2.19*01	.00	.00	.00	.00	.00	.00	.00
GE 72	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
GA 73	.00	4.01*01	.00	.00	.00	.00	.00	.00	.00	.00	.00
GE 73	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
GA 74	.00	1.42*02	.00	.00	.00	.00	.00	.00	.00	.00	.00
GE 74	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
GA 75	.00	2.28*02	.00	.00	.00	.00	.00	.00	.00	.00	.00
GE 75M	.00	2.19*02	.00	.00	.00	.00	.00	.00	.00	.00	.00
GE 75	.00	2.28*02	.00	.00	.00	.00	.00	.00	.00	.00	.00
AS 75	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
GA 76	.00	7.61*02	.00	.00	.00	.00	.00	.00	.00	.00	.00
EE 76	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AS 76	.00	3.32*00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SE 76	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
GE 77M	.00	2.08*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
GE 77	.00	9.75*02	.00	.00	.00	.00	.00	.00	.00	.00	.00
AS 77	.00	2.58*03	4.00*04	.00	.00	.00	.00	.00	.00	.00	.00
SE 77M	.00	7.65*00	1.38*04	.00	.00	.00	.00	.00	.00	.00	.00
SE 77	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
GE 78	.00	4.25*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
AS 78M	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AS 78	.00	6.27*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
SE 78	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AS 79	.00	1.47*04	.00	.00	.00	.00	.00	.00	.00	.00	.00
SE 79M	.00	1.47*04	.00	.00	.00	.00	.00	.00	.00	.00	.00
SE 79	.00	1.55*01	1.55*01	1.55*01	1.55*01	1.55*01	1.55*01	1.55*01	1.55*01	1.55*01	1.55*01
SA 79	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AS 80	.00	2.62*04	.00	.00	.00	.00	.00	.00	.00	.00	.00
SE 80	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
BR 80M	.00	2.54*00	.00	.00	.00	.00	.00	.00	.00	.00	.00
BR 80	.00	1.27*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 80	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AS 81	.00	4.25*01	.00	.00	.00	.00	.00	.00	.00	.00	.00
SE 81M	.00	4.25*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
SE 81	.00	3.92*04	.00	.00	.00	.00	.00	.00	.00	.00	.00
BR 81	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 81M	.00	1.34*02	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 81	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SE 82	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PR 82M	.00	7.67*02	.00	.00	.00	.00	.00	.00	.00	.00	.00
BR 82	.00	8.54*02	3.25*04	.00	.00	.00	.00	.00	.00	.00	.00
NR 82	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SE 82M	.00	5.83*04	.00	.00	.00	.00	.00	.00	.00	.00	.00
SE 83	.00	4.92*04	.00	.00	.00	.00	.00	.00	.00	.00	.00
BR 83	.00	1.07*05	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 83M	.00	1.07*05	.00	.00	.00	.00	.00	.00	.00	.00	.00
BR 83	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SE 84	.00	2.22*05	.00	.00	.00	.00	.00	.00	.00	.00	.00
EP 84M	.00	4.49*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 84	.00	2.72*05	.00	.00	.00	.00	.00	.00	.00	.00	.00

POWER= 35.00mw, SURFMP= 12000.MWD, FLUX= 3.09*10N/CM002-SIC

NUCLIDE RADIOACTIVITY, CURIES
BASES = MG OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	D. Y	D. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
HR 04	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SL 05	.00	2.56*05	.00	.00	.00	.00	.00	.00	.00	.00	.00
GR 05	.00	2.56*05	.00	.00	.00	.00	.00	.00	.00	.00	.00
HR 05H	.00	3.89*05	.00	.00	.00	.00	.00	.00	.00	.00	.00
AR 05	.00	5.12*03	5.05*03	4.99*03	4.81*03	4.51*03	3.72*03	2.70*03	1.62*03	2.07*02	8.36*00
GR 05	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
HR 06	.00	4.46*05	.00	.00	.00	.00	.00	.00	.00	.00	.00
AR 06	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
HR 06H	.00	2.26*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
GR 06	.00	3.82*02	6.47*00	4.85*01	2.39*04	3.16*00	.00	.00	.00	.00	.00
SR 06	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
HR 07	.00	5.48*05	.00	.00	.00	.00	.00	.00	.00	.00	.00
AR 07	.00	5.70*05	.00	.00	.00	.00	.00	.00	.00	.00	.00
HR 07	.00	8.31*06	8.32*06	8.32*06	8.32*06	8.32*06	8.32*06	8.32*06	8.32*06	8.32*06	8.32*06
SR 07H	.00	4.23*02	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 07	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
HR 08	.00	7.96*05	.00	.00	.00	.00	.00	.00	.00	.00	.00
AR 08	.00	8.22*05	.00	.00	.00	.00	.00	.00	.00	.00	.00
GR 08	.00	8.22*05	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 08	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
HR 09	.00	1.01*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
HR 09	.00	1.05*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
HR 09	.00	1.05*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 09H	.00	1.11*06	3.42*05	1.36*05	8.71*03	6.69*03	3.03*05	8.10*06	.00	.00	.00
Y 09	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
HR 09	.00	1.15*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
GR 09	.00	1.15*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 10C	.00	3.38*04	3.36*04	3.36*04	3.29*04	3.21*04	2.98*04	2.66*04	2.06*04	9.83*03	2.86*03
Y 10H	.00	1.01*00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Y 10	.00	3.44*04	3.36*04	3.36*04	3.29*04	3.21*04	2.98*04	2.66*04	2.06*04	9.83*03	2.86*03
GR 10	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
HR 11	.00	8.25*05	.00	.00	.00	.00	.00	.00	.00	.00	.00
GR 11	.00	1.28*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 11	.00	1.37*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
Y 11H	.00	8.06*05	.00	.00	.00	.00	.00	.00	.00	.00	.00
Y 11	.00	1.40*06	8.60*05	2.15*05	1.91*04	2.57*02	8.31*04	2.82*03	.00	.00	.00
GR 11	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
HR 12	.00	4.79*05	.00	.00	.00	.00	.00	.00	.00	.00	.00
HR 12	.00	1.30*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 12	.00	1.30*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
Y 12	.00	1.47*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
GR 12	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
HR 13	.00	1.32*05	.00	.00	.00	.00	.00	.00	.00	.00	.00
GR 13	.00	1.31*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 13	.00	1.33*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
Y 13	.00	1.55*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
GR 13	.00	7.56*01	7.55*01	7.55*01	7.55*01	7.55*01	7.55*01	7.55*01	7.55*01	7.55*01	7.55*01
HR 13H	.00	1.82*02	2.78*02	3.88*02	5.48*02	8.96*02	1.88*01	3.11*01	6.99*01	6.99*01	7.55*01
HR 13	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
HR 14	.00	4.92*04	.00	.00	.00	.00	.00	.00	.00	.00	.00
GR 14	.00	4.83*05	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 14	.00	1.43*06	.00	.00	.00	.00	.00	.00	.00	.00	.00

POWER: 15-000W, CURRENT: 12000-600A, FLUX: 3500+1500CMMOZ-35C

[illegible]

POWER= 35.00MW, BURNUP= 12000.MWD, FLUX= 5.00E+13n/cm2-SEC

NUCLIDE RADIOACTIVITY, CURIES
 BASIS : WT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
RU105	.00	7.16E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
RH125N	.00	7.16E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
RH125	.00	5.16E+05	9.74E-13	.00	.00	.00	.00	.00	.00	.00	.00
PD105	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TC106	.00	5.43E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
RU106	.00	1.89E+05	1.59E+05	1.40E+05	9.47E+04	4.75E+04	5.99E+03	1.90E+02	1.97E-01	1.97E-10	2.06E-25
RH106N	.00	6.29E+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
RH106	.00	3.29E+05	1.59E+05	1.40E+05	9.47E+04	4.75E+04	5.99E+03	1.90E+02	1.97E-01	1.97E-10	2.06E-25
PD106	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
RU107	.00	3.87E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
RH107	.00	3.87E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
PD107N	.00	7.78E+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
PD107	.00	2.34E-02	2.34E-02	2.34E-02	2.34E-02	2.34E-02	2.34E-02	2.34E-02	2.34E-02	2.34E-02	2.34E-02
AG107	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
RU108	.00	2.59E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
RH108	.00	2.59E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
PD108	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AB108	.00	1.94E-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
CD108	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
RH109	.00	1.43E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
PD109N	.00	1.84E+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
PD109	.00	1.52E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
AS109N	.00	1.52E+05	2.40E-08	2.40E-08	1.91E-08	1.09E-08	2.04E-09	1.25E-10	4.45E-13	2.43E-20	.00
AC109	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CD109	.00	3.33E-08	2.40E-08	2.40E-08	1.91E-08	1.09E-08	2.04E-09	1.25E-10	4.45E-13	2.43E-20	.00
RH110	.00	5.33E+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
PD110	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AB110N	.00	4.13E+02	3.22E+02	2.66E+02	1.52E+02	5.57E+01	2.77E+00	1.06E-02	8.37E-07	1.66E-20	.00
AG110	.00	3.73E+04	4.19E+01	3.46E+01	1.97E+01	7.25E+00	3.40E+01	2.42E-03	1.09E-07	9.96E-21	.00
CD110	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PD111N	.00	1.29E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
PD111	.00	2.66E+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
AG111N	.00	2.66E+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
PD111	.00	2.66E+04	6.52E+00	1.01E-02	5.83E-11	1.27E-25	.00	.00	.00	.00	.00
CD111N	.00	4.41E+00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CD111	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PD112	.00	1.43E+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
AG112	.00	1.43E+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
CD112	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PD113	.00	1.31E+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
AG113N	.00	1.31E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
AG113	.00	1.18E+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
CD113N	.00	1.49E-01	1.40E-01	1.33E-01	7.13E-01	6.74E-01	5.45E-01	4.57E-01	2.78E-01	6.10E-02	5.30E-03
CD113	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TD113	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PD114	.00	7.67E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
AG114	.00	7.67E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
CD114	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TD114N	.00	2.74E-02	1.85E-03	2.48E-03	1.73E-04	1.39E-04	2.76E-13	2.79E-24	.00	.00	.00
TD114	.00	4.44E-02	7.58E-03	2.47E-03	1.67E-04	1.05E-04	2.46E-13	2.69E-24	.00	.00	.00
SA114	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PD115	.00	6.41E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00

POWER: 35.00MW, BURNDUP: 12000.HRD, FLUX: 3.89*13N/CM*2-SEC

NUCLIDE RADIOACTIVITY, CURIES
 Basis: 1 MG OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	30. Y	100. Y
AG115M	.00	1.80*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
AG115	.00	4.62*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
CD115M	.00	4.03*02	9.48*01	3.06*01	1.12*00	3.10*03	6.59*11	1.08*23	.00	.00	.00
CD115	.00	6.11*03	4.30*09	1.52*10	.00	.00	.00	.00	.00	.00	.00
IN115M	.00	6.11*03	4.70*09	1.66*10	.00	.00	.00	.00	.00	.00	.00
SA115	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SA115	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AG116	.00	6.07*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
CE116	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN116M	.00	7.88*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN116	.00	7.64*02	.00	.00	.00	.00	.00	.00	.00	.00	.00
SA116	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AG117	.00	6.19*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
CO117M	.00	2.68*00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CO117	.00	6.20*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN117M	.00	6.20*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN117	.00	2.92*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
SA117M	.00	7.23*00	6.39*02	2.62*03	1.01*07	1.91*15	.00	.00	.00	.00	.00
SA117	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CO118	.00	6.19*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN118M	.00	7.39*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN118	.00	6.19*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
SA118	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CE119M	.00	3.24*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
CE119	.00	3.24*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN119M	.00	6.88*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN119	.00	3.24*02	.00	.00	.00	.00	.00	.00	.00	.00	.00
SA119M	.00	8.57*00	6.68*00	5.50*00	3.11*00	1.13*00	5.42*02	3.42*04	1.37*08	4.72*22	.00
SA119	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CO120	.00	1.66*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN120M	.00	3.33*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN120	.00	3.33*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
SA120	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CD121	.00	7.31*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN121M	.00	7.31*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN121	.00	1.01*02	.00	.00	.00	.00	.00	.00	.00	.00	.00
SA121M	.00	5.13*05	5.12*05	5.11*05	5.08*05	5.04*05	4.90*05	4.68*05	4.27*05	3.25*05	2.00*05
SA121	.00	7.83*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
SA122	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN122	.00	7.76*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
SA122	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SA122M	.00	3.00*01	.00	.00	.00	.00	.00	.00	.00	.00	.00
SA122	.00	3.00*02	6.13*08	1.89*15	.00	.00	.00	.00	.00	.00	.00
IN123	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN123M	.00	7.99*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
SA123	.00	6.65*02	.00	.00	.00	.00	.00	.00	.00	.00	.00
SA123M	.00	6.66*02	.00	.00	.00	.00	.00	.00	.00	.00	.00
SA123	.00	6.06*03	3.68*03	2.50*03	1.06*02	2.42*01	9.68*04	1.55*14	.00	.00	.00
SA123	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN123M	.00	3.27*02	1.92*02	1.27*02	3.76*03	4.32*04	6.54*07	1.31*11	5.23*21	.00	.00
IN123	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN124	.00	1.08*00	.00	.00	.00	.00	.00	.00	.00	.00	.00

POWER = 36.00MW, BURNUP = 12000.MWD, FLUX = 1.00E+13N/CM^2-SEC

NUCLIDE RADIOACTIVITY, CURIES
Basis = MG OF HEAVY METAL CHARGED TO REACTOR

	CHANGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
SN120	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SB120M	.00	3.23E+00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SB120	.00	1.37E+01	2.63E+01	1.16E+01	1.08E+00	1.59E+02	5.08E+08	3.97E+17	.00	.00	.00
TE120	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN125M	.00	5.69E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN125	.00	1.00E+04	1.37E+01	7.55E+02	2.01E+04	9.01E+20	.00	.00	.00	.00	.00
SB125	.00	2.55E+03	2.49E+03	2.37E+03	2.05E+03	1.59E+03	7.54E+02	2.03E+02	1.54E+01	7.05E+01	1.88E+04
TE125M	.00	1.11E+02	9.99E+02	9.29E+02	8.45E+02	4.57E+02	1.04E+02	8.41E+01	6.47E+00	2.92E+01	7.77E+09
TE125	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN126	.00	1.92E+01	1.92E+01	1.92E+01	1.92E+01	1.92E+01	1.92E+01	1.92E+01	1.92E+01	1.92E+01	1.92E+01
SB126M	.00	6.12E+00	1.92E+01	1.92E+01	1.92E+01	1.92E+01	1.92E+01	1.92E+01	1.92E+01	1.92E+01	1.92E+01
SB126	.00	2.39E+01	1.02E+01	1.99E+01	1.91E+01	1.91E+01	1.91E+01	1.91E+01	1.91E+01	1.91E+01	1.91E+01
TE126	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN127M	.00	8.23E+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN127	.00	4.27E+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
SB127	.00	6.28E+04	6.55E+03	2.39E+08	2.70E+24	.00	.00	.00	.00	.00	.00
TE127M	.00	1.10E+04	6.51E+03	4.17E+03	1.13E+03	1.11E+02	1.08E+01	9.42E+07	7.69E+17	.00	.00
TE127	.00	5.99E+04	6.99E+03	4.13E+03	1.12E+03	1.10E+02	1.03E+01	9.32E+07	7.61E+17	.00	.00
1227	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN128	.00	1.78E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
SB128M	.00	1.72E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
SB128	.00	2.37E+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE128	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1228	.00	1.77E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE128	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN129M	.00	3.52E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN129	.00	9.49E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
SB129	.00	3.59E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE129M	.00	5.66E+04	9.09E+03	2.16E+03	3.32E+01	1.99E+02	1.45E+12	.00	.00	.00	.00
TE129	.00	1.38E+05	5.83E+03	1.40E+03	2.13E+01	1.29E+02	2.96E+12	.00	.00	.00	.00
1229	.00	1.22E+02	1.25E+02	1.26E+02	1.29E+02	1.29E+02	1.29E+02	1.29E+02	1.29E+02	1.29E+02	1.29E+02
TE129M	.00	9.40E+01	3.86E+04	4.97E+07	1.69E+14	.00	.00	.00	.00	.00	.00
TE129	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN130	.00	6.35E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
SB130M	.00	5.71E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
SB130	.00	6.98E+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE130	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1330M	.00	7.30E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
1330	.00	1.06E+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE130	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN131	.00	9.27E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
SB131	.00	9.61E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE131M	.00	1.91E+05	3.03E+17	.00	.00	.00	.00	.00	.00	.00	.00
TE131	.00	8.28E+05	5.53E+18	.00	.00	.00	.00	.00	.00	.00	.00
1331	.00	9.40E+05	4.18E+02	1.01E+00	2.12E+04	4.65E+22	.00	.00	.00	.00	.00
TE131M	.00	7.57E+03	1.15E+02	1.99E+00	1.16E+05	5.58E+15	.00	.00	.00	.00	.00
TE131	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN132	.00	1.30E+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
SB132M	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN132	.00	1.32E+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE132	.00	1.13E+06	6.12E+03	2.02E+09	.00	.00	.00	.00	.00	.00	.00
1332	.00	1.37E+06	6.31E+03	2.04E+09	.00	.00	.00	.00	.00	.00	.00

POWER: 35.00MW, BURNDUP: 12000.MWD, FLUX: 3.09E13M/CMO2-SEC

NUCLIDE RADIOACTIVITY, CURIES
0.515 = MT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
HE132	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SB133	.00	1.18E+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
FE133M	.00	3.47E+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
FE133	.00	5.28E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
TI133	.00	1.72E+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
XE133M	.00	4.83E+04	7.82E-04	3.72E-37	.00	.00	.00	.00	.00	.00	.00
XL133	.00	1.85E+06	1.46E+03	3.12E+15	.00	.00	.00	.00	.00	.00	.00
CS133	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SB134	.00	1.83E+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
FE134	.00	1.98E+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
TI134	.00	2.22E+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
XE134	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS134M	.00	2.45E+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS134	.00	3.65E+04	3.63E+04	3.39E+04	2.80E+04	2.28E+03	1.38E+03	4.58E+02	1.78E+02	8.10E-11	.00
BA134	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
FE135	.00	1.73E+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
TI135	.00	1.73E+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
FE135M	.00	5.20E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
FE135	.00	4.33E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS135M	.00	4.28E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS135	.00	9.46E-02	9.52E-02	9.52E-02	9.52E-02	9.52E-02	9.52E-02	9.52E-02	9.52E-02	9.52E-02	9.52E-02
PA135M	.00	1.28E+00	.00	.00	.00	.00	.00	.00	.00	.00	.00
BA135	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TI134	.00	7.79E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
FE136	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS136	.00	2.45E+04	2.02E+02	4.46E+00	4.53E-05	2.97E-13	.00	.00	.00	.00	.00
BA136	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TI137	.00	1.73E+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
FE137	.00	1.81E+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS137	.00	3.96E+04	3.44E+04	3.42E+04	3.87E+04	3.78E+04	3.53E+04	3.14E+04	2.50E+04	1.25E+04	3.43E+03
BA137M	.00	3.70E+04	3.68E+04	3.67E+04	3.62E+04	3.54E+04	3.30E+04	2.94E+04	2.33E+04	1.17E+04	3.67E+03
FE137	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TI138	.00	1.66E+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
FE138	.00	1.73E+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS138	.00	1.74E+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
BA138	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TI139	.00	1.66E+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
FE139	.00	1.52E+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS139	.00	1.83E+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
BA139	.00	1.85E+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
LA139	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
FE140	.00	1.07E+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS140	.00	1.68E+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
PA140	.00	1.79E+06	1.37E+04	3.10E+02	4.61E-03	1.18E-11	.00	.00	.00	.00	.00
EA140	.00	1.85E+06	1.58E+04	1.57E+03	5.30E-03	1.36E-11	.00	.00	.00	.00	.00
CE140	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
FE141	.00	3.89E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS141	.00	1.79E+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
BA141	.00	1.71E+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
LA141	.00	1.74E+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
CE141	.00	1.76E+06	2.58E+05	5.76E+04	7.14E+02	2.88E-01	1.90E-11	.00	.00	.00	.00
PA141	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

PNEL: 35.0000, BURNUP: 12000.000, FLUX: 3.09+130/CM**2-SEC

NUCLIDE RADIIACIITY, CURIES
BASIS : 1G OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
XE142	.00	1.10+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS142	.00	9.63+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
BA142	.00	1.57+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
LA142	.00	1.06+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
CE142	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PR142	.00	1.84+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
NO142	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SE143	.00	2.05+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS143	.00	5.06+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
BA143	.00	1.28+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
LA143	.00	1.55+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
CE143	.00	1.55+06	3.08+14	.00	.00	.00	.00	.00	.00	.00	.00
PR143	.00	1.50+06	1.77+02	3.77+02	1.58+02	1.49+10	.00	.00	.00	.00	.00
NO143	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
LA144	.00	1.07+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
CE144	.00	4.73+05	7.03+05	5.91+05	3.58+05	1.47+05	1.01+04	1.17+02	1.57+02	1.82+14	.00
PR144	.00	8.43+05	7.03+05	5.91+05	3.58+05	1.47+05	1.01+04	1.17+02	1.57+02	1.82+14	.00
NO145	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CE145	.00	1.00+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
PR145	.00	1.28+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
LA145	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CE146	.00	6.57+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
PR146	.00	6.57+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
NO146	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CE147	.00	6.73+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
PR147	.00	6.73+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
NO147	.00	6.88+05	2.44+03	3.15+03	8.54+05	1.06+14	.00	.00	.00	.00	.00
PR147	.00	9.13+04	9.30+04	8.85+04	7.67+04	5.85+04	2.65+04	7.05+03	5.00+02	1.79+03	3.21+07
NO148	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CE148	.00	5.05+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
PR148	.00	5.06+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
NO148	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PR148H	.00	3.28+04	7.43+03	2.34+03	7.91+01	1.91+01	2.67+04	2.14+22	.00	.00	.00
PR148	.00	1.44+05	5.99+02	1.88+02	6.35+00	1.53+02	2.14+10	1.74+23	.00	.00	.00
NO149	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CE149	.00	3.35+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
PR149	.00	1.63+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
NO149	.00	5.89+05	3.42+07	1.03+14	.00	.00	.00	.00	.00	.00	.00
NO150	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PR150	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
NO150	.00	6.58+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
NO150	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
NO151	.00	1.73+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
PR151	.00	1.73+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
NO151	.00	6.58+02	6.63+02	6.62+02	6.59+02	6.51+02	6.38+02	6.13+02	5.86+02	6.46+02	2.99+02
EU151	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PR152	.00	1.14+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
NO152	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU152H	.00	2.03+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU152	.00	6.67+00	6.40+00	6.36+00	6.22+00	3.98+00	3.35+00	2.51+00	1.47+00	2.89+03	1.38+02
CL152	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PR153	.00	6.33+04	.00	.00	.00	.00	.00	.00	.00	.00	.00

POWER= 35.00MW, SHUTUP= 12000JWD, FLUX= 1.09*10¹³W/CW*2-SEC

NUCLIDE RADIOACTIVITY, CURIES
BASES : W OF HEAVY METAL CHARGED TO REACTOR

	CHANGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
SM153	.00	2.22+05	1.24+09	5.66+20	.00	.00	.00	.00	.00	.00	.00
EU153	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
GC153	.00	1.62+00	1.43+00	1.15+00	6.40+01	2.25+01	9.74+03	5.21+05	1.44+09	3.14+23	.00
PM154	.00	4.50+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
SM154	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CU154	.00	7.89+02	7.80+02	7.74+02	7.55+02	7.23+02	6.35+02	5.11+02	3.12+02	9.04+01	1.04+01
GO154	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SM155	.00	1.04+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU155	.00	1.55+03	1.50+03	1.40+03	1.13+03	7.67+02	2.83+02	1.58+01	7.78+01	7.96+04	3.84+14
GO155	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SM156	.00	1.01+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU156	.00	5.44+04	4.55+02	3.37+01	2.56+03	1.19+10	.00	.00	.00	.00	.00
GO156	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SM157	.00	9.60+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU157	.00	9.61+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
GO157	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU158	.00	4.42+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
GO158	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU159	.00	2.32+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
GO159	.00	2.43+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU159	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU160	.00	1.03+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
GO160	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU160	.00	2.03+02	8.53+01	4.35+01	6.05+00	1.80+01	4.40+04	1.14+13	.00	.00	.00
GO160	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU161	.00	4.10+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU161	.00	4.04+02	4.80+02	4.25+05	4.70+14	.00	.00	.00	.00	.00	.00
EU161	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU162	.00	1.99+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU162	.00	1.99+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU162	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU162	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU163	.00	4.64+01	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU163	.00	4.31+01	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU163	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU164	.00	2.99+01	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU164	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU165	.00	4.33+01	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU165	.00	1.08+01	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU165	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU166	.00	6.64+00	6.97+08	4.36+14	.00	.00	.00	.00	.00	.00	.00
EU166	.00	1.42+05	1.42+05	1.42+05	1.42+05	1.42+05	1.42+05	1.42+05	1.42+05	1.42+05	1.42+05
EU166	.00	1.24+01	1.04+07	6.50+14	.00	.00	.00	.00	.00	.00	.00
EU166	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU167	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TOTAL	.00	1.60+08	5.16+04	3.19+06	1.30+06	6.16+05	2.00+05	1.27+05	9.25+04	6.46+04	1.37+04

POWER = 35.00MW, BURNUP = 12000-MWD, FLOW = 3.09-13MCMOZ-SEC

ELEMENTAL ACTIVITY, CURVES
BASIS : MT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	D. Y	D. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
N	.00	2.37+02	2.34+02	2.31+02	2.28+02	2.12+02	1.7+02	1.35+02	7.47+01	1.92+01	8.48+01
Zn	.00	1.47+01	1.52+01	2.04+04	.00	.00	.00	.00	.00	.00	.00
GA	.00	1.19+01	2.19+01	2.72+04	.00	.00	.00	.00	.00	.00	.00
AS	.00	5.29+04	4.64+04	.00	.00	.00	.00	.00	.00	.00	.00
SE	.00	4.43+05	1.55+01	1.55+01	1.55+01	1.55+01	1.55+01	1.55+01	1.55+01	1.55+01	1.55+01
RE	.00	1.94+04	3.25+04	.00	.00	.00	.00	.00	.00	.00	.00
RR	.00	5.99+04	5.05+03	4.99+03	4.81+03	4.81+03	3.72+03	2.70+03	1.47+03	2.07+02	8.34+00
RS	.00	6.28+04	4.47+00	4.81+01	2.44+04	8.32+04	8.32+04	8.32+04	8.32+04	8.32+04	8.32+04
SR	.00	4.07+04	1.35+05	1.48+05	4.26+04	3.22+04	2.98+04	2.64+04	2.04+04	9.83+03	2.46+03
Y	.00	1.18+07	5.23+05	2.48+05	5.20+04	3.24+04	2.98+04	2.64+04	2.04+04	9.83+03	2.46+03
ZR	.00	5.04+04	4.46+05	1.04+05	3.43+04	4.98+02	7.41+01	7.55+01	7.55+01	7.55+01	7.55+01
AB	.00	1.20+07	1.04+04	5.84+05	7.34+04	1.54+03	1.47+01	3.13+01	4.89+01	4.98+01	7.51+01
MO	.00	7.43+04	3.53+04	1.00+01	.00	.00	.00	.00	.00	.00	.00
TC	.00	4.02+04	5.43+00	5.43+00	5.43+00	5.43+00	5.43+00	5.43+00	5.43+00	5.43+00	5.43+00
RU	.00	2.70+04	3.87+05	2.09+05	9.64+04	4.75+04	5.99+03	1.90+02	1.92+01	1.97+01	2.04+01
RM	.00	3.95+04	3.98+05	2.10+05	9.64+04	4.75+04	5.99+03	1.90+02	1.92+01	1.97+01	2.04+01
PD	.00	2.99+05	2.34+02	2.34+02	2.34+02	2.34+02	2.34+02	2.34+02	2.34+02	2.34+02	2.34+02
RG	.00	2.97+05	3.71+02	1.01+02	1.71+02	6.10+01	3.13+00	2.10+02	9.48+01	1.11+01	.00
CO	.00	3.44+04	9.52+01	1.13+01	1.43+00	6.47+01	5.85+01	4.57+01	2.74+01	4.30+01	5.10+01
IN	.00	7.79+04	1.54+02	5.85+03	3.40+04	2.15+04	5.42+03	5.47+04	.00	.00	.00
SH	.00	3.44+04	3.70+03	2.50+03	8.03+02	1.07+02	4.19+01	1.42+01	1.42+01	1.42+01	1.42+01
SW	.00	6.42+04	2.57+03	2.38+03	2.05+03	1.59+03	7.35+02	2.04+02	1.59+02	2.89+01	2.42+01
TE	.00	8.44+04	2.88+04	1.28+04	5.15+03	8.74+02	3.05+02	8.45+01	6.47+00	2.92+03	7.77+04
I	.00	1.18+07	4.18+02	1.02+00	1.26+02	1.26+02	1.26+02	1.26+02	1.26+02	1.26+02	1.26+02
FE	.00	9.50+04	1.32+02	1.99+00	1.16+05	5.58+05	.00	.00	.00	.00	.00
CS	.00	8.10+04	7.57+04	7.31+04	6.67+04	5.78+04	4.25+04	3.28+04	2.57+04	1.25+04	3.73+03
EA	.00	4.24+04	5.45+04	1.20+04	3.42+04	3.54+04	3.30+04	2.94+04	2.31+04	1.17+04	3.67+03
LA	.00	4.27+04	3.58+04	1.57+02	5.30+03	3.34+03	.00	.00	.00	.00	.00
CE	.00	7.74+04	9.58+05	4.48+05	3.59+05	1.47+05	1.01+04	1.17+02	1.57+02	3.82+04	.00
PR	.00	5.35+04	7.18+05	5.91+05	3.54+05	1.47+05	1.01+04	1.17+02	1.57+02	3.82+04	.00
PD	.00	1.23+04	2.44+03	3.15+01	8.54+05	1.04+04	.00	.00	.00	.00	.00
PM	.00	1.28+04	1.01+05	9.10+04	7.43+04	5.45+04	2.45+04	7.05+03	5.00+02	1.79+03	5.21+01
SR	.00	2.74+05	6.63+02	6.42+02	6.59+02	6.54+02	6.38+02	6.17+02	5.64+02	4.44+02	2.99+02
CU	.00	7.44+04	3.14+03	2.21+01	1.44+03	1.44+03	4.42+02	5.50+02	1.14+02	9.04+01	1.04+01
GO	.00	3.04+03	1.41+00	1.15+00	6.40+01	2.25+01	4.74+03	5.21+05	1.49+09	3.48+23	.00
YB	.00	4.74+02	8.53+01	4.35+01	4.05+00	1.40+01	4.40+04	1.14+03	.00	.00	.00
BT	.00	4.04+01	6.97+04	4.34+04	.00	.00	.00	.00	.00	.00	.00
MO	.00	1.24+01	1.43+05	1.42+05	1.42+05	1.42+05	1.42+05	1.42+05	1.42+05	1.42+05	1.42+05
TOTALS	.00	1.40+08	5.34+06	3.19+06	1.30+06	6.16+05	2.00+05	8.27+05	7.25+04	4.46+04	1.17+04
SUMTOT	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TOTALS	.00	1.40+08	5.34+06	6.16+05	1.27+05	4.46+04					

TABLE A-2

QUANTITIES OF FISSION PRODUCTS
IN SPENT FUEL VS. DECAY TIMES

POWER = 35,000W, BURNUP = 12000 MW/D, FUEL = 3.09*13N/CM*02-SEC

NUCLIDE CONCENTRATIONS, GRAMS
BASIS = MT OF HEAVY METAL CHARGED TO REACTOR

		CHARGE	DISCHARGE	0.1	0.1	1.0	1.0	5.0	10.0	20.0	50.0	100.0
				2.13E-02	2.30E-02	2.33E-02	2.33E-02	1.88E-02	1.39E-02	7.92E-03	1.99E-03	8.72E-05
238	U	.00	1.57E-05	1.63E-05	2.18E-05	.00	.00	.00	.00	.00	.00	.00
235	U	.00	1.76E-06	1.70E-06	9.47E-07	.00	.00	.00	.00	.00	.00	.00
232	Th	.00	1.36E-03	1.38E-03	1.38E-03	1.38E-03	1.38E-03	1.38E-03	1.38E-03	1.38E-03	1.38E-03	1.38E-03
231	Pa	.00	4.54E-06	.00	.00	.00	.00	.00	.00	.00	.00	.00
230	Th	.00	4.87E-03	4.87E-03	4.87E-03	4.87E-03	4.87E-03	4.87E-03	4.87E-03	4.87E-03	4.87E-03	4.87E-03
229	Ac	.00	4.83E-07	.00	.00	.00	.00	.00	.00	.00	.00	.00
228	Ac	.00	1.69E-02	1.69E-02	1.69E-02	1.69E-02	1.69E-02	1.69E-02	1.69E-02	1.69E-02	1.69E-02	1.69E-02
227	Ac	.00	1.62E-07	.00	.00	.00	.00	.00	.00	.00	.00	.00
226	Ac	.00	6.99E-08	.00	.00	.00	.00	.00	.00	.00	.00	.00
225	Ac	.00	7.46E-06	.00	.00	.00	.00	.00	.00	.00	.00	.00
224	Ac	.00	3.18E-02	3.18E-02	3.18E-02	3.18E-02	3.18E-02	3.18E-02	3.18E-02	3.18E-02	3.18E-02	3.18E-02
223	Ac	.00	1.64E-07	.00	.00	.00	.00	.00	.00	.00	.00	.00
222	Ac	.00	1.03E-01	1.03E-01	1.03E-01	1.03E-01	1.03E-01	1.03E-01	1.03E-01	1.03E-01	1.03E-01	1.03E-01
221	Ac	.00	2.23E-06	.00	.00	.00	.00	.00	.00	.00	.00	.00
220	Ac	.00	2.19E-04	2.21E-04	2.21E-04	2.21E-04	2.21E-04	2.21E-04	2.21E-04	2.21E-04	2.21E-04	2.21E-04
219	Ac	.00	7.80E-07	.00	.00	.00	.00	.00	.00	.00	.00	.00
218	Ac	.00	2.17E-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
217	Ac	.00	2.82E-03	4.41E-03	3.79E-03	.00	.00	.00	.00	.00	.00	.00
216	Ac	.00	9.13E-01	1.66E-06	.00	.00	.00	.00	.00	.00	.00	.00
215	Ac	.00	3.62E-01	3.45E-01	3.45E-01	3.45E-01	3.45E-01	3.45E-01	3.45E-01	3.45E-01	3.45E-01	3.45E-01
214	Ac	.00	2.29E-09	.00	.00	.00	.00	.00	.00	.00	.00	.00
213	Ac	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
212	Ac	.00	2.36E-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
211	Ac	.00	8.73E-01	8.74E-01	8.74E-01	8.74E-01	8.74E-01	8.74E-01	8.74E-01	8.74E-01	8.74E-01	8.74E-01
210	Ac	.00	5.55E-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
209	Ac	.00	2.93E-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
208	Ac	.00	2.22E-00	2.22E-00	2.22E-00	2.22E-00	2.22E-00	2.22E-00	2.22E-00	2.22E-00	2.22E-00	2.22E-00
207	Ac	.00	2.02E-04	2.07E-04	2.12E-04	2.25E-04	2.49E-04	3.20E-04	4.38E-04	6.75E-04	1.39E-03	2.57E-03
206	Ac	.00	2.73E-06	.00	.00	.00	.00	.00	.00	.00	.00	.00
205	Ac	.00	3.90E-00	3.90E-00	3.90E-00	3.90E-00	3.90E-00	3.90E-00	3.90E-00	3.90E-00	3.90E-00	3.90E-00
204	Ac	.00	2.84E-07	.00	.00	.00	.00	.00	.00	.00	.00	.00
203	Ac	.00	8.27E-06	.00	.00	.00	.00	.00	.00	.00	.00	.00
202	Ac	.00	1.24E-01	1.24E-01	1.24E-01	1.24E-01	1.24E-01	1.24E-01	1.24E-01	1.24E-01	1.24E-01	1.24E-01
201	Ac	.00	1.03E-06	.00	.00	.00	.00	.00	.00	.00	.00	.00
200	Ac	.00	1.04E-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
199	Ac	.00	3.18E-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
198	Ac	.00	5.97E-00	5.90E-00	5.90E-00	5.90E-00	5.90E-00	5.90E-00	5.90E-00	5.90E-00	5.90E-00	5.90E-00
197	Ac	.00	1.25E-08	.00	.00	.00	.00	.00	.00	.00	.00	.00
196	Ac	.00	2.00E-02	2.00E-02	2.00E-02	2.00E-02	2.00E-02	2.00E-02	2.00E-02	2.00E-02	2.00E-02	2.00E-02
195	Ac	.00	1.30E-01	1.30E-01	1.30E-01	1.30E-01	1.30E-01	1.30E-01	1.30E-01	1.30E-01	1.30E-01	1.30E-01
194	Ac	.00	2.39E-06	.00	.00	.00	.00	.00	.00	.00	.00	.00
193	Ac	.00	7.89E-08	3.00E-22	1.82E-36	.00	.00	.00	.00	.00	.00	.00
192	Ac	.00	6.15E-02	6.23E-02	6.23E-02	6.23E-02	6.23E-02	6.23E-02	6.23E-02	6.23E-02	6.23E-02	6.23E-02
191	Ac	.00	3.00E-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
190	Ac	.00	5.87E-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
189	Ac	.00	8.86E-03	.00	.00	.00	.00	.00	.00	.00	.00	.00
188	Ac	.00	5.29E-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
187	Ac	.00	2.00E-01	2.00E-01	2.00E-01	2.00E-01	2.00E-01	2.00E-01	2.00E-01	2.00E-01	2.00E-01	2.00E-01
186	Ac	.00	3.27E-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
185	Ac	.00	1.20E-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
184	Ac	.00	3.15E-03	.00	.00	.00	.00	.00	.00	.00	.00	.00

POWER: 15.00MW, BURNUP: 12000.MWD, FLUX: 3.09+13N/CM*2-SEC

NUCLIDE CONCENTRATIONS, GRAMS
BASIS: MT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
SR 84	.00	4.22+01	4.22+01	4.22+01	4.22+01	4.22+01	4.22+01	4.22+01	4.22+01	4.22+01	4.22+01
SR 85	.00	7.51+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 86	.00	3.47+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 87	.00	3.44+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 88	.00	1.32+01	1.30+01	1.28+01	1.23+01	1.16+01	9.59+00	6.93+00	3.45+00	3.31+01	2.15+02
SR 89	.00	3.06+01	3.00+01	3.00+01	3.04+01	4.02+01	4.22+01	4.48+01	4.81+01	5.12+01	5.17+01
SR 90	.00	1.44+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 91	.00	8.13+01	8.13+01	8.13+01	8.13+01	8.13+01	8.13+01	8.13+01	8.13+01	8.13+01	8.13+01
SR 92	.00	1.38+00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 93	.00	2.24+03	7.96+05	5.95+06	2.95+09	3.88+15	8.88+33	.00	.00	.00	.00
SR 94	.00	1.38+02	1.60+02	1.61+02	1.61+02	1.61+02	1.61+02	1.61+02	1.61+02	1.61+02	1.61+02
SR 95	.00	2.32+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 96	.00	2.00+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 97	.00	1.01+02	1.01+02	1.01+02	1.01+02	1.01+02	1.01+02	1.01+02	1.01+02	1.01+02	1.01+02
SR 98	.00	3.32+09	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 99	.00	2.12+06	2.13+06	2.13+06	2.13+06	2.13+06	2.13+06	2.13+06	2.13+06	2.13+06	2.13+06
SR 100	.00	9.92+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 101	.00	4.94+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 102	.00	8.85+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 103	.00	1.47+02	1.47+02	1.47+02	1.47+02	1.47+02	1.47+02	1.47+02	1.47+02	1.47+02	1.47+02
SR 104	.00	3.57+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 105	.00	1.58+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 106	.00	7.63+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 107	.00	4.62+01	1.21+01	4.76+00	3.09+01	2.37+03	1.07+09	2.17+20	.00	.00	.00
SR 108	.00	3.03+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 109	.00	1.46+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 110	.00	2.39+02	2.37+02	2.36+02	2.33+02	2.27+02	2.11+02	1.97+02	1.86+02	1.75+01	2.03+01
SR 111	.00	8.96+08	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 112	.00	6.39+02	6.12+02	6.14+02	6.05+02	5.90+02	5.88+02	4.85+02	3.79+02	1.81+02	5.26+03
SR 113	.00	2.92+00	4.37+00	5.49+00	8.74+00	1.44+01	3.06+01	5.51+01	9.59+01	1.72+02	2.21+02
SR 114	.00	6.65+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 115	.00	7.42+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 116	.00	3.83+01	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 117	.00	2.95+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 118	.00	3.75+01	2.01+01	8.79+00	7.81+01	1.05+02	2.59+08	1.15+17	2.30+36	.00	.00
SR 119	.00	1.94+02	2.33+02	2.45+02	2.53+02	2.53+02	2.53+02	2.53+02	2.53+02	2.53+02	2.53+02
SR 120	.00	1.17+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 121	.00	5.61+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 122	.00	3.01+01	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 123	.00	1.52+01	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 124	.00	2.68+02	2.68+02	2.68+02	2.68+02	2.68+02	2.68+02	2.68+02	2.68+02	2.68+02	2.68+02
SR 125	.00	2.50+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 126	.00	7.12+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 127	.00	4.12+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 128	.00	4.88+01	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 129	.00	2.94+02	2.95+02	2.95+02	2.95+02	2.95+02	2.95+02	2.95+02	2.95+02	2.95+02	2.95+02
SR 130	.00	6.43+05	9.88+05	1.22+06	1.94+06	3.17+06	6.51+06	1.17+07	1.73+07	2.47+07	2.65+07
SR 131	.00	1.04+06	2.05+06	3.12+06	7.65+06	2.07+07	9.53+07	3.27+08	1.06+09	4.81+09	1.10+10
SR 132	.00	5.74+07	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 133	.00	1.45+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 134	.00	9.24+04	.00	.00	.00	.00	.00	.00	.00	.00	.00

POWER= 35.00MW, BURUP= 12000.HWD, FLUX= 3.0E+13N/CM2-SEC

NUCLIDE CONCENTRATIONS, GRAMS
BASES = MG OF HEAVY METAL CHARGED IN REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	3. Y	10. Y	20. Y	50. Y	100. Y
Y 94	.00	1.45E-02	.00	.00	.00	.00	.00	.00	.00	.00	.00
ZR 94	.00	3.54E-02	3.64E-02	3.04E-02	3.04E-02	3.04E-02	3.04E-02	3.04E-02	3.04E-02	3.04E-02	3.04E-02
MO 95	.00	9.67E-06	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 95	.00	5.10E-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
Y 95	.00	9.33E-03	.00	.00	.00	.00	.00	.00	.00	.00	.00
ZR 95	.00	7.97E-01	3.05E-01	1.45E-01	1.62E-01	3.10E-02	2.77E-07	9.85E-16	1.17E-32	.00	.00
MO 95A	.00	9.10E-02	3.74E-02	1.77E-02	2.99E-03	9.04E-05	3.00E-10	1.54E-18	.00	.00	.00
MO 95	.00	9.20E-01	2.70E-01	1.47E-01	1.86E-01	3.94E-07	3.24E-09	1.13E-15	2.48E-34	.00	.00
MO 95	.00	1.83E-02	2.47E-02	2.73E-02	3.03E-02	3.03E-02	3.03E-02	3.03E-02	3.03E-02	3.03E-02	3.03E-02
Y 96	.00	3.04E-03	.00	.00	.00	.00	.00	.00	.00	.00	.00
ZR 96	.00	3.14E-02	3.14E-02	3.14E-02	3.14E-02	3.14E-02	3.14E-02	3.14E-02	3.14E-02	3.14E-02	3.14E-02
MO 96	.00	8.42E-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
MO 96	.00	2.80E-00	2.80E-00	2.80E-00	2.80E-00	2.80E-00	2.80E-00	2.80E-00	2.80E-00	2.80E-00	2.80E-00
Y 97	.00	8.65E-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
ZR 97	.00	8.83E-01	.00	.00	.00	.00	.00	.00	.00	.00	.00
MO 97A	.00	8.31E-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
MO 97	.00	8.23E-02	.00	.00	.00	.00	.00	.00	.00	.00	.00
MO 97	.00	3.09E-02	3.10E-02	3.10E-02	3.10E-02	3.10E-02	3.10E-02	3.10E-02	3.10E-02	3.10E-02	3.10E-02
ZR 98	.00	8.74E-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
MO 98A	.00	1.73E-03	.00	.00	.00	.00	.00	.00	.00	.00	.00
MO 98	.00	8.23E-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
MO 98	.00	3.37E-02	3.07E-02	3.07E-02	3.07E-02	3.07E-02	3.07E-02	3.07E-02	3.07E-02	3.07E-02	3.07E-02
MO 99	.00	2.26E-03	.00	.00	.00	.00	.00	.00	.00	.00	.00
MO 99	.00	3.79E-00	7.47E-10	2.12E-17	.00	.00	.00	.00	.00	.00	.00
TC 99A	.00	2.95E-01	6.39E-11	1.82E-18	.00	.00	.00	.00	.00	.00	.00
TC 99	.00	3.15E-02	3.19E-02	3.19E-02	3.19E-02	3.19E-02	3.19E-02	3.19E-02	3.19E-02	3.19E-02	3.19E-02
RU 99	.00	4.05E-04	7.42E-04	9.41E-04	1.53E-03	2.57E-03	5.70E-03	1.09E-07	2.11E-02	5.24E-02	1.05E-01
MO 100	.00	3.07E-03	.00	.00	.00	.00	.00	.00	.00	.00	.00
TC 100	.00	3.47E-02	3.47E-02	3.47E-02	3.47E-02	3.47E-02	3.47E-02	3.47E-02	3.47E-02	3.47E-02	3.47E-02
TC 100	.00	1.11E-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
TC 100	.00	6.55E-00	6.55E-00	6.55E-00	6.55E-00	6.55E-00	6.55E-00	6.55E-00	6.55E-00	6.55E-00	6.55E-00
AP 101	.00	8.40E-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
PO 101	.00	1.23E-02	.00	.00	.00	.00	.00	.00	.00	.00	.00
TC 101	.00	1.18E-02	.00	.00	.00	.00	.00	.00	.00	.00	.00
PO 101	.00	2.80E-02	2.80E-02	2.80E-02	2.80E-02	2.80E-02	2.80E-02	2.80E-02	2.80E-02	2.80E-02	2.80E-02
MO 102	.00	4.42E-03	.00	.00	.00	.00	.00	.00	.00	.00	.00
TC 102A	.00	1.72E-03	.00	.00	.00	.00	.00	.00	.00	.00	.00
TC 102	.00	3.19E-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
PO 102	.00	2.53E-02	2.53E-02	2.53E-02	2.53E-02	2.53E-02	2.53E-02	2.53E-02	2.53E-02	2.53E-02	2.53E-02
MO 103	.00	6.62E-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
TC 103	.00	5.34E-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
PO 103	.00	3.59E-01	7.43E-00	2.18E-00	6.02E-02	1.00E-04	4.70E-13	6.23E-27	.00	.00	.00
RU 103A	.00	3.59E-02	7.44E-03	2.19E-03	6.01E-05	1.01E-07	4.70E-16	6.14E-30	.00	.00	.00
MO 103	.00	1.40E-02	1.68E-02	1.73E-02	1.76E-02	1.76E-02	1.76E-02	1.76E-02	1.76E-02	1.76E-02	1.76E-02
TC 104	.00	8.78E-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
TC 104	.00	9.70E-03	.00	.00	.00	.00	.00	.00	.00	.00	.00
MO 104	.00	1.54E-02	1.54E-02	1.54E-02	1.54E-02	1.54E-02	1.54E-02	1.54E-02	1.54E-02	1.54E-02	1.54E-02
RU 104A	.00	5.62E-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
MO 104	.00	1.25E-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
PO 104	.00	2.55E-01	2.55E-01	2.55E-01	2.55E-01	2.55E-01	2.55E-01	2.55E-01	2.55E-01	2.55E-01	2.55E-01
MO 105	.00	2.65E-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
TC 105	.00	5.12E-05	.00	.00	.00	.00	.00	.00	.00	.00	.00

POWER: 35.00MW, BURNUP: 12000-MWD, FLUX: 3.0E+13N/CM^2-SEC

NUCLIDE CONCENTRATIONS, GRAMS
BASIS : WT OF HEAVY METAL CHARGED TO REACTOR

	CHANGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	3. Y	10. Y	20. Y	50. Y	100. Y
RU105	.00	1.07+01	.00	.00	.00	.00	.00	.00	.00	.00	.00
RU105M	.00	1.00+00	.00	.00	.00	.00	.00	.00	.00	.00	.00
RU105	.00	6.16+01	5.70+19	4.69+13	.00	.00	.00	.00	.00	.00	.00
PD105	.00	7.35+01	7.43+01	7.43+01	7.43+01	7.43+01	7.43+01	7.43+01	7.43+01	7.43+01	7.43+01
TC106	.00	1.89+00	.00	.00	.00	.00	.00	.00	.00	.00	.00
RU106	.00	5.42+01	4.74+01	4.15+01	2.62+01	1.41+01	1.78+00	5.67+02	5.12+05	5.68+14	6.14+29
RU106M	.00	4.61+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
RU106	.00	9.26+05	4.49+05	3.93+05	2.67+05	1.34+05	1.49+06	5.36+08	5.41+11	5.56+20	5.61+35
PD106	.00	4.58+01	5.46+01	6.05+01	7.18+01	8.79+01	1.00+02	1.07+02	1.07+02	1.07+02	1.07+02
RU107	.00	4.24+00	.00	.00	.00	.00	.00	.00	.00	.00	.00
RU107	.00	4.84+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
PD107M	.00	1.67+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
PD107	.00	4.91+01	4.91+01	4.91+01	4.91+01	4.91+01	4.91+01	4.91+01	4.91+01	4.91+01	4.91+01
RU107	.00	1.80+06	3.00+06	3.93+06	4.67+06	1.15+05	2.61+05	5.04+05	9.90+05	2.45+06	4.88+06
RU108	.00	4.70+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
RU108	.00	4.72+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
PD108	.00	3.14+01	3.14+01	3.14+01	3.14+01	3.14+01	3.14+01	3.14+01	3.14+01	3.14+01	3.14+01
AB108	.00	2.70+13	.00	.00	.00	.00	.00	.00	.00	.00	.00
CU108	.00	1.03+08	1.05+08	1.05+08	1.05+08	1.05+08	1.05+08	1.05+08	1.05+08	1.05+08	1.05+08
CU109	.00	4.14+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
PD109M	.00	5.13+07	.00	.00	.00	.00	.00	.00	.00	.00	.00
PD109	.00	7.12+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
AG109M	.00	5.46+05	1.12+17	1.03+17	7.36+16	4.21+16	7.87+19	4.49+20	1.40+22	4.39+30	.00
AG109	.00	1.51+01	1.52+01	1.52+01	1.52+01	1.52+01	1.52+01	1.52+01	1.52+01	1.52+01	1.52+01
CU109	.00	1.26+11	1.10+11	9.86+12	7.20+12	4.12+12	7.70+13	4.71+14	3.76+16	4.14+24	6.70+36
PH110	.00	2.60+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
PD110	.00	6.81+00	6.81+00	6.81+00	6.81+00	6.81+00	6.81+00	6.81+00	6.81+00	6.81+00	6.81+00
AG110M	.00	8.79+02	6.87+02	5.67+02	3.23+02	1.19+02	3.97+04	3.96+06	1.78+20	1.43+23	.00
AB110	.00	8.27+06	9.97+09	6.23+09	4.49+09	1.72+09	8.56+11	5.75+13	2.59+17	2.37+30	.00
CU110	.00	2.89+03	2.50+00	2.51+00	2.94+00	2.46+00	2.97+00	2.97+00	2.97+00	2.97+00	2.97+00
PL111M	.00	2.50+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
PD111	.00	3.45+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
AG111M	.00	1.96+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
AG111	.00	1.70+01	4.10+05	4.45+08	3.71+16	4.10+31	.00	.00	.00	.00	.00
CU111M	.00	1.27+07	.00	.00	.00	.00	.00	.00	.00	.00	.00
CU111	.00	3.51+00	3.68+00	3.68+00	3.68+00	3.68+00	3.68+00	3.68+00	3.68+00	3.68+00	3.68+00
PL112	.00	7.07+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
AG112	.00	1.83+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
CU112	.00	2.03+00	2.03+00	2.03+00	2.03+00	2.03+00	2.03+00	2.03+00	2.03+00	2.03+00	2.03+00
PD113	.00	1.10+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
AG113M	.00	9.48+07	.00	.00	.00	.00	.00	.00	.00	.00	.00
AG113	.00	2.28+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
CU113M	.00	3.11+03	3.27+03	3.24+03	3.15+03	3.00+03	2.59+03	2.02+03	1.23+03	2.79+04	2.34+04
CU113	.00	2.20+01	2.22+01	2.22+01	2.22+01	2.22+01	2.22+01	2.22+01	2.22+01	2.22+01	2.22+01
IN113	.00	4.15+05	8.13+05	1.13+04	2.03+04	3.34+04	7.67+04	1.53+03	2.17+03	3.07+03	3.33+03
PL114M	.00	1.12+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
AG114	.00	3.68+07	.00	.00	.00	.00	.00	.00	.00	.00	.00
CU114	.00	3.44+00	3.44+00	3.44+00	3.44+00	3.44+00	3.44+00	3.44+00	3.44+00	3.44+00	3.44+00
IN114M	.00	1.19+06	3.45+07	1.30+07	7.54+06	4.77+11	1.20+17	1.22+20	.00	.00	.00
IN114	.00	3.26+11	5.51+12	2.29+12	1.21+13	7.67+16	1.94+22	1.95+33	.00	.00	.00
CA114	.00	1.94+06	2.34+06	2.95+06	1.06+06	3.07+06	3.07+06	3.07+06	3.07+06	3.07+06	3.07+06
PD115	.00	2.94+04	.00	.00	.00	.00	.00	.00	.00	.00	.00

POWER= 35.00MW, BURNUP= 12000.MWD, FLUX= 3.00*10¹³N/CM²-SEC

NUCLIDE CONCENTRATIONS, GRAMS
BASIS = MT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	D. Y	O. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
AG115M	.00	3.66-07	.00	.00	.00	.00	.00	.00	.00	.00	.00
AS115	.00	5.63-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
CD115M	.00	1.52-02	3.58-03	1.16-03	4.23-05	1.17-07	2.50-15	4.09-26	.00	.00	.00
CO115	.00	1.20-02	8.44-15	2.99-24	.00	.00	.00	.00	.00	.00	.00
IN115M	.00	1.01-03	7.75-16	2.74-25	.00	.00	.00	.00	.00	.00	.00
SI115	.00	6.40-01	6.66-01	6.66-01	6.67-01	6.67-01	6.67-01	6.67-01	6.67-01	6.67-01	6.67-01
SI115	.00	5.10-02	5.16-02	5.16-02	5.16-02	5.16-02	5.16-02	5.16-02	5.16-02	5.16-02	5.16-02
SG116	.00	9.28-06	.00	.00	.00	.00	.00	.00	.00	.00	.00
CD116	.00	1.04-00	1.04-00	1.04-00	1.04-00	1.04-00	1.04-00	1.04-00	1.04-00	1.04-00	1.04-00
IN116M	.00	9.58-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
SI116	.00	1.10-07	.00	.00	.00	.00	.00	.00	.00	.00	.00
SM116	.00	3.89-01	3.89-01	3.89-01	3.89-01	3.89-01	3.89-01	3.89-01	3.89-01	3.89-01	3.89-01
AG117	.00	4.24-06	.00	.00	.00	.00	.00	.00	.00	.00	.00
CD117M	.00	3.40-03	.00	.00	.00	.00	.00	.00	.00	.00	.00
CG117	.00	5.55-06	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN117M	.00	4.47-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN117	.00	7.78-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
SM117M	.00	9.07-05	1.05-06	3.29-08	1.27-12	1.77-20	1.09-00	1.09-00	1.09-00	1.09-00	1.09-00
SM117	.00	1.08-00	1.08-00	1.08-00	1.08-00	1.08-00	1.08-00	1.08-00	1.08-00	1.08-00	1.08-00
CO118	.00	1.70-06	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN118M	.00	2.04-11	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN118	.00	3.24-07	.00	.00	.00	.00	.00	.00	.00	.00	.00
SM118	.00	1.10-00	1.10-00	1.10-00	1.10-00	1.10-00	1.10-00	1.10-00	1.10-00	1.10-00	1.10-00
CG119M	.00	5.53-06	.00	.00	.00	.00	.00	.00	.00	.00	.00
CG119	.00	2.05-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN119	.00	7.37-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN119	.00	4.30-07	.00	.00	.00	.00	.00	.00	.00	.00	.00
SI119A	.00	1.95-03	1.57-03	1.25-03	7.09-04	2.57-04	1.23-05	7.80-08	3.11-12	1.99-25	.00
SI119	.00	1.16-00	1.16-00	1.16-00	1.16-00	1.16-00	1.16-00	1.16-00	1.16-00	1.16-00	1.16-00
CG120	.00	4.25-06	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN120M	.00	1.13-07	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN120	.00	1.63-06	.00	.00	.00	.00	.00	.00	.00	.00	.00
SM120	.00	1.22-00	1.22-00	1.22-00	1.22-00	1.22-00	1.22-00	1.22-00	1.22-00	1.22-00	1.22-00
CG121	.00	1.65-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN121M	.00	1.46-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN121	.00	3.26-08	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN121M	.00	1.32-06	1.32-06	1.31-06	1.31-06	1.30-06	1.26-06	1.20-06	1.10-06	8.36-07	5.10-07
SI121	.00	7.74-03	.00	.00	.00	.00	.00	.00	.00	.00	.00
SM121	.00	1.35-00	1.36-00	1.36-00	1.36-00	1.36-00	1.36-00	1.36-00	1.36-00	1.36-00	1.36-00
IN122	.00	6.28-07	.00	.00	.00	.00	.00	.00	.00	.00	.00
SM122	.00	1.49-00	1.49-00	1.49-00	1.49-00	1.49-00	1.49-00	1.49-00	1.49-00	1.49-00	1.49-00
SM122M	.00	8.18-08	.00	.00	.00	.00	.00	.00	.00	.00	.00
SI122	.00	7.88-08	1.66-13	4.95-21	.00	.00	.00	.00	.00	.00	.00
SI122	.00	2.90-02	2.90-02	2.90-02	2.90-02	2.90-02	2.90-02	2.90-02	2.90-02	2.90-02	2.90-02
IN123M	.00	1.13-06	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN123	.00	1.05-07	.00	.00	.00	.00	.00	.00	.00	.00	.00
SI123M	.00	2.53-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
SI123	.00	7.16-01	4.33-01	2.74-01	4.42-02	1.24-02	2.85-05	1.14-09	1.82-18	.00	.00
SM123	.00	4.38-01	1.22-00	1.36-00	1.36-00	1.36-00	1.36-00	1.36-00	1.36-00	1.36-00	1.36-00
IN123M	.00	3.60-06	2.11-06	1.40-06	4.14-07	4.76-08	7.21-11	1.44-15	5.76-25	.00	.00
IN122	.00	1.22-05	1.37-05	1.44-05	1.54-05	1.57-05	1.58-05	1.58-05	1.58-05	1.58-05	1.58-05
IN124	.00	4.73-07	.00	.00	.00	.00	.00	.00	.00	.00	.00

Power: 35.00MW, Burnup: 17000.MWD, PLUM: 3.00+33M/C=02-SEC

NUCLIDE CONCENTRATIONS, MASS
BASIS = MT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	1. Y	2. Y	3. Y	4. Y	5. Y	10. Y	20. Y	30. Y	100. Y
SR124	.00	2.12+00	2.12+00	2.12+00	2.12+00	2.12+00	2.12+00	2.12+00	2.12+00	2.12+00	2.12+00	2.12+00
SR125M	.00	3.30+00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR126	.00	4.20+03	1.48+03	6.61+04	6.17+25	9.07+27	2.38+12	1.98+21	.00	.00	.00	.00
SR127	.00	5.41+03	8.52+03	9.38+03	9.98+03	1.00+02	1.00+02	1.00+02	1.00+02	1.00+02	1.00+02	1.00+02
SR128M	.00	3.67+05	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR129	.00	9.33+02	1.18+04	6.79+07	1.81+13	3.63+25	.00	.00	.00	.00	.00	.00
SR130	.00	2.41+00	2.35+00	2.24+00	1.94+00	1.50+00	6.93+01	1.92+01	1.67+02	6.65+06	1.77+11	1.77+11
TC125M	.00	3.98+02	4.99+02	5.13+02	4.69+02	3.65+02	1.69+02	4.68+03	3.53+04	1.62+07	6.31+13	6.31+13
TC125	.00	2.16+01	3.58+01	4.69+01	7.78+01	1.22+00	2.05+00	2.56+00	2.78+00	2.78+00	2.78+00	2.78+00
SR126	.00	5.00+00	5.00+00	5.00+00	5.00+00	5.00+00	5.00+00	5.00+00	5.00+00	5.00+00	5.00+00	5.00+00
SR126M	.00	7.79+08	1.81+09	1.81+09	1.81+09	1.81+09	1.81+09	1.81+09	1.81+09	1.81+09	1.81+09	1.81+09
SR126	.00	2.88+04	3.68+06	1.73+06	1.69+06	1.69+06	1.69+06	1.69+06	1.69+06	1.69+06	1.69+06	1.69+06
TC126	.00	4.25+03	4.55+03	4.55+03	4.57+03	4.61+03	4.71+03	4.89+03	5.23+03	6.77+03	8.01+03	8.01+03
SR127M	.00	2.22+06	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR127	.00	5.29+03	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR127	.00	2.37+01	2.47+04	9.02+14	1.02+29	.00	.00	.00	.00	.00	.00	.00
TC127M	.00	1.17+00	6.90+01	4.82+01	3.20+01	1.17+02	2.11+05	9.99+11	8.13+21	.00	.00	.00
TC127	.00	2.28+02	2.45+03	1.57+03	4.76+04	4.17+05	3.45+08	3.55+11	2.90+23	.00	.00	.00
TC127	.00	1.07+01	1.18+03	1.17+01	1.20+01	1.21+01	1.21+01	1.21+01	1.21+01	1.21+01	1.21+01	1.21+01
SR128	.00	7.13+03	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR128M	.00	1.29+03	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR129	.00	8.71+03	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TC128	.00	3.83+01	3.83+03	3.83+03	3.83+03	3.83+03	3.83+03	3.83+03	3.83+03	3.83+03	3.83+03	3.83+03
TC128	.00	4.71+05	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR129M	.00	2.63+01	2.64+01	2.64+01	2.64+01	2.64+01	2.64+01	2.64+01	2.64+01	2.64+01	2.64+01	2.64+01
SR129	.00	1.45+02	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR129	.00	2.77+05	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR129	.00	6.34+02	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TC129M	.00	1.00+00	3.05+01	7.33+02	1.12+03	6.51+07	1.29+16	8.72+33	.00	.00	.00	.00
TC129	.00	1.40+02	2.76+04	6.62+05	1.01+06	5.88+10	1.17+19	.00	.00	.00	.00	.00
TC129	.00	7.51+01	7.68+01	7.70+01	7.71+01	7.71+01	7.71+01	7.71+01	7.71+01	7.71+01	7.71+01	7.71+01
SR129M	.00	7.42+06	3.05+09	7.08+12	1.38+19	2.40+33	.00	.00	.00	.00	.00	.00
SR129	.00	2.92+02	2.92+02	2.92+02	2.92+02	2.92+02	2.92+02	2.92+02	2.92+02	2.92+02	2.92+02	2.92+02
SR130	.00	1.14+03	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR130M	.00	2.76+03	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR130	.00	1.59+03	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TC130	.00	1.47+02	1.47+02	1.47+02	1.47+02	1.47+02	1.47+02	1.47+02	1.47+02	1.47+02	1.47+02	1.47+02
TC130M	.00	4.51+05	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TC130	.00	5.45+03	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TC130	.00	1.18+00	1.19+00	1.19+00	1.19+00	1.19+00	1.19+00	1.19+00	1.19+00	1.19+00	1.19+00	1.19+00
SR131	.00	2.20+03	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR131	.00	1.51+02	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TC131M	.00	1.77+01	3.79+23	.00	.00	.00	.00	.00	.00	.00	.00	.00
TC131	.00	1.44+02	9.67+24	.00	.00	.00	.00	.00	.00	.00	.00	.00
TC131	.00	7.59+00	3.17+03	8.35+04	1.71+13	3.15+27	.00	.00	.00	.00	.00	.00
SR131M	.00	8.95+02	1.36+03	2.35+05	1.37+10	4.60+20	.00	.00	.00	.00	.00	.00
TC131	.00	1.82+02	1.90+02	1.90+02	1.90+02	1.90+02	1.90+02	1.90+02	1.90+02	1.90+02	1.90+02	1.90+02
SR132	.00	2.03+03	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR132M	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR132	.00	1.95+03	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TC132	.00	4.36+00	2.03+06	6.62+15	6.40+34	.00	.00	.00	.00	.00	.00	.00
TC132	.00	1.33+01	6.11+10	2.03+14	.00	.00	.00	.00	.00	.00	.00	.00

POWER= 55.00MW, BURNUP= 12000.MWD, FLUX= 3.00E+13#/CM2-SEC

NUCLIDE CONCENTRATIONS, GRAMS
BASED ON WT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
HE132	.00	3.40E+02	3.55E+02	3.55E+02	3.53E+02	3.51E+02	3.53E+02	3.55E+02	3.53E+02	3.55E+02	3.55E+02
SR133	.00	3.40E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE133M	.00	5.20E+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE133	.00	4.67E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
II133	.00	1.73E+00	.00	.00	.00	.00	.00	.00	.00	.00	.00
HE133M	.00	1.00E+01	3.40E+13	4.57E+23	.00	.00	.00	.00	.00	.00	.00
HE133	.00	9.92E+00	4.80E+05	6.90E+09	1.67E+20	.00	.00	.00	.00	.00	.00
CS135	.00	4.20E+02	4.30E+02	4.30E+02	4.30E+02	4.30E+02	4.30E+02	4.30E+02	4.30E+02	4.30E+02	4.30E+02
SA134	.00	3.44E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
Y135M	.00	5.07E+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
II134	.00	4.33E+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
XE134	.00	5.69E+02	5.70E+02	5.70E+02	5.70E+02	5.70E+02	5.70E+02	5.70E+02	5.70E+02	5.70E+02	5.70E+02
CS134M	.00	3.00E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS134	.00	3.02E+03	2.70E+03	2.60E+03	2.13E+03	1.53E+03	3.50E+00	1.03E+00	3.40E+02	1.37E+06	6.27E+14
BA134	.00	3.25E+00	3.60E+00	3.60E+00	3.60E+00	3.60E+00	3.60E+00	3.60E+00	3.60E+00	3.60E+00	3.60E+00
TE135	.00	5.93E+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
II135	.00	9.99E+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
HE135M	.00	5.02E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
HE135	.00	1.71E+01	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS135M	.00	2.30E+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS135	.00	1.07E+02	1.00E+02	1.00E+02	1.00E+02	1.00E+02	1.00E+02	1.00E+02	1.00E+02	1.00E+02	1.00E+02
BA135M	.00	1.50E+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
BA135	.00	4.90E+04	5.01E+04	5.00E+04	5.20E+04	5.45E+04	4.20E+04	7.00E+04	9.90E+04	1.70E+05	2.40E+05
II136	.00	7.70E+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
XE136	.00	6.30E+02	4.30E+02	4.30E+02	4.30E+02	4.30E+02	4.30E+02	4.30E+02	4.30E+02	4.30E+02	4.30E+02
CS136	.00	3.32E+01	2.73E+03	4.55E+05	1.16E+09	4.02E+10	.00	.00	.00	.00	.00
BA136	.00	3.27E+00	3.60E+00	3.60E+00	3.60E+00	3.60E+00	3.60E+00	3.60E+00	3.60E+00	3.60E+00	3.60E+00
II137	.00	4.02E+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
XE137	.00	5.13E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS137	.00	4.55E+02	4.55E+02	4.51E+02	4.45E+02	4.35E+02	4.00E+02	3.40E+02	2.87E+02	1.43E+02	4.52E+01
BA137M	.00	4.80E+05	4.80E+05	4.81E+05	4.72E+05	4.57E+05	4.13E+05	3.40E+05	4.33E+05	2.77E+05	4.02E+05
BA137	.00	4.93E+00	7.52E+00	7.52E+00	1.53E+01	2.55E+01	5.40E+01	9.80E+01	1.73E+02	3.17E+02	4.23E+02
II138	.00	7.20E+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
HE138	.00	2.10E+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS138	.00	4.11E+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
BA138	.00	4.35E+02	4.35E+02	4.35E+02	4.35E+02	4.35E+02	4.35E+02	4.35E+02	4.35E+02	4.35E+02	4.35E+02
II139	.00	3.00E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
HE139	.00	8.60E+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS139	.00	8.20E+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
BA139	.00	8.13E+01	.00	.00	.00	.00	.00	.00	.00	.00	.00
SA139	.00	4.74E+02	4.77E+02	4.77E+02	4.77E+02	4.77E+02	4.77E+02	4.77E+02	4.77E+02	4.77E+02	4.77E+02
XE140	.00	2.12E+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS140	.00	3.31E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
BA140	.00	2.40E+01	8.00E+01	4.25E+03	6.32E+00	1.02E+16	.00	.00	.00	.00	.00
IA140	.00	1.10E+00	2.65E+02	4.40E+04	9.51E+09	2.40E+17	.00	.00	.00	.00	.00
XE140	.00	4.44E+02	4.90E+02	4.90E+02	4.90E+02	4.90E+02	4.90E+02	4.90E+02	4.90E+02	4.90E+02	4.90E+02
CE140	.00	4.72E+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS140	.00	3.73E+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
SA140	.00	2.32E+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
BA140	.00	3.05E+01	.00	.00	.00	.00	.00	.00	.00	.00	.00
CE140	.00	4.15E+01	9.00E+00	2.02E+00	2.50E+02	1.01E+05	4.63E+14	7.12E+33	.00	.00	.00
PR140	.00	3.90E+02	4.52E+02	4.50E+02	4.61E+02	4.61E+02	4.61E+02	4.61E+02	4.61E+02	4.61E+02	4.61E+02

POWER = 36.00MW, BURNDUP = 12000.MW, FLUX = 3.00E+13M/CM**2-SEC

NUCLIDE CONCENTRATIONS, GRAMS
BASIS = MT OF HEAVY METAL CHARGED TO REACTOR

CHANGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
HE142	.00	2.00E-06	.00	.00	.00	.00	.00	.00	.00	.00
CS142	.00	2.79E-05	.00	.00	.00	.00	.00	.00	.00	.00
BA142	.00	1.31E-02	.00	.00	.00	.00	.00	.00	.00	.00
LA142	.00	1.15E-01	.00	.00	.00	.00	.00	.00	.00	.00
CE142	.00	4.43E-02	4.43E-02	4.43E-02	4.43E-02	4.43E-02	4.43E-02	4.43E-02	4.43E-02	4.43E-02
PR142	.00	1.60E-02	.00	.00	.00	.00	.00	.00	.00	.00
AD142	.00	2.00E-00	2.00E-00	2.00E-00	2.00E-00	2.00E-00	2.00E-00	2.00E-00	2.00E-00	2.00E-00
HE143	.00	2.60E-07	.00	.00	.00	.00	.00	.00	.00	.00
CS143	.00	1.28E-05	.00	.00	.00	.00	.00	.00	.00	.00
BA143	.00	1.94E-04	.00	.00	.00	.00	.00	.00	.00	.00
LA143	.00	1.45E-02	.00	.00	.00	.00	.00	.00	.00	.00
CE143	.00	2.33E-00	4.64E-20	2.21E-35	.00	.00	.00	.00	.00	.00
PR143	.00	2.26E-01	2.65E-01	7.48E-03	2.37E-07	2.62E-15	.00	.00	.00	.00
AD143	.00	1.58E-02	3.83E-02	1.81E-02	1.81E-02	3.83E-02	3.83E-02	3.83E-02	3.83E-02	3.83E-02
LA144	.00	7.50E-05	.00	.00	.00	.00	.00	.00	.00	.00
CE144	.00	2.73E-02	2.18E-02	1.85E-02	1.12E-02	4.59E-01	3.17E-00	4.43E-06	1.19E-17	5.22E-17
PR144	.00	1.17E-02	9.28E-03	1.82E-03	4.74E-03	1.94E-03	1.34E-04	1.55E-00	2.09E-10	5.05E-22
AD144	.00	1.72E-02	2.26E-02	2.61E-02	3.36E-02	4.43E-02	4.43E-02	4.43E-02	4.43E-02	4.43E-02
CE145	.00	2.65E-03	.00	.00	.00	.00	.00	.00	.00	.00
PR145	.00	2.99E-01	.00	.00	.00	.00	.00	.00	.00	.00
AD145	.00	2.45E-02	2.86E-02	2.86E-02	2.86E-02	2.86E-02	2.86E-02	2.86E-02	2.86E-02	2.86E-02
CE146	.00	9.31E-03	.00	.00	.00	.00	.00	.00	.00	.00
PR146	.00	1.60E-02	.00	.00	.00	.00	.00	.00	.00	.00
AD146	.00	2.44E-02	2.44E-02	2.44E-02	2.44E-02	2.44E-02	2.44E-02	2.44E-02	2.44E-02	2.44E-02
CE147	.00	5.68E-04	.00	.00	.00	.00	.00	.00	.00	.00
PR147	.00	6.29E-03	.00	.00	.00	.00	.00	.00	.00	.00
AD147	.00	8.59E-00	3.11E-02	3.94E-04	1.07E-09	1.37E-19	.00	.00	.00	.00
CE148	.00	9.83E-01	1.00E-02	9.53E-01	8.21E-01	6.30E-01	2.85E-01	7.59E-00	5.38E-01	1.92E-04
PR148	.00	1.30E-01	1.96E-01	2.76E-01	3.78E-01	5.68E-01	9.14E-01	1.12E-02	1.19E-02	1.20E-02
AD148	.00	2.85E-04	.00	.00	.00	.00	.00	.00	.00	.00
PR148	.00	7.96E-04	.00	.00	.00	.00	.00	.00	.00	.00
AD149	.00	1.17E-02	1.37E-02	1.37E-02	1.37E-02	1.37E-02	1.37E-02	1.37E-02	1.37E-02	1.37E-02
PR149	.00	1.56E-00	3.58E-01	1.11E-01	3.76E-03	9.07E-06	1.27E-13	1.03E-26	.00	.00
CE149	.00	1.00E-00	3.66E-03	1.15E-03	3.89E-05	9.37E-08	1.31E-15	1.06E-28	.00	.00
PR149	.00	3.04E-01	3.26E-01	3.28E-01	3.30E-01	3.30E-01	3.30E-01	3.30E-01	3.30E-01	3.30E-01
AD149	.00	6.10E-04	.00	.00	.00	.00	.00	.00	.00	.00
PR149	.00	3.14E-02	.00	.00	.00	.00	.00	.00	.00	.00
AD149	.00	1.89E-00	4.43E-13	2.56E-22	.00	.00	.00	.00	.00	.00
PR149	.00	5.83E-00	7.15E-00	7.15E-00	7.15E-00	7.15E-00	7.15E-00	7.15E-00	7.15E-00	7.15E-00
AD150	.00	6.97E-01	5.97E-01	5.97E-01	5.97E-01	5.97E-01	5.97E-01	5.97E-01	5.97E-01	5.97E-01
PR150	.00	7.20E-04	.00	.00	.00	.00	.00	.00	.00	.00
SM150	.00	1.24E-02	1.24E-02	1.24E-02	1.24E-02	1.24E-02	1.24E-02	1.24E-02	1.24E-02	1.24E-02
AD151	.00	1.65E-03	.00	.00	.00	.00	.00	.00	.00	.00
PR151	.00	2.31E-01	.00	.00	.00	.00	.00	.00	.00	.00
SM151	.00	2.42E-01	2.43E-01	2.43E-01	2.43E-01	2.43E-01	2.43E-01	2.43E-01	2.43E-01	2.43E-01
EU151	.00	2.97E-02	2.75E-02	1.15E-01	2.23E-01	4.15E-01	9.82E-01	1.90E-00	3.62E-00	8.05E-00
PR152	.00	5.78E-04	.00	.00	.00	.00	.00	.00	.00	.00
SM152	.00	3.72E-01	3.72E-01	3.72E-01	3.72E-01	3.72E-01	3.72E-01	3.72E-01	3.72E-01	3.72E-01
EU152	.00	9.06E-05	.00	.00	.00	.00	.00	.00	.00	.00
EU152	.00	2.28E-02	2.25E-02	2.22E-02	2.15E-02	2.03E-02	1.71E-02	1.28E-02	7.18E-03	1.27E-03
AD152	.00	1.94E-02	1.96E-02	1.96E-02	1.94E-02	2.02E-02	2.11E-02	2.23E-02	2.35E-02	2.55E-02
PR153	.00	2.82E-04	.00	.00	.00	.00	.00	.00	.00	.00

PMWCR= 35.00MW, BURWUP= 12000.MW, FLWR= 3.00*10^6CM^2-SEC

NUCLIDE CONCENTRATIONS, GRAMS
BASIS : MT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
SM153	.00	5.08+01	7.44-15	1.30-25	.00	.00	.00	.00	.00	.00	.00
EU153	.00	2.95+01	3.00+01	3.00+01	3.00+01	3.00+01	3.00+01	3.00+01	3.00+01	3.00+01	3.00+01
GO153	.00	5.16-04	3.99-04	3.28-04	1.81-04	6.37-05	2.78-06	1.48-08	4.27-13	9.88-27	.00
PH154	.00	9.21-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
SM154	.00	1.02+01	1.02+01	1.02+01	1.02+01	1.02+01	1.02+01	1.02+01	1.02+01	1.02+01	1.02+01
EU154	.00	9.93+00	5.37+00	5.37+00	5.20+00	4.98+00	4.37+00	3.52+00	2.28+00	4.21+01	7.13+02
GO154	.00	6.56-02	1.23+01	1.44-01	2.46-01	5.17-01	1.12+00	1.98+00	3.21+00	4.88+00	5.43+00
SM155	.00	5.78-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU155	.00	1.29+00	1.18+00	1.09+00	4.83-01	4.02-01	1.91-01	2.81-02	4.10-06	6.25-09	3.01-17
GO155	.00	1.40-02	1.31-01	2.31-01	4.26-01	1.07-01	1.12+00	1.28+00	1.31+00	1.31+00	1.31+00
SM156	.00	6.59-03	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU156	.00	9.74-01	1.55-02	6.03-04	4.58-08	2.14-15	.00	.00	.00	.00	.00
GO156	.00	8.64+00	9.60+00	9.62+00	9.62+00	9.62+00	9.62+00	9.62+00	9.62+00	9.62+00	9.62+00
SM157	.00	4.01-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU157	.00	7.32-03	.00	.00	.00	.00	.00	.00	.00	.00	.00
GO157	.00	1.89-02	2.62-02	2.62-02	2.67-02	2.62-02	2.67-02	2.62-02	2.67-02	2.62-02	2.62-02
EU158	.00	1.71-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
GO158	.00	2.70+00	2.79+00	2.79+00	2.79+00	2.79+00	2.79+00	2.79+00	2.79+00	2.79+00	2.79+00
EU159	.00	3.53-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
GO159	.00	2.22-03	.00	.00	.00	.00	.00	.00	.00	.00	.00
SM159	.00	4.15-01	4.17-01	4.17-01	4.17-01	4.17-01	4.17-01	4.17-01	4.17-01	4.17-01	4.17-01
EU160	.00	2.20-06	.00	.00	.00	.00	.00	.00	.00	.00	.00
GO160	.00	1.91-01	1.91-01	1.91-01	1.91-01	1.91-01	1.91-01	1.91-01	1.91-01	1.91-01	1.91-01
EU161	.00	1.79-02	7.53-03	3.80-03	5.34-04	1.59-05	9.24-10	1.00-17	5.61-23	.00	.00
GO161	.00	1.16-02	2.80-02	3.17-02	3.50-02	3.55-02	3.55-02	3.55-02	3.55-02	3.55-02	3.55-02
SM161	.00	1.16-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU161	.00	3.45-03	4.09-03	1.61-10	4.00-19	4.33-35	.00	.00	.00	.00	.00
GO161	.00	5.45-02	5.80-02	5.80-02	5.80-02	5.80-02	5.80-02	5.80-02	5.80-02	5.80-02	5.80-02
SM162	.00	1.78-06	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU162M	.00	1.28-06	.00	.00	.00	.00	.00	.00	.00	.00	.00
SM162	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
GO162	.00	3.84-02	3.84-02	3.84-02	3.84-02	3.84-02	3.84-02	3.84-02	3.84-02	3.84-02	3.84-02
SM163M	.00	2.81-07	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU163	.00	1.44-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
GO163	.00	2.61-02	2.61-02	2.61-02	2.61-02	2.61-02	2.61-02	2.61-02	2.61-02	2.61-02	2.61-02
SM164	.00	3.60-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
GO164	.00	7.21-03	7.22-03	7.22-03	7.22-03	7.22-03	7.22-03	7.22-03	7.22-03	7.22-03	7.22-03
EU165M	.00	4.79-08	.00	.00	.00	.00	.00	.00	.00	.00	.00
GO165	.00	1.32-06	.00	.00	.00	.00	.00	.00	.00	.00	.00
SM165	.00	5.81-03	5.82-03	5.82-03	5.82-03	5.82-03	5.82-03	5.82-03	5.82-03	5.82-03	5.82-03
GO166	.00	2.86-05	3.01-13	1.48-19	.00	.00	.00	.00	.00	.00	.00
MC166M	.00	7.91-06	7.91-06	7.91-06	7.90-06	7.90-06	7.89-06	7.88-06	7.88-06	7.88-06	7.87-06
MC166	.00	1.79-05	1.48-13	9.26-20	.00	.00	.00	.00	.00	.00	.00
EU166	.00	1.51-03	2.56-03	1.56-03	1.56-03	1.56-03	1.56-03	1.56-03	1.56-03	1.56-03	1.56-03
GO167	.00	1.27-04	1.27-04	1.27-04	1.27-04	1.27-04	1.27-04	1.27-04	1.27-04	1.27-04	1.27-04
TOTAL	.00	1.27+04	1.27+04	1.27+04	1.27+04	1.27+04	1.27+04	1.27+04	1.27+04	1.27+04	1.27+04

POWER= 35.00MW. BURDUP= 12000.0WD. FLUX= 5.00e+14n/cm^2-SEC

ELEMENT CONCENTRATIONS, GRAMS
BASIS : WT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	D. Y	D. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
H	.00	2.44E-02	2.41E-02	2.38E-02	2.31E-02	2.18E-02	1.88E-02	1.59E-02	1.02E-03	1.46E-03	6.72E-05
ZN	.00	1.57E-05	1.63E-05	2.18E-05	.00	.00	.00	.00	.00	.00	.00
GA	.00	1.01E-05	1.09E-05	9.49E-05	.00	.00	.00	.00	.00	.00	.00
GE	.00	1.27E-01	1.27E-01	1.27E-01	1.27E-01	1.27E-01	1.27E-01	1.27E-01	1.27E-01	1.27E-01	1.27E-01
AS	.00	3.11E-02	3.14E-02	3.14E-02	3.14E-02	3.14E-02	3.14E-02	3.14E-02	3.14E-02	3.14E-02	3.14E-02
SE	.00	2.03E-01	2.03E-01	2.03E-01	2.03E-01	2.03E-01	2.03E-01	2.03E-01	2.03E-01	2.03E-01	2.03E-01
BR	.00	5.91E-05	5.90E-05	5.90E-05	5.90E-05	5.90E-05	5.90E-05	5.90E-05	5.90E-05	5.90E-05	5.90E-05
PC	.00	1.57E-02	1.57E-02	1.57E-02	1.57E-02	1.57E-02	1.57E-02	1.57E-02	1.57E-02	1.57E-02	1.57E-02
SR	.00	1.40E-02	1.40E-02	1.40E-02	1.40E-02	1.40E-02	1.40E-02	1.40E-02	1.40E-02	1.40E-02	1.40E-02
VB	.00	4.26E-02	3.96E-02	3.88E-02	3.80E-02	3.70E-02	3.58E-02	3.33E-02	2.93E-02	2.16E-02	1.67E-02
V	.00	2.13E-02	2.07E-02	2.03E-02	1.99E-02	1.99E-02	1.99E-02	1.99E-02	1.99E-02	1.99E-02	1.99E-02
ZO	.00	1.46E-03	1.45E-03	1.42E-03	1.40E-03	1.40E-03	1.40E-03	1.40E-03	1.40E-03	1.40E-03	1.40E-03
NB	.00	4.21E-01	2.71E-01	1.48E-01	1.08E-01	5.98E-02	7.46E-04	1.43E-03	2.79E-03	6.87E-03	1.37E-02
NO	.00	1.15E-03	1.21E-03	1.19E-03	1.27E-03	1.27E-03	1.27E-03	1.27E-03	1.27E-03	1.27E-03	1.27E-03
TC	.00	3.15E-02	3.19E-02	3.19E-02	3.19E-02	3.19E-02	3.19E-02	3.19E-02	3.19E-02	3.19E-02	3.19E-02
RU	.00	7.86E-02	7.48E-02	7.37E-02	7.27E-02	7.08E-02	6.95E-02	6.94E-02	6.93E-02	6.93E-02	6.94E-02
RH	.00	1.40E-02	1.40E-02	1.40E-02	1.40E-02	1.40E-02	1.40E-02	1.40E-02	1.40E-02	1.40E-02	1.40E-02
PD	.00	2.32E-02	2.42E-02	2.48E-02	2.51E-02	2.75E-02	2.87E-02	2.89E-02	2.89E-02	2.89E-02	2.89E-02
AG	.00	1.54E-01	1.52E-01	1.52E-01	1.52E-01	1.52E-01	1.52E-01	1.52E-01	1.52E-01	1.52E-01	1.52E-01
CO	.00	1.31E-01	1.33E-01	1.33E-01	1.34E-01	1.34E-01	1.34E-01	1.34E-01	1.34E-01	1.34E-01	1.34E-01
IN	.00	6.47E-01	6.46E-01	6.46E-01	6.48E-01	6.48E-01	6.48E-01	6.48E-01	6.70E-01	6.71E-01	6.71E-01
SN	.00	1.44E-01	1.40E-01	1.39E-01	1.37E-01	1.36E-01	1.36E-01	1.36E-01	1.36E-01	1.36E-01	1.36E-01
SB	.00	5.04E-02	4.93E-02	4.95E-02	4.85E-02	4.50E-02	3.70E-02	3.20E-02	3.03E-02	3.01E-02	3.01E-02
TE	.00	1.93E-02	1.87E-02	1.87E-02	1.86E-02	1.87E-02	1.88E-02	1.88E-02	1.88E-02	1.88E-02	1.88E-02
I	.00	9.58E-01	8.82E-01	6.82E-01	6.91E-01	6.92E-01	6.92E-01	6.92E-01	6.92E-01	6.92E-01	6.92E-01
LE	.00	1.95E-03	1.95E-03	1.95E-03	1.95E-03	1.95E-03	1.95E-03	1.95E-03	1.95E-03	1.95E-03	1.95E-03
CS	.00	1.02E-03	1.03E-03	1.02E-03	1.01E-03	9.96E-02	9.57E-02	9.08E-02	8.32E-02	6.89E-02	5.91E-02
RA	.00	4.71E-02	4.52E-02	4.55E-02	4.66E-02	4.82E-02	5.21E-02	5.70E-02	6.45E-02	7.89E-02	9.67E-02
LA	.00	6.40E-02	6.79E-02	6.71E-02	6.77E-02	6.77E-02	6.77E-02	6.77E-02	6.77E-02	6.77E-02	6.77E-02
CL	.00	1.25E-03	1.17E-03	1.12E-03	1.05E-03	9.83E-02	9.40E-02	9.37E-02	9.37E-02	9.37E-02	9.37E-02
FA	.00	4.22E-02	4.52E-02	4.59E-02	4.61E-02	4.61E-02	4.61E-02	4.61E-02	4.61E-02	4.61E-02	4.61E-02
NO	.00	1.27E-03	1.28E-03	1.37E-03	1.44E-03	1.51E-03	1.55E-03	1.56E-03	1.56E-03	1.56E-03	1.56E-03
PM	.00	1.03E-02	1.01E-02	9.54E-03	8.21E-03	6.30E-03	2.85E-03	7.59E-04	5.38E-04	1.92E-04	1.45E-04
SM	.00	2.45E-02	2.45E-02	2.41E-02	2.74E-02	2.93E-02	3.27E-02	3.47E-02	3.52E-02	3.46E-02	3.43E-02
CU	.00	3.73E-03	3.67E-03	3.66E-03	3.63E-03	3.60E-03	3.56E-03	3.55E-03	3.55E-03	3.57E-03	3.45E-03
GO	.00	1.17E-01	1.29E-01	1.30E-01	1.34E-01	1.39E-01	1.49E-01	1.59E-01	1.72E-01	1.86E-01	1.94E-01
TR	.00	4.37E-01	4.25E-01	4.21E-01	4.18E-01	4.17E-01	4.17E-01	4.17E-01	4.17E-01	4.17E-01	4.17E-01
OT	.00	1.44E-01	1.58E-01	1.61E-01	1.65E-01	1.65E-01	1.65E-01	1.65E-01	1.65E-01	1.65E-01	1.65E-01
MO	.00	5.84E-03	5.82E-03	5.82E-03	5.82E-03	5.82E-03	5.82E-03	5.82E-03	5.82E-03	5.82E-03	5.82E-03
ER	.00	1.64E-03	1.64E-03	1.64E-03	1.64E-03	1.64E-03	1.64E-03	1.64E-03	1.64E-03	1.64E-03	1.64E-03
TOTALS	.00	1.27E-04	1.27E-04	1.27E-04	1.27E-04	1.27E-04	1.27E-04	1.27E-04	1.27E-04	1.27E-04	1.27E-04
SUBTOT	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TOTALS	.00	1.27E-04	1.27E-04	1.27E-04	1.27E-04	1.27E-04	1.27E-04	1.27E-04	1.27E-04	1.27E-04	1.27E-04

TABLE A-3

ACTIVITIES OF TRANSURANIC NUCLIDES IN SPENT FUEL VS. DECAY TIMES

POWER: 35.00MW, BURNUP: 12000.0MB, FUEL: 1.00E+13MC0002-100

 NUCLIDE RADIOACTIVITY, CURIES
 BASIS = RT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
NE 9	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PL207	.00	5.40E-08	1.01E-07	1.42E-07	2.02E-07	5.32E-07	1.18E-06	3.18E-06	8.00E-06	2.86E-05	7.15E-05
PL208	.00	3.47E-05	6.08E-05	7.49E-05	1.24E-04	2.11E-04	3.46E-04	5.35E-04	8.56E-04	4.23E-04	2.61E-04
PL209	.00	2.47E-10	7.77E-11	9.34E-11	1.40E-10	2.55E-10	5.45E-10	1.04E-09	2.08E-09	5.61E-09	1.29E-08
PL204	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PL207	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PL206	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PL209	.00	1.12E-04	3.99E-09	4.43E-09	7.26E-09	1.16E-08	2.46E-08	4.74E-08	9.47E-08	2.55E-07	5.26E-07
PL210	.00	5.19E-11	6.27E-11	9.69E-11	2.62E-10	8.91E-10	2.13E-09	4.29E-09	2.79E-07	3.27E-06	1.90E-05
PL211	.00	5.41E-08	1.02E-07	1.42E-07	2.93E-07	5.55E-07	1.38E-06	3.14E-06	8.02E-06	2.87E-05	7.17E-05
PL212	.00	1.02E-04	1.49E-04	2.18E-04	3.57E-04	5.86E-04	1.10E-03	1.44E-03	1.54E-03	1.17E-03	7.25E-04
PL214	.00	3.01E-04	4.77E-09	6.34E-09	1.23E-08	2.61E-08	1.15E-07	3.90E-07	1.45E-06	6.87E-06	3.32E-05
PL214	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PL216	.00	3.00E-11	6.28E-11	9.69E-11	2.62E-10	8.91E-10	2.13E-09	4.29E-09	2.80E-07	3.27E-06	1.90E-05
PL211	.00	5.41E-08	1.02E-07	1.42E-07	2.93E-07	5.55E-07	1.38E-06	3.14E-06	8.02E-06	2.87E-05	7.17E-05
PL212	.00	1.02E-04	1.49E-04	2.18E-04	3.57E-04	5.86E-04	1.10E-03	1.44E-03	1.54E-03	1.17E-03	7.25E-04
PL213	.00	1.12E-08	3.99E-09	4.43E-09	7.26E-09	1.16E-08	2.46E-08	4.74E-08	9.47E-08	2.55E-07	5.26E-07
PL214	.00	3.01E-09	4.77E-09	6.34E-09	1.23E-08	2.61E-08	1.15E-07	3.90E-07	1.45E-06	6.87E-06	3.32E-05
PL211	.00	5.41E-12	2.26E-11	3.93E-11	1.31E-10	5.42E-10	5.44E-09	4.29E-09	2.80E-07	3.27E-06	1.90E-05
PL211	.00	1.46E-10	3.05E-10	4.26E-10	8.74E-10	1.40E-09	4.15E-09	9.58E-09	2.41E-08	6.40E-08	2.15E-07
PL212	.00	6.52E-05	1.04E-04	1.39E-04	2.24E-04	3.75E-04	7.04E-04	9.51E-04	2.88E-04	7.54E-04	4.44E-04
PL213	.00	1.10E-02	3.90E-09	4.43E-09	7.26E-09	1.16E-08	2.46E-08	4.74E-08	9.47E-08	2.55E-07	5.26E-07
PL214	.00	3.01E-09	4.77E-09	6.34E-09	1.23E-08	2.61E-08	1.15E-07	3.90E-07	1.45E-06	6.87E-06	3.32E-05
PL215	.00	5.41E-08	1.02E-07	1.42E-07	2.93E-07	5.55E-07	1.38E-06	3.14E-06	8.02E-06	2.87E-05	7.17E-05
PL216	.00	1.02E-04	1.49E-04	2.18E-04	3.57E-04	5.86E-04	1.10E-03	1.44E-03	1.54E-03	1.17E-03	7.25E-04
PL216	.00	3.01E-09	4.77E-09	6.34E-09	1.23E-08	2.61E-08	1.15E-07	3.90E-07	1.45E-06	6.87E-06	3.32E-05
AT217	.00	1.12E-08	3.99E-09	4.43E-09	7.26E-09	1.16E-08	2.46E-08	4.74E-08	9.47E-08	2.55E-07	5.26E-07
PL219	.00	5.41E-12	1.02E-07	1.42E-07	2.93E-07	5.55E-07	1.38E-06	3.14E-06	8.02E-06	2.87E-05	7.17E-05
PL220	.00	1.02E-04	1.49E-04	2.18E-04	3.57E-04	5.86E-04	1.10E-03	1.44E-03	1.54E-03	1.17E-03	7.25E-04
PL222	.00	3.01E-09	4.77E-09	6.34E-09	1.23E-08	2.61E-08	1.15E-07	3.90E-07	1.45E-06	6.87E-06	3.32E-05
PL221	.00	1.12E-08	3.99E-09	4.43E-09	7.26E-09	1.16E-08	2.46E-08	4.74E-08	9.47E-08	2.55E-07	5.26E-07
PL223	.00	1.04E-09	1.76E-09	2.38E-09	4.09E-09	7.45E-09	1.44E-08	4.47E-08	1.12E-07	4.01E-07	1.00E-06
PL223	.00	5.41E-08	1.02E-07	1.42E-07	2.93E-07	5.55E-07	1.38E-06	3.14E-06	8.02E-06	2.87E-05	7.17E-05
PL224	.00	1.02E-04	1.49E-04	2.18E-04	3.57E-04	5.86E-04	1.10E-03	1.44E-03	1.54E-03	1.17E-03	7.25E-04
PL225	.00	1.24E-08	3.90E-09	4.43E-09	7.26E-09	1.16E-08	2.46E-08	4.74E-08	9.47E-08	2.55E-07	5.26E-07
PL226	.00	3.10E-09	4.77E-09	6.34E-09	1.23E-08	2.61E-08	1.15E-07	3.90E-07	1.45E-06	6.87E-06	3.32E-05
PL226	.00	1.24E-13	2.42E-13	3.63E-13	8.65E-13	2.26E-12	9.90E-12	3.10E-11	9.07E-11	3.09E-10	6.44E-10
PL225	.00	1.12E-08	3.99E-09	4.43E-09	7.26E-09	1.16E-08	2.46E-08	4.74E-08	9.47E-08	2.55E-07	5.26E-07
PL227	.00	7.45E-08	1.26E-07	1.67E-07	2.92E-07	5.32E-07	1.38E-06	3.14E-06	8.02E-06	2.87E-05	7.17E-05
PL228	.00	1.26E-13	2.42E-13	3.63E-13	8.65E-13	2.26E-12	9.90E-12	3.10E-11	9.07E-11	3.09E-10	6.44E-10
PL227	.00	6.04E-08	1.09E-07	1.49E-07	2.88E-07	5.24E-07	1.34E-06	3.15E-06	7.97E-06	2.83E-05	7.07E-05
PL228	.00	1.05E-04	1.49E-04	2.17E-04	3.56E-04	5.85E-04	1.10E-03	1.44E-03	1.54E-03	1.17E-03	7.25E-04
PL229	.00	2.95E-09	4.01E-09	6.83E-09	7.26E-09	1.16E-08	2.46E-08	4.74E-08	9.47E-08	2.55E-07	5.26E-07
PL220	.00	1.18E-05	1.75E-05	7.04E-05	2.84E-05	4.41E-05	8.95E-05	1.45E-04	3.17E-04	7.75E-04	1.54E-03
PL231	.00	6.02E-03	4.39E-02	4.34E-02	6.34E-02	6.34E-02	4.38E-02	4.38E-02	4.37E-02	4.38E-02	4.38E-02
PL232	.00	3.81E-12	5.67E-12	7.17E-12	1.14E-11	1.49E-11	4.16E-11	7.94E-11	1.55E-10	3.82E-10	7.41E-10
PL231	.00	2.52E-03	.00	.00	.00	.00	.00	.00	.00	.00	.00
PL234	.00	1.20E-01	1.20E-01	1.20E-01	1.20E-01	1.20E-01	1.20E-01	1.20E-01	1.20E-01	1.20E-01	1.20E-01
PL231	.00	6.43E-06	6.72E-06	6.40E-06	7.43E-06	6.37E-06	1.12E-05	1.58E-05	2.52E-05	5.32E-05	9.99E-05
PL233	.00	6.72E-02	2.40E-22	.00	.00	.00	.00	.00	.00	.00	.00
PL233	.00	5.75E-02	7.34E-02	7.27E-02	1.30E-02	7.30E-02	7.31E-02	7.34E-02	7.44E-02	7.44E-02	8.75E-02
PL234N	.00	3.21E-01	1.20E-01	1.20E-01	1.20E-01	1.20E-01	1.20E-01	1.20E-01	1.20E-01	1.20E-01	1.20E-01

PWR - CASE 4 - 12,000 MW/FTO BURNUP - FUEL DECAY TIMES
 POWER: 35.00MW, BURNUP: 12000.MWD, FLUEN: 3.09E+13N/CHEM2-SEC

NUCLEIDE RADIOACTIVITY, CURIES
 BASIS = MT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
PA234	.00	1.55E-03	3.20E-04	3.20E-04	3.20E-04	3.20E-04	3.20E-04	3.20E-04	3.20E-04	3.20E-04
U232	.00	4.10E-04	8.70E-04	9.11E-04	1.02E-03	1.18E-03	1.46E-03	1.59E-03	1.52E-03	1.49E-03
U233	.00	4.62E-05	4.53E-05	4.53E-05	4.55E-05	4.58E-05	4.68E-05	4.88E-05	5.15E-05	6.13E-05
U234	2.26E+00	1.75E+00	1.75E+00	1.75E+00	1.75E+00	1.75E+00	1.75E+00	1.75E+00	1.76E+00	1.77E+00
U235	6.99E+02	4.38E+02	4.38E+02	4.38E+02	4.38E+02	4.38E+02	4.38E+02	4.38E+02	4.38E+02	4.38E+02
U236	.00	1.54E-01	1.54E-01	1.54E-01	1.54E-01	1.54E-01	1.54E-01	1.54E-01	1.54E-01	1.54E-01
U237	.00	4.48E+05	4.38E+01	4.49E-01	4.04E-01	3.66E-01	3.39E-01	3.14E-01	3.95E-02	3.68E-03
U238	3.22E-01	3.20E-01	3.20E-01	3.20E-01	3.20E-01	3.20E-01	3.20E-01	3.20E-01	3.20E-01	3.20E-01
U239	.00	1.75E+07	.00	.00	.00	.00	.00	.00	.00	.00
U240	.00	2.62E-20	1.00E-19	1.58E-19	7.26E-19	6.26E-19	1.53E-18	3.02E-18	6.02E-18	1.50E-17
NP236	.00	5.60E-01	.00	.00	.00	.00	.00	.00	.00	.00
NP237	.00	6.91E-02	7.30E-02	7.30E-02	7.30E-02	7.30E-02	7.30E-02	7.30E-02	7.30E-02	7.30E-02
NP238	.00	1.68E-04	9.63E-09	6.93E-09	.00	.00	.00	.00	.00	.00
NP239	.00	1.75E+07	2.61E-01	2.61E-01	2.61E-01	2.61E-01	2.61E-01	2.61E-01	2.61E-01	2.61E-01
NP240M	.00	2.62E-20	1.00E-19	1.58E-19	7.26E-19	6.26E-19	1.53E-18	3.02E-18	6.02E-18	1.50E-17
NP240	.00	2.62E-20	.00	.00	.00	.00	.00	.00	.00	.00
PU236	.00	2.48E-02	2.36E-02	2.36E-02	1.97E-02	1.54E-02	7.98E-03	2.20E-03	1.49E-04	1.31E-07
PU238	.00	1.89E-02	1.95E+02	1.95E+02	1.96E+02	1.96E+02	1.96E+02	1.96E+02	1.96E+02	9.77E+01
PU239	.00	2.43E-02	2.48E+02	2.48E+02	2.48E+02	2.48E+02	2.48E+02	2.48E+02	2.48E+02	2.47E+02
PU240	.00	1.66E-02	1.66E+02	1.66E+02	1.66E+02	1.66E+02	1.66E+02	1.66E+02	1.66E+02	1.65E+02
PU241	.00	1.74E-04	1.74E-04	1.73E-04	1.68E-04	1.61E-04	1.39E-04	1.10E-04	6.81E-05	1.64E-05
PU242	.00	6.74E-02	6.74E-02	6.74E-02	6.74E-02	6.74E-02	6.74E-02	6.74E-02	6.74E-02	6.74E-02
PU243	.00	1.63E-04	4.24E-11	4.24E-11	4.24E-11	4.24E-11	4.24E-11	4.24E-11	4.24E-11	4.24E-11
PU244	.00	2.62E-20	1.00E-19	1.58E-19	7.26E-19	6.26E-19	1.53E-18	3.02E-18	6.02E-18	1.50E-17
PU245	.00	3.19E-15	.00	.00	.00	.00	.00	.00	.00	.00
AN241	.00	6.07E+00	1.30E+01	1.83E+01	3.36E+01	5.99E+01	1.31E+02	2.29E+02	3.64E+02	5.17E+02
AN242M	.00	4.05E-01	4.05E-01	4.04E-01	4.03E-01	4.01E-01	3.96E-01	3.87E-01	3.70E-01	3.53E-01
AN242	.00	4.16E+03	4.05E+01	4.04E+01	4.03E+01	4.01E+01	3.96E+01	3.87E+01	3.70E+01	3.53E+01
AN243	.00	2.80E-01	2.81E+01	2.81E+01	2.81E+01	2.81E+01	2.81E+01	2.81E+01	2.81E+01	2.80E+01
AN244	.00	1.76E+03	1.30E+22	2.05E+22	4.24E+22	8.15E+22	1.99E+23	3.94E+23	7.84E+23	1.95E+20
AN245	.00	1.06E-12	8.68E-13	7.14E-13	4.73E-13	2.11E-13	1.00E-14	3.14E-16	1.05E-19	.00
CM242	.00	8.88E-02	6.14E+02	4.56E+02	3.91E+02	4.06E+01	7.07E-01	3.18E-01	3.03E-01	2.66E-01
CM243	.00	5.52E-02	3.50E-02	3.49E-02	3.49E-02	3.37E-02	3.16E-02	2.83E-02	2.28E-02	1.19E-02
CM244	.00	1.10E-01	1.39E+01	1.08E+01	1.08E+01	1.02E+01	9.05E+00	7.48E+00	5.13E+00	1.62E+00
CM245	.00	6.25E-04	6.25E-04	6.25E-04	6.25E-04	6.25E-04	6.25E-04	6.25E-04	6.24E-04	6.23E-04
CM246	.00	3.50E-05	3.50E-05	3.50E-05	3.50E-05	3.50E-05	3.49E-05	3.49E-05	3.47E-05	3.45E-05
CM247	.00	4.24E-11	4.24E-11	4.24E-11	4.24E-11	4.24E-11	4.24E-11	4.24E-11	4.24E-11	4.24E-11
CM248	.00	3.91E-11	3.91E-11	3.91E-11	3.91E-11	3.91E-11	3.91E-11	3.91E-11	3.91E-11	3.91E-11
CM249	.00	1.18E-06	3.55E-16	2.33E-17	7.89E-23	.00	.00	.00	.00	.00
CM250	.00	1.27E-18	1.27E-18	1.27E-18	1.27E-18	1.27E-18	1.27E-18	1.27E-18	1.27E-18	1.27E-18
CF249	.00	1.04E-08	5.79E-08	4.96E-08	3.15E-08	1.61E-08	1.26E-09	2.22E-11	7.00E-13	2.18E-25
CF250	.00	1.17E-07	1.27E-18	1.27E-18	1.27E-18	1.27E-18	1.27E-18	1.27E-18	1.27E-18	1.27E-18
CF251	.00	9.69E-12	4.06E-11	4.06E-11	1.05E-10	1.43E-10	1.77E-10	1.79E-10	1.75E-10	1.65E-10
CF252	.00	3.61E-10	3.59E-10	3.59E-10	3.45E-10	3.28E-10	2.19E-10	2.14E-10	1.24E-10	2.57E-11
CF253	.00	1.37E-12	1.37E-12	1.37E-12	1.37E-12	1.37E-12	1.36E-12	1.35E-12	1.32E-12	1.27E-12
CF254	.00	7.60E-11	7.13E-11	6.76E-11	5.85E-11	4.90E-11	2.05E-11	5.53E-12	4.03E-13	1.56E-16
CF255	.00	3.79E-12	1.84E-13	7.49E-15	2.54E-18	1.70E-24	.00	.00	.00	.00
ES254	.00	4.38E-18	1.56E-16	7.00E-17	6.58E-18	1.98E-19	6.98E-23	.00	.00	.00
ES253	.00	1.66E-12	5.25E-13	7.19E-14	1.08E-16	4.05E-22	.00	.00	.00	.00
TOTAL	2.65E+00	3.56E+07	3.87E+04	3.89E+04	1.77E+04	1.08E+04	1.47E+04	1.18E+04	2.77E+03	2.71E+03

POWER = 35.00MW, BURNUP = 12000.MWD, FLUX = 3.09+13N/CM2-SEC

ELEMENTAL ACTIVITY, CURIES
BASIS = MG OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
TL	.00	3.67-05	6.09-05	1.86-05	1.29-04	2.11-04	3.98-04	5.38-04	5.66-04	4.51-04	3.33-04
PH	.00	1.02-04	1.69-04	2.18-04	3.57-04	5.66-04	1.10-03	1.49-03	1.55-03	1.21-03	8.50-04
HI	.00	1.02-04	1.69-04	2.18-04	3.57-04	5.66-04	1.10-03	1.49-03	1.55-03	1.21-03	8.50-04
PO	.00	1.67-04	2.77-04	3.57-04	5.85-04	9.61-04	1.81-03	2.44-03	2.56-03	1.97-03	1.35-03
SI	.00	1.17-04	1.94-04	4.93-04	7.26-04	1.18-04	2.48-04	4.78-04	9.47-04	2.55-03	5.86-03
BN	.00	1.02-04	1.69-04	2.18-04	3.57-04	5.66-04	1.10-03	1.49-03	1.55-03	1.21-03	8.50-04
FR	.00	1.22-04	5.25-04	6.77-04	1.13-04	1.90-04	4.41-04	9.20-04	2.07-03	6.56-03	1.59-04
RA	.00	1.02-04	1.69-04	2.18-04	3.57-04	5.66-04	1.10-03	1.49-03	1.55-03	1.21-03	8.51-04
AC	.00	6.57-04	1.10-07	1.71-07	2.99-07	5.44-07	1.41-06	3.24-06	8.11-06	2.89-05	7.23-05
TH	.00	9.25-01	3.64-01	5.64-01	3.64-01	3.64-01	3.65-01	3.65-01	3.65-01	3.65-01	3.66-01
PA	.00	6.67-01	3.91-01	1.93-01	3.93-01	3.93-01	3.93-01	3.93-01	3.94-01	3.99-01	4.07-01
U	2.65+00	1.80+07	4.61+01	2.71+00	2.67+00	2.65+00	2.60+00	2.53+00	2.44+00	2.33+00	2.31+00
NP	.00	1.76+07	1.54-01	1.54-01	3.54-01	3.54-01	3.54-01	3.54-01	3.55-01	3.59-01	3.66-01
PU	.00	3.45+04	1.61+04	1.79+04	1.74+04	1.67+04	1.45+04	1.16+04	7.41+03	2.19+03	6.56+02
AM	.00	5.93+03	1.41+03	1.94+03	3.47+03	6.10+03	1.32+02	2.30+02	3.65+02	5.18+02	5.25+02
CM	.00	6.97+02	6.75+02	6.67+02	2.01+02	5.04+01	6.79+00	7.62+00	5.82+00	1.89+00	4.53-01
BR	.00	1.87-07	5.79-08	4.96-08	3.15-08	1.41-08	1.25-09	2.22-11	7.00-15	1.27-18	1.27-18
CF	.00	4.52-10	4.73-10	4.86-10	5.10-10	5.21-10	4.79-10	4.00-10	3.03-10	1.92-10	1.53-10
ES	.00	1.66-12	5.25-13	7.19-14	1.08-14	6.05-22	.00	.00	.00	.00	.00
TOTALS	2.65+00	3.56+07	1.67+04	1.89+04	1.77+04	1.68+04	1.47+04	1.18+04	7.79+03	2.71+03	1.19+03
SUBTOT	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

TOTALS 2.65+00 3.56+07 1.67+04 1.89+04 1.77+04 1.68+04 1.47+04 1.18+04 7.79+03 2.71+03 1.19+03

TABLE A-1

QUANTITIES OF TRANSURANIC NUCLIDES
IN SPENT FUEL VS. DECAY TIMES

POWER: 35.0MW, BURNUP: 12000-MWD, FUEL: 3.09+13M/CW+2-SEC

NUCLIDE CONCENTRATIONS, GRAMS
BASIS = WT OF HEAVY METAL CHARGED TO REACTOR

NUCL	CHARGE	DISCHARGE	0. Y	5. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
PL207	.00	3.22-03	5.86-03	2.60-03	1.18-02	1.77-02	3.96-02	6.54-02	1.35-01	3.75-01	7.85-01
PL207	.00	2.05-16	5.35-16	1.47-16	1.54-15	2.60-15	7.27-15	1.66-14	6.27-14	1.91-13	3.77-13
PL208	.00	1.26-13	2.69-13	2.69-13	8.40-13	7.23-13	1.36-12	1.83-12	1.91-12	1.95-12	8.93-12
PL209	.00	6.03-19	2.16-19	2.39-19	3.92-19	6.23-19	1.33-18	2.55-18	5.10-18	1.37-17	3.15-17
PL210	.00	7.13-16	2.32-15	4.76-15	2.29-14	1.47-13	3.08-12	6.32-11	5.81-10	1.77-09	2.16-07
PL211	.00	5.15-12	1.28-11	2.22-11	7.01-11	2.29-10	1.35-09	5.62-09	2.78-08	2.41-07	1.24-06
PL212	.00	1.25-08	2.59-08	4.07-08	1.05-07	2.99-07	1.34-06	4.03-06	1.03-05	2.67-05	4.55-05
PL213	.00	2.67-15	8.77-16	9.74-16	1.60-15	2.55-15	5.45-15	1.04-10	2.08-14	5.61-14	1.29-13
PL214	.00	3.93-13	7.74-13	1.19-12	2.23-12	1.10-11	8.79-11	5.29-10	2.63-09	4.03-08	2.35-07
PL215	.00	2.19-15	4.12-15	5.75-15	1.18-14	2.16-14	5.60-14	1.29-13	3.25-13	1.29-12	2.90-12
PL216	.00	7.10-11	1.21-10	1.66-10	2.58-10	4.20-10	7.49-10	1.07-09	1.11-09	8.41-09	5.22-09
PL217	.00	6.17-17	1.45-16	1.93-16	3.76-16	6.58-16	5.50-15	1.19-14	4.37-14	2.54-13	1.01-12
PL218	.00	1.24-12	1.40-12	2.23-12	3.54-12	7.27-12	2.91-11	1.02-10	5.88-10	2.44-09	1.04-08
PL219	.00	2.43-16	5.05-16	7.80-16	2.11-15	7.18-15	5.75-14	3.46-13	2.25-12	2.44-11	1.53-10
PL220	.00	1.33-16	2.45-16	1.43-16	7.04-16	1.26-15	3.34-15	7.70-15	1.93-14	6.91-14	1.73-13
PL221	.00	6.76-12	1.15-11	1.49-11	2.44-11	4.00-11	7.52-11	1.02-10	1.05-10	4.02-11	4.95-11
PL222	.00	5.96-16	2.12-16	2.36-16	3.84-16	6.17-16	1.32-15	2.52-15	5.04-15	1.36-14	3.12-14
PL223	.00	6.74-17	1.07-16	1.42-16	2.77-16	6.11-16	2.57-15	4.75-15	3.21-14	1.40-13	7.43-13
PL224	.00	2.10-15	5.07-15	8.76-15	2.91-14	1.20-13	1.22-12	9.52-12	6.20-11	7.26-10	2.22-09
PL225	.00	1.58-21	2.97-21	4.14-21	6.53-21	1.55-20	4.04-20	9.31-20	2.34-19	6.34-19	2.00-18
PL226	.00	6.17-22	6.10-22	9.84-22	1.27-21	2.11-21	3.97-21	5.57-21	4.23-21	2.62-21	2.02-21
PL227	.00	6.69-25	3.09-25	3.43-25	5.63-25	8.99-25	1.92-24	3.67-24	7.34-24	1.98-23	4.56-23
PL228	.00	1.16-23	1.81-23	2.40-23	6.68-23	1.07-22	4.35-22	1.46-21	5.43-21	3.21-20	1.26-19
PL229	.00	1.66-21	3.49-21	4.81-21	1.00-20	1.83-20	4.75-20	1.09-19	2.25-19	9.83-19	2.44-18
PL230	.00	2.97-16	4.85-16	6.25-16	1.02-15	1.68-15	5.16-15	8.27-15	6.43-15	3.37-15	2.06-15
PL231	.00	1.06-17	1.69-17	2.24-17	4.34-17	9.95-17	4.06-16	1.18-15	5.04-15	2.49-14	1.17-13
PL232	.00	6.89-21	2.45-21	2.72-21	4.44-21	7.13-21	1.52-20	2.41-20	5.83-20	1.57-19	3.60-19
PL233	.00	9.20-19	7.40-19	1.10-17	2.27-17	4.14-17	1.07-16	2.46-16	6.23-16	2.23-15	5.57-15
PL234	.00	1.11-13	1.89-13	2.38-13	3.69-13	6.40-13	1.20-12	1.62-12	1.64-12	1.29-12	7.92-13
PL235	.00	1.45-16	5.10-16	4.12-16	6.01-16	1.83-15	7.44-15	2.53-12	9.24-12	5.50-11	2.15-10
PL236	.00	6.32-17	2.25-17	2.50-17	6.09-17	6.14-17	1.40-16	2.67-16	5.34-16	1.44-15	3.32-15
PL237	.00	2.72-17	4.40-17	6.09-17	1.07-16	1.94-16	5.05-16	1.17-15	2.97-15	1.05-14	2.62-14
PL238	.00	1.05-12	1.48-12	2.71-12	5.49-12	1.04-11	2.69-11	6.27-11	1.56-10	5.54-10	1.90-09
PL239	.00	6.16-10	1.05-09	1.36-09	2.23-09	3.64-09	6.07-09	9.24-09	9.44-09	7.13-09	4.53-09
PL240	.00	3.15-13	4.95-14	1.17-13	1.45-13	2.46-13	4.32-13	1.21-12	2.42-12	6.50-12	1.49-11
PL241	.00	3.13-09	4.82-09	6.41-09	1.25-08	2.85-08	1.16-07	3.95-07	1.45-06	4.54-06	3.35-05
PL242	.00	5.16-16	1.03-15	1.55-15	3.70-15	9.72-15	4.23-14	1.32-13	1.84-13	1.32-12	2.94-12
PL243	.00	1.93-13	4.87-14	7.63-14	1.25-13	2.00-13	4.27-13	8.16-13	1.43-12	4.39-12	1.01-11
PL244	.00	1.02-09	1.73-09	2.29-09	4.00-09	7.10-09	1.90-08	4.37-08	1.10-07	3.93-07	9.43-07
PL245	.00	5.40-20	1.66-19	1.42-19	3.86-19	1.01-18	4.41-18	1.38-17	4.04-17	1.36-16	3.07-16
PL246	.00	1.92-12	5.44-12	4.72-12	9.12-12	1.66-11	4.32-11	9.94-11	2.50-10	8.94-10	2.74-09
PL247	.00	1.24-07	2.05-07	2.64-07	4.33-07	7.12-07	1.34-06	1.81-06	1.84-06	1.43-06	8.83-07
PL248	.00	1.18-08	1.87-08	2.26-08	3.39-08	5.42-08	1.16-07	2.21-07	4.47-07	1.19-06	2.74-06
PL249	.00	7.04-09	9.01-08	1.05-03	1.49-03	2.27-03	4.46-03	6.50-03	1.67-02	3.99-02	7.95-02
PL250	.00	1.14-04	6.24-04	6.24-04	6.24-04	6.24-04	6.24-04	6.24-04	6.24-04	6.24-04	6.24-04
PL251	.00	3.48-05	5.19-05	6.51-05	1.04-04	1.73-04	3.81-04	7.26-04	1.67-03	3.50-03	6.94-03
PL252	.00	6.90-11	.00	.00	.00	.00	.00	.00	.00	.00	.00
PL253	.00	1.16-05	1.13-05	1.13-05	1.13-05	1.13-05	1.13-05	1.13-05	1.13-05	1.13-05	1.13-05
PL254	.00	1.15-04	1.41-04	1.45-04	1.56-04	1.76-04	2.15-04	3.33-04	5.29-04	1.12-03	2.10-03
PL255	.00	2.04-07	6.04-07	.00	.00	.00	.00	.00	.00	.00	.00
PL256	.00	2.81-04	3.49-04	3.56-04	3.57-04	3.57-04	3.57-04	3.59-04	3.64-04	3.66-04	4.27-04
PL257	.00	4.67-10	4.65-10	4.65-10	4.65-10	4.65-10	4.65-10	4.65-10	4.65-10	4.65-10	4.65-10

POWER: 35.00% BURNDUP: 12000.MWD, FLUX: 3.09E+13N/CM^2-SEC

NUCLIDE CONCENTRATIONS, GRAMS
BASES: MT OF HEAVY METAL CHARGE TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
PA234	.00	6.78E-10	1.01E-10	1.01E-10	1.01E-10	1.01E-10	1.01E-10	1.01E-10	1.01E-10	1.01E-10	1.01E-10
U232	.00	3.78E-05	4.07E-05	4.26E-05	4.77E-05	5.50E-05	6.80E-05	7.47E-05	7.60E-05	5.34E-05	3.30E-05
U233	.00	4.77E-03	4.78E-03	4.78E-03	4.80E-03	4.84E-03	4.84E-03	5.10E-03	5.44E-03	4.87E-03	4.35E-03
U238	3.66E+02	2.87E+02	2.84E+02	2.87E+02	2.87E+02	2.87E+02	2.83E+02	2.83E+02	2.88E+02	2.86E+02	2.88E+02
U235	1.25E+04	7.04E+04	2.04E+04	2.04E+04	2.04E+04	2.04E+04	2.04E+04	2.04E+04	2.04E+04	2.04E+04	2.04E+04
U236	.00	2.43E+03	2.43E+03	2.43E+03	2.43E+03	2.43E+03	2.43E+03	2.43E+03	2.43E+03	2.43E+03	2.43E+03
U237	.00	5.49E+00	5.36E+04	5.49E+04	4.95E+06	4.77E+04	4.10E+06	3.23E+06	2.03E+06	4.84E+07	4.50E+08
U238	9.67E+05	9.59E+05	9.59E+05	9.59E+05	9.59E+05	9.59E+05	9.59E+05	9.59E+05	9.59E+05	9.59E+05	9.59E+05
U239	.00	5.23E-01	.00	.00	.00	.00	.00	.00	.00	.00	.00
U240	.00	2.83E-24	1.08E-25	1.470E-25	3.52E-25	6.76E-25	1.45E-24	3.28E-24	6.50E-24	1.42E-23	3.24E-23
NP236	.00	9.28E-07	.00	.00	.00	.00	.00	.00	.00	.00	.00
NP237	.00	9.81E-01	1.04E+02	1.04E+02	1.04E+02	1.04E+02	1.04E+02	1.04E+02	1.04E+02	1.12E+02	1.24E+02
NP238	.00	2.94E-01	3.68E-14	3.42E-14	.00	.00	.00	.00	.00	.00	.00
NP239	.00	7.51E-01	1.73E+06	1.42E+06	1.21E+06	1.21E+06	1.21E+06	1.21E+06	1.21E+06	1.20E+06	1.20E+06
NP240M	.00	2.44E-28	7.32E-28	1.07E-27	3.04E-27	5.83E-27	1.42E-26	2.87E-26	5.61E-26	1.40E-25	2.79E-25
NP240	.00	2.77E-03	.00	.00	.00	.00	.00	.00	.00	.00	.00
Pu236	.00	4.17E-05	4.45E-05	4.24E-05	3.70E-05	2.90E-05	1.40E-05	4.15E-06	3.64E-07	2.47E-10	1.29E-15
Pu238	.00	1.12E-01	1.15E+01	1.16E+01	1.16E+01	1.13E+01	1.09E+01	1.01E+01	1.01E+01	7.46E+00	5.40E+00
Pu239	.00	3.96E+03	4.04E+03	4.04E+03	4.04E+03	4.04E+03	4.04E+03	4.04E+03	4.04E+03	4.03E+03	4.02E+03
Pu240	.00	7.55E+02	7.55E+02	7.55E+02	7.55E+02	7.55E+02	7.55E+02	7.54E+02	7.54E+02	7.51E+02	7.48E+02
Pu241	.00	1.34E+02	1.72E+02	1.30E+02	1.46E+02	1.58E+02	1.37E+02	1.09E+02	6.72E+01	1.62E+01	1.51E+00
Pu242	.00	1.13E+01	1.75E+01	1.73E+01	1.73E+01	1.73E+01	1.73E+01	1.73E+01	1.73E+01	1.73E+01	1.73E+01
Pu243	.00	6.18E-03	1.64E-17	1.64E-17	1.64E-17	1.64E-17	1.64E-17	1.64E-17	1.64E-17	1.64E-17	1.64E-17
Pu244	.00	3.48E-15	5.66E-15	8.91E-15	1.48E-14	3.54E-14	8.63E-14	1.71E-13	3.41E-13	8.49E-13	1.70E-12
Pu245	.00	2.44E-21	.00	.00	.00	.00	.00	.00	.00	.00	.00
Am241	.00	1.77E+00	3.79E+00	5.34E+00	9.81E+00	1.75E+01	3.83E+01	6.48E+01	1.48E+02	1.53E+02	1.53E+02
Am242M	.00	4.17E-02	4.16E-02	4.16E-02	4.15E-02	4.13E-02	4.03E-02	3.99E-02	3.87E-02	3.87E-02	2.44E-02
Am242	.00	5.16E-03	5.00E-07	4.99E-07	4.98E-07	4.96E-07	4.89E-07	4.78E-07	4.51E-07	3.98E-07	3.17E-07
Am243	.00	1.45E+00	1.46E+00	1.46E+00	1.46E+00	1.46E+00	1.46E+00	1.46E+00	1.46E+00	1.45E+00	1.45E+00
Am244	.00	5.94E-05	4.39E-10	6.92E-10	3.43E-09	2.75E-09	6.70E-09	1.33E-08	2.64E-08	6.59E-08	1.32E-07
Am245	.00	1.71E-19	1.40E-19	1.40E-19	1.40E-19	1.40E-19	1.40E-19	1.40E-19	1.40E-19	1.40E-19	1.40E-19
Cm242	.00	2.68E-01	1.85E-01	1.34E-01	5.76E-02	1.23E-02	2.13E-04	9.59E-05	9.16E-05	7.99E-05	6.30E-05
Cm243	.00	7.65E-04	7.61E-04	7.58E-04	7.49E-04	7.33E-04	6.87E-04	6.16E-04	4.94E-04	2.59E-04	4.77E-05
Cm244	.00	1.35E-01	1.34E-01	1.33E-01	1.30E-01	1.25E-01	1.12E-01	9.23E-02	6.24E-02	1.99E-02	2.94E-03
Cm245	.00	5.59E-03	3.54E-03	3.54E-03	3.54E-03	3.54E-03	3.54E-03	3.54E-03	3.53E-03	3.53E-03	3.51E-03
Cm246	.00	1.13E-04	1.13E-04	1.13E-04	1.13E-04	1.13E-04	1.13E-04	1.13E-04	1.13E-04	1.13E-04	1.12E-04
Cm247	.00	4.80E-07	4.80E-07	4.80E-07	4.80E-07	4.80E-07	4.80E-07	4.80E-07	4.80E-07	4.80E-07	4.80E-07
Cm248	.00	9.55E-09	9.55E-09	9.55E-09	9.55E-09	9.55E-09	9.55E-09	9.55E-09	9.55E-09	9.55E-09	9.55E-09
Cm249	.00	9.99E-14	3.01E-23	1.97E-24	6.49E-24	.00	.00	.00	.00	.00	.00
Cm250	.00	1.55E-17	3.55E-17	3.55E-17	3.55E-17	3.55E-17	3.55E-17	3.55E-17	3.55E-17	3.54E-17	3.54E-17
Bk249	.00	4.22E-11	3.46E-11	2.97E-11	1.89E-11	4.42E-12	7.50E-13	1.33E-14	4.19E-14	1.31E-14	.00
Bk250	.00	3.01E-14	3.27E-25	3.27E-25	3.27E-25	3.27E-25	3.27E-25	3.27E-25	3.27E-25	3.26E-25	3.25E-25
Cf250	.00	2.33E-12	9.94E-12	1.49E-11	2.57E-11	3.61E-11	4.35E-11	4.30E-11	4.30E-11	4.05E-11	3.67E-11
Cf251	.00	3.30E-12	3.29E-12	3.25E-12	3.16E-12	2.99E-12	2.55E-12	1.96E-12	1.15E-12	2.35E-13	1.61E-14
Cf252	.00	8.68E-13	9.68E-13	9.67E-13	9.67E-13	9.66E-13	9.66E-13	9.66E-13	9.66E-13	9.66E-13	9.66E-13
Cf253	.00	1.42E-13	1.33E-13	1.26E-13	1.09E-13	4.19E-14	3.82E-14	1.03E-14	7.51E-16	2.90E-19	5.94E-25
Cf254	.00	1.31E-14	3.94E-16	2.58E-19	4.16E-23	5.47E-29	.00	.00	.00	.00	.00
Cf255	.00	5.15E-20	1.84E-20	4.23E-21	7.74E-22	2.33E-23	8.21E-29	.00	.00	.00	.00
ES253	.00	6.45E-17	2.11E-17	2.49E-18	4.34E-21	2.43E-26	.00	.00	.00	.00	.00
TOTAL	1.00E+04	9.87E+05	9.87E+05	9.87E+05	9.87E+05	9.87E+05	9.87E+05	9.87E+05	9.87E+05	9.87E+05	9.87E+05

POWER: 55.00MW, SHUTDOWN: 12000.MWD, FLUX: 3.0E+13W/CM^2-SEC

ELEMENT CONCENTRATIONS, GRAMS
BASIS : MG OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
MC	.00	3.22-03	5.86-03	7.60-03	1.18-02	1.37-02	3.46-02	6.54-02	1.35-01	3.75-01	7.85-01
TL	.00	1.26-13	2.09-13	2.70-13	4.42-13	7.26-13	1.37-12	1.85-12	1.95-12	1.60-12	1.27-12
Pb	.00	1.25-08	2.60-08	4.08-08	1.06-07	2.96-07	1.34-06	4.03-06	1.03-05	2.70-05	4.72-05
Bi	.00	8.20-12	1.34-11	1.71-11	2.79-11	4.73-11	1.04-10	2.03-10	4.95-10	2.59-09	1.11-08
PO	.00	2.40-15	5.57-15	9.37-15	3.01-14	1.22-13	1.22-12	9.53-12	6.70-11	7.26-10	4.22-09
AT	.00	6.89-21	2.45-21	2.72-21	4.46-21	7.13-21	1.52-20	2.91-20	5.23-20	1.57-19	3.60-19
W	.00	1.11-13	2.15-13	2.79-13	4.70-13	8.22-13	1.95-12	4.16-12	1.10-11	5.63-11	2.16-10
FR	.00	9.04-17	6.85-17	6.59-17	1.48-16	2.60-16	6.45-16	1.43-15	3.46-15	1.19-14	2.95-14
RA	.00	3.77-09	5.88-09	7.77-09	1.47-08	3.21-08	1.23-07	4.04-07	1.46-06	8.57-06	3.35-05
AC	.00	1.02-09	1.73-09	2.29-09	4.00-09	7.30-09	1.90-08	4.37-08	1.10-07	3.93-07	9.83-07
TH	.00	7.59-06	9.67-06	1.13-05	1.61-05	2.45-05	5.00-05	9.25-05	1.78-02	4.34-02	6.66-02
PA	.00	1.38-04	1.45-04	1.48-04	1.60-04	1.79-04	2.38-04	3.36-04	5.32-04	1.12-03	2.10-03
U	1.00+06	9.82+05	9.82+05	9.82+05	9.82+05	9.82+05	9.82+05	9.82+05	9.82+05	9.82+05	9.82+05
NP	.00	1.73-02	1.04-02	1.04-02	1.04-02	1.04-02	1.04-02	1.04-02	1.04-02	1.12-02	1.24-02
PU	.00	4.92+03	4.99+03	4.99+03	4.99+03	4.99+03	4.99+03	4.99+03	4.99+03	4.83+03	4.80+03
AM	.00	3.77+00	5.29+00	6.85+00	1.13+01	1.43+01	3.98+01	6.43+01	1.08+02	1.52+02	1.55+02
CM	.00	4.07-01	1.24-01	1.35-01	1.72-01	1.42-01	1.16-01	9.67-02	6.72-02	2.39-02	6.11-03
BR	.00	4.12-11	3.46-11	2.75-11	1.89-11	8.42-12	7.50-13	1.33-14	4.10-14	3.26-15	3.25-15
CF	.00	6.64-12	1.42-11	1.91-11	2.98-11	4.00-11	4.70-11	8.66-11	4.50-11	4.16-11	3.75-11
LS	.00	6.65-17	2.11-17	2.89-18	4.34-21	2.81-26	.00	.00	.00	.00	.00
TOTALS	1.00+06	9.82+05	9.82+05	9.82+05	9.82+05	9.82+05	9.82+05	9.82+05	9.82+05	9.82+05	9.82+05
SUBTOT1	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TOTALS	1.00+06	9.82+05	9.82+05	9.82+05	9.82+05	9.82+05	9.82+05	9.82+05	9.82+05	9.82+05	9.82+05

TABLE A-5

ACTIVITIES OF LIGHT ELEMENTS AND
MATERIALS OF CONSTRUCTION
PRESENT IN SPENT FUEL
VS. DECAY TIMES

POWER: 35,000kW, BURNUP: 12000.MWD, FUEL: 3.0%²³⁵U/CMO2-55C

MULTIPLY RADIOACTIVITY, CURIES
BASIS: MT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
N 1	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
N 2	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
N 3	.00	6.38-06	6.32-06	4.27-06	4.14-06	3.91-06	3.30-06	2.44-06	1.47-06	2.62-07	1.38-08
N 4	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
NC 5	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
NC 6	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
NC 7	.00	9.44-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
LI 8	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
LI 9	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
LI 10	.00	5.07-13	.00	.00	.00	.00	.00	.00	.00	.00	.00
BE 11	.00	1.63-03	.00	.00	.00	.00	.00	.00	.00	.00	.00
BE 12	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
BE 13	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
BE 14	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
BE 15	.00	9.34-08	9.34-08	9.34-08	9.34-08	9.34-08	9.34-08	9.34-08	9.34-08	9.34-08	9.34-08
BE 16	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
BE 17	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
BE 18	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
BE 19	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
BE 20	.00	1.37-14	.00	.00	.00	.00	.00	.00	.00	.00	.00
C 12	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
C 13	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
C 14	.00	7.19-04	7.19-04	7.19-04	7.19-04	7.19-04	7.19-04	7.19-04	7.19-04	7.19-04	7.19-04
N 15	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
N 16	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
N 17	.00	1.54-02	.00	.00	.00	.00	.00	.00	.00	.00	.00
N 18	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
N 19	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
N 20	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
N 21	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
N 22	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
N 23	.00	2.37-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
NA 24	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
NA 25	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
NA 26	.00	5.59-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
NA 27	.00	3.70-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
NA 28	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
NA 29	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
NA 30	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
NA 31	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
NA 32	.00	6.31-02	.00	.00	.00	.00	.00	.00	.00	.00	.00
AL 27	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AL 28	.00	5.48-01	.00	.00	.00	.00	.00	.00	.00	.00	.00
AL 29	.00	1.42-00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SI 28	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SI 29	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SI 30	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SI 31	.00	1.49-01	.00	.00	.00	.00	.00	.00	.00	.00	.00
P 31	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
P 32	.00	1.93-03	2.44-05	8.26-07	3.94-11	8.05-19	.00	.00	.00	.00	.00
P 33	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

POWER: 35.00MW, Burnup: 12000-MWD, FLUX: 5.09E+13N/CM^2-SEC

NUCLIDE RADIOACTIVITY, CURIES
BASIS: MT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	3. Y	10. Y	20. Y	50. Y	100. Y
P 30	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
S 32	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
S 33	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
S 34	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
S 35	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
S 36	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
S 37	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CL 38	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CL 39	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CL 40	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AR 36	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AR 37	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AR 38	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AR 39	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AR 40	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AR 41	.00	7.74-13	.00	.00	.00	.00	.00	.00	.00	.00	.00
K 39	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
K 40	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
K 41	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
K 42	.00	1.05-16	.00	.00	.00	.00	.00	.00	.00	.00	.00
K 43	.00	5.29-21	.00	.00	.00	.00	.00	.00	.00	.00	.00
K 44	.00	1.77-12	.00	.00	.00	.00	.00	.00	.00	.00	.00
CA 40	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CA 41	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CA 42	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CA 43	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CA 44	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CA 45	.00	8.39-12	5.75-12	4.29-12	1.81-12	3.90-13	3.91-15	1.82-18	3.94-25	.00	.00
CA 46	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CA 47	.00	1.72-08	1.79-14	4.01-19	.00	.00	.00	.00	.00	.00	.00
CA 48	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CA 49	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SC 45	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SC 46	.00	1.51-16	1.10-15	4.03-15	1.34-16	1.41-17	4.22-21	.00	.00	.00	.00
SC 47	.00	4.67-05	1.29-12	2.53-18	.00	.00	.00	.00	.00	.00	.00
SC 48	.00	1.13-04	1.77-19	.00	.00	.00	.00	.00	.00	.00	.00
SC 49	.00	2.12-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
SC 50	.00	2.09-06	.00	.00	.00	.00	.00	.00	.00	.00	.00
TI 46	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TI 47	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TI 48	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TI 49	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TI 50	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TI 51	.00	9.44-02	.00	.00	.00	.00	.00	.00	.00	.00	.00
V 49	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
V 50	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
V 51	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
V 52	.00	1.10-02	.00	.00	.00	.00	.00	.00	.00	.00	.00
V 53	.00	1.54-01	.00	.00	.00	.00	.00	.00	.00	.00	.00
V 54	.00	1.77-03	.00	.00	.00	.00	.00	.00	.00	.00	.00
CR 50	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

POWER= 35.00MW, BURNUP= 12000.MWD, FLUX= 5.09*13N/CM**2-SEC

NUCLIDE RADIOACTIVITY, CURIES
BASIS : MT OF HEAVY METAL CHARGED TO REACTOR

	CMAPLE	DISCHARGE	0. Y	1. Y	2. Y	3. Y	4. Y	5. Y	10. Y	20. Y	50. Y	100. Y
CM 51	.00	1.97*04	2.00*03	3.66*02	2.18*00	2.91*04	3.28*16	.00	.00	.00	.00	.00
CM 52	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CM 53	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CM 54	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CM 55	.00	2.49*02	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
MM 54	.00	5.42*02	4.82*02	4.10*02	2.57*02	1.18*02	9.07*00	1.39*01	3.27*05	4.23*16	.00	.00
MM 55	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
MM 56	.00	2.64*05	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
MM 57	.00	2.51*00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
MM 58	.00	8.92*03	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
FE 54	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
FE 55	.00	3.35*03	3.14*03	2.98*03	2.57*03	1.97*03	8.43*02	2.33*02	1.67*01	5.44*03	8.43*09	.00
FE 56	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
FE 57	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
FE 58	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
FE 59	.00	4.95*02	1.24*02	4.21*01	1.78*00	6.42*03	3.00*10	1.61*22	.00	.00	.00	.00
CO 58M	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CO 58	.00	2.61*04	1.09*04	5.51*03	7.04*02	2.15*01	5.08*04	9.88*12	.00	.00	.00	.00
CG 54	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CO 60M	.00	2.22*02	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CO 60	.00	4.87*01	4.71*01	4.40*01	4.27*01	3.74*01	2.52*01	1.30*01	3.49*00	6.89*02	9.21*05	.00
CO 61	.00	1.07*01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CO 62	.00	1.69*00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
NI 58	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
NI 59	.00	3.77*00	3.77*00	3.77*00	3.77*00	3.77*00	3.77*00	3.77*00	3.77*00	3.77*00	3.77*00	.00
NI 60	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
NI 61	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
NI 62	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
NI 63	.00	5.48*02	5.47*02	5.46*02	5.44*02	5.40*02	5.28*02	5.06*02	4.71*02	3.76*02	2.58*02	.00
NI 64	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
NI 65	.00	1.95*03	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CU 62	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CU 63	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CU 64	.00	1.16*00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CU 65	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CU 66	.00	4.18*00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Zn 63	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Zn 64	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Zn 65	.00	1.60*05	1.24*05	1.02*05	5.70*04	2.63*04	4.13*08	5.21*10	1.69*14	.00	.00	.00
Zn 66	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Zn 67	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Zn 68	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Zn 69M	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Zn 69	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Zn 70	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Zn 71M	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Zn 71	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
GA 69	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
GA 70	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
GA 71	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
GL 70	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 88	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

POWER= 35.00MW, BURNUP= 12000.MWD, FLUX= 3.09E+13N/CM^2-SEC

NUCLIDE RADIOACTIVITY, CURIES
BASIS : WT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
SR 87	.00	3.21E-01	9.67E-00	3.80E-00	2.46E-01	1.89E-03	8.58E-10	2.29E-10	.00	.00	.00
SR 90	.00	1.21E-04	1.20E-04	1.19E-04	1.18E-04	1.15E-04	1.07E-04	9.42E-05	7.36E-05	3.51E-05	1.02E-05
SR 91	.00	6.23E-00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Y 90M	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Y 90	.00	1.23E-03	1.20E-04	1.19E-04	1.18E-04	1.15E-04	1.07E-04	9.42E-05	7.36E-05	3.51E-05	1.02E-05
Y 91M	.00	3.89E-00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Y 91	.00	8.53E-01	2.49E-01	1.29E-01	1.15E-00	1.55E-02	3.81E-08	1.70E-17	.00	.00	.00
ZR 90	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
ZR 91	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
ZR 92	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
ZR 93	.00	3.17E-02	3.17E-02	3.17E-02	3.17E-02	3.17E-02	3.17E-02	3.17E-02	3.17E-02	3.17E-02	3.17E-02
ZR 94	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
ZR 95	.00	2.43E-04	9.30E-03	9.91E-03	4.94E-02	1.00E-01	8.45E-05	2.94E-13	.00	.00	.00
ZR 96	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
ZR 97	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 93M	.00	1.41E-04	1.13E-03	1.42E-03	2.22E-03	3.74E-03	7.70E-03	1.31E-02	2.05E-02	2.93E-02	3.15E-02
NR 93	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 94	.00	1.30E-15	1.30E-15	1.30E-15	1.30E-15	1.30E-15	1.30E-15	1.30E-15	1.30E-15	1.30E-15	1.30E-15
NR 95	.00	2.29E-04	1.44E-04	8.15E-03	1.03E-03	2.21E-01	1.79E-04	6.24E-13	.00	.00	.00
NR 96	.00	1.02E-01	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 97	.00	7.50E-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
PD 92	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PD 93	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PD 93M	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PD 94	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PD 95	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PD 96	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PD 97	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PD 98	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PD 99	.00	1.56E-08	3.07E-18	8.71E-26	.00	.00	.00	.00	.00	.00	.00
PD100	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PC101	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TC 99M	.00	1.35E-08	2.93E-18	8.32E-26	.00	.00	.00	.00	.00	.00	.00
TC 99	.00	7.37E-15	7.98E-15	7.98E-15	7.98E-15	7.98E-15	7.98E-15	7.98E-15	7.98E-15	7.98E-15	7.97E-15
TC101	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
RU101	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CO113A	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CO113	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CO115M	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CO115	.00	1.52E-03	1.07E-15	3.37E-25	.00	.00	.00	.00	.00	.00	.00
CO119M	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CO119	.00	5.61E-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
CU121	.00	1.70E-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
JA113	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
JA119M	.00	5.61E-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
JA119	.00	5.25E-02	.00	.00	.00	.00	.00	.00	.00	.00	.00
JA121M	.00	1.70E-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
JA121	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SA114	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SA115	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SA116	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SA117M	.00	1.05E-04	1.22E-02	3.40E-00	3.47E-04	2.05E-12	.00	.00	.00	.00	.00

POWER: 35.00MW, BURNUP: 32000.MWD, FLUX: 1.00E+13N/CM^2-SEC

NUCLIDE RADIOACTIVITY, Curies
Basis: 1g of HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
SN117	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN118	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN119M	.00	1.40E+02	1.09E+03	9.00E+00	5.09E+06	1.05E+00	8.44E-02	5.40E-04	2.22E-06	1.43E-21	.00
SN119	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN120	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN121M	.00	1.03E-01	1.03E-01	1.03E-01	1.02E-01	1.01E-01	9.85E-02	9.41E-02	8.59E-02	6.54E-02	4.14E-02
SN121	.00	1.77E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN122	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN123M	.00	7.94E+01	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN123	.00	3.33E-01	2.03E-01	1.34E+01	4.37E-02	5.76E-03	1.32E-05	5.29E-10	8.44E-19	.00	.00
SN124	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN125M	.00	7.24E+01	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN125	.00	3.03E+00	3.93E-03	2.27E-05	6.04E-12	1.21E-23	.00	.00	.00	.00	.00
SB121	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SB123	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SE124M	.00	5.76E-02	.00	.00	.00	.00	.00	.00	.00	.00	.00
SB124	.00	1.39E+00	4.90E-01	2.18E-01	2.04E-02	2.98E-04	9.51E-10	6.53E-19	.00	.00	.00
SB125	.00	3.54E+01	1.49E+01	1.42E+01	1.23E+01	9.51E+00	4.40E+00	1.72E+00	9.34E-02	4.23E-05	1.12E-10
SB126M	.00	3.21E-02	.00	.00	.00	.00	.00	.00	.00	.00	.00
SB126	.00	7.01E-02	4.17E-04	9.83E-06	1.12E-10	1.19E-19	.00	.00	.00	.00	.00
TE124	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE125M	.00	4.75E+00	5.55E+00	5.63E+00	5.07E+00	3.94E+00	1.82E+00	5.15E-01	3.48E-02	1.75E-05	4.46E-11
TE125	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE126	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TA120	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TA121	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TA122M	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TA122	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
W120	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
W121	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
W122	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
W123M	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
W123	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
W124	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
W125M	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
W125	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
W126	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
W127	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TOTAL	.00	3.19E+05	4.17E+04	2.25E+04	5.11E+03	2.73E+03	1.44E+03	7.40E+02	4.95E+02	1.80E+02	2.42E+02

POWER: 35.00MW, BURNUP: 12000-MWD, FLUX: 5.00E+13W/CM^2-SEC

ELEMENTAL ACTIVITY, CURSES
BASIS - MG OF HEAVY METAL CHARGED TO REACTOR

	CHANGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
H	.00	4.38E-04	4.32E-04	4.27E-04	4.14E-04	3.97E-04	3.30E-04	2.49E-04	1.42E-04	2.62E-07	1.54E-08
BE	.00	1.63E-03	9.34E-04	9.34E-04	9.34E-04	9.34E-04	9.34E-04	9.34E-04	9.34E-04	9.34E-04	9.34E-04
C	.00	7.19E-04	7.19E-04	7.19E-04	7.19E-04	7.19E-04	7.19E-04	7.19E-04	7.19E-04	7.19E-04	7.19E-04
P	.00	1.93E-03	2.44E-05	4.24E-01	3.44E-11	8.05E-19	.00	.00	.00	.00	.00
CA	.00	1.72E-04	5.77E-12	4.29E-12	1.81E-12	1.80E-13	1.91E-15	1.82E-18	3.44E-25	.00	.00
SC	.00	2.33E-04	1.30E-12	4.03E-15	7.38E-14	3.61E-17	4.22E-21	.00	.00	.00	.00
CR	.00	1.49E-04	2.08E-03	3.64E-02	2.18E-03	2.41E-04	3.28E-16	.00	.00	.00	.00
MM	.00	2.65E-05	4.82E-02	4.10E-02	2.57E-02	1.21E-02	9.07E-03	1.19E-01	3.27E-05	4.23E-16	.00
FL	.00	3.84E-03	3.26E-03	3.02E-03	2.57E-03	1.97E-03	8.83E-02	2.33E-02	1.62E-01	5.44E-03	8.83E-09
CO	.00	2.64E-04	1.09E-04	5.36E-03	7.92E-02	5.89E-01	2.57E-01	1.30E-01	3.49E-01	6.64E-02	9.21E-05
N1	.00	2.51E-03	5.51E-02	5.50E-02	5.48E-02	5.43E-02	5.37E-02	5.12E-02	4.75E-02	3.81E-02	2.62E-02
Zn	.00	1.60E-05	1.24E-05	1.02E-05	5.70E-06	2.63E-06	4.13E-08	5.21E-10	1.64E-14	.00	.00
SR	.00	3.43E-01	4.67E-01	3.80E-01	2.47E-01	2.01E-03	1.07E-04	9.42E-05	7.34E-05	3.51E-05	1.02E-05
V	.00	1.12E-03	2.95E-01	1.29E-01	1.15E-04	1.56E-02	3.07E-04	9.42E-05	7.34E-05	3.51E-05	1.02E-05
Zr	.00	2.43E-04	9.30E-03	4.41E-03	4.94E-02	1.01E-01	3.18E-02	3.17E-02	3.17E-02	3.17E-02	3.17E-02
MO	.00	2.24E-04	1.44E-04	8.15E-03	1.03E-03	2.21E-03	7.68E-03	1.31E-02	2.05E-02	2.93E-02	3.15E-02
RO	.00	1.54E-08	3.07E-18	8.71E-26	.00	.00	.00	.00	.00	.00	.00
TC	.00	1.35E-08	7.98E-15	7.98E-15	7.98E-15	7.98E-15	7.98E-15	7.98E-15	7.98E-15	7.98E-15	7.97E-15
CO	.00	2.25E-03	1.07E-15	3.77E-25	.00	.00	.00	.00	.00	.00	.00
SH	.00	1.24E-04	1.33E-02	1.30E-01	5.24E-01	1.94E-01	1.47E-01	9.43E-02	8.59E-02	4.54E-02	4.14E-02
SB	.00	1.74E-01	1.54E-01	1.44E-01	1.23E-01	9.51E-01	4.40E-01	1.22E-01	9.33E-02	4.23E-05	1.12E-10
TC	.00	4.75E-05	5.55E-01	5.61E-01	5.07E-01	3.94E-01	1.82E-01	5.05E-01	1.88E-01	1.75E-05	4.66E-11
TOTALS	.00	3.79E-05	4.17E-04	2.25E-04	5.71E-03	2.73E-03	1.44E-03	7.60E-02	4.95E-02	3.40E-02	2.62E-02
SUBTOT	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TOTALS	.00	3.79E-05	2.25E-04	2.73E-03	2.60E-02	1.80E-02					

TABLE A-6

QUANTITIES OF LIGHT ELEMENTS AND
MATERIALS OF CONSTRUCTION
PRESENT IN SPENT FUEL
VS. DECAY TIMES

- POWER: 35-CONV. BURNUP: 12000.MWD, FLUX: 3.09*10¹⁴/CM²-SEC

KUCLIDE CONCENTRATIONS, GRAMS
BASIS : WT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
H 1	-00	7.38-02	7.38-02	7.38-02	7.38-02	7.38-02	7.38-02	7.38-02	7.38-02	7.38-02	7.38-02
H 2	-00	1.79-05	1.79-05	1.79-05	1.79-05	1.79-05	1.79-05	1.79-05	1.79-05	1.79-05	1.79-05
H 3	-00	4.52-10	4.46-10	4.41-10	4.27-10	4.04-10	3.81-10	2.57-10	1.46-10	2.70-11	1.61-12
H 4	-00	3.95-26	3.95-26	3.95-26	3.95-26	3.95-26	3.95-26	3.95-26	3.95-26	3.95-26	3.95-26
HE 3	-00	3.58-12	9.01-12	1.46-11	2.83-11	5.17-11	1.15-10	1.98-10	3.00-10	4.28-10	4.54-10
HE 4	-00	3.76-01	3.76-01	3.76-01	3.76-01	3.76-01	3.76-01	3.76-01	3.76-01	3.76-01	3.76-01
HE 6	-00	4.07-16	-00	-00	-00	-00	-00	-00	-00	-00	-00
LI 6	-00	4.08-09	4.08-09	4.08-09	4.08-09	4.08-09	4.08-09	4.08-09	4.08-09	4.08-09	4.08-09
LI 7	-00	2.65-13	2.65-13	2.65-13	2.65-13	2.65-13	2.65-13	2.65-13	2.65-13	2.65-13	2.65-13
LI 8	-00	3.02-25	-00	-00	-00	-00	-00	-00	-00	-00	-00
FE 8	-00	3.46-31	-00	-00	-00	-00	-00	-00	-00	-00	-00
BE 9	-00	6.55-05	6.55-05	6.55-05	6.55-05	6.55-05	6.55-05	6.55-05	6.55-05	6.55-05	6.55-05
BE 10	-00	6.53-06	6.53-06	6.53-06	6.53-06	6.53-06	6.53-06	6.53-06	6.53-06	6.53-06	6.53-06
BE 11	-00	-00	-00	-00	-00	-00	-00	-00	-00	-00	-00
B 10	-00	3.68-13	8.14-13	1.16-12	2.18-12	3.99-12	9.42-12	1.85-11	3.66-11	9.09-11	1.81-10
B 11	-00	9.14-14	9.14-14	9.14-14	9.14-14	9.14-14	9.14-14	9.14-14	9.14-14	9.14-14	9.14-14
B 12	-00	2.92-28	-00	-00	-00	-00	-00	-00	-00	-00	-00
C 12	1.06-02	1.06-02	1.06-02	1.06-02	1.06-02	1.06-02	1.06-02	1.06-02	1.06-02	1.06-02	1.06-02
C 13	1.18-00	2.38-00	2.38-00	2.38-00	2.38-00	2.38-00	2.38-00	2.38-00	2.38-00	2.38-00	2.38-00
C 14	-00	1.61-04	1.61-04	1.61-04	1.61-04	1.61-04	1.61-04	1.61-04	1.61-04	1.61-04	1.61-04
N 13	-00	-00	-00	-00	-00	-00	-00	-00	-00	-00	-00
N 14	-00	4.05-09	1.08-08	1.46-08	2.56-08	4.51-08	1.04-07	2.01-07	3.96-07	9.79-07	1.95-06
N 15	-00	7.12-14	7.12-14	7.12-14	7.12-14	7.12-14	7.12-14	7.12-14	7.12-14	7.12-14	7.12-14
N 16	-00	1.59-09	-00	-00	-00	-00	-00	-00	-00	-00	-00
O 16	1.34-05	1.34-05	1.34-05	1.34-05	1.34-05	1.34-05	1.34-05	1.34-05	1.34-05	1.34-05	1.34-05
O 17	-00	2.87-00	2.87-00	2.87-00	2.87-00	2.87-00	2.87-00	2.87-00	2.87-00	2.87-00	2.87-00
O 18	-00	1.37-21	1.37-21	1.37-21	1.37-21	1.37-21	1.37-21	1.37-21	1.37-21	1.37-21	1.37-21
O 19	-00	2.44-34	-00	-00	-00	-00	-00	-00	-00	-00	-00
F 19	-00	5.93-34	5.93-34	5.93-34	5.93-34	5.93-34	5.93-34	5.93-34	5.93-34	5.93-34	5.93-34
F 20	-00	2.32-22	-00	-00	-00	-00	-00	-00	-00	-00	-00
NE 20	-00	1.40-16	1.40-16	1.40-16	1.40-16	1.40-16	1.40-16	1.40-16	1.40-16	1.40-16	1.40-16
NE 21	-00	9.02-19	9.02-19	9.02-19	9.02-19	9.02-19	9.02-19	9.02-19	9.02-19	9.02-19	9.02-19
NE 22	-00	6.10-09	6.10-09	6.10-09	6.10-09	6.10-09	6.10-09	6.10-09	6.10-09	6.10-09	6.10-09
NE 23	-00	1.82-15	-00	-00	-00	-00	-00	-00	-00	-00	-00
NA 22	-00	-00	-00	-00	-00	-00	-00	-00	-00	-00	-00
NA 23	-00	4.79-10	4.79-10	4.79-10	4.79-10	4.79-10	4.79-10	4.79-10	4.79-10	4.79-10	4.79-10
NA 24	-00	4.42-15	-00	-00	-00	-00	-00	-00	-00	-00	-00
NA 25	-00	4.91-15	-00	-00	-00	-00	-00	-00	-00	-00	-00
NA 26	-00	1.15-12	1.15-12	1.15-12	1.15-12	1.15-12	1.15-12	1.15-12	1.15-12	1.15-12	1.15-12
NA 25	-00	4.45-04	4.45-04	4.45-04	4.45-04	4.45-04	4.45-04	4.45-04	4.45-04	4.45-04	4.45-04
NA 26	-00	1.97-04	1.97-04	1.97-04	1.97-04	1.97-04	1.97-04	1.97-04	1.97-04	1.97-04	1.97-04
NA 27	-00	5.87-11	-00	-00	-00	-00	-00	-00	-00	-00	-00
AL 27	-00	2.04-06	2.04-06	2.04-06	2.04-06	2.04-06	2.04-06	2.04-06	2.04-06	2.04-06	2.04-06
AL 28	-00	1.88-09	-00	-00	-00	-00	-00	-00	-00	-00	-00
AL 29	-00	1.86-09	-00	-00	-00	-00	-00	-00	-00	-00	-00
SI 28	3.69-02	3.69-02	3.69-02	3.69-02	3.69-02	3.69-02	3.69-02	3.69-02	3.69-02	3.69-02	3.69-02
SI 29	1.88-01	1.88-01	1.88-01	1.88-01	1.88-01	1.88-01	1.88-01	1.88-01	1.88-01	1.88-01	1.88-01
SI 30	1.24-01	1.24-01	1.24-01	1.24-01	1.24-01	1.24-01	1.24-01	1.24-01	1.24-01	1.24-01	1.24-01
SI 31	-00	3.87-07	-00	-00	-00	-00	-00	-00	-00	-00	-00
P 31	-00	8.14-04	8.14-04	8.14-04	8.14-04	8.14-04	8.14-04	8.14-04	8.14-04	8.14-04	8.14-04
P 32	-00	6.75-09	6.75-09	6.75-09	6.75-09	6.75-09	6.75-09	6.75-09	6.75-09	6.75-09	6.75-09
P 33	-00	-00	-00	-00	-00	-00	-00	-00	-00	-00	-00

Power: 35.00MW, BURNUP: 12000.MWD, FLUX: 5.09E13N/CM2-SEC

MULTIPLY CONCENTRATIONS, GRAMS
BASIS : 1% OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
P 34	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
S 32	.00	5.12-08	5.19-08	5.19-08	5.19-08	5.19-08	5.19-08	5.19-08	5.19-08	5.19-08	5.19-08
S 33	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
S 34	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
S 35	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
S 36	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
S 37	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CL 35	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CL 36	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CL 37	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CL 38	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AR 37	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AR 38	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AR 39	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AR 40	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AR 41	.00	1.85-20	.00	.00	.00	.00	.00	.00	.00	.00	.00
K 39	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
K 40	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
K 41	.00	1.87-17	1.87-17	1.87-17	1.87-17	1.87-17	1.87-17	1.87-17	1.87-17	1.87-17	1.87-17
K 42	.00	2.74-23	.00	.00	.00	.00	.00	.00	.00	.00	.00
K 43	.00	1.82-27	.00	.00	.00	.00	.00	.00	.00	.00	.00
P 44	.00	9.11-21	.00	.00	.00	.00	.00	.00	.00	.00	.00
CA 40	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CA 41	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CA 42	.00	3.02-21	3.05-21	3.05-21	3.05-21	3.05-21	3.05-21	3.05-21	3.05-21	3.05-21	3.05-21
CA 43	.00	6.43-20	6.43-20	6.43-20	6.43-20	6.43-20	6.43-20	6.43-20	6.43-20	6.43-20	6.43-20
CA 44	.00	9.37-10	9.37-10	9.37-10	9.37-10	9.37-10	9.37-10	9.37-10	9.37-10	9.37-10	9.37-10
CA 45	.00	4.77-16	3.27-16	2.44-16	1.63-16	2.22-17	2.22-19	1.03-22	2.24-29	.00	.00
CA 46	.00	3.02-10	3.02-10	3.02-10	3.02-10	3.02-10	3.02-10	3.02-10	3.02-10	3.02-10	3.02-10
CA 47	.00	2.40-14	2.92-20	6.53-25	.00	.00	.00	.00	.00	.00	.00
CA 48	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CA 49	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SC 45	.00	1.78-16	3.28-16	4.11-16	5.52-16	4.33-16	6.55-16	6.55-16	6.55-16	6.55-16	6.55-16
SC 46	.00	4.46-19	2.12-19	1.19-19	2.18-20	1.07-21	1.25-25	3.44-32	.00	.00	.00
SC 47	.00	1.19-10	1.60-18	3.12-24	.00	.00	.00	.00	.00	.00	.00
SC 48	.00	7.61-11	1.19-25	3.66-37	.00	.00	.00	.00	.00	.00	.00
SC 49	.00	3.18-13	.00	.00	.00	.00	.00	.00	.00	.00	.00
SC 50	.00	9.57-16	.00	.00	.00	.00	.00	.00	.00	.00	.00
TI 46	.00	2.25-19	4.59-19	5.52-19	6.69-19	6.71-19	6.71-19	6.71-19	6.71-19	6.71-19	6.71-19
TI 47	.00	1.98-04	1.98-04	1.98-04	1.98-04	1.98-04	1.98-04	1.98-04	1.98-04	1.98-04	1.98-04
TI 48	.00	1.04-07	1.04-07	1.04-07	1.04-07	1.04-07	1.04-07	1.04-07	1.04-07	1.04-07	1.04-07
TI 49	.00	4.34-04	4.34-04	4.34-04	4.34-04	4.34-04	4.34-04	4.34-04	4.34-04	4.34-04	4.34-04
TI 50	.00	2.01-03	2.01-03	2.01-03	2.01-03	2.01-03	2.01-03	2.01-03	2.01-03	2.01-03	2.01-03
TI 51	.00	1.49-10	.00	.00	.00	.00	.00	.00	.00	.00	.00
T 49	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
V 50	.00	8.05-03	8.05-03	8.05-03	8.05-03	8.05-03	8.05-03	8.05-03	8.05-03	8.05-03	8.05-03
V 51	.00	1.57-00	1.76-00	1.78-00	1.78-00	1.78-00	1.78-00	1.78-00	1.78-00	1.78-00	1.78-00
V 52	.00	1.02-07	.00	.00	.00	.00	.00	.00	.00	.00	.00
V 53	.00	4.25-10	.00	.00	.00	.00	.00	.00	.00	.00	.00
V 54	.00	2.04-12	.00	.00	.00	.00	.00	.00	.00	.00	.00
CR 50	1.78+02	1.77+02	1.77+02	1.77+02	1.77+02	1.77+02	1.77+02	1.77+02	1.77+02	1.77+02	1.77+02

POWER: 35.0MW, BURNUP: 12000.MWD, FLUX: 5.00E+13N/CM2-SEC

NUCLIDE CONCENTRATIONS, DPMs
BASIS : WT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
CR 51	.00	2.13+01	2.26+02	3.95+03	2.34+04	2.67+09	3.55+21	.00	.00	.00
CR 52	3.44+03	3.43+03	3.43+03	3.43+03	3.43+03	3.43+03	3.43+03	3.43+03	3.43+03	3.43+03
CR 53	3.89+02	3.87+02	3.87+02	3.87+02	3.87+02	3.87+02	3.87+02	3.87+02	3.87+02	3.87+02
CR 54	9.67+01	1.01+02	1.01+02	1.01+02	1.01+02	1.01+02	1.01+02	1.01+02	1.01+02	1.01+02
CR 55	.00	2.55+07	.00	.00	.00	.00	.00	.00	.00	.00
CR 56	.00	1.81+02	6.03+02	5.14+02	3.21+02	1.39+02	14+03	1.74+05	4.04+09	5.30+20
CR 55	2.16+03	2.13+03	2.13+03	2.13+03	2.13+03	2.13+03	2.13+03	2.13+03	2.13+03	2.13+03
CR 56	.00	1.27+02	.00	.00	.00	.00	.00	.00	.00	.00
CR 57	.00	1.30+09	.00	.00	.00	.00	.00	.00	.00	.00
CR 58	.00	3.02+12	.00	.00	.00	.00	.00	.00	.00	.00
FE 54	8.87+02	8.80+02	8.80+02	8.80+02	8.80+02	8.80+02	8.80+02	8.80+02	8.80+02	8.80+02
FE 55	.00	1.34+00	1.25+00	1.19+00	1.03+00	7.86+01	3.53+01	9.31+02	4.47+03	2.17+04
FE 56	1.39+04	1.39+04	1.39+04	1.39+04	1.39+04	1.39+04	1.39+04	1.39+04	1.39+04	1.39+04
FE 57	3.25+02	3.45+02	3.45+02	3.45+02	3.45+02	3.45+02	3.45+02	3.45+02	3.45+02	3.45+02
FE 58	4.71+01	4.97+01	5.07+01	5.04+01	5.05+01	5.05+01	5.05+01	5.05+01	5.05+01	5.05+01
FE 59	.00	1.01+02	2.51+03	8.55+04	3.62+05	1.30+07	6.09+15	3.69+27	.00	.00
CO 50A	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CO 50	.00	8.27+01	3.45+01	1.74+01	2.37+02	6.80+04	1.61+08	3.13+16	1.18+31	.00
CO 59	.00	9.82+01	9.89+01	9.91+01	9.92+01	9.93+01	9.94+01	9.94+01	1.00+00	1.03+00
CO 60A	.00	7.83+07	.00	.00	.00	.00	.00	.00	.00	.00
CO 60	.00	4.30+02	4.18+02	4.08+02	3.77+02	3.30+02	2.22+02	1.45+02	3.04+03	3.91+05
CO 61	.00	3.45+01	.00	.00	.00	.00	.00	.00	.00	.00
CO 62	.00	7.74+09	.00	.00	.00	.00	.00	.00	.00	.00
NI 50	1.97+04	1.92+04	1.92+04	1.92+04	1.92+04	1.92+04	1.92+04	1.92+04	1.92+04	1.92+04
NI 59	.00	4.98+01	4.98+01	4.98+01	4.98+01	4.98+01	4.98+01	4.98+01	4.98+01	4.98+01
NI 60	7.36+03	7.35+03	7.35+03	7.35+03	7.35+03	7.35+03	7.35+03	7.35+03	7.35+03	7.35+03
NI 61	3.11+02	3.21+02	3.21+02	3.21+02	3.21+02	3.21+02	3.21+02	3.21+02	3.21+02	3.21+02
NI 62	1.02+03	1.01+03	1.01+03	1.01+03	1.01+03	1.01+03	1.01+03	1.01+03	1.01+03	1.01+03
NI 63	.00	8.88+00	8.86+00	8.85+00	8.81+00	8.75+00	8.55+00	8.23+00	7.64+00	6.09+00
NI 64	2.54+02	2.54+02	2.54+02	2.54+02	2.54+02	2.54+02	2.54+02	2.54+02	2.54+02	2.54+02
NI 65	.00	1.04+04	.00	.00	.00	.00	.00	.00	.00	.00
CU 62	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CU 63	.00	3.12+02	4.76+02	6.04+02	9.78+02	1.64+01	3.59+01	6.76+01	1.27+00	2.82+00
CU 64	.00	3.04+07	.00	.00	.00	.00	.00	.00	.00	.00
CU 65	.00	2.23+01	2.23+01	2.23+01	2.23+01	2.23+01	2.23+01	2.23+01	2.23+01	2.23+01
CU 66	.00	3.41+09	.00	.00	.00	.00	.00	.00	.00	.00
ZN 63	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
ZN 64	.00	1.68+05	1.69+05	1.69+05	1.69+05	1.69+05	1.69+05	1.69+05	1.69+05	1.69+05
ZN 65	.00	1.95+09	1.51+09	1.24+09	6.95+10	2.47+10	3.11+11	6.35+14	2.06+18	7.08+32
ZN 66	.00	2.43+04	2.43+04	2.43+04	2.43+04	2.43+04	2.43+04	2.43+04	2.43+04	2.43+04
ZN 67	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
ZN 68	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
ZN 69A	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
ZN 69	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
ZN 70	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
ZN 71A	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
ZN 71	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
GA 69	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
GA 70	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
GA 71	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SE 70	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 00	.00	6.83+02	6.83+02	6.83+02	6.83+02	6.83+02	6.83+02	6.83+02	6.83+02	6.83+02

POWLO= 35.00MW, BURAMP= 12000.AMD, LUT= 3.09*13N/CH002-5CC

NUCLIDE CONCENTRATIONS, UMARS
BASIS : MT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	30. Y	100. Y
SR 84	.00	3.14+03	3.42+04	1.35+04	8.73+06	6.71+08	3.04+10	8.12+25	.00	.00	.00
SR 90	.00	8.53+07	8.47+07	8.83+07	8.32+07	8.12+07	7.34+07	6.66+07	5.21+07	2.48+07	7.23+08
SR 93	.00	3.75+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
Y 9CM	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Y 90	.00	2.78+03	2.20+10	2.19+10	2.14+10	2.11+10	1.76+10	1.73+10	1.35+10	6.45+11	1.89+11
Y 93M	.00	2.68+08	.00	.00	.00	.00	.00	.00	.00	.00	.00
Y 91	.00	3.49+03	1.21+03	5.30+04	4.71+05	6.34+07	1.56+12	4.96+27	.00	.00	.00
ZR 90	1.18+05	1.18+05	1.18+05	1.18+05	1.18+05	1.18+05	1.18+05	1.18+05	1.18+05	1.18+05	1.18+05
ZR 91	2.57+04	2.57+04	2.57+04	2.57+04	2.57+04	2.57+04	2.57+04	2.57+04	2.57+04	2.57+04	2.57+04
ZR 92	3.94+04	3.94+04	3.94+04	3.94+04	3.94+04	3.94+04	3.94+04	3.94+04	3.94+04	3.94+04	3.94+04
ZR 93	.00	1.24+01	1.24+01	1.24+01	1.24+01	1.24+01	1.24+01	1.24+01	1.24+01	1.24+01	1.24+01
ZR 94	4.02+04	4.02+04	4.02+04	4.02+04	4.02+04	4.02+04	4.02+04	4.02+04	4.02+04	4.02+04	4.02+04
ZR 95	.00	1.15+00	4.40+01	2.08+01	2.33+02	4.75+04	3.99+09	1.39+17	1.64+30	.00	.00
ZR 96	6.44+03	6.44+03	6.44+03	6.44+03	6.44+03	6.44+03	6.44+03	6.44+03	6.44+03	6.44+03	6.44+03
AB 92	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AB 93M	.00	2.62+06	3.99+06	5.04+06	6.04+06	1.32+05	2.77+05	4.63+05	7.26+05	1.04+06	1.11+04
AB 93	.00	4.10+08	8.33+08	1.27+07	3.15+07	8.59+07	3.98+06	1.35+05	4.43+05	1.85+04	4.63+04
AB 94	.00	6.85+12	6.85+12	6.85+12	6.85+12	6.85+12	6.85+12	6.85+12	6.85+12	6.85+12	6.85+12
AB 95	.00	5.62+01	3.80+01	2.08+01	2.47+02	5.62+04	4.57+09	1.59+17	.00	.00	.00
AB 96	.00	7.19+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
AB 97	.00	2.78+14	.00	.00	.00	.00	.00	.00	.00	.00	.00
AB 92	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AB 93	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AB 93M	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AB 94	.00	4.41+20	1.03+19	1.48+19	2.82+19	5.16+19	1.23+18	2.42+18	4.79+18	1.19+17	2.38+17
AB 95	.00	2.41+00	5.31+00	1.11+00	4.01+00	4.12+00	4.12+00	4.12+00	4.12+00	4.12+00	4.12+00
AB 96	.00	3.56+02	3.56+02	3.56+02	3.56+02	3.56+02	3.56+02	3.56+02	3.56+02	3.56+02	3.56+02
AB 97	.00	5.37+06	5.37+06	5.37+06	5.37+06	5.37+06	5.37+06	5.37+06	5.37+06	5.37+06	5.37+06
AB 98	.00	1.26+09	1.26+09	1.26+09	1.26+09	1.26+09	1.26+09	1.26+09	1.26+09	1.26+09	1.26+09
AB 99	.00	3.29+10	6.49+24	1.84+31	.00	.00	.00	.00	.00	.00	.00
PC120	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
MC101	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TC 99M	.00	2.57+15	5.55+25	1.58+32	.00	.00	.00	.00	.00	.00	.00
TC 99	.00	4.28+13	4.64+13	4.64+13	4.64+13	4.64+13	4.64+13	4.64+13	4.64+13	4.64+13	4.64+13
TC101	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CU101	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CU113M	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CU113	.00	1.59+07	1.59+07	1.59+07	1.59+07	1.59+07	1.59+07	1.59+07	1.59+07	1.59+07	1.59+07
CU115M	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CU115	.00	2.98+09	2.09+21	7.40+31	.00	.00	.00	.00	.00	.00	.00
CU119M	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CU119	.00	1.55+12	.00	.00	.00	.00	.00	.00	.00	.00	.00
CU121	.00	3.84+13	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN113	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN119M	.00	6.39+12	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN119	.00	6.98+11	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN123M	.00	3.60+13	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN121	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SH114	2.31+01	2.31+01	2.31+01	2.31+01	2.31+01	2.31+01	2.31+01	2.31+01	2.31+01	2.31+01	2.31+01
SH115	1.23+01	1.23+01	1.23+01	1.23+01	1.23+01	1.23+01	1.23+01	1.23+01	1.23+01	1.23+01	1.23+01
SH116	5.02+02	5.02+02	5.02+02	5.02+02	5.02+02	5.02+02	5.02+02	5.02+02	5.02+02	5.02+02	5.02+02
SH117M	.00	1.31+01	1.53+01	4.77+05	1.84+09	2.57+17	.00	.00	.00	.00	.00

POWER= 35.00MW, DURNUP= 12000.HRD, FLUX= 3.00E+13M/CM^2-SEC

NUCLIDE CONCENTRATIONS, GRAMS
 BASIS : MT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
SM117	2.66E+02	2.66E+02	2.67E+02	2.67E+02	2.67E+02	2.67E+02	2.67E+02	2.67E+02	2.67E+02	2.67E+02	2.67E+02
SM118	8.46E+02	8.46E+02	8.46E+02	8.46E+02	8.46E+02	8.46E+02	8.46E+02	8.46E+02	8.46E+02	8.46E+02	8.46E+02
SM119M	.00	3.19E-03	2.49E-03	2.05E-03	1.36E-03	4.21E-04	2.07E-05	1.28E-07	5.10E-12	3.25E-25	.00
SM119	3.01E+02	3.00E+02	3.00E+02	3.00E+02	3.00E+02	3.00E+02	3.00E+02	3.00E+02	3.00E+02	3.00E+02	3.00E+02
SM120	1.15E+03	1.15E+03	1.15E+03	1.15E+03	1.15E+03	1.15E+03	1.15E+03	1.15E+03	1.15E+03	1.15E+03	1.15E+03
SM121M	.00	2.65E-03	2.65E-03	2.64E-03	2.63E-03	2.60E-03	2.53E-03	2.42E-03	2.27E-03	1.68E-03	1.06E-03
SM121	.00	1.65E-03	.00	.00	.00	.00	.00	.00	.00	.00	.00
SM122	1.65E+02	1.65E+02	1.65E+02	1.65E+02	1.65E+02	1.65E+02	1.65E+02	1.65E+02	1.65E+02	1.65E+02	1.65E+02
SM123M	.00	2.08E-06	.00	.00	.00	.00	.00	.00	.00	.00	.00
SM123	.00	3.90E-05	2.37E-05	1.60E-05	5.16E-06	6.78E-07	1.56E-09	6.27E-14	9.93E-23	.00	.00
SM124	2.03E+02	2.03E+02	2.03E+02	2.03E+02	2.03E+02	2.03E+02	2.03E+02	2.03E+02	2.03E+02	2.03E+02	2.03E+02
SM125M	.00	4.66E-07	.00	.00	.00	.00	.00	.00	.00	.00	.00
SM125	.00	2.71E-05	3.55E-08	2.04E-10	5.44E-17	1.09E-28	.00	.00	.00	.00	.00
SB121	.00	3.67E-01	3.69E-01	3.69E-01	3.69E-01	3.69E-01	3.69E-01	3.69E-01	3.69E-01	3.70E-01	3.71E-01
SB123	.00	1.67E-02	1.68E-02	1.68E-02	1.68E-02	1.68E-02	1.68E-02	1.68E-02	1.68E-02	1.68E-02	1.68E-02
SB124M	.00	5.89E-11	.00	.00	.00	.00	.00	.00	.00	.00	.00
SB124	.00	3.89E-05	2.79E-05	1.24E-05	1.16E-06	3.70E-08	5.42E-14	3.72E-23	.00	.00	.00
SB125	.00	1.50E-02	1.41E-02	1.34E-02	1.18E-02	8.97E-03	6.15E-03	1.15E-03	8.81E-05	3.99E-08	1.06E-13
SM126M	.00	4.73E-10	.00	.00	.00	.00	.00	.00	.00	.00	.00
SB126	.00	8.45E-07	5.75E-09	3.19E-10	1.95E-15	2.15E-24	.00	.00	.00	.00	.00
TE126	.00	1.43E-04	1.49E-04	2.10E-04	2.21E-04	2.22E-04	2.22E-04	2.22E-04	2.22E-04	2.22E-04	2.22E-04
TE125M	.00	2.64E-04	3.08E-04	3.31E-04	2.61E-04	2.19E-04	1.01E-04	2.60E-05	2.15E-04	9.72E-10	2.58E-15
TE125	.00	1.58E-03	2.45E-03	3.12E-03	4.95E-03	7.64E-03	1.24E-02	1.57E-02	1.67E-02	1.68E-02	1.68E-02
TE126	.00	1.19E-05	1.27E-05	1.28E-05	1.28E-05	1.28E-05	1.28E-05	1.28E-05	1.28E-05	1.28E-05	1.28E-05
TA126G	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TA123	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TA122M	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TA122	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
W12C	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
W181	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
W182	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
W183M	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
W183	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
W184	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
W185M	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
W185	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
W186	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
W187	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TOTAL	4.18E+05	4.18E+05	4.18E+05	4.18E+05	4.18E+05	4.18E+05	4.18E+05	4.18E+05	4.18E+05	4.18E+05	4.18E+05

POWER= 35.00mw, Burnup= 12000.MWD, FLUX= 3.0E+15A/CMS2-SEC

ELEMENT CONCENTRATIONS, GRAMS
BASIS = WT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
H	.00	2.38E-02	7.38E-02	7.38E-02	7.38E-02	7.38E-02	7.38E-02	7.38E-02	7.38E-02	7.38E-02	7.38E-02
HE	.00	3.76E-01	3.76E-01	3.76E-01	3.76E-01	3.76E-01	3.76E-01	3.76E-01	3.76E-01	3.76E-01	3.76E-01
LI	.00	4.08E-09	4.08E-09	4.08E-09	4.08E-09	4.08E-09	4.08E-09	4.08E-09	4.08E-09	4.08E-09	4.08E-09
BE	.00	7.20E-05	7.20E-05	7.20E-05	7.20E-05	7.20E-05	7.20E-05	7.20E-05	7.20E-05	7.20E-05	7.20E-05
B	.00	4.59E-13	9.05E-13	1.25E-12	2.27E-12	4.08E-12	9.51E-12	1.46E-11	3.67E-11	9.10E-11	1.81E-10
C	1.07E+02	1.08E+02	1.08E+02	1.08E+02	1.08E+02	1.08E+02	1.08E+02	1.08E+02	1.08E+02	1.08E+02	1.08E+02
N	.00	7.67E-09	1.09E-08	1.94E-08	2.58E-08	4.51E-08	1.04E-07	2.01E-07	3.99E-07	7.79E-07	1.95E-06
O	1.35E+05	1.34E+05	1.34E+05	1.34E+05	1.34E+05	1.34E+05	1.34E+05	1.34E+05	1.34E+05	1.34E+05	1.34E+05
F	.00	2.32E-22	5.93E-34	5.93E-34	5.93E-34	5.93E-34	5.93E-34	5.93E-34	5.93E-34	5.93E-34	5.93E-34
NE	.00	6.10E-09	6.10E-09	6.10E-09	6.10E-09	6.10E-09	6.10E-09	6.10E-09	6.10E-09	6.10E-09	6.10E-09
NA	.00	4.79E-10	4.79E-10	4.79E-10	4.79E-10	4.79E-10	4.79E-10	4.79E-10	4.79E-10	4.79E-10	4.79E-10
MG	.00	6.43E-04	6.43E-04	6.43E-04	6.43E-04	6.43E-04	6.43E-04	6.43E-04	6.43E-04	6.43E-04	6.43E-04
SI	.00	2.04E-06	2.04E-06	2.04E-06	2.04E-06	2.04E-06	2.04E-06	2.04E-06	2.04E-06	2.04E-06	2.04E-06
AL	4.00E+02	4.00E+02	4.00E+02	4.00E+02	4.00E+02	4.00E+02	4.00E+02	4.00E+02	4.00E+02	4.00E+02	4.00E+02
P	.00	8.14E-04	8.14E-04	8.14E-04	8.14E-04	8.14E-04	8.14E-04	8.14E-04	8.14E-04	8.14E-04	8.14E-04
S	.00	5.79E-08	5.79E-08	5.79E-08	5.79E-08	5.79E-08	5.79E-08	5.79E-08	5.79E-08	5.79E-08	5.79E-08
K	.00	1.47E-17	1.47E-17	1.47E-17	1.47E-17	1.47E-17	1.47E-17	1.47E-17	1.47E-17	1.47E-17	1.47E-17
CA	.00	1.24E-09	1.24E-09	1.24E-09	1.24E-09	1.24E-09	1.24E-09	1.24E-09	1.24E-09	1.24E-09	1.24E-09
SC	.00	1.96E-10	3.30E-16	4.31E-16	5.52E-16	6.33E-16	6.55E-16	6.55E-16	6.55E-16	6.55E-16	6.55E-16
VJ	.00	2.64E-03	2.64E-03	2.64E-03	2.64E-03	2.64E-03	2.64E-03	2.64E-03	2.64E-03	2.64E-03	2.64E-03
V	.00	1.58E+00	1.77E+00	1.79E+00	1.79E+00	1.79E+00	1.79E+00	1.79E+00	1.79E+00	1.79E+00	1.79E+00
CR	4.10E+03	4.10E+03	4.10E+03	4.10E+03	4.10E+03	4.10E+03	4.10E+03	4.10E+03	4.10E+03	4.10E+03	4.10E+03
MN	2.14E+03	2.13E+03	2.13E+03	2.13E+03	2.13E+03	2.13E+03	2.13E+03	2.13E+03	2.13E+03	2.13E+03	2.13E+03
FE	1.52E+04	1.52E+04	1.52E+04	1.52E+04	1.52E+04	1.52E+04	1.52E+04	1.52E+04	1.52E+04	1.52E+04	1.52E+04
CO	.00	1.85E+00	1.38E+00	1.21E+00	1.05E+00	1.03E+00	1.02E+00	1.01E+00	1.00E+00	1.01E+00	1.03E+00
NI	2.82E+04	2.82E+04	2.82E+04	2.82E+04	2.82E+04	2.82E+04	2.82E+04	2.82E+04	2.82E+04	2.82E+04	2.82E+04
CU	.00	2.56E-01	2.31E-01	2.04E-01	3.21E-01	3.67E-01	5.05E-01	6.99E-01	1.50E+00	3.04E+00	6.95E+00
Zn	.00	2.57E-04	2.57E-04	2.57E-04	2.57E-04	2.57E-04	2.57E-04	2.57E-04	2.57E-04	2.57E-04	2.57E-04
SR	.00	6.89E-02	6.86E-02	6.86E-02	6.83E-02	6.83E-02	6.83E-02	6.83E-02	6.83E-02	6.83E-02	6.83E-02
Y	.00	5.75E-03	1.21E-03	6.30E-04	6.31E-04	6.36E-04	1.97E-10	1.33E-10	1.35E-10	4.45E-11	1.88E-11
ZR	2.30E+05	2.30E+05	2.30E+05	2.30E+05	2.30E+05	2.30E+05	2.30E+05	2.30E+05	2.30E+05	2.30E+05	2.30E+05
NB	.00	5.82E-01	3.60E-01	2.09E-01	2.62E-02	5.16E-04	3.12E-05	5.99E-05	1.17E-04	2.88E-04	5.74E-04
MO	.00	2.45E+00	3.35E+00	1.75E+00	4.11E+00	4.16E+00	4.16E+00	4.16E+00	4.16E+00	4.16E+00	4.16E+00
TC	.00	4.31E-13	4.44E-13	4.44E-13	4.44E-13	4.44E-13	4.44E-13	4.44E-13	4.44E-13	4.44E-13	4.44E-13
CD	.00	1.62E-07	1.59E-07	1.59E-07	1.59E-07	1.59E-07	1.59E-07	1.59E-07	1.59E-07	1.59E-07	1.59E-07
SN	3.47E+03	3.47E+03	3.47E+03	3.47E+03	3.47E+03	3.47E+03	3.47E+03	3.47E+03	3.47E+03	3.47E+03	3.47E+03
SB	.00	3.99E-01	4.00E-01	3.99E-01	3.97E-01	3.95E-01	3.90E-01	3.87E-01	3.84E-01	3.87E-01	3.87E-01
TE	.00	1.99E-03	2.97E-03	3.44E-03	5.47E-03	6.10E-03	1.24E-02	1.59E-02	1.70E-02	1.71E-02	1.71E-02
TOTALS	4.18E+05	4.18E+05	4.18E+05	4.18E+05	4.18E+05	4.18E+05	4.18E+05	4.18E+05	4.18E+05	4.18E+05	4.18E+05
SUBTOT	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TOTALS	4.18E+05	4.18E+05	4.18E+05	4.18E+05	4.18E+05	4.18E+05	4.18E+05	4.18E+05	4.18E+05	4.18E+05	4.18E+05

APPENDIX B
ORIGEN CALCULATIONS
Power - 35.00 MW/MTU
Burnup - 20,000 MWD/MTU

TERA CORPORATION

TABLE B-1

ACTIVITIES OF FISSION PRODUCTS IN SPENT FUEL VS. DECAY TIMES

POWER: 35,000w. BURNUP: 20000.MWD. FUEL: 3.20*10⁴CM²-SEC

NUCLIDE RADIOACTIVITY, CURIES
BASIS: MT OF HEAVY METAL CHARGED TO REACTOR

	CM ² -SEC	DISCHARGE	0. Y	0. Y	1. Y	2. Y	3. Y	10. Y	20. Y	50. Y	100. Y
N 3	.00	6.14*02	0.08*02	4.03*02	3.91*02	3.89*02	3.32*02	2.35*02	1.33*02	2.87*01	3.48*00
24 32	.00	1.66*01	1.93-13	2.59-24	.00	.00	.00	.00	.00	.00	.00
64 72	.00	1.66*01	2.38-13	3.31-24	.00	.00	.00	.00	.00	.00	.00
62 72	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
64 73	.00	4.33*01	.00	.00	.00	.00	.00	.00	.00	.00	.00
62 73	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
64 74	.00	1.59*02	.00	.00	.00	.00	.00	.00	.00	.00	.00
62 74	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
64 75	.00	2.26*02	.00	.00	.00	.00	.00	.00	.00	.00	.00
62 75M	.00	2.17*02	.00	.00	.00	.00	.00	.00	.00	.00	.00
62 75	.00	2.26*02	.00	.00	.00	.00	.00	.00	.00	.00	.00
45 75	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
64 76	.00	2.73*02	.00	.00	.00	.00	.00	.00	.00	.00	.00
62 76	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
45 76	.00	5.98*00	.00	.00	.00	.00	.00	.00	.00	.00	.00
51 76	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
62 77M	.00	2.10*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
62 77	.00	9.90*02	.00	.00	.00	.00	.00	.00	.00	.00	.00
45 77	.00	2.58*03	6.72-14	.00	.00	.00	.00	.00	.00	.00	.00
51 77M	.00	2.82*00	1.42-16	.00	.00	.00	.00	.00	.00	.00	.00
51 77	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
51 78	.00	6.39*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
45 78M	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
45 78	.00	6.91*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
51 78	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
45 79	.00	1.40*04	.00	.00	.00	.00	.00	.00	.00	.00	.00
51 79M	.00	1.90*04	.00	.00	.00	.00	.00	.00	.00	.00	.00
51 79	.00	2.51-01	2.51-01	2.51-01	2.51-01	2.51-01	2.51-01	2.51-01	2.51-01	2.51-01	2.51-01
45 79	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
45 80	.00	2.37*04	.00	.00	.00	.00	.00	.00	.00	.00	.00
51 80	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
64 80M	.00	2.41*00	.00	.00	.00	.00	.00	.00	.00	.00	.00
64 80	.00	1.20*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 60	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
45 81	.00	6.34*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
51 81M	.00	6.35*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
51 81	.00	3.80*04	.00	.00	.00	.00	.00	.00	.00	.00	.00
64 81	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 81M	.00	2.26*02	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 81	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
51 82	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
62 82M	.00	1.39*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
PF 82	.00	1.51*03	5.74-16	.00	.00	.00	.00	.00	.00	.00	.00
PF 82	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
51 83M	.00	4.82*04	.00	.00	.00	.00	.00	.00	.00	.00	.00
51 83	.00	4.39*04	.00	.00	.00	.00	.00	.00	.00	.00	.00
64 83	.00	9.01*04	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 83M	.00	9.02*04	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 83	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
51 84	.00	2.01*05	.00	.00	.00	.00	.00	.00	.00	.00	.00
64 84M	.00	4.06*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
64 84	.00	2.01*05	.00	.00	.00	.00	.00	.00	.00	.00	.00

POWER= 35.00MW, SHUTDOWN= 20000.MWD, FLUT= 3.20*10E/CHOO2-1EC

NUCLIDE RADIOACTIVITY, CURIES
BASES = WT OF HEAVY METAL CHARGED TO REACTOR

	CHANGE	DISCHARGE	D. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
HR 04	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SL 05	.00	2.78+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
BR 05	.00	2.29+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
HR 05H	.00	2.58+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
HR 05	.00	7.86+03	7.78+03	7.65+03	7.38+03	6.92+03	5.71+03	4.14+03	2.19+03	3.18+02	1.28+01
HR 05	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
GR 06	.00	3.92+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
HR 06	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
HR 06H	.00	3.32+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
HR 06	.00	3.15+02	1.13+01	8.85-01	4.19+04	5.52-10	.00	.00	.00	.00	.00
SR 06	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PR 07	.00	4.81+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
HR 07	.00	5.50+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
PA 07	.00	1.30-05	1.30-05	1.30-05	1.30-05	1.30-05	1.30-05	1.30-05	1.30-05	1.30-05	1.30-05
SR 07H	.00	1.33-01	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 07	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
BR 08	.00	7.03+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
HR 08	.00	7.31+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
PA 08	.00	7.32+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 08	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
HR 09	.00	8.78+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
HR 09	.00	9.22+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
PR 09	.00	9.29+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 09	.00	1.01+06	3.05+05	1.20+05	7.77+03	5.97+01	2.71-05	7.23-16	.00	.00	.00
Y 09	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
HR 10	.00	1.02+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
PR 10	.00	1.03+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 10	.00	5.24+04	5.22+04	5.16+04	5.11+04	4.98+04	4.85+04	4.69+04	1.20+04	1.53+04	4.44+03
Y 10H	.00	1.90+00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Y 10	.00	5.43+04	5.23+04	5.18+04	5.11+04	4.99+04	4.83+04	4.69+04	1.20+04	1.53+04	4.45+03
ZR 10	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
HR 11	.00	1.43+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
PR 11	.00	1.35+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 11	.00	1.23+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
Y 11H	.00	7.23+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
Y 11	.00	1.28+06	4.47+05	1.94+05	1.78+04	2.35+02	5.77-04	2.57-13	.00	.00	.00
ZR 11	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
HR 12	.00	6.42+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
RR 12	.00	1.19+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 12	.00	1.18+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
Y 12	.00	1.35+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
ZR 12	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
HR 13	.00	1.46+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
PR 13	.00	1.44+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 13	.00	1.44+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
Y 13	.00	1.44+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
ZR 13	.00	1.21+00	1.21+00	1.21+00	1.21+00	1.21+00	1.21+00	1.21+00	1.21+00	1.21+00	1.21+00
HR 13H	.00	4.85-02	6.30-02	7.42-02	1.06-01	2.61-01	3.10-01	5.12-01	7.91-01	1.12+00	1.20+00
AS 13	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
HR 14	.00	4.98+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
PR 14	.00	4.51+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 14	.00	1.35+06	.00	.00	.00	.00	.00	.00	.00	.00	.00

POWER: 35.00MW, BURNDUP: 20000.MWD, FLUX: 3.20*13N/CM2-SEC

NUCLIDE RADIOACTIVITY, CURIES
BASES: MT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
Y 94	.00	1.35*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
ZR 94	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 95	.00	6.47*05	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 95	.00	1.22*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
Y 95	.00	1.43*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
ZR 95	.00	1.47*06	6.43*05	3.04*05	3.40*04	6.92*02	5.82*03	2.03*11	.00	.00	.00
NR 95M	.00	3.96*04	1.36*04	6.45*03	7.27*02	1.47*01	1.24*04	6.10*13	.00	.00	.00
NS 95	.00	1.68*06	1.06*06	5.76*05	7.23*04	1.54*03	1.26*02	6.19*11	.00	.00	.00
MO 95	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Y 96	.00	1.66*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
ZR 96	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
NS 96	.00	1.39*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
MO 96	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Y 97	.00	1.65*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
ZR 97	.00	1.65*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 97M	.00	1.58*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
NS 97	.00	1.65*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
Y 97	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
ZR 97	.00	1.66*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 97M	.00	1.66*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
NS 98	.00	1.59*04	.00	.00	.00	.00	.00	.00	.00	.00	.00
MO 98	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
NS 99	.00	1.78*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
MO 99	.00	1.56*06	3.52*04	5.98*12	.00	.00	.00	.00	.00	.00	.00
TC 99M	.00	1.55*06	3.36*04	5.54*12	.00	.00	.00	.00	.00	.00	.00
TC 99	.00	6.16*00	8.93*00	8.93*00	8.93*00	8.93*00	8.93*00	8.93*00	8.93*00	8.93*00	8.93*00
NS 99	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
NS 100	.00	1.64*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
TC 100	.00	1.13*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
NS 100	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
NS 101	.00	1.59*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
NS 101	.00	1.40*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
TC 101	.00	1.40*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
NS 101	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
NS 102	.00	1.46*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
TC 102M	.00	1.39*05	.00	.00	.00	.00	.00	.00	.00	.00	.00
TC 102	.00	1.39*05	.00	.00	.00	.00	.00	.00	.00	.00	.00
NS 102	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TC 103	.00	1.27*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
NS 103	.00	1.27*06	2.63*05	7.72*04	2.12*03	3.55*00	1.46*04	2.17*22	.00	.00	.00
NS 103M	.00	1.27*06	2.63*05	7.73*04	2.13*03	3.56*00	1.46*04	2.17*22	.00	.00	.00
NS 103	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
NS 104	.00	1.13*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
TC 104	.00	1.13*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
NS 104	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
NS 104M	.00	4.23*04	.00	.00	.00	.00	.00	.00	.00	.00	.00
NS 104	.00	5.79*05	.00	.00	.00	.00	.00	.00	.00	.00	.00
NS 104	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
NS 105	.00	4.79*05	.00	.00	.00	.00	.00	.00	.00	.00	.00
TC 105	.00	6.81*05	.00	.00	.00	.00	.00	.00	.00	.00	.00

POWER = 35.00MW, BURNDUP = 20000.000, FLUX = 3.20E13n/cm2-SEC

NUCLIDE RADIOACTIVITY, CURIES
BASIS = MT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
PU105	.00	8.86E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
AM105M	.00	8.86E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
AM105	.00	8.13E+05	5.74E-13	.00	.00	.00	.00	.00	.00	.00	.00
PO105	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TC106	.00	7.04E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
RU106	.00	3.47E+05	7.83E+05	2.57E+05	1.74E+05	8.74E+04	1.10E+04	3.50E+03	3.54E+03	3.63E+10	3.79E+25
RM106M	.00	8.26E+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
RM106	.00	5.11E+05	2.93E+05	2.57E+05	1.74E+05	8.74E+04	1.10E+04	3.50E+02	3.54E+01	3.63E+10	3.79E+25
PD106	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
RU107	.00	5.23E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
RM107	.00	5.13E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
PD107M	.00	1.04E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
PD107	.00	5.14E+02	5.14E+02	5.14E+02	5.14E+02	5.14E+02	5.14E+02	5.14E+02	5.14E+02	5.14E+02	5.14E+02
AG107	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
RU108	.00	3.52E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
RM108	.00	3.52E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
PD108	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AC108	.00	7.64E+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
CU108	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
RM109	.00	1.95E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
PD109M	.00	4.64E+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
PD109	.00	2.17E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
AG109M	.00	2.17E+05	3.05E+07	2.74E+07	2.00E+07	1.35E+07	2.14E+06	1.23E+06	4.89E+12	2.56E+19	.00
AC109	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CU109	.00	3.50E+07	3.05E+07	2.74E+07	2.00E+07	1.35E+07	2.14E+06	1.23E+06	4.89E+12	2.56E+19	.00
RM110	.00	7.16E+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
PD110	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AG110M	.00	1.36E+03	1.04E+03	8.75E+02	4.96E+02	1.83E+02	4.10E+00	6.11E+02	2.75E+06	2.52E+19	.00
AG110	.00	8.51E+04	1.28E+02	1.14E+02	6.46E+03	2.38E+03	1.18E+00	1.94E+03	3.58E+07	3.27E+20	.00
CU110	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PD111M	.00	1.47E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
PL111	.00	3.48E+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
AG111M	.00	3.53E+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
AC111	.00	3.51E+04	8.60E+00	1.33E+07	7.66E+11	1.88E+25	.00	.00	.00	.00	.00
CU111M	.00	1.84E+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
CO111	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PO112	.00	1.85E+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
AG112	.00	3.85E+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
CO112	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PD113	.00	1.45E+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
AG113M	.00	8.45E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
AC113	.00	1.21E+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
CU113M	.00	2.77E+00	2.73E+00	2.71E+00	2.63E+00	2.51E+00	2.14E+00	1.49E+00	1.03E+00	2.53E+03	1.94E+02
CU113	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PL114	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PD114	.00	9.20E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
AG114	.00	9.20E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
CU114	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PL114M	.00	2.26E+01	5.91E+02	2.24E+02	1.10E+03	8.23E+06	2.08E+12	2.10E+23	.00	.00	.00
PL114	.00	3.12E+01	5.70E+02	2.16E+02	1.24E+03	7.94E+06	2.00E+12	2.02E+23	.00	.00	.00
SA114	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PO115	.00	7.59E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00

POWER= 35.00MW, BURMP= 20000.MWD, FLUX= 3.20*13H/CM2-SEC

NUCLEON RADIOACTIVITY, CURIES
 $0.015 = 10$ OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
AG115M	.00	2.13*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
AG115	.00	5.47*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
CD115M	.00	5.02*02	1.18*02	1.81*03	1.39*00	1.66-03	8.22-11	1.35-23	.00	.00	.00
CG115	.00	7.33*03	5.16-04	1.83-18	.00	.00	.00	.00	.00	.00	.00
JA115M	.00	7.33*03	5.63-04	1.99-18	.00	.00	.00	.00	.00	.00	.00
JA115	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SA115	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AG116	.00	7.07*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
CG116	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
JA116M	.00	6.59*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
JA116	.00	1.22*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
SA116	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AG117	.00	7.26*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
CG117M	.00	5.54*00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CD117	.00	7.27*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
JA117M	.00	7.27*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
JA117	.00	3.44*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
SA117M	.00	2.21*01	2.63-03	3.37-03	4.44-15	.00	.00	.00	.00	.00	.00
SA117	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CG118	.00	7.26*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
JA118M	.00	9.85-03	.00	.00	.00	.00	.00	.00	.00	.00	.00
JA118	.00	7.26*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
SA118	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CG119M	.00	3.77*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
CD119	.00	3.77*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
JA119M	.00	7.54*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
JA119	.00	3.77*02	.00	.00	.00	.00	.00	.00	.00	.00	.00
SA119M	.00	1.30*01	1.01*01	6.34*00	4.72*00	1.71*00	8.21-02	5.19-04	2.07*04	1.32-21	.00
SA119	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CG120	.00	7.66*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
JA120M	.00	3.64*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
JA120	.00	3.64*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
SA120	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CG121	.00	8.39*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
JA121M	.00	8.39*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
JA121	.00	1.10*02	.00	.00	.00	.00	.00	.00	.00	.00	.00
SA121M	.00	1.45-04	1.63-04	1.64-04	1.64-04	1.62-04	1.58-04	1.53-04	1.38-04	1.05-04	6.63-05
SA121	.00	8.52*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
SA121	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
JA122	.00	8.31*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
SA122	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SA122M	.00	6.00*01	.00	.00	.00	.00	.00	.00	.00	.00	.00
SA122	.00	6.00*02	1.24-03	3.74-15	.00	.00	.00	.00	.00	.00	.00
JA122	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
JA123M	.00	9.25*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
JA123	.00	1.12*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
SA123M	.00	1.12*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
SA123	.00	4.09*03	6.93*03	1.33*03	1.07*03	1.43*02	3.23-03	1.79-05	2.06-14	.00	.00
SA123	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
JA123M	.00	1.07-01	8.67-02	5.69-02	1.64-02	1.94-03	2.94-04	5.67-11	2.35-20	.00	.00
JA123	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
JA124	.00	1.25*04	.00	.00	.00	.00	.00	.00	.00	.00	.00

POWER= 35.00MW, BURNUP= 20000.MWD, FLUX= 3.20+134/CM^2-SEC

NUCLIDE RADIOACTIVITY, CURIES
BASES = MT OF HEAVY METAL CHARGED TO REACTOR

	CHANGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
Sm124	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Sm124M	.00	7.88+00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Sb124	.00	1.82+02	6.42+01	2.46+01	2.47+00	3.92+02	1.25+07	8.56+17	.00	.00	.00
Te124	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Sm125M	.00	7.03+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
Sm125	.00	1.23+04	1.62+01	9.27+02	2.47+04	4.94+20	.00	.00	.00	.00	.00
Sm125	.00	4.86+03	4.67+03	4.45+03	3.45+03	2.98+03	1.38+03	3.82+02	2.93+01	1.32+02	3.52+00
Te125M	.00	1.54+03	1.76+03	1.77+03	1.39+03	1.23+03	5.71+02	1.58+02	1.21+01	6.48+03	1.44+08
Te125	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Sm126	.00	2.78+01	2.78+01	2.78+01	2.78+01	2.78+01	2.78+01	2.78+01	2.78+01	2.78+01	2.78+01
Sb126M	.00	1.27+01	2.78+01	2.78+01	2.78+01	2.78+01	2.78+01	2.78+01	2.78+01	2.78+01	2.78+01
Sb126	.00	3.76+01	5.30+01	2.81+01	2.75+01	2.75+01	2.75+01	2.75+01	2.75+01	2.75+01	2.75+01
Te126	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Sm127M	.00	8.98+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
Sm127	.00	7.17+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
Sb127	.00	7.28+04	7.58+03	2.77+04	3.13+24	.00	.00	.00	.00	.00	.00
Te127M	.00	1.43+04	8.40+03	5.38+03	1.44+03	1.43+02	1.34+03	1.21+04	9.92+17	.00	.00
Te127	.00	7.09+04	8.30+03	5.32+03	1.44+03	1.41+02	1.33+03	1.20+04	9.81+17	.00	.00
I127	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Sm128	.00	2.05+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
Sb128M	.00	1.49+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
Sb128	.00	2.72+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
Te128	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
I126	.00	5.72+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
Te128	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Sm129M	.00	3.78+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
Sm129	.00	6.86+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
Sm129	.00	3.83+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
Te129M	.00	6.12+04	9.83+03	2.34+03	3.54+01	2.10+02	4.16+12	.00	.00	.00	.00
Te129	.00	3.62+05	6.30+03	1.51+03	2.30+01	1.34+02	2.66+12	.00	.00	.00	.00
I129	.00	2.14+02	2.17+02	2.18+02	2.18+02	2.18+02	2.18+02	2.18+02	2.18+02	2.18+02	2.18+02
Sm129M	.00	3.53+00	1.45+03	3.37+04	8.35+14	.00	.00	.00	.00	.00	.00
Te129	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Sm130	.00	6.53+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
Sm130M	.00	5.47+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
Sm130	.00	7.21+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
Te130	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
I130M	.00	1.35+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
I130	.00	2.01+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
Sm130	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Sm131	.00	9.52+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
Sb131	.00	9.67+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
Te131M	.00	1.45+05	3.11+17	.00	.00	.00	.00	.00	.00	.00	.00
Te131	.00	8.51+05	5.68+18	.00	.00	.00	.00	.00	.00	.00	.00
I131	.00	9.70+05	4.31+02	1.04+00	2.14+04	4.10+22	.00	.00	.00	.00	.00
Te131M	.00	7.43+03	1.18+02	2.05+00	1.20+05	5.16+15	.00	.00	.00	.00	.00
Te131	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Sm132	.00	1.37+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
Sb132M	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Sb132	.00	1.35+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
Te132	.00	1.35+04	6.23+03	2.05+09	.00	.00	.00	.00	.00	.00	.00
I132	.00	1.40+06	6.42+03	2.11+09	.00	.00	.00	.00	.00	.00	.00

POWER= 35.0MW, BURUP= 20000.0WD, FLUX= 3.20*10¹³/CM²-SEC

NUCLIDE RADIOACTIVITY, CURIES
BASED ON 1% OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
FE132	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SP133	.00	1.16*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE133N	.00	1.07*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE133	.00	5.29*05	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE133	.00	1.00*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE133N	.00	4.58*06	7.76*06	3.69*17	.00	.00	.00	.00	.00	.00	.00
TE133	.00	1.00*06	1.68*01	1.69*03	3.19*15	.00	.00	.00	.00	.00	.00
CS133	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR133	.00	1.00*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE133N	.00	1.00*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE133	.00	2.18*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE133N	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS133N	.00	4.21*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS133	.00	1.26*05	9.57*04	8.97*06	7.47*04	5.29*04	1.92*04	1.54*03	1.20*02	6.72*01	2.14*10
BA134	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE135	.00	1.68*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE135	.00	1.70*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE135N	.00	5.17*05	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE135N	.00	4.06*05	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS135N	.00	1.00*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS135	.00	1.56*01	1.57*01	1.57*01	1.57*01	1.57*01	1.57*01	1.57*01	1.57*01	1.57*01	1.57*01
SR135N	.00	6.30*00	.00	.00	.00	.00	.00	.00	.00	.00	.00
BA135	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE136	.00	7.21*05	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE136	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS136	.00	3.97*06	3.23*02	7.74*00	1.36*06	4.75*13	.00	.00	.00	.00	.00
BA136	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE137	.00	1.73*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE137	.00	1.41*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS137	.00	6.40*06	6.56*06	6.53*06	6.44*06	6.30*06	5.88*06	5.23*06	4.15*06	2.08*06	6.54*03
BA137N	.00	6.17*06	6.13*06	6.16*06	6.03*06	5.84*06	5.49*06	4.69*06	3.88*06	1.99*06	6.12*03
TE137	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE137	.00	1.67*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE138	.00	1.74*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS138	.00	1.75*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
BA138	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE139	.00	1.42*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE139	.00	1.49*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS139	.00	1.79*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
BA139	.00	1.81*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE139	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE140	.00	1.04*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS140	.00	1.64*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
BA140	.00	1.75*06	1.38*06	1.01*02	4.50*03	1.16*11	.00	.00	.00	.00	.00
TE140	.00	1.75*06	1.54*06	1.49*02	5.18*03	1.33*11	.00	.00	.00	.00	.00
CS140	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE141	.00	3.82*05	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS141	.00	1.19*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
BA141	.00	1.65*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE141	.00	1.65*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS141	.00	1.70*06	2.44*05	4.38*04	6.90*02	2.74*01	1.49*11	.00	.00	.00	.00
BA141	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

POWER= 35.00MW, BURNDUP: 20000.MWD, FLUX: 1.20*10¹⁴/CM²-SEC

NUCLIDE RADIOACTIVITY, Curies
BASE: = MG OF HEAVY METAL CHARGED TO REACTOR

	CMAGG	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	30. Y	100. Y
KE142	.00	1.08*05	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS142	.00	9.34*05	.00	.00	.00	.00	.00	.00	.00	.00	.00
BA142	.00	1.52*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
LA142	.00	1.60*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
CE142	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PO142	.00	1.47*04	.00	.00	.00	.00	.00	.00	.00	.00	.00
KJ142	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
LI142	.00	2.05*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
CE143	.00	4.66*05	.00	.00	.00	.00	.00	.00	.00	.00	.00
BA143	.00	1.22*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
LA143	.00	1.49*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
CE143	.00	1.49*06	2.47*14	.00	.00	.00	.00	.00	.00	.00	.00
PR143	.00	1.44*06	1.72*04	4.91*02	1.53*02	1.44*10	.00	.00	.00	.00	.00
LI143	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
LA144	.00	1.39*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
CE144	.00	1.11*06	4.95*05	7.54*05	4.57*05	1.87*05	1.29*04	1.50*02	2.01*02	4.88*14	.00
PR144	.00	1.13*06	4.95*05	7.54*05	4.57*05	1.87*05	1.29*04	1.50*02	2.01*02	4.88*14	.00
KE144	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CE145	.00	1.04*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
PR145	.00	1.04*06	.00	.00	.00	.00	.00	.00	.00	.00	.00
ND145	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CE146	.00	4.32*05	.00	.00	.00	.00	.00	.00	.00	.00	.00
PR146	.00	4.32*05	.00	.00	.00	.00	.00	.00	.00	.00	.00
ND146	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CE147	.00	4.55*05	.00	.00	.00	.00	.00	.00	.00	.00	.00
PR147	.00	4.55*05	.00	.00	.00	.00	.00	.00	.00	.00	.00
ND147	.00	4.84*01	2.48*03	1.18*01	4.49*05	1.05*14	.00	.00	.00	.00	.00
SP147	.00	1.03*05	1.08*05	1.02*05	9.21*04	4.76*04	3.04*04	8.15*03	5.78*02	2.06*01	3.71*07
SP147	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CE148	.00	5.02*05	.00	.00	.00	.00	.00	.00	.00	.00	.00
PR148	.00	5.03*05	.00	.00	.00	.00	.00	.00	.00	.00	.00
ND148	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PR148M	.00	3.94*04	4.93*03	2.81*03	9.50*01	2.29*01	3.20*04	2.40*22	.00	.00	.00
PR148	.00	2.09*05	7.19*02	2.26*02	7.63*00	1.44*02	2.57*10	2.09*23	.00	.00	.00
SM148	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PR149	.00	3.39*05	.00	.00	.00	.00	.00	.00	.00	.00	.00
ND149	.00	3.76*05	.00	.00	.00	.00	.00	.00	.00	.00	.00
PR149	.00	4.69*05	3.88*07	1.16*16	.00	.00	.00	.00	.00	.00	.00
SM149	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
ND150	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PR150	.00	4.90*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
SM150	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
LI151	.00	1.86*05	.00	.00	.00	.00	.00	.00	.00	.00	.00
PR151	.00	1.86*05	.00	.00	.00	.00	.00	.00	.00	.00	.00
SM151	.00	9.22*02	9.27*02	9.25*02	9.21*02	9.14*02	8.92*02	8.57*02	7.92*02	4.21*02	4.18*02
LI151	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PR152	.00	1.32*05	.00	.00	.00	.00	.00	.00	.00	.00	.00
SM152	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
LI152M	.00	3.07*02	.00	.00	.00	.00	.00	.00	.00	.00	.00
LI152	.00	1.99*00	7.58*00	7.79*00	7.54*00	7.12*00	5.99*00	4.48*00	2.52*00	4.45*01	2.49*02
LI152	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PR153	.00	7.10*04	.00	.00	.00	.00	.00	.00	.00	.00	.00

POWER: 35.00MW, BURNUP: 20000.MWD, FLUX: 3.20*13N/CM*2-SEC

NUCLIDE RADIOACTIVITY, CURTES
BASE: WT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
SM153	.00	3.53*05	5.16*04	9.01*20	.00	.00	.00	.00	.00	.00	.00
EU153	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
GE153	.00	8.39*00	6.48*00	5.30*00	2.95*00	1.03*00	4.48*02	2.40*04	6.85*09	1.80*22	.00
PM154	.00	5.31*04	.00	.00	.00	.00	.00	.00	.00	.00	.00
SM154	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU154	.00	2.66*03	2.43*03	2.91*03	2.55*03	2.26*03	1.98*03	1.59*03	1.03*03	2.82*02	2.23*01
EU154	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SM155	.00	3.84*04	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU155	.00	3.27*03	2.98*03	2.77*03	2.83*03	1.57*03	4.82*02	1.30*03	3.58*00	1.58*05	2.41*04
GE155	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SM156	.00	1.78*04	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU156	.00	1.36*05	1.67*03	6.58*01	4.99*03	2.33*10	.00	.00	.00	.00	.00
EU156	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SM157	.00	1.24*04	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU157	.00	1.24*04	.00	.00	.00	.00	.00	.00	.00	.00	.00
GE157	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU158	.00	5.88*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
GE158	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU159	.00	3.09*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
GE159	.00	3.34*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU159	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU160	.00	1.40*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
GE160	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU160	.00	5.57*02	2.35*02	1.20*02	1.66*03	4.97*03	1.32*05	3.13*13	.00	.00	.00
EU160	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
GE161	.00	5.58*02	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU161	.00	5.55*02	6.58*02	5.82*05	6.47*14	.00	.00	.00	.00	.00	.00
EU161	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
GE162	.00	2.73*02	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU162M	.00	2.73*02	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU162	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU162	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU162M	.00	4.23*01	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU163	.00	6.02*01	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU163	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU164	.00	4.12*01	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU164	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU165M	.00	1.18*02	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU165	.00	3.52*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
MC165	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU166	.00	9.29*00	9.76*08	6.10*14	.00	.00	.00	.00	.00	.00	.00
MC166M	.00	9.13*05	9.13*05	9.13*05	9.12*05	9.10*05	9.08*05	9.02*05	8.87*05	8.62*05	.00
MC166	.00	3.46*03	1.44*07	9.10*14	.00	.00	.00	.00	.00	.00	.00
EU166	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU167	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TOTAL	.00	3.61*08	6.17*06	3.80*06	1.81*06	9.11*05	3.15*05	2.03*05	1.44*05	7.20*04	2.20*04

PM000: 35.0000, BURMP= 20000.RND, FLUX= 3.20E+13N/CM^2-SEC

ELEMENTAL ACTIVITY, CURIES
BASIS = MT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
H	.00	6.14E+02	6.08E+02	4.03E+02	3.93E+02	3.69E+02	3.17E+02	2.35E+02	1.34E+02	2.67E+01	1.48E+00
2H	.00	1.88E+01	1.83E+13	2.59E+24	.00	.00	.00	.00	.00	.00	.00
6A	.00	1.22E+03	2.78E+13	3.71E+24	.00	.00	.00	.00	.00	.00	.00
AS	.00	5.10E+04	4.72E+14	.00	.00	.00	.00	.00	.00	.00	.00
SE	.00	5.76E+05	2.51E+01	2.51E+01	2.51E+01	2.51E+01	2.51E+01	2.51E+01	2.51E+01	2.51E+01	2.51E+01
SR	.00	4.97E+06	5.79E+16	.00	.00	.00	.00	.00	.00	.00	.00
NR	.00	4.97E+06	5.79E+03	7.65E+03	7.28E+03	6.92E+03	5.71E+03	4.14E+03	2.18E+03	3.18E+02	1.24E+01
OB	.00	7.55E+04	1.13E+01	4.75E+01	4.32E+04	1.30E+05	1.30E+05	1.30E+05	1.30E+05	1.30E+05	1.30E+05
SR	.00	7.50E+04	3.57E+05	1.72E+05	3.49E+04	4.89E+04	4.63E+04	4.09E+04	3.24E+04	1.53E+04	4.44E+03
Y	.00	1.12E+07	5.00E+05	2.48E+05	6.44E+04	5.01E+04	4.63E+04	4.09E+04	3.20E+04	1.53E+04	4.45E+03
ZR	.00	4.99E+06	6.41E+05	3.04E+05	3.40E+04	4.93E+02	1.22E+00	1.21E+00	1.21E+00	1.21E+00	1.21E+00
AS	.00	1.20E+07	1.67E+04	5.83E+05	7.30E+04	1.55E+03	3.22E+01	5.12E+01	7.91E+01	1.12E+00	1.20E+00
NO	.00	8.14E+06	3.52E+04	9.98E+12	.00	.00	.00	.00	.00	.00	.00
TC	.00	8.75E+06	8.93E+00	8.93E+00	8.93E+00	8.93E+00	8.93E+00	8.93E+00	8.93E+00	8.93E+00	8.93E+00
RU	.00	3.33E+04	5.56E+05	3.34E+05	1.76E+05	8.74E+04	1.10E+04	3.50E+02	3.54E+01	3.63E+10	3.79E+25
BN	.00	5.14E+06	5.56E+05	3.34E+05	1.76E+05	8.74E+04	1.10E+04	3.50E+02	3.54E+01	3.63E+10	3.79E+25
PD	.00	4.04E+05	5.14E+02	5.14E+02	5.14E+02	5.14E+02	5.14E+02	5.14E+02	5.14E+02	5.14E+02	5.14E+02
AG	.00	4.38E+05	1.23E+03	5.88E+02	5.83E+02	2.07E+02	1.03E+01	6.90E+02	3.11E+06	5.40E+19	.00
CO	.00	4.60E+04	1.23E+02	4.00E+01	4.03E+00	2.51E+00	2.16E+00	1.49E+00	1.03E+00	2.33E+01	1.94E+02
IN	.00	8.64E+04	1.16E+01	4.40E+02	2.56E+03	1.62E+05	4.08E+12	4.12E+23	.00	.00	.00
SA	.00	3.62E+04	4.94E+03	3.36E+03	1.37E+03	1.43E+02	6.84E+01	2.79E+01	2.78E+01	2.78E+01	2.78E+01
SB	.00	6.71E+06	4.74E+03	4.74E+03	3.85E+03	2.48E+03	1.38E+03	3.62E+02	2.99E+01	5.67E+01	5.53E+01
TE	.00	8.66E+06	3.46E+04	1.33E+04	4.55E+03	1.52E+03	5.71E+02	1.58E+02	1.23E+01	5.48E+03	1.46E+08
I	.00	1.37E+07	4.11E+02	1.36E+00	2.18E+02	2.18E+02	2.18E+02	2.18E+02	2.18E+02	2.18E+02	2.18E+02
HC	.00	9.47E+06	1.36E+02	2.30E+00	1.20E+05	5.78E+35	.00	.00	.00	.00	.00
BA	.00	6.04E+06	1.62E+05	1.55E+05	1.33E+05	1.15E+05	7.79E+04	5.59E+04	4.17E+04	2.08E+04	8.54E+03
CS	.00	8.02E+06	7.87E+04	6.13E+04	6.03E+04	5.89E+04	5.49E+04	4.89E+04	3.88E+04	1.94E+04	8.12E+03
LA	.00	7.96E+06	1.54E+04	3.40E+02	5.18E+03	1.33E+31	.00	.00	.00	.00	.00
CE	.00	7.14E+06	1.14E+04	8.72E+05	4.58E+05	1.87E+05	1.29E+04	1.50E+02	2.03E+02	4.88E+14	.00
PR	.00	5.99E+06	9.12E+05	7.50E+05	4.57E+05	1.87E+05	1.29E+04	1.50E+02	2.03E+02	4.88E+14	.00
NO	.00	1.25E+06	2.44E+03	1.14E+04	4.49E+05	1.05E+14	.00	.00	.00	.00	.00
PM	.00	1.47E+06	1.17E+05	1.05E+05	8.82E+04	6.76E+04	3.06E+04	8.15E+03	5.78E+02	2.06E+03	3.71E+07
SH	.00	4.23E+05	9.27E+02	9.25E+02	9.21E+02	9.14E+02	8.92E+02	8.67E+02	7.92E+02	6.23E+02	4.18E+02
EU	.00	1.35E+05	7.09E+03	5.25E+03	4.59E+03	3.78E+03	2.47E+03	1.47E+03	1.04E+03	2.82E+02	3.23E+03
GO	.00	4.18E+03	4.48E+00	5.15E+00	2.95E+00	1.03E+00	4.48E+02	2.40E+04	6.85E+09	1.60E+22	.00
YB	.00	1.53E+03	2.35E+02	1.20E+02	1.66E+01	4.97E+01	1.32E+05	3.13E+13	.00	.00	.00
DY	.00	1.62E+02	9.76E+09	6.10E+14	.00	.00	.00	.00	.00	.00	.00
HQ	.00	3.46E+01	9.14E+05	9.30E+05	9.12E+05	9.10E+05	9.08E+05	9.02E+05	8.87E+05	8.62E+05	8.47E+05
TOTALS	.00	1.61E+08	6.81E+06	3.00E+06	1.81E+06	9.11E+05	3.15E+05	2.03E+05	1.49E+05	7.20E+04	2.20E+04
SUBTOT	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TOTALS	.00	1.61E+08	3.00E+06	9.11E+05	2.03E+05	7.20E+04

TABLE B-2

QUANTITIES OF FISSION PRODUCTS
IN SPENT FUEL VS. DECAY TIMESPOWER = 35,000W, BURNUP = 20000 MWDT, FLUX = $3.20 \times 10^{13} \text{ CM}^{-2} \text{ SEC}^{-1}$ NUCLIDE CONCENTRATIONS, GRAMS
BASIS = RT OF HEAVY METAL CHARGED TO REACTOR

		CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
H 3		.00	4.27-02	4.21-02	4.16-02	4.03-02	3.82-02	3.22-02	2.43-02	1.38-02	7.55-03	1.52-04
Zn 72	.00	1.99-05	2.07-19	2.07-19	.00	.00	.00	.00	.00	.00	.00	.00
Ca 72	.00	6.04-06	6.79-20	1.20-30	.00	.00	.00	.00	.00	.00	.00	.00
Ge 72	.00	2.62-03	2.65-03	2.65-03	2.65-03	2.65-03	2.65-03	2.65-03	2.65-03	2.65-03	2.65-03	2.65-03
Se 72	.00	4.93-06	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Ge 73	.00	8.57-03	8.58-03	8.58-03	8.58-03	8.58-03	8.58-03	8.58-03	8.58-03	8.58-03	8.58-03	8.58-03
Se 74	.00	4.93-07	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Se 74	.00	5.06-02	5.06-02	5.06-02	5.06-02	5.06-02	5.06-02	5.06-02	5.06-02	5.06-02	5.06-02	5.06-02
Se 75	.00	1.80-07	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Ge 75M	.00	6.92-08	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Ge 75	.00	7.39-06	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
As 75	.00	5.19-02	5.19-02	5.19-02	5.19-02	5.19-02	5.19-02	5.19-02	5.19-02	5.19-02	5.19-02	5.19-02
Ge 76	.00	1.60-07	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Se 76	.00	1.75-01	1.75-01	1.75-01	1.75-01	1.75-01	1.75-01	1.75-01	1.75-01	1.75-01	1.75-01	1.75-01
As 76	.00	5.84-06	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Se 76	.00	6.32-04	6.36-04	6.36-04	6.36-04	6.36-04	6.36-04	6.36-04	6.36-04	6.36-04	6.36-04	6.36-04
Ge 77M	.00	7.73-07	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Ge 77	.00	2.75-04	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
As 77	.00	2.46-03	4.49-20	3.86-33	.00	.00	.00	.00	.00	.00	.00	.00
Se 77M	.00	9.34-10	2.44-24	.00	.00	.00	.00	.00	.00	.00	.00	.00
Se 77	.00	5.76-01	5.76-01	5.76-01	5.76-01	5.76-01	5.76-01	5.76-01	5.76-01	5.76-01	5.76-01	5.76-01
Ge 78	.00	2.34-04	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
As 78M	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
As 78	.00	2.67-04	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Se 79	.00	1.49-00	1.49-00	1.49-00	1.49-00	1.49-00	1.49-00	1.49-00	1.49-00	1.49-00	1.49-00	1.49-00
As 79	.00	5.27-05	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Se 79M	.00	2.29-05	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Se 79	.00	3.60-00	3.60-00	3.60-00	3.60-00	3.60-00	3.60-00	3.60-00	3.60-00	3.60-00	3.60-00	3.60-00
Br 79	.00	3.35-04	3.44-04	3.51-04	3.73-04	4.11-04	5.27-04	7.79-04	1.10-03	2.25-03	4.17-03	
As 80	.00	2.57-06	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Se 80	.00	6.30-00	6.30-00	6.30-00	6.30-00	6.30-00	6.30-00	6.30-00	6.30-00	6.30-00	6.30-00	6.30-00
Br 80M	.00	2.69-07	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Br 80	.00	6.95-06	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
As 80	.00	1.92-01	1.92-01	1.92-01	1.92-01	1.92-01	1.92-01	1.92-01	1.92-01	1.92-01	1.92-01	1.92-01
As 81	.00	1.03-06	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Se 81M	.00	1.07-04	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Se 81	.00	3.05-04	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Br 82	.00	9.62-00	9.62-00	9.62-00	9.62-00	9.62-00	9.62-00	9.62-00	9.62-00	9.62-00	9.62-00	9.62-00
Kr 83M	.00	2.11-08	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Kr 83	.00	5.55-02	5.55-02	5.55-02	5.55-02	5.55-02	5.55-02	5.55-02	5.55-02	5.55-02	5.55-02	5.55-02
Se 82	.00	2.09-01	2.09-01	2.09-01	2.09-01	2.09-01	2.09-01	2.09-01	2.09-01	2.09-01	2.09-01	2.09-01
Br 82M	.00	3.69-06	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Br 82	.00	1.39-03	5.30-22	2.51-36	.00	.00	.00	.00	.00	.00	.00	.00
Br 82	.00	1.72-01	1.73-01	1.73-01	1.73-01	1.73-01	1.73-01	1.73-01	1.73-01	1.73-01	1.73-01	1.73-01
Se 83M	.00	2.68-05	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Se 83	.00	4.67-04	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Fe 83	.00	5.75-03	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Fe 83M	.00	4.64-03	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PR 83	.00	2.98-01	2.98-01	2.98-01	2.98-01	2.98-01	2.98-01	2.98-01	2.98-01	2.98-01	2.98-01	2.98-01
Se 84	.00	2.96-04	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Br 84M	.00	1.09-05	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Br 84	.00	2.86-03	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

POWER: 35.00MW, BURNUP: 20000.MWD, FLUX: 3.20+13W/CM**2-SEC

NUCLIDE CONCENTRATIONS, GRAMS
BASIS = MT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	3. Y	10. Y	20. Y	50. Y	100. Y
NR 84	.00	6.90+01	6.90+01	6.90+01	6.90+01	6.90+01	6.90+01	6.90+01	6.90+01	6.90+01	6.90+01
SE 85	.00	6.71+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
PR 85	.00	3.10+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 85H	.00	3.08+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 85	.00	2.02+01	1.99+01	1.96+01	1.89+01	1.78+01	1.66+01	1.08+01	5.59+00	8.15+01	3.29+02
NR 85	.00	6.11+01	6.14+01	6.17+01	6.24+01	6.35+01	6.66+01	7.07+01	7.57+01	8.05+01	8.13+01
BC 86	.00	1.61+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
PD 86	.00	1.27+02	1.27+02	1.27+02	1.27+02	1.27+02	1.27+02	1.27+02	1.27+02	1.27+02	1.27+02
PD 86H	.00	1.58+08	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 86	.00	3.91+03	1.39+04	1.74+05	5.16+09	6.79+15	1.55+32	.00	.00	.00	.00
SR 86	.00	3.98+02	4.36+02	4.37+02	4.37+02	4.37+02	4.37+02	4.37+02	4.37+02	4.37+02	4.37+02
ER 87	.00	2.04+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 87	.00	1.77+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 87	.00	1.58+02	1.58+02	1.58+02	1.58+02	1.58+02	1.58+02	1.58+02	1.58+02	1.58+02	1.58+02
NR 87H	.00	1.04+08	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 87	.00	1.08+05	1.08+05	1.08+05	1.08+05	1.08+05	1.08+05	1.08+05	1.08+05	1.08+05	1.08+05
ER 88	.00	9.76+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 88	.00	5.75+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 88	.00	6.09+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 88	.00	2.30+02	2.30+02	2.30+02	2.30+02	2.30+02	2.30+02	2.30+02	2.30+02	2.30+02	2.30+02
ER 89	.00	3.12+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 89	.00	1.80+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 89	.00	6.73+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 89	.00	3.59+01	1.08+01	4.25+00	2.75+01	9.58+10	2.56+20	.00	.00	.00	.00
Y 89	.00	2.74+02	2.99+02	3.06+02	3.10+02	3.10+02	3.10+02	3.10+02	3.10+02	3.10+02	3.10+02
NR 90	.00	2.69+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 90	.00	1.42+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 90	.00	3.70+02	3.68+02	3.66+02	3.61+02	3.53+02	3.27+02	2.89+02	2.26+02	1.08+02	3.14+01
Y 90H	.00	1.69+07	.00	.00	.00	.00	.00	.00	.00	.00	.00
Y 90	.00	9.98+02	9.57+02	9.52+02	9.19+02	8.51+02	7.52+02	5.88+02	2.80+02	8.17+03	3.47+02
NR 90	.00	7.78+00	1.00+01	1.18+01	1.68+01	2.56+01	5.08+01	8.88+01	1.52+02	2.70+02	3.47+02
NR 91	.00	5.98+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
PR 91	.00	6.85+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 91	.00	3.44+01	.00	.00	.00	.00	.00	.00	.00	.00	.00
Y 91H	.00	1.75+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
Y 91	.00	5.26+01	1.83+01	8.03+00	7.18+01	9.63+03	2.36+08	1.05+17	2.10+36	.00	.00
NR 91	.00	3.47+02	3.81+02	3.92+02	3.99+02	4.00+02	4.00+02	4.00+02	4.00+02	4.00+02	4.00+02
NR 92	.00	1.08+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 92	.00	5.18+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 92	.00	9.47+09	.00	.00	.00	.00	.00	.00	.00	.00	.00
Y 92	.00	1.80+01	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 92	.00	4.27+02	4.28+02	4.28+02	4.28+02	4.28+02	4.28+02	4.28+02	4.28+02	4.28+02	4.28+02
NR 93	.00	2.81+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 93	.00	6.64+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 93	.00	5.71+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
Y 93	.00	4.37+01	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 93	.00	4.71+02	4.72+02	4.72+02	4.72+02	4.72+02	4.72+02	4.72+02	4.72+02	4.72+02	4.72+02
NR 93H	.00	1.72+06	2.23+04	2.62+04	3.76+04	5.69+04	1.10+03	1.81+03	2.87+03	3.44+03	4.25+03
NR 93	.00	4.67+06	7.15+06	9.52+06	1.67+05	4.28+05	1.71+04	5.45+04	1.79+03	3.12+03	1.77+02
NR 94	.00	5.80+07	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 94	.00	1.57+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 94	.00	6.78+08	.00	.00	.00	.00	.00	.00	.00	.00	.00

POWER= 35.00MW, BURBUP= 20000.WVD, FLUX= 3.20*10^14CM^2-SEC

NUCLIDE CONCENTRATIONS, GRAMS
BASIS = MT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
Y 94	.00	1.37*02	.00	.00	.00	.00	.00	.00	.00	.00	.00
ZR 94	.00	4.95*02	4.95*02	4.95*02	4.95*02	4.95*02	4.95*02	4.95*02	4.95*02	4.95*02	4.95*02
NR 95	.00	9.61*04	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 95	.00	4.93*04	.00	.00	.00	.00	.00	.00	.00	.00	.00
Y 95	.00	9.00*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
ZR 95	.00	9.91*01	3.03*01	1.44*01	1.61*00	3.27*02	2.75*07	9.57*16	1.16*32	.00	.00
NR 95H	.00	9.43*02	3.71*02	1.76*02	1.97*03	4.01*05	3.37*10	1.13*18	.00	.00	.00
NR 95	.00	4.28*01	2.70*01	1.47*01	1.84*00	3.91*02	3.21*07	1.12*15	2.67*34	.00	.00
NR 95	.00	3.71*02	4.35*02	4.64*02	4.69*02	4.93*02	4.93*02	4.93*02	4.93*02	4.93*02	4.93*02
Y 96	.00	1.97*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
ZR 96	.00	5.15*02	5.15*02	5.15*02	5.15*02	5.15*02	5.15*02	5.15*02	5.15*02	5.15*02	5.15*02
NR 96	.00	9.75*04	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 96	.00	1.09*01	1.61*01	1.09*01	1.09*01	1.09*01	1.09*01	1.09*01	1.09*01	1.09*01	1.09*01
Y 97	.00	8.50*05	.00	.00	.00	.00	.00	.00	.00	.00	.00
ZR 97	.00	4.88*01	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 97H	.00	6.17*04	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 97	.00	6.13*02	.00	.00	.00	.00	.00	.00	.00	.00	.00
PD 97	.00	5.11*02	5.12*02	5.12*02	5.12*02	5.12*02	5.12*02	5.12*02	5.12*02	5.12*02	5.12*02
ZR 98	.00	6.67*04	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 98H	.00	1.73*01	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 98	.00	9.55*04	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 98	.00	5.13*02	5.13*02	5.13*02	5.13*02	5.13*02	5.13*02	5.13*02	5.13*02	5.13*02	5.13*02
NR 99	.00	2.24*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 99	.00	3.77*00	7.44*10	2.11*17	.00	.00	.00	.00	.00	.00	.00
IC 99H	.00	2.94*01	6.37*11	1.81*18	.00	.00	.00	.00	.00	.00	.00
IC 99	.00	5.20*02	5.24*02	5.24*02	5.24*02	5.24*02	5.24*02	5.24*02	5.24*02	5.24*02	5.24*02
NR 99	.00	1.34*03	1.76*03	2.09*03	1.05*03	4.77*03	9.41*03	1.85*02	3.56*02	8.70*02	1.73*01
NR100	.00	3.09*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
PD100	.00	5.83*02	5.83*02	5.83*02	5.83*02	5.83*02	5.83*02	5.83*02	5.83*02	5.83*02	5.83*02
TC100	.00	2.20*05	.00	.00	.00	.00	.00	.00	.00	.00	.00
PD100	.00	1.90*01	1.90*01	1.90*01	1.90*01	1.90*01	1.90*01	1.90*01	1.90*01	1.90*01	1.90*01
NR100	.00	8.54*04	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR100	.00	1.25*02	.00	.00	.00	.00	.00	.00	.00	.00	.00
TC100	.00	1.20*02	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR100	.00	4.70*02	4.70*02	4.70*02	4.70*02	4.70*02	4.70*02	4.70*02	4.70*02	4.70*02	4.70*02
PD100	.00	8.81*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
TC100H	.00	1.80*03	.00	.00	.00	.00	.00	.00	.00	.00	.00
TC100	.00	3.34*05	.00	.00	.00	.00	.00	.00	.00	.00	.00
PD100	.00	4.40*02	4.40*02	4.40*02	4.40*02	4.40*02	4.40*02	4.40*02	4.40*02	4.40*02	4.40*02
NR100	.00	7.18*04	.00	.00	.00	.00	.00	.00	.00	.00	.00
TC100	.00	5.79*04	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR100	.00	3.97*01	8.21*00	2.41*00	6.63*02	1.11*04	5.18*13	6.77*27	.00	.00	.00
NR100H	.00	3.97*02	8.21*01	2.41*03	6.64*05	1.11*07	5.19*16	6.78*30	.00	.00	.00
NR100	.00	2.35*02	2.67*02	2.72*02	2.75*02	2.75*02	2.75*02	2.75*02	2.75*02	2.75*02	2.75*02
NR100	.00	8.11*04	.00	.00	.00	.00	.00	.00	.00	.00	.00
TC100	.00	1.13*02	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR100	.00	2.89*02	2.89*02	2.89*02	2.89*02	2.89*02	2.89*02	2.89*02	2.89*02	2.89*02	2.89*02
NR100H	.00	1.03*04	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR100	.00	2.29*04	.00	.00	.00	.00	.00	.00	.00	.00	.00
PD100	.00	8.17*01	8.17*01	8.17*01	8.17*01	8.17*01	8.17*01	8.17*01	8.17*01	8.17*01	8.17*01
NR100	.00	3.27*04	.00	.00	.00	.00	.00	.00	.00	.00	.00
TC100	.00	4.57*05	.00	.00	.00	.00	.00	.00	.00	.00	.00

POWER: 35.00MW, BURNUP: 20000.MWD, FLUX: 3.20*13M/CM**2-SEC

NUCLIDE CONCENTRATIONS, GRAMS
BASIS = MT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
RU305	-0C	1.33E-01	+00	+00	+00	+00	+00	+00	+00	+00	+00
RU305M	-0C	3.71E-04	+00	+00	+00	+00	+00	+00	+00	+00	+00
RH105	-00	7.45E-01	6.61E-19	5.48E-33	+00	+00	+00	+00	+00	+00	+00
PD105	-00	1.45E-02	1.46E-02	1.46E-02	1.46E-02	1.46E-02	1.46E-02	1.46E-02	1.46E-02	1.46E-02	1.46E-02
TC104	-00	2.45E-04	+00	+00	+00	+00	+00	+00	+00	+00	+00
BU106	-00	1.03E-02	6.72E-01	7.66E-01	5.19E-01	2.50E-01	3.78E-01	1.00E-01	1.05E-04	1.08E-13	1.13E-28
SP106M	-00	6.05E-03	+00	+00	+00	+00	+00	+00	+00	+00	+00
RH106	-00	1.50E-04	8.25E-05	7.23E-05	6.91E-05	2.46E-05	3.11E-06	9.67E-08	9.98E-11	1.07E-19	1.07E-34
FD106	-00	1.13E-02	1.29E-02	1.40E-02	1.45E-02	1.91E-02	2.13E-02	2.17E-02	2.17E-02	2.17E-02	2.17E-02
BU107	-00	1.23E-03	+00	+00	+00	+00	+00	+00	+00	+00	+00
PH107	-00	6.42E-03	+00	+00	+00	+00	+00	+00	+00	+00	+00
PD107M	-00	2.17E-05	+00	+00	+00	+00	+00	+00	+00	+00	+00
PD107	-00	1.06E-02	1.08E-02	1.08E-02	1.08E-02	1.08E-02	1.08E-02	1.08E-02	1.08E-02	1.08E-02	1.08E-02
AG107	-00	6.57E-06	9.15E-06	1.12E-05	1.72E-05	2.79E-05	5.99E-05	1.13E-04	2.20E-04	5.40E-04	1.07E-03
AL108	-00	9.10E-04	+00	+00	+00	+00	+00	+00	+00	+00	+00
GA108	-00	5.13E-05	+00	+00	+00	+00	+00	+00	+00	+00	+00
PD108	-00	7.13E-01	7.13E-01	7.13E-01	7.13E-01	7.13E-01	7.13E-01	7.13E-01	7.13E-01	7.13E-01	7.13E-01
AG108	-00	1.36E-12	+00	+00	+00	+00	+00	+00	+00	+00	+00
CD108	-00	6.48E-08	6.48E-08	6.48E-08	6.48E-08	6.48E-08	6.48E-08	6.48E-08	6.48E-08	6.48E-08	6.48E-08
SP109	-00	5.45E-05	+00	+00	+00	+00	+00	+00	+00	+00	+00
PD109M	-00	1.76E-06	+00	+00	+00	+00	+00	+00	+00	+00	+00
PD109	-00	1.52E-01	+00	+00	+00	+00	+00	+00	+00	+00	+00
AG109M	-00	6.19E-05	1.18E-14	1.38E-16	7.74E-17	4.42E-17	6.27E-18	5.06E-19	1.68E-21	9.87E-29	+00
AG109	-00	3.16E-01	3.17E-01	3.17E-01	3.17E-01	3.17E-01	3.17E-01	3.17E-01	3.17E-01	3.17E-01	3.17E-01
CD109	-00	1.32E-10	1.35E-10	1.04E-10	1.57E-11	6.33E-11	6.09E-12	4.95E-13	1.85E-15	9.66E-23	7.05E-35
RU110	-00	5.46E-06	+00	+00	+00	+00	+00	+00	+00	+00	+00
FD110	-00	1.53E-01	1.53E-01	1.53E-01	1.53E-01	1.53E-01	1.53E-01	1.53E-01	1.53E-01	1.53E-01	1.53E-01
AG110M	-00	2.89E-01	2.26E-01	1.86E-01	1.06E-01	3.90E-02	1.96E-03	1.30E-05	5.86E-10	5.36E-23	+00
AL110	-00	2.02E-05	3.20E-08	2.70E-08	1.56E-08	5.66E-09	2.81E-10	1.28E-12	6.57E-17	7.78E-30	+00
CU110	-01	1.15E-01	1.11E-01	1.11E-01	1.17E-01	1.13E-01	1.13E-01	1.13E-01	1.13E-01	1.13E-01	1.13E-01
PD111M	-00	2.87E-04	+00	+00	+00	+00	+00	+00	+00	+00	+00
PD111	-00	6.52E-04	+00	+00	+00	+00	+00	+00	+00	+00	+00
AL111M	-00	2.57E-05	+00	+00	+00	+00	+00	+00	+00	+00	+00
AG111	-00	2.24E-01	5.48E-05	8.51E-08	6.90E-16	1.07E-30	+00	+00	+00	+00	+00
CD111M	-00	5.27E-07	+00	+00	+00	+00	+00	+00	+00	+00	+00
CU111	-00	7.70E-00	7.92E-00	7.92E-00	7.92E-00	7.92E-00	7.92E-00	7.92E-00	7.92E-00	7.92E-00	7.92E-00
PD112	-00	1.39E-02	+00	+00	+00	+00	+00	+00	+00	+00	+00
AG112	-00	2.12E-03	+00	+00	+00	+00	+00	+00	+00	+00	+00
CU112	-00	9.39E-00	9.35E-00	9.35E-00	9.35E-00	9.35E-00	9.35E-00	9.35E-00	9.35E-00	9.35E-00	9.35E-00
PD113	-00	1.22E-05	+00	+00	+00	+00	+00	+00	+00	+00	+00
AG113M	-00	1.05E-06	+00	+00	+00	+00	+00	+00	+00	+00	+00
AL113	-00	2.50E-03	+00	+00	+00	+00	+00	+00	+00	+00	+00
CU113M	-00	1.22E-02	1.21E-02	1.20E-02	1.17E-02	1.11E-02	9.56E-03	7.86E-03	6.55E-03	1.03E-03	8.66E-05
CU113	-00	2.25E-01	2.28E-01	2.28E-01	2.28E-01	2.28E-01	2.28E-01	2.28E-01	2.28E-01	2.28E-01	2.28E-01
PD114	-00	2.15E-04	3.63E-04	4.97E-04	8.26E-04	1.39E-03	2.92E-03	5.07E-03	7.17E-03	1.16E-02	1.24E-02
RU114	-00	1.35E-05	+00	+00	+00	+00	+00	+00	+00	+00	+00
AL114	-00	6.64E-07	+00	+00	+00	+00	+00	+00	+00	+00	+00
CU114	-00	6.54E-00	6.54E-00	6.54E-00	6.54E-00	6.54E-00	6.54E-00	6.54E-00	6.54E-00	6.54E-00	6.54E-00
PD114M	-00	8.94E-06	2.58E-06	9.78E-07	3.68E-08	3.59E-10	9.07E-17	9.15E-28	+00	+00	+00
PD114	-00	2.27E-10	4.15E-11	1.57E-11	9.13E-13	5.77E-15	1.46E-21	1.46E-32	+00	+00	+00
SP114	-00	2.21E-05	2.81E-05	2.96E-05	3.03E-05	3.06E-05	3.06E-05	3.06E-05	3.06E-05	3.06E-05	3.06E-05
PD115	-00	3.48E-06	+00	+00	+00	+00	+00	+00	+00	+00	+00

POWER= 35.00MW, BURNUP= 20000.MWD, FLUX= 3.2D+23M/CM^2-SEC

NUCLIDE CONCENTRATIONS, GRAMS
BASIS = MT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
AG115M	+00	6.33-07	.00	.00	.00	.00	.00	.00	.00	.00	.00
AG115	+00	6.66-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
CG115M	+00	1.90-02	9.66-03	1.66-03	5.27-05	1.66-07	3.11-15	5.09-20	.00	.00	.00
CG115	+00	1.66-02	1.01-14	3.58-24	.00	.00	.00	.00	.00	.00	.00
IN115M	+00	1.21-03	9.30-16	3.29-25	.00	.00	.00	.00	.00	.00	.00
IN115	+00	9.36-01	9.66-01	9.66-01	9.70-01	9.70-01	9.70-01	9.70-01	9.70-01	9.70-01	9.70-01
SN115	+00	9.87-02	9.95-02	9.95-02	9.95-02	9.95-02	9.95-02	9.95-02	9.95-02	9.95-02	9.95-02
AG116	+00	1.09-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
CG116	+00	1.97+00	1.97+00	1.97+00	1.97+00	1.97+00	1.97+00	1.97+00	1.97+00	1.97+00	1.97+00
IN116M	+00	1.53-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN116	+00	1.75-07	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN116	+00	1.37+00	1.07+00	1.07+00	1.07+00	1.07+00	1.07+00	1.07+00	1.07+00	1.07+00	1.07+00
CG117	+00	6.97-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
CG117M	+00	7.03-07	.00	.00	.00	.00	.00	.00	.00	.00	.00
CG117	+00	6.51-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN117M	+00	5.24-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN117	+00	9.16-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN117M	+00	2.86-04	3.30-06	1.03-07	3.98-12	5.56-20	.00	.00	.00	.00	.00
SN117	+00	2.05+00	2.05+00	2.05+00	2.05+00	2.05+00	2.05+00	2.05+00	2.05+00	2.05+00	2.05+00
CG118	+00	2.23-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN118M	+00	2.61-11	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN118	+00	3.63-07	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN118	+00	2.08+00	2.08+00	2.08+00	2.08+00	2.08+00	2.08+00	2.08+00	2.08+00	2.08+00	2.08+00
CG119M	+00	6.96-06	.00	.00	.00	.00	.00	.00	.00	.00	.00
CG119	+00	2.30-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN119M	+00	8.58-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN119	+00	5.01-07	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN119M	+00	2.96-03	2.30-03	1.90-03	1.07-03	3.90-04	1.87-05	1.18-07	9.72-12	3.02-25	.00
CG120	+00	2.18+00	2.18+00	2.18+00	2.18+00	2.18+00	2.18+00	2.18+00	2.18+00	2.18+00	2.18+00
IN120M	+00	9.90-06	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN120	+00	1.21-07	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN120	+00	1.88-06	.00	.00	.00	.00	.00	.00	.00	.00	.00
CG121	+00	2.29+00	2.29+00	2.29+00	2.29+00	2.29+00	2.29+00	2.29+00	2.29+00	2.29+00	2.29+00
IN121M	+00	1.67-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN121	+00	1.67-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN121M	+00	3.53-08	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN121	+00	9.24-06	9.23-06	9.23-06	9.23-06	9.23-06	9.23-06	9.23-06	9.23-06	9.23-06	9.23-06
CG122	+00	6.88-03	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN121	+00	2.47+00	2.48+00	2.48+00	2.48+00	2.48+00	2.48+00	2.48+00	2.48+00	2.48+00	2.48+00
IN122	+00	1.19-07	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN122	+00	2.71+00	2.71+00	2.71+00	2.71+00	2.71+00	2.71+00	2.71+00	2.71+00	2.71+00	2.71+00
SN122M	+00	1.63-07	.00	.00	.00	.00	.00	.00	.00	.00	.00
SE122	+00	1.57-03	3.30-13	9.88-21	.00	.00	.00	.00	.00	.00	.00
IN122	+00	9.42-02	9.42-02	9.42-02	9.42-02	9.42-02	9.42-02	9.42-02	9.42-02	9.42-02	9.42-02
IN123M	+00	3.67-06	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN123	+00	1.22-07	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN123M	+00	2.94-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN123	+00	9.53-01	5.79-01	3.92-01	1.26-01	1.66-02	3.81-05	1.52-09	2.47-18	.00	.00
CG123	+00	2.10+00	2.48+00	2.93+00	3.04+00	3.05+00	3.05+00	3.05+00	3.05+00	3.05+00	3.05+00
IN123M	+00	1.62-05	9.49-06	6.27-06	1.86-06	2.18-07	3.24-10	6.47-15	2.54-24	.00	.00
IN123	+00	6.76-05	7.43-05	7.75-05	8.14-05	8.36-05	8.38-05	8.38-05	8.38-05	8.38-05	8.38-05
IN124	+00	5.50-07	.00	.00	.00	.00	.00	.00	.00	.00	.00

POWER: 35.00MW, BURRUP: 20000, WUO, FLUID: 3.2043MFCM002-SEC

NUCLIDE CONCENTRATIONS, GRAMS
BASIS : WT OF HEAVY METAL CHARGED TO REACTOR

CHARGE	DISCHARGE	D. Y	D. Y	3. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
SR124	-00	3.99+00	3.99+00	3.99+00	3.99+00	3.99+00	3.99+00	3.99+00	3.99+00	3.99+00
SR124M	-00	8.05+09	.00	.00	.00	.00	.00	.00	.00	.00
SR124	-00	1.03+02	3.66+03	1.63+03	1.52+04	2.23+06	1.10+12	4.87+21	.00	.00
TE124	-00	2.87+02	3.18+02	3.34+02	3.99+02	3.50+02	3.50+02	3.50+02	3.50+02	3.50+02
SR125M	-00	6.53+05	.00	.00	.00	.00	.00	.00	.00	.00
SR125	-00	1.11+01	1.45+04	6.34+07	2.22+13	4.46+25	.00	.00	.00	.00
SR125	-00	6.58+00	6.41+00	6.20+00	3.63+00	2.81+00	1.30+00	3.60+01	2.76+02	1.25+05
TE125M	-00	6.67+02	9.78+02	9.81+02	8.82+02	6.85+02	3.17+02	8.78+03	6.74+04	3.04+07
TE125	-00	7.24+01	1.00+00	1.21+00	1.78+00	2.63+00	4.17+00	5.14+00	5.48+00	5.51+00
SR126	-00	9.80+00	9.80+00	9.80+00	9.80+00	9.80+00	9.80+00	9.80+00	9.80+00	9.80+00
SR126M	-00	1.61+07	3.56+09	3.56+09	3.56+09	3.56+09	3.56+09	3.56+09	3.56+09	3.56+09
TE126	-00	4.56+04	6.38+06	3.38+06	3.32+06	3.32+06	3.32+06	3.32+06	3.32+06	3.32+06
TE126	-00	1.16+02	1.20+02	1.21+02	1.21+02	1.24+02	1.27+02	1.34+02	1.54+02	1.88+02
SR127M	-00	2.62+06	.00	.00	.00	.00	.00	.00	.00	.00
SR127	-00	6.10+03	.00	.00	.00	.00	.00	.00	.00	.00
SR127	-00	2.74+01	2.86+08	1.04+13	1.18+29	.00	.00	.00	.00	.00
TE127M	-00	1.52+00	8.90+03	3.70+01	1.55+07	1.51+02	1.42+25	1.09+20	.00	.00
TE127	-00	2.70+02	3.16+03	2.09+03	3.44+04	5.38+05	5.08+08	4.57+13	3.73+23	.00
TE127	-00	2.23+03	2.33+03	2.16+03	2.20+03	2.21+03	2.22+03	2.22+03	2.22+03	2.22+03
SR128	-00	6.21+03	.00	.00	.00	.00	.00	.00	.00	.00
SR128M	-00	1.88+03	.00	.00	.00	.00	.00	.00	.00	.00
SR128	-00	6.98+03	.00	.00	.00	.00	.00	.00	.00	.00
TE128	-00	7.15+01	7.15+02	7.15+03	7.15+03	7.15+03	7.15+03	7.15+03	7.15+03	7.15+03
TE128	-00	9.13+05	.00	.00	.00	.00	.00	.00	.00	.00
SR129	-00	6.81+01	6.82+01	6.82+01	6.82+01	6.82+01	6.82+01	6.82+01	6.82+01	6.82+01
SR129M	-00	1.55+02	.00	.00	.00	.00	.00	.00	.00	.00
SR129	-00	3.20+05	.00	.00	.00	.00	.00	.00	.00	.00
SR129	-00	6.78+02	.00	.00	.00	.00	.00	.00	.00	.00
TE129M	-00	2.05+00	3.30+01	7.92+02	1.21+03	7.03+07	1.40+16	9.47+33	.00	.00
TE129	-00	1.71+02	2.68+04	7.76+05	1.07+06	6.35+10	1.26+19	.00	.00	.00
TE129	-00	1.32+02	1.33+02	1.34+02	1.34+02	1.34+02	1.34+02	1.34+02	1.34+02	1.34+02
SR129M	-00	2.39+05	1.34+06	2.66+11	5.03+19	9.02+33	.00	.00	.00	.00
TE129	-00	5.08+02	5.08+02	5.08+02	5.08+02	5.08+02	5.08+02	5.08+02	5.08+02	5.08+02
SR130	-00	1.17+03	.00	.00	.00	.00	.00	.00	.00	.00
SR130M	-00	2.84+03	.00	.00	.00	.00	.00	.00	.00	.00
SR130	-00	1.64+03	.00	.00	.00	.00	.00	.00	.00	.00
TE130	-00	2.51+02	2.51+02	2.51+02	2.51+02	2.51+02	2.51+02	2.51+02	2.51+02	2.51+02
TE130M	-00	6.67+05	.00	.00	.00	.00	.00	.00	.00	.00
SR130	-00	1.03+02	.00	.00	.00	.00	.00	.00	.00	.00
SR130	-00	3.39+00	3.60+00	3.60+00	3.60+00	3.60+00	3.60+00	3.60+00	3.60+00	3.60+00
SR131	-00	2.23+03	.00	.00	.00	.00	.00	.00	.00	.00
SR131	-00	1.55+02	.00	.00	.00	.00	.00	.00	.00	.00
TE131M	-00	1.82+01	3.90+23	.00	.00	.00	.00	.00	.00	.00
TE131	-00	1.68+02	9.89+26	.00	.00	.00	.00	.00	.00	.00
TE131	-00	7.81+00	3.48+03	8.42+06	1.77+13	3.87+27	.00	.00	.00	.00
TE131M	-00	9.27+02	1.61+03	2.43+05	1.42+10	6.62+20	.00	.00	.00	.00
TE131	-00	2.83+02	2.91+02	2.91+02	2.91+02	2.91+02	2.91+02	2.91+02	2.91+02	2.91+02
SR132	-00	2.24+03	.00	.00	.00	.00	.00	.00	.00	.00
SR132M	-00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR132	-00	1.84+03	.00	.00	.00	.00	.00	.00	.00	.00
SR132	-00	4.44+00	2.05+04	6.34+15	6.52+34	.00	.00	.00	.00	.00
SR132	-00	1.35+01	6.22+10	2.05+16	.00	.00	.00	.00	.00	.00

POWER: 35.00MW, SUPPUP: 20000.WWD, FLUX: 3.2E+13W/CM^2-SEC

NUCLIDE CONCENTRATIONS, GRAMS
BASIS : MT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
HE132	.00	6.27+02	6.32+02	6.32+02	6.32+02	6.32+02	6.32+02	6.32+02	6.32+02	6.32+02	6.32+02
SB133	.00	3.44+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
HE133M	.00	5.19+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE133	.00	4.47+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE133	.00	3.69+00	.00	.00	.00	.00	.00	.00	.00	.00	.00
HE133M	.00	1.05+01	1.79+01	8.50+01	.00	.00	.00	.00	.00	.00	.00
HE133	.00	3.02+01	9.03+05	9.01+09	1.70+20	.00	.00	.00	.00	.00	.00
CS133	.00	6.71+02	6.83+02	6.83+02	6.83+02	6.83+02	6.83+02	6.83+02	6.83+02	6.83+02	6.83+02
SG134	.00	3.18+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE134	.00	5.77+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE134	.00	8.18+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
HE134	.00	9.47+02	9.47+02	9.47+02	9.47+02	9.47+02	9.47+02	9.47+02	9.47+02	9.47+02	9.47+02
CS134M	.00	5.22+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS134	.00	7.99+01	1.35+01	6.89+01	5.70+01	9.06+01	1.47+01	2.77+00	9.28+02	1.63+06	1.45+13
HE134	.00	1.47+01	2.11+01	2.51+01	1.77+01	5.40+01	7.99+01	9.19+01	9.46+01	9.46+01	9.46+01
TE135	.00	6.82+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE135	.00	4.90+01	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE135M	.00	5.73+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
HE135	.00	1.41+01	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS135M	.00	6.86+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS135	.00	1.77+02	1.78+02	1.78+02	1.78+02	1.78+02	1.78+02	1.78+02	1.78+02	1.78+02	1.78+02
HE135M	.00	7.79+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
HE135	.00	4.01+03	4.03+03	4.03+03	4.06+03	4.10+03	4.22+03	4.43+03	4.84+03	4.07+03	8.12+03
TE136	.00	7.28+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
HE136	.00	1.41+03	1.41+03	1.41+03	1.41+03	1.41+03	1.41+03	1.41+03	1.41+03	1.41+03	1.41+03
CS136	.00	5.31+01	4.37+03	1.05+04	1.85+06	6.42+18	.00	.00	.00	.00	.00
HE136	.00	8.12+03	9.05+00	9.05+00	9.05+00	9.05+00	9.05+00	9.05+00	9.05+00	9.05+00	9.05+00
TE137	.00	4.82+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
HE137	.00	5.15+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS137	.00	7.58+02	7.58+02	7.50+02	7.43+02	7.28+02	6.75+02	6.02+02	4.77+02	2.39+02	7.52+01
HE137M	.00	1.15+04	1.14+04	1.13+04	1.12+04	1.09+04	1.02+04	9.09+05	7.21+05	3.61+05	1.14+05
HE137	.00	1.57+01	1.80+01	2.13+01	3.10+01	4.79+01	9.64+01	1.70+02	2.94+02	5.13+02	6.94+02
TE138	.00	1.20+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
HE138	.00	2.17+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS138	.00	6.14+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
HE138	.00	7.30+02	7.30+02	7.30+02	7.30+02	7.30+02	7.30+02	7.30+02	7.30+02	7.30+02	7.30+02
TE139	.00	3.50+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
HE139	.00	3.88+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS139	.00	1.25+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
HE139	.00	1.11+01	.00	.00	.00	.00	.00	.00	.00	.00	.00
HE139	.00	7.88+02	7.88+02	7.88+02	7.88+02	7.88+02	7.88+02	7.88+02	7.88+02	7.88+02	7.88+02
TE140	.00	2.07+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS140	.00	1.38+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
HE140	.00	2.41+01	1.84+01	4.18+03	6.17+08	1.58+16	.00	.00	.00	.00	.00
HE140	.00	3.22+00	2.77+02	6.26+04	9.30+09	2.39+17	.00	.00	.00	.00	.00
CS140	.00	7.39+02	8.10+02	8.10+02	8.10+02	8.10+02	8.10+02	8.10+02	8.10+02	8.10+02	8.10+02
TE141	.00	9.53+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS141	.00	3.57+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
HE141	.00	2.43+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
HE141	.00	2.94+01	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS141	.00	5.95+01	4.72+00	1.95+00	2.41+02	9.75+06	6.42+16	6.84+33	.00	.00	.00
PR141	.00	6.91+02	7.42+02	7.49+02	7.51+02	7.51+02	7.51+02	7.51+02	7.51+02	7.51+02	7.51+02

POWER= 35.00MW, BURNUP= 20000-MWD, FLUX= 3.20E13N/CM^2-SEC

NUCLIDE CONCENTRATIONS, GRAMS
BASIS = MG OF HEAVY METAL CHARGED TO REACTOR

CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
XE142	.00	2.04E-06	.00	.00	.00	.00	.00	.00	.00	.00
CS142	.00	2.70E-05	.00	.00	.00	.00	.00	.00	.00	.00
PA142	.00	3.27E-02	.00	.00	.00	.00	.00	.00	.00	.00
LS142	.00	1.14E-01	.00	.00	.00	.00	.00	.00	.00	.00
CE142	.00	7.26E-02	7.27E-02	7.27E-02	7.27E-02	7.27E-02	7.27E-02	7.27E-02	7.27E-02	7.27E-02
PR142	.00	3.02E-02	.00	.00	.00	.00	.00	.00	.00	.00
N2142	.00	6.63E-00	6.62E-00	6.62E-00	6.62E-00	6.62E-00	6.62E-00	6.62E-00	6.62E-00	6.62E-00
XL143	.00	2.00E-07	.00	.00	.00	.00	.00	.00	.00	.00
CS143	.00	1.23E-05	.00	.00	.00	.00	.00	.00	.00	.00
PA143	.00	1.06E-04	.00	.00	.00	.00	.00	.00	.00	.00
LS143	.00	1.59E-02	.00	.00	.00	.00	.00	.00	.00	.00
CE143	.00	2.25E-00	4.07E-20	2.13E-35	.00	.00	.00	.00	.00	.00
PR143	.00	2.19E-01	2.57E-01	3.46E-03	2.10E-07	2.16E-15	.00	.00	.00	.00
N2143	.00	5.54E-02	5.78E-02	5.78E-02	5.78E-02	5.78E-02	5.78E-02	5.78E-02	5.78E-02	5.78E-02
LA144	.00	7.10E-05	.00	.00	.00	.00	.00	.00	.00	.00
CE144	.00	3.09E-02	2.80E-02	2.36E-02	1.43E-02	3.67E-01	4.09E-00	4.69E-02	6.30E-04	1.53E-17
PA144	.00	1.09E-02	1.19E-02	9.99E-03	6.05E-03	2.48E-03	1.71E-04	1.98E-04	2.66E-10	6.46E-22
N2144	.00	4.19E-02	4.88E-02	5.32E-02	6.75E-02	7.09E-02	7.66E-02	7.69E-02	7.69E-02	7.69E-02
CE145	.00	2.41E-03	.00	.00	.00	.00	.00	.00	.00	.00
PR145	.00	2.88E-01	.00	.00	.00	.00	.00	.00	.00	.00
N2145	.00	4.54E-02	4.55E-02	4.55E-02	4.55E-02	4.55E-02	4.55E-02	4.55E-02	4.55E-02	4.55E-02
CE146	.00	9.04E-03	.00	.00	.00	.00	.00	.00	.00	.00
PA146	.00	1.55E-02	.00	.00	.00	.00	.00	.00	.00	.00
N2146	.00	4.13E-02	4.13E-02	4.13E-02	4.13E-02	4.13E-02	4.13E-02	4.13E-02	4.13E-02	4.13E-02
CE147	.00	5.55E-04	.00	.00	.00	.00	.00	.00	.00	.00
PA147	.00	4.25E-03	.00	.00	.00	.00	.00	.00	.00	.00
N2147	.00	4.54E-00	3.10E-02	3.92E-04	1.06E-09	1.32E-19	.00	.00	.00	.00
PR147	.00	1.35E-02	1.16E-02	1.10E-02	9.49E-01	7.28E-01	3.29E-01	4.77E-00	6.22E-01	2.22E-04
SH147	.00	2.71E-01	3.40E-01	4.05E-01	5.57E-01	7.78E-01	1.18E-02	1.42E-02	1.50E-02	1.51E-02
CE148	.00	2.85E-04	.00	.00	.00	.00	.00	.00	.00	.00
PA148	.00	7.92E-04	.00	.00	.00	.00	.00	.00	.00	.00
N2148	.00	2.27E-02	2.27E-02	2.27E-02	2.27E-02	2.27E-02	2.27E-02	2.27E-02	2.27E-02	2.27E-02
PR148	.00	1.88E-00	4.25E-01	1.34E-01	4.52E-03	1.09E-05	3.52E-13	1.28E-26	.00	.00
SH148	.00	1.28E-00	4.40E-03	1.38E-03	4.67E-05	1.12E-07	1.57E-15	1.28E-28	.00	.00
PA149	.00	7.46E-01	1.73E-01	7.76E-01	7.77E-01	7.77E-01	7.77E-01	7.77E-01	7.77E-01	7.77E-01
N2149	.00	6.17E-04	.00	.00	.00	.00	.00	.00	.00	.00
PR149	.00	3.22E-02	.00	.00	.00	.00	.00	.00	.00	.00
SH149	.00	1.69E-00	9.78E-13	2.94E-22	.00	.00	.00	.00	.00	.00
SH149	.00	6.13E-00	7.85E-00	7.85E-00	7.85E-00	7.85E-00	7.85E-00	7.85E-00	7.85E-00	7.85E-00
N2150	.00	1.03E-02	1.03E-02	1.03E-02	1.03E-02	1.03E-02	1.03E-02	1.03E-02	1.03E-02	1.03E-02
PR150	.00	8.97E-04	.00	.00	.00	.00	.00	.00	.00	.00
SH150	.00	2.30E-02	2.30E-02	2.30E-02	2.30E-02	2.30E-02	2.30E-02	2.30E-02	2.30E-02	2.30E-02
N2151	.00	1.79E-03	.00	.00	.00	.00	.00	.00	.00	.00
PR151	.00	7.50E-01	.00	.00	.00	.00	.00	.00	.00	.00
SH151	.00	3.38E-01	3.40E-01	3.40E-01	3.36E-01	3.28E-01	3.15E-01	2.97E-01	2.79E-01	1.54E-01
EU151	.00	4.16E-02	1.09E-01	1.63E-01	3.17E-01	5.81E-01	1.37E-00	2.65E-00	5.04E-00	1.12E-01
SH152	.00	6.39E-04	.00	.00	.00	.00	.00	.00	.00	.00
SH152	.00	6.24E-01	6.28E-01	6.28E-01	6.28E-01	6.28E-01	6.28E-01	6.28E-01	6.28E-01	6.28E-01
EU152M	.00	1.38E-04	.00	.00	.00	.00	.00	.00	.00	.00
EU152	.00	4.07E-02	4.02E-02	3.97E-02	3.85E-02	3.63E-02	3.05E-02	2.29E-02	1.24E-02	2.27E-03
GU152	.00	5.37E-02	5.40E-02	5.40E-02	5.40E-02	5.51E-02	5.67E-02	5.88E-02	6.16E-02	6.44E-02
PR153	.00	3.14E-04	.00	.00	.00	.00	.00	.00	.00	.00

POWER= 35.00MW, BURNUP= 20000.MWD, FLUX= 3.20*13N/CM**2-SEC

NUCLIDE CONCENTRATIONS, GRAMS
BASIS = MT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	3. Y	10. Y	20. Y	30. Y	100. Y
SM153	.00	8.10-01	1.18-14	2.01-25	.00	.00	.00	.00	.00	.00	.00
EU153	.00	6.37-03	6.45-01	6.45-01	6.45-01	6.45-01	6.45-01	6.45-01	6.45-01	6.45-01	6.45-01
GD153	.00	2.38-03	1.84-03	1.30-03	8.35-04	2.93-04	1.27-05	6.80-08	1.84-12	4.54-26	.00
PM154	.00	1.09-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
SM154	.00	1.94-01	1.94-01	1.94-01	1.94-01	1.94-01	1.94-01	1.94-01	1.94-01	1.94-01	1.94-01
EU154	.00	1.44-01	1.44-01	1.44-01	1.44-01	1.44-01	1.44-01	1.44-01	1.44-01	1.44-01	1.44-01
GD154	.00	1.25-01	5.05-01	6.44-01	1.04-02	1.73-02	3.63-02	4.28-02	1.01-03	1.53-03	1.70-03
SM155	.00	1.27-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU155	.00	2.57-00	2.34-00	2.17-00	1.75-00	1.19-00	3.78-01	5.57-02	1.23-03	1.24-03	5.97-17
GD155	.00	7.71-02	2.58-01	4.23-01	6.44-01	1.40-02	2.22-02	2.54-02	2.54-02	2.54-02	2.54-02
SM156	.00	6.11-03	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU156	.00	1.11-00	2.97-02	1.18-03	8.94-04	4.18-15	.00	.00	.00	.00	.00
GD156	.00	2.37-01	2.56-01	2.57-01	2.57-01	2.57-01	2.57-01	2.57-01	2.57-01	2.57-01	2.57-01
SM157	.00	5.16-06	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU157	.00	9.47-03	.00	.00	.00	.00	.00	.00	.00	.00	.00
GD157	.00	2.35-02	3.30-02	3.30-02	3.30-02	3.30-02	3.30-02	3.30-02	3.30-02	3.30-02	3.30-02
EU158	.00	2.27-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
GD158	.00	6.03-00	6.07-00	6.07-00	6.07-00	6.07-00	6.07-00	6.07-00	6.07-00	6.07-00	6.07-00
EU159	.00	4.70-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
GD159	.00	3.05-03	.00	.00	.00	.00	.00	.00	.00	.00	.00
PM159	.00	8.80-01	8.83-01	8.83-01	8.83-01	8.83-01	8.83-01	8.83-01	8.83-01	8.83-01	8.83-01
EU160	.00	2.97-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
GD160	.00	4.32-01	4.32-01	4.32-01	4.32-01	4.32-01	4.32-01	4.32-01	4.32-01	4.32-01	4.32-01
TS160	.00	4.92-02	2.07-02	1.06-02	1.47-03	4.19-05	1.17-09	2.74-17	1.55-12	.00	.00
CU160	.00	7.66-02	1.65-01	1.15-01	1.24-01	1.24-01	1.24-01	1.24-01	1.24-01	1.24-01	1.24-01
CL161	.00	1.77-06	.00	.00	.00	.00	.00	.00	.00	.00	.00
TS161	.00	4.22-03	5.54-03	4.95-10	5.47-19	6.33-35	.00	.00	.00	.00	.00
DT161	.00	1.11-01	1.15-01	1.15-01	1.15-01	1.15-01	1.15-01	1.15-01	1.15-01	1.15-01	1.15-01
GD162	.00	2.44-06	.00	.00	.00	.00	.00	.00	.00	.00	.00
TS162M	.00	1.76-06	.00	.00	.00	.00	.00	.00	.00	.00	.00
TS162	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
DT162	.00	8.73-02	8.73-02	8.73-02	8.73-02	8.73-02	8.73-02	8.73-02	8.73-02	8.73-02	8.73-02
TS163M	.00	3.41-03	.00	.00	.00	.00	.00	.00	.00	.00	.00
TS163	.00	2.04-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
DT163	.00	7.42-02	7.42-02	7.42-02	7.42-02	7.42-02	7.42-02	7.42-02	7.42-02	7.42-02	7.42-02
TS164	.00	4.95-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
DT164	.00	2.14-02	2.15-02	2.15-02	2.15-02	2.15-02	2.15-02	2.15-02	2.15-02	2.15-02	2.15-02
DT165M	.00	1.30-03	.00	.00	.00	.00	.00	.00	.00	.00	.00
DT165	.00	4.29-08	.00	.00	.00	.00	.00	.00	.00	.00	.00
MC165	.00	2.27-02	2.27-02	2.27-02	2.27-02	2.27-02	2.27-02	2.27-02	2.27-02	2.27-02	2.27-02
DT166	.00	4.01-03	4.21-13	2.63-19	.00	.00	.00	.00	.00	.00	.00
MC166M	.00	5.08-05	5.08-05	5.08-05	5.08-05	5.08-05	5.07-05	5.03-05	5.03-05	4.94-05	4.80-05
MC166	.00	4.92-05	2.07-13	1.30-19	.00	.00	.00	.00	.00	.00	.00
EU166	.00	5.30-03	5.39-03	5.39-03	5.39-03	5.39-03	5.39-03	5.39-03	5.39-03	5.39-03	5.39-03
EU167	.00	4.63-04	4.63-04	4.63-04	4.63-04	4.63-04	4.63-04	4.63-04	4.63-04	4.63-04	4.63-04
TOTAL	.00	2.12-04	2.12-04	2.12-04	2.12-04	2.12-04	2.12-04	2.12-04	2.12-04	2.12-04	2.12-04

POB: 35.00MB, BURNUP: 20000.MWD, FLUX: 3.20E13N/CM2-SEC

ELEMENT CONCENTRATIONS, GRAMS
BASIS = MT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
H	.00	4.27E-02	4.21E-02	4.16E-02	4.03E-02	3.81E-02	3.22E-02	2.43E-02	1.38E-02	2.55E-03	1.52E-04
ZN	.00	1.99E-03	1.97E-03	2.76E-30	.00	.00	.00	.00	.00	.00	.00
CA	.00	1.10E-03	8.99E-20	1.20E-30	.00	.00	.00	.00	.00	.00	.00
AL	.00	2.11E-01	2.17E-01	2.17E-01	2.17E-01	2.17E-01	2.17E-01	2.17E-01	2.17E-01	2.17E-01	2.17E-01
SI	.00	5.47E-02	5.19E-02	5.19E-02	5.19E-02	5.19E-02	5.19E-02	5.19E-02	5.19E-02	5.19E-02	5.19E-02
FE	.00	1.29E-01	1.24E-01	1.24E-01	1.24E-01	1.24E-01	1.24E-01	1.24E-01	1.24E-01	1.24E-01	1.24E-01
FM	.00	9.63E-00	9.62E-00	9.62E-00	9.62E-00	9.62E-00	9.62E-00	9.62E-00	9.62E-00	9.62E-00	9.62E-00
NR	.00	2.47E-02	2.46E-02	2.46E-02	2.45E-02	2.44E-02	2.41E-02	2.37E-02	2.32E-02	2.27E-02	2.26E-02
SR	.00	2.19E-02	2.20E-02	2.20E-02	2.21E-02	2.22E-02	2.25E-02	2.29E-02	2.34E-02	2.39E-02	2.39E-02
Y	.00	6.37E-02	6.40E-02	6.41E-02	6.42E-02	6.43E-02	6.50E-02	6.60E-02	6.74E-02	6.90E-02	7.02E-02
TE	.00	3.27E-02	3.18E-02	3.14E-02	3.10E-02	3.10E-02	3.10E-02	3.10E-02	3.10E-02	3.10E-02	3.10E-02
NE	.00	2.34E-03	2.33E-03	2.33E-03	2.33E-03	2.33E-03	2.36E-03	2.40E-03	2.44E-03	2.58E-03	2.66E-03
AR	.00	4.29E-01	2.72E-01	1.47E-01	1.04E-00	3.68E-02	1.27E-03	2.36E-03	4.54E-03	1.11E-02	2.20E-02
PO	.00	1.99E-03	2.05E-03	2.08E-03	2.11E-03	2.11E-03	2.11E-03	2.11E-03	2.11E-03	2.11E-03	2.11E-03
TC	.00	5.20E-02	5.24E-02	5.24E-02	5.24E-02	5.24E-02	5.24E-02	5.24E-02	5.24E-02	5.24E-02	5.24E-02
BU	.00	1.16E-03	1.31E-03	1.30E-03	1.27E-03	1.24E-03	1.22E-03	1.22E-03	1.22E-03	1.22E-03	1.22E-03
BR	.00	2.16E-02	2.16E-02	2.12E-02	2.15E-02	2.15E-02	2.15E-02	2.15E-02	2.15E-02	2.15E-02	2.15E-02
PD	.00	5.34E-02	5.13E-02	5.12E-02	5.17E-02	5.17E-02	6.35E-02	6.19E-02	6.19E-02	6.19E-02	6.19E-02
AL	.00	3.21E-01	3.19E-01	3.19E-01	3.18E-01	3.17E-01	3.17E-01	3.17E-01	3.17E-01	3.17E-01	3.17E-01
CO	.00	3.18E-01	3.21E-01	3.21E-01	3.22E-01	3.23E-01	3.23E-01	3.23E-01	3.23E-01	3.23E-01	3.23E-01
IN	.00	4.19E-01	9.66E-01	9.69E-01	9.71E-01	9.72E-01	9.73E-01	9.75E-01	9.78E-01	9.82E-01	9.83E-01
SW	.00	2.74E-01	2.68E-01	2.67E-01	2.64E-01	2.63E-01	2.63E-01	2.63E-01	2.63E-01	2.63E-01	2.63E-01
SE	.00	9.55E-00	9.37E-00	9.34E-00	9.04E-00	8.33E-00	6.64E-00	5.90E-00	5.56E-00	5.54E-00	5.54E-00
TE	.00	1.32E-02	1.25E-02	1.24E-02	1.24E-02	1.25E-02	1.27E-02	1.28E-02	1.28E-02	1.28E-02	1.28E-02
I	.00	1.62E-02	1.55E-02	1.55E-02	1.56E-02	1.56E-02	1.56E-02	1.56E-02	1.56E-02	1.56E-02	1.56E-02
SE	.00	1.28E-03	1.28E-03	1.28E-03	1.28E-03	1.28E-03	1.28E-03	1.28E-03	1.28E-03	1.28E-03	1.28E-03
CS	.00	1.64E-03	1.64E-03	1.64E-03	1.64E-03	1.64E-03	1.64E-03	1.64E-03	1.64E-03	1.64E-03	1.64E-03
PA	.00	1.93E-02	1.78E-02	1.78E-02	1.78E-02	1.78E-02	1.78E-02	1.78E-02	1.78E-02	1.78E-02	1.78E-02
LA	.00	1.68E-02	1.64E-02	1.64E-02	1.64E-02	1.64E-02	1.64E-02	1.64E-02	1.64E-02	1.64E-02	1.64E-02
CE	.00	1.92E-03	1.83E-03	1.77E-03	1.68E-03	1.60E-03	1.54E-03	1.54E-03	1.54E-03	1.54E-03	1.54E-03
NR	.00	1.14E-02	1.03E-02	1.03E-02	1.03E-02	1.03E-02	1.03E-02	1.03E-02	1.03E-02	1.03E-02	1.03E-02
ND	.00	2.19E-03	2.27E-03	2.31E-03	2.41E-03	2.44E-03	2.55E-03	2.55E-03	2.55E-03	2.55E-03	2.55E-03
PH	.00	1.20E-02	1.16E-02	1.10E-02	9.49E-03	7.28E-03	5.24E-03	4.77E-03	4.27E-03	2.22E-04	3.44E-10
SM	.00	6.54E-02	6.48E-02	6.42E-02	6.47E-02	6.47E-02	6.48E-02	6.47E-02	6.47E-02	6.47E-02	6.47E-02
EU	.00	6.52E-01	6.38E-01	6.35E-01	6.29E-01	6.19E-01	6.10E-01	6.02E-01	5.97E-01	5.97E-01	5.97E-01
GO	.00	1.07E-01	1.10E-01	1.13E-01	1.14E-01	1.14E-01	1.14E-01	1.14E-01	1.14E-01	1.14E-01	1.14E-01
TO	.00	9.34E-01	9.04E-01	8.94E-01	8.85E-01	8.85E-01	8.85E-01	8.85E-01	8.85E-01	8.85E-01	8.85E-01
CT	.00	3.10E-01	4.04E-01	4.14E-01	4.23E-01	4.24E-01	4.24E-01	4.24E-01	4.24E-01	4.24E-01	4.24E-01
NO	.00	2.28E-02	2.28E-02	2.28E-02	2.28E-02	2.28E-02	2.28E-02	2.28E-02	2.28E-02	2.28E-02	2.28E-02
ER	.00	1.97E-03	6.66E-03	6.06E-03	6.06E-03	6.06E-03	6.06E-03	6.06E-03	6.06E-03	6.06E-03	6.06E-03
TOTALS	.00	2.12E-04	2.12E-04	2.12E-04	2.12E-04	2.12E-04	2.12E-04	2.12E-04	2.12E-04	2.12E-04	2.12E-04
SUBTOT	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TOTALS	.00	2.12E-04	2.12E-04	2.12E-04	2.12E-04	2.12E-04	2.12E-04	2.12E-04	2.12E-04	2.12E-04	2.12E-04

TABLE B-3

POWER= 34.00dBm, BURSTUP= 20000.000, FLUX= 3.20+13M/LM002-SEC

NUCLIDE RADIOACTIVITY, CURIES
BASIS : MG OF HEAVY METAL CHARGED TO REACTOR

ME	Q	CHARGE	DISCHARGE	0.5	0.5	1.5	2.5	5.5	10.5	20.5	50.5	100.5
L1201	+00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00
L1202	+00	+2.29-07	+3.36-07	+4.22-07	+5.33-07	+1.19-06	+2.67-06	+5.11-06	+1.00-05	+2.02-05	+4.07-05	+8.07-05
L1203	+00	+1.29-04	+1.05-04	+2.31-04	+7.66-04	+6.07-04	+1.21-03	+1.71-03	+1.01-03	+1.30-03	+1.63-03	+2.03-03
L1209	+00	+0.32-10	+2.93-10	+2.36-10	+3.11-10	+4.31-10	+7.99-10	+1.00-09	+2.04-09	+7.73-09	+1.00-08	+1.00-08
P3205	+00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00
P4207	+00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00
P4208	+00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00
P4209	+00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00
P4210	+00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00
P4211	+00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00
P4212	+00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00
P4213	+00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00
P4214	+00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00
P4215	+00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00	+0.00
 

POWER: 35.00MW, BURNUP: 20000.MWD, FLUX: 3.2D+13W/CM^2-SEC

NUCLIDE RADIOACTIVITY, CURIES
BASIS: MT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	30. Y	100. Y
U234	.00	3.07-03	3.18-04	3.18-04	3.14-04	3.18-04	3.18-04	3.18-04	3.18-04	3.18-04	3.18-04
U235	.00	2.37-03	2.24-03	2.45-03	2.87-03	3.48-03	4.58-03	5.13-03	6.95-03	3.73-03	2.50-03
U238	.00	5.67-05	5.64-05	5.65-05	5.69-05	5.77-05	5.98-05	6.33-05	7.04-05	9.27-05	1.18-04
U234	2.26+00	1.85+00	1.85+00	1.45+00	1.45+00	1.45+00	1.46+00	1.47+00	1.48+00	1.54+00	1.60+00
U235	6.99+02	3.12-02	3.12-02	3.12-02	3.12-02	3.12-02	3.12-02	3.12-02	3.13-02	3.13-02	3.13-02
U236	.00	2.21-03	2.21-03	2.21-03	2.21-03	2.21-03	2.21-03	2.21-03	2.21-03	2.22-03	2.22-03
U237	.00	6.19+05	6.18+05	1.24+00	1.35+00	1.10+00	9.54+01	7.53-01	4.68-01	3.13-01	1.65-02
U238	3.22-01	3.18-01	3.18-01	3.18-01	3.18-01	3.18-01	3.18-01	3.18-01	3.18-01	3.18-01	3.18-01
U239	.00	1.90+07	.00	.00	.00	.00	.00	.00	.00	.00	.00
U240	.00	4.51-18	1.76-17	2.63-17	3.17-17	9.68-17	2.32-16	4.52-16	9.10-16	2.28-15	4.52-15
NP236	.00	1.39+00	.00	.00	.00	.00	.00	.00	.00	.00	.00
NP237	.00	3.57-03	1.63-03	1.63-03	1.63-03	1.63-03	1.64-03	1.64-03	1.67-03	1.80-03	2.05-03
NP238	.00	1.90+05	2.39+04	2.31+18	.00	.00	.00	.00	.00	.00	.00
NP239	.00	1.69+07	2.58+00	2.58+00	2.58+00	2.58+00	2.58+00	2.58+00	2.57+00	2.57+00	2.55+00
NP240M	.00	6.51-18	1.78-17	2.63-17	3.17-17	9.68-17	2.32-16	4.58-16	9.10-16	2.28-15	4.52-15
NP240	.00	3.00+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
PU236	.00	9.53-02	9.04-02	8.83-02	7.53-02	2.85-02	6.43-03	7.44-04	5.02-07	2.62-12	1.64-12
PU238	.00	7.25+02	7.46+02	7.51+02	7.57+02	7.61+02	7.13+02	6.59+02	5.22+02	3.54+02	1.54+02
PU239	.00	2.94+02	2.94+02	2.99+02	2.99+02	2.99+02	2.99+02	2.99+02	2.99+02	2.99+02	2.99+02
PU240	.00	3.15+02	3.15+02	3.15+02	3.15+02	3.15+02	3.15+02	3.15+02	3.14+02	3.14+02	3.12+02
PU241	.00	5.04+04	4.98+04	4.93+04	4.80+04	4.58+04	3.97+04	3.23+04	1.95+04	4.69+03	4.37+02
PU242	.00	3.51-01	3.51-01	3.51-01	3.51-01	3.51-01	3.51-01	3.51-01	3.51-01	3.51-01	3.51-01
PU243	.00	9.23+04	3.56+09	1.56-09	3.56-09	3.56-09	3.56-09	3.56-09	3.56-09	3.56-09	3.56-09
PU244	.00	6.52-18	1.77-17	2.63-17	3.17-17	9.70-17	2.33-16	4.59-16	9.11-16	2.27-15	4.53-15
PL245	.00	8.65-13	.00	.00	.00	.00	.00	.00	.00	.00	.00
AM241	.00	2.67+01	4.59+01	6.11+01	1.05+02	1.80+02	3.83+02	6.62+02	1.07+03	1.88+03	1.50+03
AM242M	.00	2.31+00	2.31+00	2.31+00	2.30+00	2.29+00	2.26+00	2.27+00	2.11+00	1.84+00	1.66+00
AM242	.00	1.95+04	2.31+00	2.31+00	2.30+00	2.29+00	2.26+00	2.27+00	2.11+00	1.84+00	1.66+00
AM243	.00	2.57+00	2.58+00	2.58+00	2.58+00	2.58+00	2.58+00	2.57+00	2.57+00	2.57+00	2.55+00
AM244	.00	1.76+04	2.30+20	3.62+20	6.73+20	1.26-19	3.02-19	5.96-19	1.18-18	2.95-18	5.89-18
AM245	.00	2.58+10	2.17+10	1.81+10	1.15+10	5.23+12	9.57+12	8.23+14	2.35+17	.00	.00
CM242	.00	6.44+03	4.44+03	3.30+03	1.38+03	2.49+02	6.61+00	1.81+00	1.73+00	1.51+00	1.20+00
CM243	.00	4.31-01	4.29-01	4.27-01	4.22-01	4.13-01	3.87-01	3.67-01	2.79-01	1.46-01	4.54-02
CM244	.00	1.82+02	1.80+02	1.79+02	1.75+02	1.64+02	1.50+02	1.24+02	8.46+01	2.68+01	3.95+00
CM245	.00	1.84+02	1.84+02	1.84+02	1.84+02	1.84+02	1.84+02	1.84+02	1.84+02	1.84+02	1.84+02
CM246	.00	1.70+03	1.70+03	1.70+03	1.70+03	1.70+03	1.69+03	1.69+03	1.69+03	1.68+03	1.67+03
CM247	.00	3.56+09	3.56+09	3.56+09	3.56+09	3.56+09	3.56+09	3.56+09	3.56+09	3.56+09	3.56+09
CM248	.00	5.89+09	5.89+09	5.89+09	5.89+09	5.89+09	5.89+09	5.89+09	5.89+09	5.89+09	5.89+09
CM249	.00	1.93+04	4.43+13	2.91+14	9.84+18	6.60+24	.00	.00	.00	.00	.00
CM250	.00	3.72-16	3.72-16	3.72-16	3.72-16	3.72-16	3.72-16	3.71-16	3.71-16	3.71-16	3.70-16
AM249	.00	3.71-05	1.61+05	1.23+05	7.66+06	3.62+04	3.04+07	5.40+09	1.70+12	3.11+23	.00
FM250	.00	3.10+05	3.72-16	3.72-16	3.72-16	3.72-16	3.71-16	3.71-16	3.71-16	3.71-16	3.70-16
CF246	.00	5.40+09	1.10+08	1.59+08	2.66+08	3.69+08	4.42+08	4.45+08	4.37+08	4.12+08	3.73+08
CF250	.00	1.29+07	1.28+07	1.27+07	1.23+07	1.17+07	9.99+06	7.66+06	4.51+06	9.20+06	4.50+10
CF251	.00	7.05+10	7.05+10	7.05+10	7.04+10	7.04+10	7.02+10	7.00+10	6.94+10	6.78+10	6.53+10
CF252	.00	6.59+08	6.55+08	6.23+08	5.38+08	4.14+08	1.95+08	5.09+09	1.70+10	1.43+13	2.93+19
CF253	.00	4.74+09	1.43+10	9.36+12	3.17+15	2.12+21	.00	.00	.00	.00	.00
CF254	.00	8.42+13	1.07+13	1.16+13	1.31+14	2.00+16	7.05+22	.00	.00	.00	.00
IS253	.00	2.67+09	6.85+10	9.27+11	1.37+13	7.49+19	.00	.00	.00	.00	.00
TOTAL	2.65+00	3.82+03	3.59+04	5.42+08	6.11+04	4.78+04	6.16+04	3.35+04	2.19+04	7.35+03	2.72+03

POWER= 35.0000, BURNUP= 20000.000, FLUX= 3.20E+13N/CM^2-SEC

ELEMENTAL ACTIVITY, CURIES
BASIS = MT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	U. Y	D. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
TL	.00	1.29E-04	1.86E-04	2.31E-04	3.67E-04	6.08E-04	1.21E-03	1.71E-03	1.82E-03	1.41E-03	9.12E-04
PS	.00	3.59E-04	5.15E-04	6.41E-04	1.02E-03	1.69E-03	3.36E-03	4.75E-03	5.04E-03	3.87E-03	2.47E-03
BI	.00	3.59E-04	5.15E-04	6.41E-04	1.02E-03	1.69E-03	3.36E-03	4.75E-03	5.04E-03	3.87E-03	2.47E-03
PO	.00	8.88E-04	8.48E-04	1.05E-03	1.67E-03	2.77E-03	5.51E-03	7.76E-03	8.25E-03	6.33E-03	4.02E-03
AT	.00	4.29E-04	1.10E-04	1.07E-04	1.41E-04	1.96E-04	3.63E-04	6.58E-04	1.24E-03	3.60E-03	8.93E-03
BN	.00	3.59E-04	5.15E-04	6.41E-04	1.02E-03	1.69E-03	3.36E-03	4.75E-03	5.04E-03	3.87E-03	2.47E-03
FW	.00	4.63E-04	1.65E-04	1.75E-04	2.68E-04	3.82E-04	7.31E-04	1.31E-03	2.75E-03	7.56E-03	1.78E-04
PA	.00	3.59E-04	5.15E-04	6.41E-04	1.02E-03	1.69E-03	3.36E-03	4.75E-03	5.04E-03	3.87E-03	2.47E-03
AC	.00	1.20E-03	4.00E-03	4.87E-03	7.48E-03	1.22E-02	2.46E-02	5.18E-02	1.06E-01	2.86E-01	6.19E-01
TM	.00	1.18E-00	3.49E-01	3.50E-01	3.50E-01	3.51E-01	3.52E-01	3.54E-01	3.54E-01	3.53E-01	3.53E-01
PA	.00	6.77E-01	4.76E-01	4.81E-01	4.81E-01	4.81E-01	4.82E-01	4.82E-01	4.81E-01	4.98E-01	5.23E-01
U	2.65E+00	3.96E+07	4.89E+01	3.76E+00	3.18E+00	3.13E+00	2.99E+00	2.80E+00	2.51E+00	2.22E+00	2.18E+00
NP	.00	1.92E+07	2.79E+00	2.79E+00	2.79E+00	2.79E+00	2.79E+00	2.79E+00	2.79E+00	2.75E+00	2.76E+00
PU	.00	1.64E+05	5.11E+04	5.07E+04	5.09E+04	4.72E+04	4.11E+04	3.26E+04	2.08E+04	5.82E+03	1.40E+03
PM	.00	3.72E+04	5.31E+01	6.83E+01	1.12E+02	1.87E+02	3.90E+02	6.69E+02	1.05E+03	1.89E+03	1.53E+03
CM	.00	6.63E+03	4.62E+03	3.98E+03	1.55E+03	4.62E+02	1.55E+02	1.24E+02	8.67E+01	2.85E+01	5.22E+00
BN	.00	4.83E-05	1.41E-05	1.21E-05	7.66E-06	3.62E-06	3.04E-07	5.80E-09	1.70E-12	3.71E-16	3.70E-16
CF	.00	2.08E-07	2.69E-07	2.06E-07	2.06E-07	1.96E-07	1.64E-07	1.27E-07	8.98E-08	5.10E-08	3.86E-08
ES	.00	2.67E-09	6.85E-10	9.27E-11	1.37E-11	7.69E-12	.00	.00	.00	.00	.00
TOTALS	2.65E+00	3.90E+07	5.50E+04	5.02E+04	5.11E+04	4.78E+04	4.16E+04	3.35E+04	2.10E+04	7.35E+03	2.92E+03
SUBTOT1	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

TOTALS 2.65E+00 3.90E+07 5.02E+04 4.78E+04 5.11E+04 4.78E+04 4.16E+04 3.35E+04 2.10E+04 7.35E+03 2.92E+03

TABLE B-4

QUANTITIES OF TRANSURANIC NUCLIDES
IN SPENT FUEL VS. DECAY TIMES

POWER: 35.00MW, BURNUP: 20000.MWD, FLUX: 5.20E13#/CM**2-SEC

NUCLIDE CONCENTRATIONS, GRAMS
BASIS = MT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	D. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
ML	0.00	2.33E-02	3.66E-02	4.97E-02	6.14E-02	8.00E-02	1.27E-01	2.07E-01	3.79E-01	9.79E-01	1.99E+00
TL207	0.00	1.20E-15	1.77E-15	2.43E-15	3.88E-15	6.30E-15	1.18E-14	2.68E-14	8.50E-14	1.44E-13	3.18E-13
TL208	0.00	9.47E-13	6.36E-13	7.91E-13	1.25E-12	2.08E-12	4.14E-12	5.85E-12	6.20E-12	4.73E-12	2.92E-12
TL209	0.00	2.28E-18	5.94E-19	5.73E-19	7.61E-19	1.05E-18	1.95E-18	1.53E-18	8.94E-18	1.94E-17	9.50E-17
Pa206	0.00	6.96E-15	1.11E-14	2.66E-14	1.72E-14	3.10E-13	1.89E-12	4.47E-11	5.40E-10	1.55E-08	1.68E-07
Pa207	0.00	3.76E-11	6.55E-11	9.47E-11	7.23E-10	6.00E-10	2.87E-09	1.04E-08	4.14E-08	2.73E-07	1.18E-06
Pa208	0.00	6.57E-08	1.09E-07	1.53E-07	1.39E-07	8.82E-07	1.99E-06	1.24E-05	3.27E-05	8.63E-05	1.48E-04
Pa209	0.00	9.12E-15	2.43E-15	2.34E-15	3.41E-15	4.31E-15	7.99E-15	1.44E-14	2.84E-14	7.93E-14	1.96E-13
Pa210	0.00	1.70E-12	2.59E-12	3.39E-12	6.63E-12	1.68E-11	9.85E-11	5.15E-10	5.33E-09	3.49E-08	2.03E-07
Pa211	0.00	9.28E-15	1.34E-14	1.71E-14	2.98E-14	4.65E-14	1.06E-13	2.07E-13	4.24E-13	1.15E-12	2.45E-12
Pa212	0.00	2.57E-10	3.69E-10	4.59E-10	7.29E-10	1.21E-09	2.41E-09	3.80E-09	3.60E-09	2.74E-09	1.70E-09
Pa214	0.00	2.31E-14	2.96E-14	3.54E-14	5.59E-14	1.05E-13	3.53E-13	1.10E-12	3.85E-12	2.23E-11	8.75E-11
Bi209	0.00	7.67E-12	1.01E-11	1.09E-11	1.37E-11	2.05E-11	5.40E-11	1.56E-10	5.47E-10	3.85E-09	9.58E-08
Bi210	0.00	1.11E-15	1.64E-15	2.16E-15	4.33E-15	1.10E-14	6.43E-14	3.36E-13	2.03E-12	2.28E-11	3.37E-10
Bi211	0.00	5.53E-14	8.17E-14	1.02E-13	1.37E-13	2.89E-13	6.33E-13	1.24E-12	2.52E-12	6.82E-12	1.46E-11
Bi212	0.00	2.45E-11	1.52E-11	1.36E-11	6.94E-11	1.15E-10	2.29E-10	5.24E-10	1.43E-09	2.62E-09	1.62E-09
Bi213	0.00	2.26E-15	5.88E-16	5.67E-16	7.53E-16	1.04E-15	1.93E-15	3.49E-15	6.87E-15	1.92E-14	4.75E-14
Bi214	0.00	1.69E-16	2.14E-16	2.60E-16	4.17E-16	7.75E-16	1.40E-15	8.09E-15	2.89E-14	1.44E-13	6.43E-13
Pa210	0.00	1.37E-14	2.24E-14	3.13E-14	6.97E-14	2.01E-13	2.80E-12	9.26E-12	5.59E-11	6.29E-10	1.65E-09
Pa211	0.00	6.49E-21	9.87E-21	1.24E-20	2.14E-20	3.99E-20	7.44E-20	1.49E-19	3.05E-19	8.25E-19	1.77E-18
Pa212	0.00	1.79E-21	1.86E-21	2.11E-21	3.49E-21	6.08E-21	1.21E-20	1.71E-20	1.81E-20	1.38E-20	8.53E-21
Pa213	0.00	3.49E-24	8.56E-25	8.24E-25	1.10E-24	1.52E-24	2.82E-24	5.08E-24	1.00E-23	2.79E-23	6.92E-23
Pa214	0.00	2.47E-23	3.68E-23	4.40E-23	4.94E-23	1.31E-22	4.40E-22	1.37E-21	4.74E-21	2.77E-20	1.09E-19
Pa215	0.00	1.86E-21	1.15E-20	1.45E-20	2.52E-20	4.11E-20	9.01E-20	1.76E-19	3.54E-19	9.70E-19	2.08E-18
Pa216	0.00	1.13E-15	1.48E-15	1.84E-15	2.42E-15	4.84E-15	9.63E-15	1.36E-14	1.44E-14	1.10E-14	6.79E-15
Pa218	0.00	2.62E-17	3.43E-17	4.11E-17	6.48E-17	1.22E-16	4.10E-16	1.28E-15	6.46E-15	2.58E-14	1.01E-13
At217	0.00	2.61E-20	6.80E-21	6.55E-21	8.70E-21	1.20E-20	2.23E-20	4.03E-20	7.94E-20	2.22E-19	5.44E-19
Pa219	0.00	1.74E-17	2.61E-17	3.29E-17	5.71E-17	9.30E-17	2.04E-16	3.98E-16	6.12E-16	2.20E-15	4.70E-15
Pa220	0.00	3.91E-13	5.62E-13	6.99E-13	1.11E-12	1.68E-12	3.68E-12	5.17E-12	5.48E-12	4.18E-12	2.58E-12
Pa222	0.00	4.91E-14	4.31E-14	1.54E-14	1.14E-13	2.24E-13	7.52E-13	2.34E-12	6.19E-12	4.74E-11	1.86E-10
Pa223	0.00	2.39E-16	6.23E-17	4.01E-17	7.98E-17	1.10E-16	2.05E-16	3.70E-16	7.27E-16	2.03E-15	5.00E-15
Pa224	0.00	1.01E-16	1.42E-16	1.74E-16	2.68E-16	4.37E-16	9.58E-16	1.87E-15	3.62E-15	1.03E-14	2.21E-14
Pa225	0.00	4.46E-12	6.55E-12	8.24E-12	1.43E-11	2.33E-11	5.11E-11	9.97E-11	2.04E-10	5.51E-10	1.18E-09
Pa226	0.00	2.74E-09	3.21E-09	4.00E-09	6.34E-09	1.05E-08	2.09E-08	2.96E-08	3.14E-08	2.39E-08	1.48E-08
Pa228	0.00	1.13E-12	2.63E-13	2.76E-13	3.61E-13	6.99E-13	9.26E-13	1.67E-12	3.24E-12	9.19E-12	2.26E-11
Pa226	0.00	7.68E-09	9.82E-09	1.17E-08	1.85E-08	3.49E-08	1.17E-07	3.65E-07	1.24E-06	7.38E-06	2.90E-05
Pa228	0.00	2.25E-15	3.36E-15	4.40E-15	8.33E-15	1.68E-14	6.88E-14	2.02E-13	5.79E-13	1.92E-12	8.20E-12
Ac225	0.00	7.30E-13	1.40E-13	1.83E-13	2.44E-13	3.37E-13	6.26E-13	1.13E-12	2.27E-12	6.67E-12	3.24E-11
Ac227	0.00	3.80E-09	5.33E-09	6.53E-09	1.01E-08	1.64E-08	3.60E-08	7.02E-08	1.43E-07	3.88E-07	8.30E-07
Ac228	0.00	2.35E-19	3.50E-19	3.59E-19	8.70E-19	1.92E-18	7.14E-18	2.11E-17	5.74E-17	2.00E-16	4.43E-16
Th227	0.00	7.10E-12	1.11E-11	1.38E-11	2.27E-11	3.70E-11	8.19E-11	1.60E-10	3.26E-10	8.42E-10	1.88E-09
Th228	0.00	4.34E-07	6.25E-07	7.77E-07	1.23E-06	2.05E-06	4.08E-06	5.71E-06	6.17E-06	6.64E-06	2.88E-06
Th229	0.00	4.10E-08	4.72E-08	5.70E-08	6.61E-08	9.15E-08	1.70E-07	3.04E-07	6.05E-07	1.48E-06	4.17E-06
Th230	0.00	9.54E-08	1.12E-07	1.24E-07	1.40E-07	2.25E-07	4.20E-07	7.44E-07	1.40E-06	3.43E-06	4.92E-06
Th231	0.00	1.61E-06	5.88E-06	5.89E-06	5.89E-06	5.89E-06	5.89E-06	5.89E-06	5.89E-06	5.90E-06	5.90E-06
Th232	0.00	6.68E-05	1.11E-04	1.30E-04	1.64E-04	2.66E-04	5.64E-04	1.04E-03	2.48E-03	5.06E-03	1.01E-02
Th233	0.00	1.48E-10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Th234	0.00	1.33E-05	1.37E-05	1.37E-05	1.37E-05	1.37E-05	1.37E-05	1.37E-05	1.37E-05	1.37E-05	1.37E-05
Pa231	0.00	3.00E-04	3.05E-04	3.04E-04	3.16E-04	3.30E-04	3.72E-04	4.42E-04	5.62E-04	1.00E-03	1.70E-03
Pa232	0.00	4.95E-07	1.48E-07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pa233	0.00	6.93E-06	7.67E-06	7.94E-06	7.94E-06	7.94E-06	7.94E-06	8.03E-06	8.17E-06	8.40E-06	1.00E-05
Pa234m	0.00	4.67E-10	4.62E-10	4.62E-10	4.62E-10	4.62E-10	4.62E-10	4.62E-10	4.62E-10	4.62E-10	4.62E-10

POWER= 35.00MW, BURNUP= 20000.MWD, FLUX= 3.20*13N/CM^2-SEC

NUCLIDE CONCENTRATIONS, GRAMS
BASIS = MT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
PA234	.00	1.55+09	1.60+10	1.60+10	1.60+10	1.60+10	1.60+10	1.60+10	1.60+10	1.60+10	1.60+10
U237	.00	9.88+05	1.07+04	1.14+04	1.14+04	1.14+04	1.14+04	1.14+04	1.14+04	1.14+04	1.14+04
U233	.00	5.93+03	5.95+03	5.96+03	6.00+03	6.08+03	6.31+03	6.68+03	7.03+03	9.79+03	1.41+04
U235	1.66+02	2.14+02	2.14+02	2.14+02	2.14+02	2.14+02	2.14+02	2.14+02	2.14+02	2.14+02	2.14+02
U235	1.24+04	1.46+04	1.46+04	1.46+04	1.46+04	1.46+04	1.46+04	1.46+04	1.46+04	1.46+04	1.46+04
U236	.00	3.49+03	3.49+03	3.49+03	3.49+03	3.49+03	3.49+03	3.49+03	3.49+03	3.49+03	3.49+03
U237	.00	8.31+00	8.19+04	1.51+05	1.41+05	1.35+05	1.17+05	9.22+04	5.73+04	1.39+04	1.28+07
U238	9.67+05	9.53+05	9.53+05	9.53+05	9.53+05	9.53+05	9.53+05	9.53+05	9.53+05	9.53+05	9.53+05
U239	.00	5.46+01	.00	.00	.00	.00	.00	.00	.00	.00	.00
U240	.00	7.03+24	1.90+23	2.84+23	5.58+23	1.05+22	2.51+22	9.95+22	9.82+22	7.44+21	4.88+21
NP236	.00	2.10+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
NP237	.00	2.23+02	2.11+02	2.11+02	2.11+02	2.11+02	2.11+02	2.11+02	2.11+02	2.11+02	2.11+02
NP238	.00	7.28+01	9.13+14	8.47+24	.00	.00	.00	.00	.00	.00	.00
NP239	.00	8.14+01	1.11+05	1.11+05	1.11+05	1.11+05	1.11+05	1.11+05	1.11+05	1.11+05	1.11+05
NP240	.00	4.07+26	1.64+25	2.45+25	4.81+25	9.02+25	2.16+24	4.27+24	8.47+24	2.11+23	4.21+23
NP240	.00	2.73+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
Pu236	.00	1.79+04	1.70+04	1.62+04	1.47+04	1.11+04	5.35+05	1.59+05	1.59+05	9.44+04	4.93+15
Pu238	.00	4.29+01	4.42+01	4.45+01	4.49+01	4.49+01	4.49+01	4.49+01	4.49+01	4.49+01	4.49+01
Pu238	.00	4.80+03	4.88+03	4.88+03	4.88+03	4.88+03	4.88+03	4.88+03	4.88+03	4.88+03	4.88+03
Pu240	.00	1.43+03	1.43+03	1.43+03	1.43+03	1.43+03	1.43+03	1.43+03	1.43+03	1.43+03	1.43+03
Pu241	.00	4.95+02	4.90+02	4.85+02	4.72+02	4.51+02	3.91+02	3.08+02	1.97+02	4.61+01	4.27+00
Pu242	.00	9.00+01	9.00+01	9.00+01	9.00+01	9.00+01	9.00+01	9.00+01	9.00+01	9.00+01	9.00+01
Pu243	.00	1.56+02	1.37+15	1.37+15	1.37+15	1.37+15	1.37+15	1.37+15	1.37+15	1.37+15	1.37+15
Pu244	.00	1.48+13	9.08+13	1.49+12	2.92+12	5.48+12	1.31+11	2.59+11	4.15+11	1.28+10	2.56+10
Pu244	.00	1.17+19	.00	.00	.00	.00	.00	.00	.00	.00	.00
AM241	.00	1.44+00	1.34+01	1.78+01	3.06+01	5.24+01	1.12+02	1.93+02	3.06+02	4.33+02	4.39+02
AM242M	.00	2.38+01	2.37+01	2.37+01	2.36+01	2.35+01	2.32+01	2.27+01	2.17+01	1.49+01	1.51+01
AM242	.00	2.41+02	2.45+06	2.45+06	2.44+06	2.43+06	2.39+06	2.37+06	2.34+06	2.27+06	1.61+06
AM243	.00	1.34+01	1.34+01	1.34+01	1.34+01	1.34+01	1.34+01	1.34+01	1.34+01	1.34+01	1.34+01
AM244	.00	5.95+04	7.75+24	1.15+27	2.27+27	4.25+27	1.02+26	2.01+26	3.99+26	9.44+26	1.99+25
AM245	.00	4.17+17	3.41+17	2.43+17	1.86+17	8.10+18	7.39+19	1.31+20	4.13+24	.00	.00
CM242	.00	1.95+00	1.34+00	5.96+01	4.16+01	3.85+02	1.39+03	5.47+04	5.27+04	4.55+04	3.62+04
CM243	.00	9.37+03	9.32+03	9.28+03	9.17+03	8.97+03	8.41+03	7.54+03	6.07+03	3.17+03	1.07+03
CM244	.00	2.25+00	2.23+00	2.21+00	2.16+00	2.08+00	1.86+00	1.53+00	1.05+00	3.31+01	4.86+02
CM245	.00	9.38+02	9.38+02	9.38+02	9.38+02	9.37+02	9.37+02	9.37+02	9.36+02	9.34+02	9.30+02
CM246	.00	5.49+03	5.49+03	5.49+03	5.49+03	5.49+03	5.49+03	5.49+03	5.49+03	5.49+03	5.49+03
CM247	.00	4.03+05	4.03+05	4.03+05	4.03+05	4.03+05	4.03+05	4.03+05	4.03+05	4.03+05	4.03+05
CM248	.00	1.44+06	1.44+06	1.44+06	1.44+06	1.44+06	1.44+06	1.44+06	1.44+06	1.44+06	1.44+06
CM249	.00	1.44+11	3.75+20	2.46+21	4.35+25	5.59+31	.00	.00	.00	.00	.00
CM250	.00	4.52+15	4.52+15	4.52+15	4.52+15	4.52+15	4.52+15	4.52+15	4.52+15	4.52+15	4.52+15
AM249	.00	1.03+09	8.92+09	7.21+09	4.59+09	2.05+09	1.82+10	3.23+12	1.07+15	3.18+24	.00
AM250	.00	7.94+12	9.55+23	9.55+23	9.55+23	9.55+23	9.54+23	9.54+23	9.54+23	9.53+23	9.51+23
CF249	.00	8.34+10	2.68+09	3.89+09	6.51+09	9.03+09	1.08+08	1.09+08	1.07+08	1.01+08	1.19+09
CF251	.00	1.18+09	1.17+09	1.16+09	1.13+09	1.07+09	9.13+10	7.00+10	4.12+10	8.41+11	5.99+12
CF252	.00	4.45+10	4.45+10	4.45+10	4.45+10	4.45+10	4.45+10	4.45+10	4.45+10	4.45+10	4.45+10
CF253	.00	1.10+10	1.10+10	1.10+10	1.10+10	1.10+10	1.10+10	1.10+10	1.10+10	1.10+10	1.10+10
CF254	.00	1.43+13	9.92+15	3.73+16	1.09+19	1.33+24	.00	.00	.00	.00	.00
ES253	.00	1.03+16	3.62+17	1.62+17	1.54+18	2.35+20	8.29+24	6.77+35	.00	.00	.00
ES253	.00	1.03+13	2.75+14	3.72+15	5.52+18	3.09+23	.00	.00	.00	.00	.00
TOTAL	1.00+06	9.79+05	9.79+05	9.79+05	9.79+05	9.79+05	9.79+05	9.79+05	9.79+05	9.79+05	9.79+05

POWER: 35.00MW, BURNUP: 20000-MWD, FLUX: 3.20*13W/CM**2-SEC

ELEMENT CONCENTRATIONS, GRAMS
BASIS : WT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
HE	.00	2.33-02	3.66-02	4.47-02	6.19-02	8.00-02	1.24-01	2.02-01	3.79-01	9.79-01	1.98+00
LI	.00	4.44-13	6.37-13	7.93-13	1.26-12	2.09-12	4.11-12	5.88-12	6.25-12	4.87-12	3.24-12
PI	.00	6.60-08	1.04-07	1.53-07	3.40-07	8.89-07	4.00-06	1.24-05	3.27-05	8.66-05	1.49-04
SI	.00	3.24-11	4.53-11	5.47-11	8.37-11	1.36-10	2.83-10	4.80-10	8.92-10	3.74-09	1.63-08
PO	.00	1.48-14	2.40-14	3.31-14	5.27-14	2.06-13	1.41-12	9.28-12	5.59-11	6.29-10	3.65-09
AT	.00	2.61-20	6.80-21	6.55-21	8.10-21	1.20-20	2.23-20	4.03-20	7.94-20	2.72-19	5.44-19
BN	.00	4.40-13	6.25-13	7.75-13	1.23-12	2.06-12	4.42-12	7.52-12	1.37-11	5.16-11	1.89-10
FR	.00	3.40-16	2.04-16	2.34-16	3.48-16	5.47-16	1.16-15	2.24-15	4.55-15	1.24-14	2.73-14
BA	.00	9.89-09	1.30-08	1.58-08	2.49-08	4.55-08	1.38-07	3.94-07	1.33-06	7.41-06	2.70-05
AC	.00	3.80-09	5.33-09	6.53-09	1.03-08	1.64-08	3.40-08	7.02-08	1.44-07	3.88-07	6.30-07
TH	.00	1.06-03	1.24-03	1.39-03	1.81-03	2.55-03	4.40-03	8.56-03	1.61-02	3.94-02	7.43-02
PA	.00	3.28-04	3.13-04	3.16-04	3.24-04	3.34-04	3.40-04	4.50-04	5.90-04	1.01-03	1.73-03
U	1.00+06	9.72+05	9.72+05	9.72+05	9.72+05	9.72+05	9.72+05	9.72+05	9.72+05	9.72+05	9.72+05
NP	.00	3.05+02	2.31+02	2.31+02	2.31+02	2.32+02	2.32+02	2.33+02	3.37+02	2.55+02	2.90+02
PU	.00	4.46+03	6.93+03	6.93+03	6.97+03	6.89+03	6.63+03	6.75+03	6.63+03	6.46+03	6.40+03
AM	.00	2.13+01	2.70+01	3.15+01	4.42+01	6.61+01	1.25+02	2.07+02	3.19+02	4.46+02	4.52+02
CM	.00	4.30+00	3.68+00	3.32+00	2.66+00	2.28+00	1.97+00	1.64+00	1.15+00	4.34-01	1.49-01
SK	.00	1.03-08	8.42-09	1.23-09	4.59-09	2.05-09	1.82-10	3.23-12	1.02-15	9.53-23	9.51-23
CF	.00	2.59-09	4.43-09	5.61-09	8.18-09	1.06-08	1.22-08	1.27-08	1.16-08	1.06-08	9.58-09
ES	.00	1.07-13	2.75-14	3.72-15	5.52-16	3.09-23	.00	.00	.00	.00	.00
TOTALS	1.00+06	9.79+05	9.79+05	9.79+05	9.79+05	9.79+05	9.79+05	9.79+05	9.79+05	9.79+05	9.79+05
SUBTOT	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

TOTALS 1.00+06 9.79+05 9.79+05 9.79+05 9.79+05 9.79+05

TABLE B-5

ACTIVITIES OF LIGHT ELEMENTS AND
MATERIALS OF CONSTRUCTION
PRESENT IN SPENT FUEL
VS. DECAY TIMES

POWER: 35,000W, BURNUP: 20000MWD, FUEL: 3.20*10²⁴CM⁻²-SEC

NUCLEIDE RADIOACTIVITY, CURIES
BASIS = MT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	D. Y	D. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
H 1	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
H 2	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
H 3	.00	2.03-05	2.00-05	1.98-05	1.97-05	1.81-05	1.53-05	1.15-05	6.57-06	1.21-06	7.23-08
H 4	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
MC 3	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
ME 4	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
ME 6	.00	1.77-03	.00	.00	.00	.00	.00	.00	.02	.00	.00
LI 6	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
LI 7	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
LI 8	.00	2.36-12	.00	.00	.00	.00	.00	.00	.00	.00	.00
BE 8	.00	3.26-03	.00	.00	.00	.00	.00	.00	.00	.00	.00
BE 9	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
BE 10	.00	7.00-07	2.00-07	2.00-07	2.00-07	2.00-07	2.00-07	2.00-07	2.00-07	2.00-07	2.00-07
BE 11	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
B 10	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
B 11	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
B 12	.00	1.24-11	.00	.00	.00	.00	.00	.00	.00	.00	.00
C 12	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
C 13	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
C 14	.00	2.14-03	2.14-03	2.14-03	2.14-03	2.14-03	2.13-03	2.13-03	2.13-03	2.12-03	2.11-03
N 13	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
N 14	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
N 15	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
N 16	.00	1.72-02	.00	.00	.00	.00	.00	.00	.00	.00	.00
O 16	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
O 17	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
O 18	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
O 19	.00	4.95-23	.00	.00	.00	.00	.00	.00	.00	.00	.00
F 19	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
F 20	.00	3.86-11	.00	.00	.00	.00	.00	.00	.00	.00	.00
NE 20	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
NE 21	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
NE 22	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AL 21	.00	4.45-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
AR 22	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AR 23	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AR 24	.00	1.12-07	.00	.00	.00	.00	.00	.00	.00	.00	.00
AR 25	.00	6.95-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
MG 24	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
MG 25	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
ME 26	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
MG 27	.00	6.70-02	.00	.00	.00	.00	.00	.00	.00	.00	.00
AL 27	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AL 28	.00	5.97-01	.00	.00	.00	.00	.00	.00	.00	.00	.00
AL 29	.00	1.99-00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SI 28	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SI 29	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SI 30	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SI 31	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SI 32	.00	1.23-02	.00	.00	.00	.00	.00	.00	.00	.00	.00
P 31	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
P 32	.00	3.71-03	4.73-05	1.57-06	7.59-11	1.55-10	.00	.00	.00	.00	.00
P 33	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

POWER: 35.00MW, BURNUP: 20000.MWD, FLUX: 3.20E13N/CM^2-SEC

NUCLEOT RADIOACTIVITY, CURIES
BASIS : MG OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100.
P 34	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
S 32	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
S 33	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
S 34	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
S 35	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
S 36	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
S 37	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CL 35	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CL 36	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CL 37	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CL 38	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AR 34	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AR 37	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AR 38	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AR 39	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AR 40	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AR 41	.00	2.50-12	.00	.00	.00	.00	.00	.00	.00	.00	.00
K 39	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
K 40	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
K 41	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
K 42	.00	9.19-14	.00	.00	.00	.00	.00	.00	.00	.00	.00
K 43	.00	2.95-20	.00	.00	.00	.00	.00	.00	.00	.00	.00
K 44	.00	5.72-12	.00	.00	.00	.00	.00	.00	.00	.00	.00
CA 40	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CA 41	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CA 42	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CA 43	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CA 44	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CA 45	.00	3.67-11	2.51-11	1.87-11	7.90-12	1.70-12	1.71-13	7.94-14	1.77-24	.00	.00
CA 46	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
FA 47	.00	3.37-09	3.52-14	7.87-15	.00	.00	.00	.00	.00	.00	.00
CA 48	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CA 49	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SC 45	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SC 46	.00	1.58-13	1.50-14	4.20-14	7.71-15	3.77-16	4.41-20	.00	.00	.00	.00
SC 47	.00	1.81-04	2.42-12	4.89-14	.00	.00	.00	.00	.00	.00	.00
SC 48	.00	2.22-04	3.48-19	.00	.00	.00	.00	.00	.00	.00	.00
SC 49	.00	3.98-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
SC 50	.00	2.92-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
TI 46	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TI 47	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TI 48	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TI 49	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TI 50	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
FI 51	.00	1.10-01	.00	.00	.00	.00	.00	.00	.00	.00	.00
V 49	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
V 50	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
V 51	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
V 52	.00	1.63-02	.00	.00	.00	.00	.00	.00	.00	.00	.00
V 53	.00	8.17-01	.00	.00	.00	.00	.00	.00	.00	.00	.00
V 54	.00	8.72-03	.00	.00	.00	.00	.00	.00	.00	.00	.00
CR 50	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

POWER= 35.00MW, BURNUP= 20000.MWD, FLUX= 3.2D+13MCM+2-SEC

NUCLIDE RADIOACTIVITY, Curies
BASIS = MT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	30. Y	100. Y
CR 51	.00	2.13+04	2.26+03	3.96+02	2.38+00	2.61+04	3.56+16	.00	.00	.00	.00
CR 52	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CR 53	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CR 54	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CR 55	.00	2.79+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
RU 54	.00	8.32+02	6.77+02	5.77+02	5.63+02	1.56+02	1.28+01	1.95+01	4.59+05	5.95+16	.00
RU 55	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
RU 56	.00	2.85+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
RU 57	.00	2.87+00	.00	.00	.00	.00	.00	.00	.00	.00	.00
RU 58	.00	1.02+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
FE 54	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
FE 55	.00	5.36+03	5.07+03	4.77+03	4.10+03	3.18+03	1.41+03	1.17+02	2.59+01	8.70+03	1.41+08
FE 56	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
FE 57	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
FE 58	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
FE 59	.00	5.66+02	1.41+02	4.80+01	2.03+00	7.32+03	3.42+10	2.07+22	.00	.00	.00
CO 59M	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CO 59	.00	2.78+04	1.18+04	5.87+03	7.98+02	2.29+01	5.41+04	1.05+11	.00	.00	.00
CO 59	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CO 60M	.00	4.66+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
CO 60	.00	1.13+02	1.12+02	1.09+02	1.02+02	8.90+01	5.99+01	3.10+01	8.30+00	1.59+01	2.19+04
CO 61	.00	1.43+01	.00	.00	.00	.00	.00	.00	.00	.00	.00
CO 62	.00	3.83+00	.00	.00	.00	.00	.00	.00	.00	.00	.00
NI 58	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
NI 59	.00	6.50+00	6.50+00	6.50+00	6.50+00	6.50+00	6.50+00	6.50+00	6.50+00	6.50+00	6.49+00
NI 60	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
NI 61	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
NI 62	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
NI 63	.00	9.40+02	9.38+02	9.37+02	9.33+02	9.26+02	9.05+02	8.72+02	8.08+02	6.45+02	4.42+02
NI 64	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
NI 65	.00	2.13+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
CU 62	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CU 63	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CU 64	.00	3.56+00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CU 65	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CU 66	.00	7.78+00	.00	.00	.00	.00	.00	.00	.00	.00	.00
ZN 63	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
ZN 64	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
ZN 65	.00	1.25+04	9.69+05	7.95+05	6.05+05	1.58+05	7.12+07	4.06+09	1.37+13	.00	.00
ZN 66	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
ZN 67	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
ZN 68	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
ZN 69M	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
ZN 69	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
ZN 70	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
ZN 71M	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
ZN 71	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
GA 69	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
GA 70	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
GA 71	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AL 70	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 88	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

POWER: 35.00MW, BURNUP: 20000-MWD, FLUX: 3.20E+13N/CM^2-SEC

NUCLIDE RADIOACTIVITY, CURTES
BASIS: 1G OF HEAVY METAL CHARGED TO REACTOR

	CHANGE	DISCHARGE	G. Y	O. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
SR 89	.00	3.52E+03	3.06E+03	4.37E+03	2.70E+01	2.08E+03	9.03E+10	2.51E+20	.00	.00	.00
SR 90	.00	3.83E+04	3.11E+04	3.30E+04	3.05E+04	2.98E+04	2.77E+04	2.45E+04	1.91E+04	1.12E+05	2.86E+05
SR 91	.00	6.79E+00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Y 90M	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Y 90	.00	1.34E+03	3.23E+04	3.10E+04	3.03E+04	2.98E+04	2.77E+04	2.45E+04	1.91E+04	1.12E+05	2.86E+05
Y 91M	.00	4.02E+00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Y 91	.00	9.37E+01	3.24E+01	1.42E+01	1.76E+00	1.70E+02	4.10E+08	1.89E+17	.00	.00	.00
Zr 90	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Zr 91	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Zr 92	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Zr 93	.00	5.45E+02	5.45E+02	5.45E+02	5.45E+02	5.45E+02	5.45E+02	5.45E+02	5.45E+02	5.45E+02	5.45E+02
Zr 94	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Zr 95	.00	2.66E+04	1.83E+04	4.88E+03	5.47E+02	1.13E+01	9.33E+05	3.25E+13	.00	.00	.00
Zr 96	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Nb 92	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Nb 93M	.00	2.01E+03	2.72E+03	3.22E+03	4.47E+03	7.15E+03	1.39E+02	2.10E+02	3.56E+02	5.04E+02	5.42E+02
Nb 93	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Nb 94	.00	1.07E+14	1.07E+14	1.07E+14	1.07E+14	1.07E+14	1.07E+14	1.07E+14	1.07E+14	1.07E+14	1.07E+14
Nb 95	.00	2.56E+04	1.66E+04	9.25E+03	3.28E+03	2.84E+01	1.99E+04	6.93E+13	.00	.00	.00
Nb 96	.00	1.25E+01	.00	.00	.00	.00	.00	.00	.00	.00	.00
Nb 97	.00	6.21E+08	.00	.00	.00	.00	.00	.00	.00	.00	.00
Mo 92	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Mo 93	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Mo 93M	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Mo 94	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Mo 95	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Mo 96	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Mo 97	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Mo 98	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Mo 99	.00	2.36E+07	4.65E+17	3.32E+24	.00	.00	.00	.00	.00	.00	.00
PD100	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PD101	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TC 99M	.00	2.25E+07	4.45E+17	1.28E+24	.00	.00	.00	.00	.00	.00	.00
TC 99	.00	1.88E+13	1.97E+13	1.97E+13	1.97E+13	1.97E+13	1.97E+13	1.97E+13	1.97E+13	1.97E+13	1.97E+13
IC101	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
IC102	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CO110M	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CO111	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CO115M	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CO115	.00	1.46E+03	1.16E+15	4.12E+25	.00	.00	.00	.00	.00	.00	.00
CO116M	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CL119	.00	6.11E+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
CU119	.00	1.84E+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN113	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN119M	.00	6.11E+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN119	.00	5.71E+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN121M	.00	1.84E+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN121	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SA114	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SA115	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SA116	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SA117M	.00	1.14E+04	1.32E+02	4.13E+00	1.59E+04	2.21E+12	.00	.00	.00	.00	.00

POWER= 35.00MW, BURNUP= 20000.MWD, FLUX= 3.20E+13N/CM^2-SEC

NUCLIDE RADIOACTIVITY, Curies
Basis = MT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
SN117	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN118	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN119M	.00	1.91E+01	1.99E+01	1.23E+01	6.95E+00	2.52E+00	1.21E-01	7.66E-06	3.05E-08	1.95E-21	.00
SN119	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN120	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN121M	.00	1.77E-01	1.77E-01	1.77E-01	1.76E-01	1.74E-01	1.69E-01	1.62E-01	1.48E-01	1.12E-01	7.13E-02
SN121	.00	1.93E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN122	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN123M	.00	8.65E+01	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN123	.00	3.91E-01	2.91E-01	1.88E-01	5.79E-02	6.97E-03	1.59E-05	6.35E-10	1.01E-19	.00	.00
SN124	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN125M	.00	3.88E+01	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN125	.00	3.28E+00	4.31E-03	2.47E-05	6.59E-12	1.32E-23	.00	.00	.00	.00	.00
SN126	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN127M	.00	1.06E-01	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN127	.00	2.51E+00	4.86E-01	3.95E-01	3.69E-02	5.42E-06	1.72E-09	1.18E-18	.00	.00	.00
SN128	.00	2.58E+01	2.43E+01	2.31E+01	2.00E+01	1.55E+01	7.17E+00	1.99E+00	1.52E+01	6.88E-05	1.63E-10
SN128M	.00	6.59E-02	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN129	.00	1.27E-01	8.68E-06	1.38E-05	2.03E-10	3.29E-19	.00	.00	.00	.00	.00
TE129	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE129M	.00	8.66E+00	7.36E+00	9.28E+00	8.27E+00	6.42E+00	2.97E+00	8.23E-01	6.33E-02	2.05E-05	7.58E-11
TE125	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE126	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE127	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE128	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE128M	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE129	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE130	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE131	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE132M	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE132	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE133	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE134	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE135	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE136	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE137	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE138	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE139	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE140	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE141	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE142	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE143	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE144	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE145	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE146	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE147	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TOTAL	.00	4.13E+05	4.78E+04	2.67E+04	4.03E+03	4.40E+03	2.01E+03	1.28E+03	8.50E+02	6.52E+02	4.09E+02

POWER: 35.00MW, BURNUP: 2000, MW, FLUX: 3.20*10¹⁴CM⁻²-SEC

ELEMENTAL ACTIVITIES, CURIES
BASIS = MT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
H	.00	2.03-05	2.00-05	1.98-05	1.92-05	1.81-05	1.53-05	1.15-05	6.57-06	1.21-06	7.23-07
DE	.00	3.06-03	2.00-07	2.00-07	2.00-07	2.00-07	2.00-07	2.00-07	2.00-07	2.00-07	2.00-07
C	.00	2.14-03	2.14-03	2.14-03	2.14-03	2.14-03	2.13-03	2.13-03	2.13-03	2.12-03	2.11-03
P	.00	5.71-03	4.73-05	1.59-06	7.59-11	1.55-16	.00	.00	.00	.00	.00
CA	.00	1.38-08	2.52-11	1.87-11	7.90-12	1.70-12	1.71-14	7.94-18	1.72-24	.00	.00
SC	.00	6.97-04	2.50-12	6.21-14	7.71-15	3.77-16	6.61-20	.00	.00	.00	.00
CR	.00	2.14-04	2.24-03	3.44-02	2.34-00	2.61-04	3.56-16	.00	.00	.00	.00
MM	.00	2.81-05	6.77-02	5.77-02	3.61-02	1.56-02	1.24-01	1.95-01	4.59-05	5.95-16	.00
FE	.00	5.92-03	5.16-03	4.62-03	4.11-03	3.14-03	1.41-03	3.72-07	2.54-01	8.70-03	1.41-08
CO	.00	2.34-04	1.77-04	3.99-03	8.99-02	3.77-02	5.99-03	3.10-03	8.34-00	1.59-01	2.34-04
NI	.00	1.07-03	9.45-02	9.43-02	9.59-02	9.52-02	9.12-02	8.78-02	8.13-02	6.51-02	4.99-02
ZN	.00	1.25-04	9.44-05	7.95-05	4.45-05	1.68-05	1.12-07	4.06-09	1.37-13	.00	.00
SR	.00	4.20-01	1.64-01	4.17-00	2.71-01	2.37-03	2.77-04	2.45-04	1.91-04	9.12-05	2.64-05
Y	.00	1.44-03	3.24-03	1.42-01	1.24-00	1.73-02	2.77-04	2.45-04	1.91-04	9.12-05	2.64-05
ZR	.00	2.49-04	1.03-04	4.48-03	5.47-02	1.12-01	5.46-02	5.45-02	5.45-02	5.45-02	5.45-02
NB	.00	2.58-04	1.66-04	9.05-03	1.14-03	2.44-02	1.41-02	2.10-02	3.56-02	5.04-02	5.12-02
PO	.00	2.36-07	4.65-17	1.32-24	.00	.00	.00	.00	.00	.00	.00
TC	.00	2.05-07	1.97-13	1.97-13	1.97-13	1.97-13	1.97-13	1.97-13	1.97-13	1.97-13	1.97-13
CD	.00	2.44-03	1.16-15	4.32-25	.00	.00	.00	.00	.00	.00	.00
SM	.00	1.35-04	1.48-02	1.48-03	7.13-00	2.70-03	2.40-01	1.63-01	1.44-01	1.17-01	7.13-02
SB	.00	2.87-01	2.52-01	2.35-01	2.01-01	1.55-01	7.17-00	1.44-00	1.57-01	6.88-05	1.63-10
TE	.00	8.66-00	7.36-00	9.28-00	8.27-00	6.42-00	2.97-00	8.23-01	6.31-02	2.85-05	7.58-11
TOTALS	.00	4.13-05	6.78-04	2.67-04	8.02-03	4.40-03	2.41-03	1.28-03	8.50-02	6.52-02	4.49-02
SUBTOT	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TOTALS	.00	4.13-05	2.67-04	4.40-03	1.28-03	6.52-02					

TABLE B-6

QUANTITIES OF LIGHT ELEMENTS AND
MATERIALS OF CONSTRUCTION
PRESENT IN SPENT FUEL
VS. DECAY TIMES

POWER: 35.0MW, BURNUP: 20000-MWD, FUEL: 3.20-13M/CY#02-SEC

NUCLIDE CONCENTRATIONS, GRAMS
BASIS : MT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
H 1	.00	1.27-01	1.27-01	1.27-01	1.27-01	1.27-01	1.27-01	1.27-01	1.27-01	1.27-01	1.27-01
H 2	.00	5.32-05	5.32-05	5.32-05	5.32-05	5.32-05	5.32-05	5.32-05	5.32-05	5.32-05	5.32-05
H 3	.00	2.00-09	2.00-09	2.00-09	1.78-09	1.87-09	1.50-09	1.19-09	6.76-10	1.25-10	7.94-12
H 4	.00	1.68-25	1.68-25	1.68-25	1.68-25	1.68-25	1.68-25	1.68-25	1.68-25	1.68-25	1.68-25
HE 3	.00	2.02-11	2.02-11	7.12-11	1.35-10	2.43-10	5.38-10	9.21-10	1.43-09	1.99-09	2.10-09
HE 4	.00	6.48-01	6.48-01	6.48-01	6.48-01	6.48-01	6.48-01	6.48-01	6.48-01	6.48-01	6.48-01
HE 6	.00	7.64-16	.00	.00	.00	.00	.00	.00	.00	.00	.00
LI 6	.00	1.06-08	1.06-08	1.06-08	1.06-08	1.06-08	1.06-08	1.06-08	1.06-08	1.06-08	1.06-08
LI 7	.00	1.13-12	1.13-12	1.13-12	1.13-12	1.13-12	1.13-12	1.13-12	1.13-12	1.13-12	1.13-12
LI 8	.00	1.40-24	.00	.00	.00	.00	.00	.00	.00	.00	.00
BE 8	.00	6.50-31	.00	.00	.00	.00	.00	.00	.00	.00	.00
BE 9	.00	1.13-04	1.13-04	1.13-04	1.13-04	1.13-04	1.13-04	1.13-04	1.13-04	1.13-04	1.13-04
BE 10	.00	1.40-05	1.40-05	1.40-05	1.40-05	1.40-05	1.40-05	1.40-05	1.40-05	1.40-05	1.40-05
BE 11	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
B 10	.00	6.70-13	1.83-12	2.57-12	4.75-12	8.46-12	2.03-11	3.47-11	7.85-11	1.95-10	3.99-10
B 11	.00	7.71-13	7.71-13	7.71-13	7.71-13	7.71-13	7.71-13	7.71-13	7.71-13	7.71-13	7.71-13
B 12	.00	2.68-27	.00	.00	.00	.00	.00	.00	.00	.00	.00
C 12	1.06-02	1.06-02	1.06-02	1.06-02	1.06-02	1.06-02	1.06-02	1.06-02	1.06-02	1.06-02	1.06-02
C 13	1.18-00	3.25-00	3.25-00	3.25-00	3.25-00	3.25-00	3.25-00	3.25-00	3.25-00	3.25-00	3.25-00
C 14	.00	4.79-04	4.79-04	4.79-04	4.79-04	4.79-04	4.79-04	4.79-04	4.79-04	4.79-04	4.79-04
N 13	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
N 14	.00	2.90-06	4.33-04	5.44-04	6.64-04	1.45-07	3.19-07	6.08-07	1.14-06	2.97-06	5.79-06
N 15	.00	6.01-13	6.01-13	6.01-13	6.01-13	6.01-13	6.01-13	6.01-13	6.01-13	6.01-13	6.01-13
N 16	.00	1.73-09	.00	.00	.00	.00	.00	.00	.00	.00	.00
O 16	1.38-05	1.38-05	1.38-05	1.38-05	1.38-05	1.38-05	1.38-05	1.38-05	1.38-05	1.38-05	1.38-05
O 17	.00	4.94-00	4.94-00	4.94-00	4.94-00	4.94-00	4.94-00	4.94-00	4.94-00	4.94-00	4.94-00
O 18	.00	1.25-20	1.25-20	1.25-20	1.25-20	1.25-20	1.25-20	1.25-20	1.25-20	1.25-20	1.25-20
O 19	.00	2.42-33	.00	.00	.00	.00	.00	.00	.00	.00	.00
F 19	.00	3.23-33	5.65-33	5.65-33	5.65-33	5.65-33	5.65-33	5.65-33	5.65-33	5.65-33	5.65-33
F 20	.00	7.53-22	.00	.00	.00	.00	.00	.00	.00	.00	.00
NE 20	.00	7.17-16	7.17-16	7.17-16	7.17-16	7.17-16	7.17-16	7.17-16	7.17-16	7.17-16	7.17-16
NE 21	.00	4.77-18	4.77-18	4.77-18	4.77-18	4.77-18	4.77-18	4.77-18	4.77-18	4.77-18	4.77-18
NE 22	.00	1.81-08	1.81-08	1.81-08	1.81-08	1.81-08	1.81-08	1.81-08	1.81-08	1.81-08	1.81-08
NE 23	.00	3.41-15	.00	.00	.00	.00	.00	.00	.00	.00	.00
NA 22	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
NA 23	.00	1.43-09	1.43-09	1.43-09	1.43-09	1.43-09	1.43-09	1.43-09	1.43-09	1.43-09	1.43-09
NA 24	.00	1.24-14	.00	.00	.00	.00	.00	.00	.00	.00	.00
NA 25	.00	9.23-16	.00	.00	.00	.00	.00	.00	.00	.00	.00
NA 26	.00	3.56-12	3.56-12	3.56-12	3.56-12	3.56-12	3.56-12	3.56-12	3.56-12	3.56-12	3.56-12
NA 25	.00	7.68-04	7.68-04	7.68-04	7.68-04	7.68-04	7.68-04	7.68-04	7.68-04	7.68-04	7.68-04
NA 26	.00	3.40-04	3.40-04	3.40-04	3.40-04	3.40-04	3.40-04	3.40-04	3.40-04	3.40-04	3.40-04
NA 27	.00	6.41-11	.00	.00	.00	.00	.00	.00	.00	.00	.00
AL 27	.00	3.53-06	3.53-06	3.53-06	3.53-06	3.53-06	3.53-06	3.53-06	3.53-06	3.53-06	3.53-06
AL 28	.00	2.05-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
AL 29	.00	2.02-09	.00	.00	.00	.00	.00	.00	.00	.00	.00
SI 28	3.69-02	3.69-02	3.69-02	3.69-02	3.69-02	3.69-02	3.69-02	3.69-02	3.69-02	3.69-02	3.69-02
SI 29	1.83-01	1.83-01	1.83-01	1.83-01	1.83-01	1.83-01	1.83-01	1.83-01	1.83-01	1.83-01	1.83-01
SI 30	1.24-01	1.24-01	1.24-01	1.24-01	1.24-01	1.24-01	1.24-01	1.24-01	1.24-01	1.24-01	1.24-01
SI 31	.00	4.22-07	.00	.00	.00	.00	.00	.00	.00	.00	.00
P 31	.00	1.40-03	1.40-03	1.40-03	1.40-03	1.40-03	1.40-03	1.40-03	1.40-03	1.40-03	1.40-03
P 32	.00	1.30-08	1.30-08	1.30-08	1.30-08	1.30-08	1.30-08	1.30-08	1.30-08	1.30-08	1.30-08
P 33	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

POWER= 36.0mw, BURNUP= 20000.MWD, FLUX= 1.20E13#/CM2-SEC

NUCLIDE CONCENTRATIONS, GMS
BASIS = WT OF HEAVY METAL CHARGED TO REACTOR

	CHANGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	3. Y	10. Y	20. Y	30. Y	100. Y
P 34	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
S 32	.00	1.59E-07	1.72E-07	1.72E-07	1.72E-07	1.72E-07	1.72E-07	1.72E-07	1.72E-07	1.72E-07	1.72E-07
S 33	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
S 34	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
S 35	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
S 36	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
S 37	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CL 35	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CL 36	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CL 37	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CL 38	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AR 36	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AR 37	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AR 38	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AR 39	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AR 40	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AR 41	.00	5.99E-20	.00	.00	.00	.00	.00	.00	.00	.00	.00
K 39	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
H 40	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
H 41	.00	9.55E-27	9.56E-27	9.56E-27	9.56E-27	9.56E-27	9.56E-27	9.56E-27	9.56E-27	9.56E-27	9.56E-27
H 42	.00	1.51E-22	.00	.00	.00	.00	.00	.00	.00	.00	.00
H 43	.00	9.05E-27	.00	.00	.00	.00	.00	.00	.00	.00	.00
K 44	.00	2.84E-20	.00	.00	.00	.00	.00	.00	.00	.00	.00
CA 40	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CA 41	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CA 42	.00	2.68E-20	2.69E-20	2.69E-20	2.69E-20	2.69E-20	2.69E-20	2.69E-20	2.69E-20	2.69E-20	2.69E-20
CA 43	.00	3.29E-19	3.29E-19	3.29E-19	3.29E-19	3.29E-19	3.29E-19	3.29E-19	3.29E-19	3.29E-19	3.29E-19
CA 44	.00	2.78E-09	2.78E-09	2.78E-09	2.78E-09	2.78E-09	2.78E-09	2.78E-09	2.78E-09	2.78E-09	2.78E-09
CA 45	.00	2.08E-15	1.03E-15	1.06E-15	8.49E-16	9.68E-17	9.70E-19	9.52E-22	9.78E-28	.00	.00
CA 46	.00	8.97E-10	8.97E-10	8.97E-10	8.97E-10	8.97E-10	8.97E-10	8.97E-10	8.97E-10	8.97E-10	8.97E-10
CA 47	.00	5.50E-14	5.74E-20	1.28E-24	.00	.00	.00	.00	.00	.00	.00
CA 48	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CA 49	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SC 45	.00	1.28E-15	1.03E-15	2.30E-15	2.91E-15	3.26E-15	3.36E-15	3.36E-15	3.36E-15	3.36E-15	3.36E-15
SC 46	.00	6.66E-18	2.71E-18	1.24E-18	2.28E-19	1.11E-20	1.38E-24	3.65E-31	.00	.00	.00
SC 47	.00	2.73E-10	2.99E-18	6.03E-24	.00	.00	.00	.00	.00	.00	.00
SC 48	.00	1.50E-10	2.34E-25	7.18E-37	.00	.00	.00	.00	.00	.00	.00
SC 49	.00	5.97E-13	.00	.00	.00	.00	.00	.00	.00	.00	.00
SC 50	.00	1.79E-15	.00	.00	.00	.00	.00	.00	.00	.00	.00
TI 46	.00	3.73E-18	6.37E-28	7.35E-38	8.36E-38	8.36E-38	8.36E-38	8.36E-38	8.36E-38	8.36E-38	8.36E-38
TI 47	.00	3.41E-04	3.41E-04	3.41E-04	3.41E-04	3.41E-04	3.41E-04	3.41E-04	3.41E-04	3.41E-04	3.41E-04
TI 48	.00	3.09E-07	3.09E-07	3.09E-07	3.09E-07	3.09E-07	3.09E-07	3.09E-07	3.09E-07	3.09E-07	3.09E-07
TI 49	.00	1.48E-04	1.48E-04	1.48E-04	1.48E-04	1.48E-04	1.48E-04	1.48E-04	1.48E-04	1.48E-04	1.48E-04
TI 50	.00	3.46E-03	3.46E-03	3.46E-03	3.46E-03	3.46E-03	3.46E-03	3.46E-03	3.46E-03	3.46E-03	3.46E-03
TI 51	.00	1.73E-10	.00	.00	.00	.00	.00	.00	.00	.00	.00
V 49	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
V 50	.00	1.36E-02	1.36E-02	1.36E-02	1.36E-02	1.36E-02	1.36E-02	1.36E-02	1.36E-02	1.36E-02	1.36E-02
V 51	.00	2.83E-00	3.04E-00	3.04E-00	3.04E-00	3.04E-00	3.04E-00	3.04E-00	3.04E-00	3.04E-00	3.04E-00
V 52	.00	1.52E-07	.00	.00	.00	.00	.00	.00	.00	.00	.00
V 53	.00	6.61E-10	.00	.00	.00	.00	.00	.00	.00	.00	.00
V 54	.00	2.79E-12	.00	.00	.00	.00	.00	.00	.00	.00	.00
CR 50	1.67E-02	1.75E-02	1.75E-02	1.75E-02	1.75E-02	1.75E-02	1.75E-02	1.75E-02	1.75E-02	1.75E-02	1.75E-02

ISOTOPE CONCENTRATIONS, GRAMS
BASIS = MT OF HEAVY METAL CHARGED TO REACTOR

TERA CORPORATION

CONFID= 85.0000, ANOMUP= 25000.0000, FI ME= 1-20013042man01-556

higher concentrations. Such

BASES - RT OF HEAVY METAL CHARGE TO REACTOR

[illegible]

POWER: 35.00W, CURRENT: 20000.AMD, FLUX: 3.20E13W/CM^2-SEC

NUCLIDE CONCENTRATIONS, GRAMS
BASIS = MT OF HEAVY METAL CHARGED TO REACTOR

[illegible]

POWER= 35.00MW, BURUPP= 26000.MW, FLUX= 3.20E13W/CM^2-SEC

ELEMENT CONCENTRATIONS, CMRS
BASIS = MI OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
H	.00	1.27-01	1.27-01	1.27-01	1.27-01	1.27-01	1.27-01	1.27-01	1.27-01	1.27-01	1.27-01
HE	.00	6.48-01	6.48-01	6.48-01	6.48-01	6.48-01	6.48-01	6.48-01	6.48-01	6.48-01	6.48-01
LI	.00	1.06-08	1.06-08	1.06-08	1.06-08	1.06-08	1.06-08	1.06-08	1.06-08	1.06-08	1.06-08
BE	.00	1.27-04	1.27-04	1.27-04	1.27-04	1.27-04	1.27-04	1.27-04	1.27-04	1.27-04	1.27-04
B	.00	1.64-12	2.40-12	3.34-12	5.52-12	9.41-12	2.11-11	4.05-11	7.93-11	1.96-10	3.90-10
C	1.07+02	3.09+02	3.09+02	3.09+02	3.09+02	3.09+02	3.09+02	3.09+02	3.09+02	3.09+02	3.09+02
N	.00	3.07-06	4.33-08	5.44-08	8.44-06	1.45-07	3.19-07	4.04-07	1.14-06	2.97-06	5.39-06
O	1.34+05	1.34+05	1.34+05	1.34+05	1.34+05	1.34+05	1.34+05	1.34+05	1.34+05	1.34+05	1.34+05
F	.00	1.33-22	5.45-33	5.65-33	5.65-33	5.65-33	5.65-33	5.65-33	5.65-33	5.65-33	5.65-33
NE	.00	1.81-08	1.81-08	1.81-08	1.81-08	1.81-08	1.81-08	1.81-08	1.81-08	1.81-08	1.81-08
NA	.00	1.43-09	1.43-09	1.43-09	1.43-09	1.43-09	1.43-09	1.43-09	1.43-09	1.43-09	1.43-09
MG	.00	1.11-03	1.11-03	1.11-03	1.11-03	1.11-03	1.11-03	1.11-03	1.11-03	1.11-03	1.11-03
AL	.00	3.55-06	3.55-06	3.55-06	3.55-06	3.55-06	3.55-06	3.55-06	3.55-06	3.55-06	3.55-06
SI	4.00+02	4.00+02	4.00+02	4.00+02	4.00+02	4.00+02	4.00+02	4.00+02	4.00+02	4.00+02	4.00+02
P	.00	1.40-03	1.40-03	1.40-03	1.40-03	1.40-03	1.40-03	1.40-03	1.40-03	1.40-03	1.40-03
S	.00	1.59-07	1.72-07	1.72-07	1.72-07	1.72-07	1.72-07	1.72-07	1.72-07	1.72-07	1.72-07
K	.00	9.56-17	9.56-17	9.56-17	9.56-17	9.56-17	9.56-17	9.56-17	9.56-17	9.56-17	9.56-17
CA	.00	3.67-09	3.67-09	3.67-09	3.67-09	3.67-09	3.67-09	3.67-09	3.67-09	3.67-09	3.67-09
SC	.00	3.73-10	1.94-15	2.30-15	2.91-15	3.26-15	3.36-15	3.36-15	3.36-15	3.36-15	3.36-15
TI	.00	4.55-03	4.55-03	4.55-03	4.55-03	4.55-03	4.55-03	4.55-03	4.55-03	4.55-03	4.55-03
V	.00	2.84+00	3.05+00	3.07+00	3.07+00	3.07+00	3.07+00	3.07+00	3.07+00	3.07+00	3.07+00
CR	4.10+03	4.10+03	4.10+03	4.10+03	4.10+03	4.10+03	4.10+03	4.10+03	4.10+03	4.10+03	4.10+03
MN	2.16+03	2.12+03	2.12+03	2.12+03	2.12+03	2.12+03	2.12+03	2.12+03	2.12+03	2.12+03	2.12+03
FE	1.52+04	1.52+04	1.52+04	1.52+04	1.52+04	1.52+04	1.52+04	1.52+04	1.52+04	1.52+04	1.52+04
CO	.00	2.87+00	2.36+00	2.38+00	2.81+00	1.98+00	1.95+00	1.93+00	1.92+00	1.93+00	1.97+00
NJ	2.82+04	2.82+04	2.82+04	2.82+04	2.82+04	2.82+04	2.82+04	2.82+04	2.82+04	2.82+04	2.82+04
CU	.00	4.72-01	5.00-01	5.22-01	5.87-01	7.00-01	8.04+00	1.58+00	2.64+00	5.25+00	8.53+00
ZN	.00	7.98-04	7.98-04	7.98-04	7.98-04	7.98-04	7.98-04	7.98-04	7.98-04	7.98-04	7.98-04
SR	.00	1.19-01	1.18-01	1.18-01	1.18-01	1.18-01	1.18-01	1.18-01	1.18-01	1.18-01	1.18-01
Y	.00	4.30-03	1.33-03	5.87-04	5.18-05	6.99-07	5.10-10	4.44-10	3.51-10	1.66-10	4.44-11
ZR	2.30+05	2.30+05	2.30+05	2.30+05	2.30+05	2.30+05	2.30+05	2.30+05	2.30+05	2.30+05	2.30+05
MO	.00	6.57-01	4.22-01	2.30-01	2.90-02	6.49-04	5.46+05	1.06-04	2.04-04	4.89-04	9.70-04
NO	.00	5.27+00	6.27+00	6.71+00	7.11+00	7.17+00	7.17+00	7.17+00	7.17+00	7.17+00	7.17+00
IC	.00	1.09-11	1.14-11	1.14-11	1.14-11	1.14-11	1.14-11	1.14-11	1.14-11	1.14-11	1.14-11
CD	.00	1.51-07	1.58-07	1.58-07	1.58-07	1.58-07	1.58-07	1.58-07	1.58-07	1.58-07	1.58-07
SN	3.47+03	3.47+03	3.47+03	3.47+03	3.47+03	3.47+03	3.47+03	3.47+03	3.47+03	3.47+03	3.47+03
SB	.00	6.77-01	6.77-01	6.76-01	6.73-01	6.69-01	6.63-01	6.56-01	6.55-01	6.56-01	6.57-01
TE	.00	5.44-03	7.05-03	8.18-03	1.11-02	1.54-02	2.33-02	2.82-02	2.99-02	3.00-02	3.00-02
TOTALS	4.18+05	4.18+05	4.18+05	4.18+05	4.18+05	4.18+05	4.18+05	4.18+05	4.18+05	4.18+05	4.18+05
SUBTOT	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TOTALS	4.18+05	4.18+05	4.18+05	4.18+05	4.18+05	4.18+05	4.18+05	4.18+05	4.18+05	4.18+05	4.18+05

POWER= 35.00MW, BURNUP= 20000.MWD, FLUX= 3.20*10¹³N/CM²-SEC

ELEMENT CONCENTRATIONS, GMS
BASIS = KG OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	C. Y	2. Y	10. Y	50. Y
H	.00	1.27-01	1.27-01	1.27-01	1.27-01	1.27-01
HE	.00	6.48-01	6.48-01	6.48-01	6.48-01	6.48-01
LI	.00	1.06-08	1.06-08	1.06-08	1.06-08	1.06-08
BE	.00	1.27-04	1.27-04	1.27-04	1.27-04	1.27-04
B	.00	1.64-12	3.34-12	9.48-12	4.05-11	1.96-10
C	1.07+02	1.09+02	1.09+02	1.09+02	1.09+02	1.09+02
N	.00	3.07-08	5.44-08	1.45-07	6.08-07	2.42-06
O	1.34+05	1.34+05	1.34+05	1.34+05	1.34+05	1.34+05
F	.00	7.53-22	5.65-33	5.65-33	5.65-33	5.65-33
NE	.00	1.81-08	1.81-08	1.81-08	1.81-08	1.81-08
NA	.00	1.93-09	1.93-09	1.93-09	1.93-09	1.93-09
MG	.00	1.11-07	1.11-03	1.11-03	1.11-03	1.11-03
AL	.00	3.55-06	3.55-06	3.55-06	3.55-06	3.55-06
SI	4.00+02	4.00+02	4.00+02	4.00+02	4.00+02	4.00+02
P	.00	1.40-03	3.40-03	1.40-03	1.40-03	1.40-03
S	.00	1.72-07	1.72-07	1.72-07	1.72-07	1.72-07
K	.00	9.56-17	9.56-17	9.56-17	9.56-17	9.56-17
CA	.00	3.67-09	3.67-09	3.67-09	3.67-09	3.67-09
SC	.00	3.73-10	3.73-15	3.73-15	3.73-15	3.73-15
TI	.00	4.55-03	4.55-03	4.55-03	4.55-03	4.55-03
V	.00	2.04+00	3.07+00	3.07+00	3.07+00	3.07+00
CR	4.10+03	4.10+03	4.10+03	4.10+03	4.10+03	4.10+03
MN	2.12+03	2.12+03	2.12+03	2.12+03	2.12+03	2.12+03
FE	1.52+04	1.52+04	1.52+04	1.52+04	1.52+04	1.52+04
CO	.00	2.87+00	2.88+00	1.98+00	1.93+00	1.93+00
NI	2.87+04	2.87+04	2.87+04	2.87+04	2.87+04	2.87+04
CU	.00	4.72-01	5.22-01	7.00-01	1.58+00	5.25+00
ZN	.00	7.98-04	7.98-04	7.98-04	7.98-04	7.98-04
SR	.00	1.18-01	1.18-01	1.18-01	1.18-01	1.18-01
Y	.00	6.30-03	5.82-04	6.49-07	4.49-10	1.68-10
ZR	2.30+05	2.30+05	2.30+05	2.30+05	2.30+05	2.30+05
NB	.00	6.57-01	4.30-03	6.44-04	1.06-04	4.49-04
MO	.00	5.27+05	6.71+00	7.13+00	7.17+00	7.17+00
TC	.00	1.09-11	1.16-11	1.16-11	1.16-11	1.16-11
CD	.00	1.41-07	1.58-07	1.58-07	1.58-07	1.58-07
SN	1.47+03	3.47+03	3.47+03	3.47+03	3.47+03	3.47+03
SB	.00	6.77-01	6.76-01	6.69-01	4.56-01	6.56-01
TE	.00	5.46-05	6.18-05	1.54-02	2.82-02	3.00-02
TOTALS	4.18+05	4.18+05	4.18+05	4.18+05	4.18+05	4.18+05

APPENDIX C
ORIGEN CALCULATIONS
Power 35.00 MW/MTU
Burnup 25,000 MWD/MTU

TERA CORPORATION

TABLE C-1

ACTIVITIES OF FISSION PRODUCTS IN SPENT FUEL VS. DECAY TIMES

PCOVER= 35.00MB. BURNUP= 25000.MWD. FLUX= 3.26E 13N/CM**2-SEC

NUCLIDE RADIOACTIVITY CURIES
BASIS = MT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	30. D	90. D	180. D	365. D	3653. D
SE 79	0.0	2.97E-01	2.97E-01	2.97E-01	2.97E-01	2.97E-01	2.97E-01
KR 85	0.0	7.87E-03	7.83E-03	7.74E-03	7.65E-03	7.58E-03	7.52E-03
NR 85	0.0	6.31E-02	1.74E-02	1.87E-01	1.39E-00	6.80E-04	0.0
SR 89	0.0	6.47E-05	6.39E-05	2.88E-05	1.12E-05	7.30E-03	6.40E-16
SR 90	0.0	6.40E-04	6.38E-04	6.36E-04	6.33E-04	6.24E-04	5.00E-04
T 90	0.0	6.65E-04	6.38E-04	6.36E-04	6.33E-04	6.24E-04	5.00E-04
T 91	0.0	1.23E-06	6.65E-03	4.25E-05	1.86E-05	1.64E-04	2.13E-13
ZR 93	0.0	2.31E-00	2.31E-00	2.31E-00	2.31E-00	2.31E-00	2.31E-00
ZR 95	0.0	1.67E-06	1.22E-04	6.44E-05	3.07E-05	3.51E-04	2.73E-11
NB 93M	0.0	1.27E-01	1.37E-01	1.56E-01	1.78E-01	2.43E-01	1.03E-00
NB 95	0.0	1.69E-06	1.56E-06	1.07E-06	5.61E-05	7.42E-04	5.88E-11
NB 95M	0.0	2.07E-04	1.54E-04	8.18E-03	3.90E-03	4.46E-02	3.48E-13
TC 99	0.0	1.11E-01	1.11E-01	1.11E-01	1.11E-01	1.11E-01	1.11E-01
RU103	0.0	1.55E-06	9.15E-05	3.20E-05	9.39E-04	2.60E-03	2.63E-22
RU108	0.0	6.18E-05	9.15E-05	3.33E-05	3.09E-05	2.10E-05	6.38E-02
RM103M	0.0	1.55E-06	9.15E-05	3.20E-05	9.40E-04	2.60E-03	2.63E-22
RM108	0.0	6.34E-05	9.15E-05	3.53E-05	3.09E-05	2.10E-05	4.38E-02
PD107	0.0	7.13E-02	7.13E-02	7.13E-02	7.13E-02	7.13E-02	7.13E-02
AG110	0.0	5.59E-04	5.14E-04	4.36E-04	3.59E-04	2.05E-04	2.42E-00
AG111	0.0	4.92E-04	3.05E-03	1.18E-01	1.74E-02	9.63E-11	0.0
CO113M	0.0	2.06E-01	2.05E-01	2.03E-01	2.01E-01	1.96E-01	1.26E-01
CO115M	0.0	1.05E-03	6.57E-02	2.59E-02	8.71E-01	3.60E-00	2.32E-22
IN114	0.0	4.46E-00	1.98E-00	8.54E-01	3.21E-01	1.82E-02	1.87E-22
IN114M	0.0	3.12E-00	2.05E-00	8.85E-01	3.32E-01	1.88E-02	1.44E-22
SN117M	0.0	3.65E-01	7.81E-00	4.01E-01	1.25E-02	4.82E-01	0.0
SN119M	0.0	7.92E-01	7.28E-01	6.14E-01	5.04E-01	2.82E-01	2.58E-03
SN121M	0.0	1.16E-01	1.16E-01	1.16E-01	1.16E-01	1.15E-01	1.01E-01
SN123	0.0	4.35E-03	3.72E-03	2.69E-03	1.85E-03	6.15E-02	1.32E-05
SN125	0.0	9.71E-03	1.13E-03	1.51E-01	9.92E-02	4.04E-08	0.0
SN126	0.0	4.01E-01	4.01E-01	4.01E-01	4.01E-01	4.01E-01	4.01E-01
SB124	0.0	2.65E-02	1.87E-02	9.39E-01	4.19E-01	3.96E-00	1.44E-16
SB125	0.0	7.27E-03	7.20E-03	6.92E-03	6.59E-03	5.71E-03	5.81E-02
SB126	0.0	6.41E-02	1.20E-02	4.24E-00	1.40E-01	5.62E-02	5.62E-02
SB129M	0.0	9.09E-02	4.01E-01	4.01E-01	4.01E-01	4.01E-01	4.01E-01
TE123M	0.0	2.40E-01	2.02E-01	1.43E-01	9.52E-02	2.90E-02	1.56E-10
TE125M	0.0	1.45E-03	1.51E-03	1.57E-03	1.56E-03	1.39E-03	1.42E-02
TE127	0.0	9.12E-04	1.18E-04	7.88E-03	5.00E-03	3.36E-03	1.13E-06
TE127M	0.0	1.36E-04	1.17E-04	7.96E-03	5.10E-03	1.39E-03	1.16E-06
TE129	0.0	2.97E-05	2.78E-04	8.00E-03	1.87E-03	2.66E-01	0.0
TE129M	0.0	8.11E-04	4.37E-04	1.26E-04	2.95E-03	4.19E-01	0.0
I129	0.0	2.33E-02	2.36E-02	2.37E-02	2.38E-02	2.38E-02	2.38E-02
I131	0.0	9.63E-05	7.40E-04	4.24E-02	1.02E-00	2.15E-08	0.0
XE131M	0.0	6.02E-03	2.49E-03	1.05E-02	1.92E-00	1.39E-05	0.0
XE133	0.0	1.98E-06	5.21E-04	2.01E-01	2.09E-03	4.52E-15	0.0
CS134	0.0	1.62E-05	1.57E-05	1.49E-05	1.40E-05	1.16E-05	5.59E-03
CS135	0.0	2.68E-01	2.68E-01	2.69E-01	2.68E-01	2.68E-01	2.68E-01
CS136	0.0	4.88E-04	9.65E-03	4.02E-02	9.61E-00	1.72E-04	0.0
CS137	0.0	6.32E-04	6.30E-04	2.27E-04	8.23E-04	8.13E-04	6.61E-04
BA136M	0.0	7.80E-03	1.58E-03	6.43E-01	1.54E-05	2.75E-05	0.0
BA137M	0.0	7.90E-04	7.85E-04	7.82E-04	7.79E-04	7.69E-04	6.25E-04
BA140	0.0	1.72E-06	3.38E-05	1.31E-04	2.95E-02	4.41E-03	0.0
LA140	0.0	1.76E-06	3.89E-05	1.51E-04	3.39E-02	5.08E-03	0.0
CE141	0.0	1.64E-06	6.68E-05	2.42E-05	5.44E-04	4.90E-02	0.0
CE144	0.0	1.17E-06	1.09E-06	9.38E-05	7.91E-05	4.80E-05	1.61E-02
PR143	0.0	1.48E-06	3.56E-05	1.86E-04	4.66E-02	1.33E-02	0.0
PR144	0.0	1.18E-06	1.09E-06	9.38E-05	7.61E-05	4.80E-05	1.61E-02
PR144M	0.0	3.40E-06	1.30E-06	1.13E-04	9.61E-03	5.76E-03	1.93E-00
ND147	0.0	6.68E-05	1.01E-05	2.29E-03	2.77E-01	6.72E-05	0.0
ND154	0.0	1.57E-06	2.43E-03	1.11E-02	2.12E-02	2.23E-10	0.0
PM147	0.0	1.96E-05	1.10E-05	1.05E-05	1.01E-05	6.73E-04	9.09E-03
PM148	0.0	2.15E-05	6.13E-03	6.30E-02	1.94E-02	6.22E-00	4.75E-24
PM148M	0.0	4.13E-04	2.49E-04	9.11E-03	2.81E-03	9.01E-01	9.79E-23
PM154	0.0	4.56E-04	2.43E-03	1.12E-01	2.12E-02	2.23E-10	0.0
SM151	0.0	9.80E-02	9.80E-02	9.84E-02	9.83E-02	9.79E-02	9.15E-02
EU152	0.0	6.06E-00	8.02E-00	7.95E-00	7.87E-00	7.64E-00	4.73E-00
EU154	0.0	6.90E-03	6.85E-03	6.76E-03	6.66E-03	6.37E-03	3.08E-03
EU155	0.0	1.60E-03	1.58E-03	1.55E-03	1.50E-03	1.39E-03	3.78E-02
EU156	0.0	1.43E-05	9.85E-04	2.36E-03	9.70E-01	8.44E-03	0.0
GD153	0.0	1.44E-01	1.32E-02	1.11E-01	9.07E-00	5.03E-00	3.90E-04
YD160	0.0	8.44E-02	6.33E-02	3.55E-02	1.82E-02	2.35E-01	5.24E-13
SUMTOT	0.0	2.40E-07	1.21E-07	6.62E-06	4.25E-06	2.06E-06	2.53E-05
TOTALS	0.0	1.45E-05	1.21E-07	6.62E-06	4.25E-06	2.06E-06	2.53E-05

TABLE C-2

QUANTITIES OF FISSION PRODUCTS IN SPENT FUEL VS. DECAY TIMES

POWER = 35.00MW, BURNUP = 25000.MWD, FLUX = 3.26E 13N/CMM2-SEC

NUCLIDE CONCENTRATIONS, GRAMS
BASIS = MT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	30. D	90. D	180. D	365. D	3653. D
GE 72	0.0	4.01E-03	4.04E-03	4.04E-03	4.04E-03	4.04E-03	4.04E-03
GE 73	0.0	1.17E-02	1.17E-02	1.17E-02	1.17E-02	1.17E-02	1.17E-02
GE 74	0.0	3.36E-02	3.36E-02	3.36E-02	3.36E-02	3.36E-02	3.36E-02
GE 76	0.0	2.77E-01	2.77E-01	2.77E-01	2.77E-01	2.77E-01	2.77E-01
AS 75	0.0	9.53E-02	9.53E-02	9.53E-02	9.53E-02	9.53E-02	9.53E-02
SE 76	0.0	1.55E-03	1.56E-03	1.56E-03	1.56E-03	1.56E-03	1.56E-03
SE 77	0.0	6.42E-01	6.45E-01	6.45E-01	6.45E-01	6.45E-01	6.45E-01
SE 78	0.0	1.60E 00	1.60E 00	1.60E 00	1.60E 00	1.60E 00	1.60E 00
SE 79	0.0	4.26E 00	4.26E 00	4.26E 00	4.26E 00	4.26E 00	4.26E 00
SE 80	0.0	1.05E 01	1.05E 01	1.05E 01	1.05E 01	1.05E 01	1.05E 01
SE 82	0.0	2.68E 01	2.68E 01	2.68E 01	2.68E 01	2.68E 01	2.68E 01
BR 81	0.0	1.74E 01	1.74E 01	1.74E 01	1.74E 01	1.74E 01	1.74E 01
KR 82	0.0	5.03E-01	5.06E-01	5.06E-01	5.06E-01	5.06E-01	5.06E-01
KR 83	0.0	3.42E 01	3.42E 01	3.42E 01	3.42E 01	3.42E 01	3.42E 01
KR 84	0.0	8.46E 01	8.46E 01	8.46E 01	8.46E 01	8.46E 01	8.46E 01
KR 85	0.0	2.01E 01	2.00E 01	1.97E 01	1.95E 01	1.88E 01	1.65E 01
KR 86	0.0	1.49E 02	1.49E 02	1.49E 02	1.49E 02	1.49E 02	1.49E 02
RB 85	0.0	8.03E 01	8.04E 01	8.06E 01	8.09E 01	8.16E 01	8.99E 01
RU 87	0.0	1.95E 02	1.95E 02	1.95E 02	1.95E 02	1.95E 02	1.95E 02
SR 85	0.0	8.68E-02	9.12E-02	9.31E-02	9.33E-02	9.33E-02	9.33E-02
SR 87	0.0	1.05E-03	1.05E-03	1.05E-03	1.05E-03	1.05E-03	1.05E-03
SR 88	0.0	2.82E 02	2.82E 02	2.82E 02	2.82E 02	2.82E 02	2.82E 02
SR 89	0.0	3.39E 01	2.25E 01	1.01E 01	3.98E 00	2.59E-01	2.41E-20
SR 90	0.0	4.52E 02	4.51E 02	4.50E 02	4.47E 02	4.41E 02	3.53E 02
Y 89	0.0	3.43E 02	3.54E 02	3.66E 02	3.72E 02	3.76E 02	3.76E 02
Y 90	0.0	1.22E-01	1.17E-01	1.17E-01	1.16E-01	1.15E-01	9.22E-02
Y 91	0.0	5.00E 01	3.53E 01	1.74E 01	7.59E 00	6.71E-01	8.69E-16
ZR 90	0.0	1.21E 01	1.30E 01	1.49E 01	1.70E 01	2.31E 01	1.11E 02
ZR 91	0.0	4.34E 02	4.49E 02	4.67E 02	4.76E 02	4.81E 02	4.84E 02
ZR 92	0.0	5.13E 02	5.13E 02	5.13E 02	5.13E 02	5.13E 02	5.13E 02
ZR 93	0.0	5.69E 02	5.70E 02	5.70E 02	5.70E 02	5.70E 02	5.70E 02
ZR 94	0.0	6.08E 02	6.08E 02	6.08E 02	6.08E 02	6.08E 02	6.08E 02
ZR 95	0.0	7.95E 01	5.79E 01	3.07E 01	1.46E 01	1.07E 00	1.30E-15
ZR 96	0.0	6.28E 02	6.28E 02	6.28E 02	6.28E 02	6.28E 02	6.28E 02
MB 95	0.0	4.30E 01	3.99E 01	2.72E 01	1.48E 01	1.89E 00	1.50E-15
NR 95M	0.0	5.42E-02	4.05E-02	2.15E-02	1.02E-02	1.17E-03	9.09E-19
MO 95	0.0	4.90E 02	5.14E 02	5.44E 02	5.83E 02	6.09E 02	6.12E 02
MO 96	0.0	1.93E 01	1.93E 01	1.93E 01	1.93E 01	1.93E 01	1.93E 01
MO 97	0.0	6.28E 02	6.29E 02	6.29E 02	6.29E 02	6.29E 02	6.29E 02
MO 98	0.0	6.38E 02	6.38E 02	6.38E 02	6.38E 02	6.38E 02	6.38E 02
MO100	0.0	7.27E 02	7.27E 02	7.27E 02	7.27E 02	7.27E 02	7.27E 02
TC 99	0.0	6.49E 02	6.53E 02	6.53E 02	6.53E 02	6.53E 02	6.53E 02
RU 99	0.0	2.10E-03	2.27E-03	2.62E-03	3.03E-03	4.23E-03	2.35E-02
RU100	0.0	3.07E 01	3.07E 01	3.07E 01	3.07E 01	3.07E 01	3.07E 01
RU101	0.0	5.93E 02	5.93E 02	5.93E 02	5.93E 02	5.93E 02	5.93E 02
RU102	0.0	5.72E 02	5.72E 02	5.72E 02	5.72E 02	5.72E 02	5.72E 02
RU103	0.0	4.83E 01	2.86E 01	5.99E 00	2.93E 00	8.10E-02	8.22E-27
RU104	0.0	3.80E 02	3.80E 02	3.80E 02	3.80E 02	3.80E 02	3.80E 02

TABLE C-2

(CONT.)

POWER= 35.00W. BURNUP= 25000.#WD. FLUX= 3.26E 13W/CM**2-SEC

NUCLIDE CONCENTRATIONS, GRAMS
BASIS 1 MT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	30. D	90. D	180. D	365. D	3653. D
RU106	0.0	1.25E 02	1.18E 02	1.04E 02	9.24E 01	6.30E 01	1.31E-01
RH103	0.0	3.23E 02	3.43E 02	3.61E 02	3.68E 02	3.71E 02	3.71E 02
RH103M	0.0	4.74E-02	2.81E-02	9.82E-03	2.88E-03	7.97E-05	4.08E-10
PD104	0.0	1.48E 02	1.48E 02	1.48E 02	1.48E 02	1.48E 02	1.48E 02
PD105	0.0	2.08E 02	2.09E 02	2.09E 02	2.09E 02	2.09E 02	2.09E 02
PD106	0.0	1.70E 02	1.77E 02	1.90E 02	2.03E 02	2.32E 02	2.95E 02
PD107	0.0	1.39E 02	1.39E 02	1.39E 02	1.39E 02	1.39E 02	1.39E 02
PD108	0.0	9.11E 01	9.11E 01	9.11E 01	9.11E 01	9.11E 01	9.11E 01
PD110	0.0	2.64E 01	2.64E 01	2.64E 01	2.64E 01	2.64E 01	2.64E 01
AG109	0.0	4.22E 01	4.24E 01	4.24E 01	4.24E 01	4.24E 01	4.24E 01
AG110	0.0	1.18E 01	1.09E 01	9.85E 00	7.63E 00	6.34E 00	5.13E-04
CD110	0.0	7.80E 00	9.73E 00	1.04E 01	1.29E 01	1.53E 01	1.96E 01
CD111	0.0	1.27E 01	1.30E 01	1.31E 01	1.31E 01	1.31E 01	1.31E 01
CD112	0.0	5.49E 00	5.70E 00	5.70E 00	5.70E 00	5.70E 00	5.70E 00
CD113	0.0	2.04E-01	2.06E-01	2.06E-01	2.06E-01	2.06E-01	2.06E-01
CD113M	0.0	9.48E-02	9.45E-02	6.37E-02	9.29E-02	5.04E-02	5.90E-32
CD114	0.0	7.09E 00	7.09E 00	7.09E 00	7.09E 00	7.09E 00	7.09E 00
CD115M	0.0	4.11E-02	2.58E-02	1.02E-02	3.42E-03	1.41E-04	9.09E-27
CD116	0.0	2.49E 00	2.49E 00	2.49E 00	2.49E 00	2.49E 00	2.49E 00
IN113	0.0	2.86E-03	3.23E-03	3.97E-03	4.82E-03	7.26E-03	3.87E-02
IN115	0.0	9.87E-01	1.02E 00	1.03E 00	1.04E 00	1.04E 00	1.04E 00
SN115	0.0	8.37E-02	8.42E-02	8.42E-02	8.42E-02	8.42E-02	8.42E-02
SN116	0.0	1.52E 00	1.52E 00	1.52E 00	1.52E 00	1.52E 00	1.52E 00
SN117	0.0	2.51E 00	2.51E 00	2.51E 00	2.51E 00	2.51E 00	2.51E 00
SN118	0.0	2.65E 00	2.65E 00	2.65E 00	2.65E 00	2.65E 00	2.65E 00
SN119	0.0	2.59E 00	2.59E 00	2.59E 00	2.60E 00	2.60E 00	2.61E 00
SN119M	0.0	1.77E-02	1.62E-02	1.37E-02	1.12E-02	6.30E-03	5.76E-37
SN120	0.0	2.70E 00	2.70E 00	2.70E 00	2.70E 00	2.70E 00	2.70E 00
SN121M	0.0	1.97E-03	1.96E-03	1.96E-03	1.95E-03	1.94E-03	1.71E-03
SN122	0.0	3.01E 00	3.01E 00	3.01E 00	3.01E 00	3.01E 00	3.01E 00
SN123	0.0	5.30E-01	4.51E-01	3.27E-01	2.25E-01	7.47E-02	1.60E-09
SN124	0.0	4.61E 00	4.61E 00	4.61E 00	4.61E 00	4.61E 00	4.61E 00
SN125	0.0	1.41E 01	1.41E 01	1.41E 01	1.41E 01	1.41E 01	1.41E 01
SB121	0.0	2.73E 00	2.74E 00	2.74E 00	2.74E 00	2.74E 00	2.74E 00
SB123	0.0	2.89E 00	2.87E 00	3.09E 00	3.19E 00	3.34E 00	3.42E 00
SB124	0.0	1.51E-02	1.07E-02	5.37E-03	2.40E-03	2.26E-04	8.21E-21
SB125	0.0	6.94E 00	6.87E 00	6.60E 00	6.29E 00	5.45E 00	5.55E-01
TE122	0.0	1.33E-01	1.34E-01	1.34E-01	1.34E-01	1.34E-01	1.34E-01
TE124	0.0	5.02E-02	5.46E-02	6.00E-02	6.29E-02	6.51E-02	6.53E-02
TE125	0.0	1.48E 00	1.42E 00	1.90E 00	2.21E 00	3.06E 00	8.03E 00
TE125M	0.0	8.02E-02	8.40E-02	8.70E-02	8.64E-02	7.72E-02	7.88E-03
TE126	0.0	3.76E-01	3.82E-01	3.84E-01	3.84E-01	3.84E-01	3.85E-01
TE127	0.0	3.45E-02	4.47E-03	2.95E-03	1.89E-03	5.14E-04	4.29E-13
TE127M	0.0	1.44E 00	1.24E 00	8.44E-01	5.41E-01	1.47E-01	1.22E-10
TE128	0.0	7.35E 01	7.35E 01	7.35E 01	7.35E 01	7.35E 01	7.35E 01
TE129M	0.0	2.68E 00	1.44E 00	4.15E 01	9.72E-02	1.38E-03	0.0
TE130	0.0	2.60E 02	2.60E 02	2.60E 02	2.60E 02	2.60E 02	2.60E 02
I127	0.0	3.13E 01	3.19E 01	3.23E 01	3.26E 01	3.30E 01	3.31E 01

TABLE C-2

(CONT.)

POWER = 35.00MW, BURNUP = 25000.MWD, FLUX = 3.25E 13N/CM2-SEC

NUCLIDE CONCENTRATIONS, GRAMS
BASIS = MT OF HEAVY METAL CHARGED TO REACTOR

CHARGE	DISCHARGE	30. D	90. D	180. D	265. D	2653. D
KE129 0.0	1.34E 02	1.35E 02	1.34E 02	1.36E 02	1.34E 02	1.36E 02
KE129 0.0	1.72E 00	1.72E 00	1.72E 00	1.72E 00	1.72E 00	1.72E 00
KE129 0.0	2.01E -03	2.04E -03	2.07E -03	2.07E -03	2.07E -03	2.13E -03
KE130 0.0	2.99E -01	3.00E -01	3.00E -01	3.00E -01	3.00E -01	3.00E -01
KE131 0.0	3.20E 02	3.35E 02	3.36E 02	3.36E 02	3.36E 02	3.36E 02
KE132 0.0	6.03E 02	6.08E 02	6.08E 02	6.08E 02	6.08E 02	6.08E 02
KE134 0.0	1.14E 03	1.14E 03	1.14E 03	1.14E 03	1.14E 03	1.14E 03
KE136 0.0	1.70E 03	1.70E 03	1.78E 03	1.78E 03	1.78E 03	1.78E 03
CS133 0.0	6.43E 02	6.49E 02	6.50E 02	6.50E 02	6.50E 02	6.50E 02
CS134 0.0	1.23E 02	1.21E 02	1.18E 02	1.08E 02	8.92E 01	4.32E 00
CS135 0.0	2.32E 02	2.33E 02	2.33E 02	2.33E 02	2.33E 02	2.33E 02
CS137 0.0	9.59E 02	9.67E 02	9.64E 02	9.49E 02	9.37E 02	7.62E 02
BA134 0.0	2.04E 01	3.20E 01	3.65E 01	6.57E 01	6.42E 01	1.49E 02
BA135 0.0	1.05E -02	1.05E -02	1.04E -02	1.04E -02	1.04E -02	1.12E -02
BA136 0.0	1.28E 01	1.33E 01	1.34E 01	1.34E 01	1.34E 01	1.34E 01
BA137 0.0	2.18E 01	2.34E 01	2.72E 01	3.14E 01	4.26E 01	2.19E 02
BA138 0.0	9.94E 02	9.94E 02	9.94E 02	9.94E 02	9.94E 02	9.94E 02
BA140 0.0	2.36E 01	4.43E 01	1.79E -01	4.04E -03	6.05E -08	0.00
LA138 0.0	7.19E -03	7.19E -03	7.19E -03	7.19E -03	7.19E -03	7.19E -03
LA139 0.0	9.58E 02	9.58E 02	9.58E 02	9.58E 02	9.58E 02	9.58E 02
CE140 0.0	9.81E 02	9.82E 02	9.88E 02	9.84E 02	9.88E 02	9.88E 02
CE141 0.0	5.73E 01	3.05E 01	6.49E 00	1.91E 00	2.42E -02	0.00
CE142 0.0	6.90E 02	6.91E 02	6.91E 02	6.91E 02	6.91E 02	6.91E 02
CE144 0.0	3.64E 02	3.40E 02	2.94E 02	2.48E 02	1.80E 02	5.04E -02
PR141 0.0	6.30E 02	6.57E 02	6.79E 02	6.83E 02	6.87E 02	6.87E 02
PR143 0.0	2.19E 01	5.29E 00	2.47E -01	6.93E -03	1.98E -07	0.00
PR144 0.0	1.56E -02	1.44E -02	1.24E -02	1.05E -02	6.35E -03	2.13E -06
ND142 0.0	1.03E 01	1.03E 01	1.03E 01	1.03E 01	1.03E 01	1.03E 01
ND143 0.0	6.78E 02	6.97E 02	7.02E 02	7.02E 02	7.02E 02	7.02E 02
ND144 0.0	6.03E 02	6.20E 02	6.75E 02	7.21E 02	8.18E 02	9.40E 02
ND145 0.0	5.49E 02	5.49E 02	5.49E 02	5.49E 02	5.49E 02	5.49E 02
ND146 0.0	6.13E 02	5.13E 02	6.13E 02	6.13E 02	6.13E 02	5.13E 02
ND146 0.0	2.82E 02	2.82E 02	2.82E 02	2.82E 02	2.82E 02	2.82E 02
ND150 0.0	1.31E 02	1.31E 02	1.31E 02	1.31E 02	1.31E 02	1.31E 02
PM147 0.0	1.14E 02	1.19E 02	1.15E 02	1.09E 02	9.41E 01	8.72E 00
PM148 0.0	1.31E 00	3.73E -02	3.84E -03	1.18E -03	3.76E -05	4.11E -29
PM148 0.0	1.93E 00	1.17E 00	4.26E -01	1.32E -01	4.22E -03	4.58E -27
SM147 0.0	3.41E 01	3.67E 01	4.18E 01	4.74E 01	6.25E 01	1.48E 02
SM148 0.0	1.03E 02	1.05E 02	1.06E 02	1.08E 02	1.07E 02	1.07E 02
SM149 0.0	6.20E 00	7.94E 00	7.94E 00	7.94E 00	7.94E 00	7.94E 00
SM150 0.0	3.00E 02	3.00E 02	3.00E 02	3.00E 02	3.00E 02	3.00E 02
SM151 0.0	3.84E 01	3.87E 01	3.86E 01	3.86E 01	3.84E 01	3.59E 01
SM152 0.0	7.42E 01	7.42E 01	7.42E 01	7.42E 01	7.42E 01	7.42E 01
SM154 0.0	2.44E 01	2.47E 01	2.47E 01	2.47E 01	2.47E 01	2.47E 01
EU151 0.0	4.30E -02	6.47E -02	1.14E -01	1.69E -01	3.30E -01	2.82E 00
EU152 0.0	4.45E -02	4.43E -02	4.39E -02	4.35E -02	4.22E -02	2.61E -02
EU153 0.0	6.38E 01	6.47E 01	6.47E 01	6.47E 01	6.47E 01	6.47E 01
EU154 0.0	2.95E 01	2.54E 01	2.50E 01	2.48E 01	2.36E 01	1.14E 01
EU155 0.0	3.37E 00	3.29E 00	3.21E 00	3.13E 00	2.68E 00	7.85E -01
EU156 0.0	2.59E 00	6.62E -01	4.29E -02	1.76E -03	1.53E -07	0.00
GO152 0.0	7.41E -02	7.42E -02	7.44E -02	7.45E -02	7.48E -02	7.93E -02
GO153 0.0	4.06E -03	3.72E -03	3.13E -03	2.58E -03	1.42E -03	1.10E -07
GO154 0.0	1.12E 00	1.29E 00	1.62E 00	2.01E 00	3.10E 00	1.53E 01
GO155 0.0	1.99E -02	5.92E -02	1.34E -01	2.84E -01	4.68E -01	2.57E 00
GO156 0.0	3.95E 01	3.75E 01	3.81E 01	3.81E 01	3.81E 01	3.61E 01
GO157 0.0	2.46E -02	3.45E -02	3.45E -02	3.45E -02	3.45E -02	3.45E -02
GO158 0.0	6.29E 00	6.29E 00	6.29E 00	6.29E 00	6.29E 00	6.29E 00
GO160 0.0	6.11E -01	6.11E -01	6.11E -01	6.11E -01	6.11E -01	6.11E -01
YB159 0.0	1.20E 00	1.20E 00	1.20E 00	1.20E 00	1.20E 00	1.20E 00
YB160 0.0	7.47E -02	5.61E -02	3.15E -02	1.61E -02	2.26E -03	4.66E -17
DY160 0.0	1.39E 01	1.37E 01	1.82E 01	1.97E 01	2.11E 01	2.13E -01
DY161 0.0	1.82E 01	1.80E 01	1.89E 01	1.89E 01	1.89E 01	1.89E 01
DY162 0.0	1.80E 01	1.50E 01	1.50E 01	1.50E 01	1.50E 01	1.50E 01
DY163 0.0	1.38E 01	1.38E 01	1.38E 01	1.38E 01	1.38E 01	1.38E 01
DY164 0.0	4.16E -02	4.16E -02	4.16E -02	4.16E -02	4.16E -02	4.16E -02
MO145 0.0	5.01E -02	5.01E -02	5.01E -02	5.01E -02	5.01E -02	5.01E -02
ER166 0.0	8.94E -03	8.94E -03	8.94E -03	8.94E -03	8.94E -03	8.94E -03
ER167 0.0	1.12E -03	1.12E -03	1.12E -03	1.12E -03	1.12E -03	1.12E -03
SUBTOT 0.0	2.64E 04	2.64E 04	2.64E 04	2.64E 04	2.64E 04	2.64E 04
TOTALS 0.0	2.64E 04	2.64E 04	2.64E 04	2.64E 04	2.64E 04	2.64E 04

TABLE C-3

ACTIVITIES OF TRANSURANIC NUCLIDES IN SPENT FUEL VS. DECAY TIMES

POWER= 35.00MW, BURNUP= 25000.MWD, FLUX= 3.26E 13N/CM**2-SEC

NUCLIDE RADIOACTIVITY, Curies
BASIS = MT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	30. D	90. D	160. D	365. D	3653. D
TH231	0.0	7.07E-01	2.53E-02	2.53E-02	2.53E-02	2.53E-02	2.53E-02
TH234	0.0	3.17E-01	3.16E-01	3.16E-01	3.16E-01	3.16E-01	3.16E-01
PA233	0.0	2.09E-01	2.10E-01	2.20E-01	2.30E-01	2.30E-01	2.32E-01
PA234M	0.0	3.21E-01	3.17E-01	3.16E-01	3.16E-01	3.16E-01	3.16E-01
U232	0.0	2.71E-03	8.88E-03	3.12E-03	3.42E-03	4.26E-03	4.43E-03
U234	1.64E 00	9.30E-01	9.30E-01	9.30E-01	9.31E-01	9.33E-01	9.68E-01
U235	7.07E-02	2.53E-02	2.53E-02	2.53E-02	2.53E-02	2.53E-02	2.53E-02
U236	0.0	2.54E-01	2.54E-01	2.54E-01	2.54E-01	2.54E-01	2.54E-01
U237	0.0	6.18E 05	3.76E 04	8.09E 01	1.77E 00	1.66E 00	1.60E 00
U238	3.22E-01	3.16E-01	3.16E-01	3.16E-01	3.16E-01	3.16E-01	3.16E-01
NP237	0.0	2.23E-01	2.30E-01	2.30E-01	2.30E-01	2.30E-01	2.32E-01
NP239	0.0	1.98E 07	2.86E 03	6.26E 00	6.25E 00	6.25E 00	6.25E 00
PU236	0.0	1.75E 01	1.73E-01	1.66E-01	1.58E-01	1.38E-01	1.55E-02
PU238	0.0	1.33E 03	1.35E 03	1.37E 03	1.38E 03	1.39E 03	1.31E 03
PU239	0.0	3.08E 02	3.13E 02	3.13E 02	3.13E 02	3.13E 02	3.13E 02
PU240	0.0	3.89E 02	3.89E 02	3.89E 02	3.89E 02	3.89E 02	3.89E 02
PU241	0.0	7.25E 04	7.22E 04	7.17E 04	7.10E 04	6.92E 04	4.51E 04
PU242	0.0	6.63E-01	6.63E-01	6.63E-01	6.63E-01	6.63E-01	6.63E-01
AM241	0.0	4.39E 01	5.36E 01	7.23E 01	9.42E 01	1.57E 02	9.60E 02
AM242M	0.0	4.25E 00	4.25E 00	4.25E 00	4.24E 00	4.23E 00	4.06E 00
AM243	0.0	3.44E 04	4.25E 00	4.25E 00	4.24E 00	4.23E 00	4.06E 00
CM242	0.0	6.24E 00	6.25E 00	6.25E 00	6.25E 00	6.25E 00	6.25E 00
CM243	0.0	1.36E 04	1.21E 04	9.35E 03	6.95E 03	2.91E 03	3.33E 00
CM244	0.0	1.14E 00	1.13E 00	1.13E 00	1.12E 00	1.11E 00	9.14E-01
CM245	0.0	5.80E 02	5.78E 02	5.74E 02	5.70E 02	5.58E 02	3.95E 02
CM246	0.0	6.39E-02	6.39E-02	6.39E-02	6.39E-02	6.39E-02	6.38E-02
CM246	0.0	8.65E-03	8.65E-03	8.65E-03	8.65E-03	8.65E-03	8.64E-03
SUBTOT	2.03E 00	2.07E 07	1.27E 05	8.39E 04	8.07E 04	7.49E 04	4.85E 04

TOTALS 2.03E 00 4.11E 07 1.27E 05 8.39E 04 8.07E 04 7.49E 04 4.85E 04

TABLE C-4

QUANTITIES OF TRANSURANIC NUCLIDES IN SPENT FUEL VS. DECAY TIMES

POWER= 35.00MW, BURNUP= 25000.MWD, FLUX= 3.26E 13N/CM**2-SEC

NUCLIDE CONCENTRATIONS, GRAMS
BASIS = MT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	30. D	90. D	160. D	365. D	3653. D
ME 4	0.0	5.86E-02	6.86E-02	8.56E-02	1.02E-01	1.34E-01	3.67E-01
U233	0.0	5.70E-03	5.01E-03	5.02E-03	5.04E-03	5.10E-03	6.05E-03
U234	2.64E 02	1.50E 02	1.50E 02	1.50E 02	1.50E 02	1.51E 02	1.56E 02
U235	3.30E 04	1.18E 04	1.18E 04	1.18E 04	1.18E 04	1.18E 04	1.18E 04
U236	0.0	4.00E 03	4.00E 03	4.01E 03	4.01E 03	4.01E 03	4.01E 03
U238	9.67E 05	9.49E 05	9.49E 05	9.49E 05	9.49E 05	9.49E 05	9.49E 05
NP237	0.0	3.18E 02	3.26E 02	3.26E 02	3.26E 02	3.26E 02	3.29E 02
PU238	0.0	7.87E 01	8.02E 01	8.09E 01	8.15E 01	8.23E 01	7.76E 01
PU239	0.0	5.02E 03	5.11E 03	5.11E 03	5.11E 03	5.11E 03	5.11E 03
PU240	0.0	1.76E 03	1.76E 03	1.76E 03	1.76E 03	1.76E 03	1.76E 03
PU241	0.0	7.13E 02	7.11E 02	7.05E 02	6.99E 02	6.80E 02	4.44E 02
PU242	0.0	1.70E 02	1.70E 02	1.70E 02	1.70E 02	1.70E 02	1.70E 02
AM241	0.0	1.28E 01	1.56E 01	2.11E 01	2.75E 01	4.58E 01	2.80E 02
AM242M	0.0	4.37E 01	4.37E 01	4.37E 01	4.36E 01	4.35E 01	4.18E 01
AM243	0.0	3.24E 01	3.25E 01	3.25E 01	3.25E 01	3.25E 01	3.25E 01
CM242	0.0	4.31E 00	3.64E 00	2.52E 00	2.50E 00	2.78E 01	1.40E-03
CM243	0.0	2.47E 02	2.46E 02	2.46E 02	2.45E 02	2.42E 02	1.99E 02
CM244	0.0	7.16E 00	7.14E 00	7.09E 00	7.04E 00	6.89E 00	4.68E 00
CM245	0.0	3.62E-01	3.62E-01	3.62E-01	3.62E-01	3.62E-01	3.61E-01
CM246	0.0	2.80E-02	2.80E-02	2.80E-02	2.80E-02	2.80E-02	2.80E-02
SUBTOT	1.00E 06	6.74E 05	9.74E 05	9.74E 05	9.74E 05	9.74E 05	9.74E 05

TOTALS 1.00E 06 9.74E 05 9.74E 05 9.74E 05 9.74E 05 9.74E 05 9.74E 05

TABLE C-5

ACTIVITIES OF LIGHT ELEMENTS AND MATERIALS OF CONSTRUCTION
PRESENT IN SPENT FUEL VS. DECAY TIMES

POWER= 35.00MW, BURNUP= 25000.MWD, FLUX= 3.26E 13M/C/M**2-SEC

NUCLIDE RADIOACTIVITY, CURIES
BASIS = MT OF HEAVY METAL CHARGED TO REACTOR

		CHARGE	DISCHARGE	30. D	90. D	180. D	365. D	3653. D
H	3	0.0	4.60E-02	4.60E-02	4.55E-02	4.51E-02	4.37E-02	2.63E-02
C	14	0.0	3.56E-01	3.56E-01	3.56E-01	3.56E-01	3.56E-01	3.56E-01
CA	45	0.0	3.24E-02	2.86E-02	2.22E-02	1.65E-02	6.99E-03	7.03E-03
SC	46	0.0	4.39E-02	3.43E-02	2.09E-02	1.17E-02	2.15E-03	3.46E-13
CR	51	0.0	1.89E-02	8.97E-03	2.01E-03	3.51E-02	2.11E-02	0.0
MN	54	0.0	2.26E-02	2.11E-02	1.84E-02	1.57E-02	9.80E-03	5.34E-02
FE	55	0.0	1.56E-02	1.53E-02	1.46E-02	1.39E-02	1.19E-02	1.06E-02
FE	59	0.0	1.70E-02	1.07E-02	4.24E-03	1.44E-03	6.13E-04	6.25E-23
CO	58	0.0	9.57E-02	7.15E-02	3.99E-02	2.02E-02	2.75E-02	3.63E-12
CO	60	0.0	5.06E-02	4.99E-02	4.88E-02	4.78E-02	4.42E-02	1.35E-03
NI	59	0.0	2.75E-02	2.75E-02	2.75E-02	2.75E-02	2.75E-02	2.75E-02
NI	63	0.0	4.34E-02	4.34E-02	4.33E-02	4.33E-02	4.31E-02	4.03E-02
SA	74	0.0	4.05E-02	2.72E-02	1.22E-02	4.80E-03	3.12E-03	2.92E-27
Y	91	0.0	1.07E-02	7.55E-03	3.70E-03	1.65E-03	1.45E-03	2.14E-17
ZR	90	0.0	7.56E-02	7.56E-02	7.56E-02	7.56E-02	7.56E-02	7.56E-02
ZR	94	0.0	3.14E-02	2.28E-02	1.20E-02	5.70E-03	6.40E-02	5.61E-13
MO	93	0.0	4.07E-02	4.42E-02	5.11E-02	5.91E-02	6.21E-02	3.74E-02
MO	95	0.0	3.02E-02	2.63E-02	1.94E-02	1.06E-02	1.33E-02	6.10E-13
MO	93	0.0	1.39E-02	1.39E-02	1.39E-02	1.39E-02	1.39E-02	1.39E-02
TC	94	0.0	1.04E-02	1.05E-02	1.05E-02	1.05E-02	1.05E-02	1.05E-02
SN	117	0.0	1.25E-02	2.84E-02	1.47E-02	4.55E-02	1.78E-04	0.0
SN	117	0.0	2.31E-02	2.13E-02	1.80E-02	1.48E-02	8.40E-02	7.24E-04
SN	121	0.0	2.89E-02	2.48E-02	2.48E-02	2.48E-02	2.48E-02	2.27E-02
SN	123	0.0	3.81E-02	3.23E-02	2.31E-02	1.57E-02	5.03E-02	6.09E-03
SB	124	0.0	1.97E-02	1.41E-02	7.33E-03	1.13E-03	2.93E-02	6.47E-17
SR	125	0.0	1.21E-02	1.14E-02	1.14E-02	1.14E-02	9.34E-02	6.32E-02
SH	126	0.0	6.26E-02	1.11E-02	4.26E-02	8.76E-02	1.03E-02	1.0
TE	125	0.0	4.10E-02	4.27E-02	4.40E-02	4.36E-02	3.40E-02	3.86E-02
SU	STDT	0.0	1.65E-02	1.40E-02	6.11E-02	5.99E-02	2.74E-02	3.44E-02
TOTAL		2.00E-02	2.13E-02	1.40E-02	6.11E-02	5.99E-02	2.74E-02	3.44E-02

TABLE C-6

QUANTITIES OF LIGHT ELEMENTS AND MATERIALS OF CONSTRUCTION
PRESENT IN SPENT FUEL VS. DECAY TIMES

POWER = 35,000W. BURNUP = 25000.MWD. FLUX = 3.25E 13W/CM**2-SEC

NUCLIDE CONCENTRATIONS, GRAMS
BASIS = MT OF HEAVY METAL CHARGED TO REACTOR

		CHARGE	DISCHARGE	30. D	90. D	180. D	365. D	3653. D
M	1	0.0	6.37E-02	6.37E-02	6.37E-02	6.37E-02	6.37E-02	6.37E-02
M	J	0.0	4.77E-02	4.74E-02	4.70E-02	4.65E-02	4.50E-02	2.71E-02
ME	J	0.0	6.46E-04	6.66E-04	1.30E-03	1.81E-03	3.25E-03	2.12E-02
ME	4	0.0	8.98E-01	8.96E-01	8.96E-01	8.96E-01	8.96E-01	8.96E-01
LI	6	1.28E-01	3.19E-02	3.19E-02	3.19E-02	3.19E-02	3.19E-02	3.19E-02
LI	7	1.87E-00	1.87E-00	1.87E-00	1.87E-00	1.87E-00	1.87E-00	1.87E-00
B	11	0.0	2.61E-03	2.61E-03	2.61E-03	2.61E-03	2.61E-03	2.61E-03
C	12	1.78E-01	1.78E-01	1.78E-01	1.78E-01	1.78E-01	1.78E-01	1.78E-01
C	13	2.84E-01	2.84E-01	2.84E-01	2.84E-01	2.84E-01	2.84E-01	2.84E-01
C	14	0.0	7.99E-02	7.99E-02	7.99E-02	7.99E-02	7.99E-02	7.99E-02
N	14	1.99E-01	1.99E-01	1.99E-01	1.99E-01	1.99E-01	1.99E-01	1.99E-01
N	15	7.93E-02	8.13E-02	8.13E-02	8.13E-02	8.13E-02	8.13E-02	8.13E-02
O	16	1.34E-05	1.34E-05	1.34E-05	1.34E-05	1.34E-05	1.34E-05	1.34E-05
O	17	5.91E-01	5.91E-01	5.91E-01	5.91E-01	5.91E-01	5.91E-01	5.91E-01
O	18	3.08E-02	3.08E-02	3.08E-02	3.08E-02	3.08E-02	3.08E-02	3.08E-02
A	27	1.08E-02	1.08E-02	1.08E-02	1.08E-02	1.08E-02	1.08E-02	1.08E-02
SI	28	1.65E-01	1.65E-01	1.65E-01	1.65E-01	1.65E-01	1.65E-01	1.65E-01
SI	29	8.75E-01	8.75E-01	8.75E-01	8.75E-01	8.75E-01	8.75E-01	8.75E-01
SI	30	5.94E-01	5.94E-01	5.94E-01	5.94E-01	5.94E-01	5.94E-01	5.94E-01
TI	46	1.37E-01	1.37E-01	1.37E-01	1.37E-01	1.37E-01	1.37E-01	1.37E-01
TI	47	1.28E-01	1.28E-01	1.28E-01	1.28E-01	1.28E-01	1.28E-01	1.28E-01
TI	48	1.32E-02	1.32E-02	1.32E-02	1.32E-02	1.32E-02	1.32E-02	1.32E-02
TI	49	1.01E-01	1.15E-01	1.15E-01	1.15E-01	1.15E-01	1.15E-01	1.15E-01
TI	50	1.01E-01	1.01E-01	1.01E-01	1.01E-01	1.01E-01	1.01E-01	1.01E-01
V	51	0.0	1.45E-02	1.45E-02	1.45E-02	1.45E-02	1.45E-02	1.45E-02
V	51	0.0	3.10E-02	3.21E-02	3.28E-02	3.33E-02	3.33E-02	3.33E-02
CR	52	1.49E-02	1.49E-02	1.49E-02	1.49E-02	1.49E-02	1.49E-02	1.49E-02
CR	51	0.0	2.06E-01	9.73E-02	2.14E-02	3.81E-03	2.24E-05	0.0
CR	52	3.07E-03	3.07E-03	3.07E-03	3.07E-03	3.07E-03	3.07E-03	3.07E-03
CR	53	3.52E-02	3.52E-02	3.52E-02	3.52E-02	3.52E-02	3.52E-02	3.52E-02
CR	54	9.89E-01	9.88E-01	9.88E-01	9.88E-01	9.88E-01	9.88E-01	9.88E-01
WM	56	2.0	2.83E-02	2.83E-02	2.83E-02	1.96E-02	1.21E-02	6.66E-02
FE	56	1.87E-01	1.78E-01	1.78E-01	1.78E-01	1.78E-01	1.78E-01	1.83E-01
FE	56	2.09E-02	2.09E-02	2.09E-02	2.09E-02	2.09E-02	2.09E-02	2.09E-02
FE	57	0.0	6.24E-01	6.10E-01	5.94E-01	5.55E-01	4.70E-01	4.33E-01
FE	58	3.43E-03	3.42E-03	3.42E-03	3.42E-03	3.42E-03	3.42E-03	3.42E-03
FE	57	8.35E-01	6.43E-01	6.43E-01	6.43E-01	6.43E-01	6.43E-01	6.43E-01
FE	58	1.24E-01	1.48E-01	1.49E-01	1.57E-01	1.51E-01	1.51E-01	1.51E-01
CO	58	0.0	7.03E-01	2.26E-01	1.26E-01	6.39E-02	4.71E-03	1.15E-10
CO	59	4.41E-01	4.49E-01	4.49E-01	4.49E-01	4.49E-01	4.49E-01	4.49E-01
CO	60	0.0	4.45E-01	4.45E-01	4.31E-01	4.20E-01	3.90E-01	1.19E-01
NI	58	6.41E-03	6.37E-03	6.37E-03	6.37E-03	6.37E-03	6.37E-03	6.37E-03
NI	59	0.0	3.63E-01	3.63E-01	3.63E-01	3.63E-01	3.63E-01	3.63E-01
NI	60	2.55E-03	2.55E-03	2.55E-03	2.55E-03	2.55E-03	2.55E-03	2.55E-03
NI	61	1.76E-02	1.76E-02	1.76E-02	1.76E-02	1.76E-02	1.76E-02	1.76E-02
NI	62	3.63E-02	3.63E-02	3.63E-02	3.63E-02	3.63E-02	3.63E-02	3.63E-02
NI	63	0.0	7.04E-01	7.03E-01	7.03E-01	7.03E-01	7.03E-01	7.03E-01
NI	64	1.13E-02	1.12E-02	1.12E-02	1.12E-02	1.12E-02	1.12E-02	1.12E-02
CU	64	0.0	4.99E-02	5.43E-02	6.30E-02	7.31E-02	8.03E-02	8.03E-02
CU	65	0.0	2.17E-01	2.17E-01	2.17E-01	2.17E-01	2.17E-01	2.17E-01
SO	66	0.0	1.62E-01	1.62E-01	1.62E-01	1.62E-01	1.62E-01	1.62E-01
ZR	90	1.24E-01	1.26E-01	1.26E-01	1.26E-01	1.26E-01	1.26E-01	1.26E-01

[illegible]

(CONT.)

TABLE C-6

TABLE C-7

CHARACTERISTICS OF THE FISSION PRODUCT
NUCLIDES PRESENT IN SPENT FUEL FOR STORAGE

Nuclide	Symbol	Half-Life	Mode of Decay	Specific Activity Ci/gm	Mev - Major Mode of Decay	Primary Daughter
Tritium	H 3	12.3Y		9,600	0.019 -	He 3
Selenium 79	Se 79	6.5×10^4 Y		0.07	0.15 -	Br 79
Krypton 85	Kr 85	10.7Y		390	0.67 0.51	Rb 85
Rubidium 86	Rb 86	18.7D		82,000	1.77 1.08	Sr 86
Strontium 89	Sr 89	50.5D		28,000	1.49 0.91	Y 89
Strontium 90	Sr 90	29Y		140	0.55 1.76(?)	Y 90
Yttrium 90	Y 90	64 H		540,000	2.29 1.76(?)	Zr 90
Yttrium 91	Y 91	58.6D		240,000	1.55 1.21	Sr 91
Zirconium 93	Zr 93	9.5×10^5 Y		0.004	0.06 0.03	Nb 93
Niobium 93m	Nb 93m	12 Y		320	0.03 -	Nb 93
Zirconium 95	Zr 95	65.5D		21,000	0.366 0.76	Nb 95
Niobium 95m	Nb 95m	3.6D		380,000	- 0.23	Nb 95
Niobium 95	Nb 95	35.1D		38,000	0.16 0.77	Mo 95
Technetium 99	Tc 99	2.1×10^5 Y		0.017	0.29 -	Ru 99
Ruthenium 103	Ru 103	39.6D		32,000	0.225 0.50	Rh 103m
Rhodium 103m	Rh 103m	56 M		3.2×10^7	- 0.04	Rh 103
Ruthenium 106	Ru 106	369D		3,400	0.039 0.51	Rh 106
Rhodium 106	Rh 106	2.2H		1.3×10^7	0.92 0.51	Pd 106
Palladium 107	Pd 107	6.5×10^6 Y		0.0005	0.035 -	Ag 107
Silver 110m	Ag 110m	252D		4,700	0.08 0.66	Cd 107
Silver 110	Ag 110	245		4.3×10^7	2.89 0.66	Cd 110
Silver 111	Ag 111	7.5D		160,000	1.03 0.34	Ag 111
Cadmium 113m	Cd 113m	14.6Y		220	0.59 0.26	In 113
Cadmium 115m	Cd 115m	44.6D		25,000	1.63 0.93	In 115
Tin 119m	Sn 119m	245D		4,500	- 0.024	Sn 119
Tin 123m	Sn 123m	129D		8,100	1.41 1.08	Sb 123
Tellurium 123m	Te 123m	120D		9,000	0.089 0.16	Te 123
Antimony 124	Sb 124	60D		17,000	0.61 1.69	Te 124
Antimony 125	Sb 125	2.73Y		1,000	0.03 0.43	Te 125
Tellurium 125m	Te 125m	58D		18,000	0.11 0.035	Te 125
Tin 126	Sn 126	10^8 Y		0.028	0.25 0.88	Sb 126
Antimony 126m	Sb 126m	19W		7.8×10^7	1.9 0.67	Sb 126
Antimony 126	Sb 126	12.4D		83,000	1.1 0.70	Te 126
Tellurium 127m	Te 127m	109D		9,300	0.088 0.058	I 127
Tellurium 127	Te 127	9.4H		2.6×10^8	0.69 0.24	I 127
Tellurium 129m	Te 129m	33.4D		30,000	1.1 0.70	I 129
Tellurium 129	Te 129	70M		2.1×10^7	1.47 0.028	I 129
Iodine 129	I 129	1.6×10^7 Y		0.00017	0.15 0.04	Xe 129
Xenon 131m	Xe 131m	12D		83,000	0.16 -	Xe 131
Iodine 131	I 131	8D		120,000	0.61 0.36	Xe 131
Cesium 134	Cs 134	2Y		1,300	0.66 0.80	Ba 134
Cesium 135	Cs 135	2.3×10^6 Y		0.001	0.21 -	Ba 135
Cesium 136	Cs 136	13D		74,000	0.34 0.82	Ba 136
Cesium 137	Cs 137	30.1Y		87	0.51 0.66	Ba 137
Barium 137m	Ba 137m	2.5M		5.5×10^8	- 0.66	Ba 137m
Barium 140	Ba 140	12.8D		73,000	1.0 0.54	La 140
Lanthanum 140	La 140	40H		560,000	1.36 1.60	Ce 140
Cerium 141	Ce 141	32.5D		28,000	0.44 0.15	Pr 141
Praseodymium 143	Pr 143	13.6D		66,000	0.931 -	Nd 143
Cerium 144	Ce 144	284D		3,200	0.32 0.03	Pr 144
Praseodymium 144	Pr 144	17.3M		7.55×10^7	3.0 0.70	Nd 144
Neodymium 147	Nd 147	11D		8,000	0.80 0.91	Pm 147
Promethium 147	Pm 147	2.6Y		940	0.23 0.21	Sm 147
Promethium 148m	Pm 148m	41.3D		21,000	0.40 0.55	Sm 148
Promethium 148	Pm 148	5.4D		160,000	2.48 0.55	Sm 148
Samarium 151	Sm 151	93Y		25.5	0.076 0.022	Eu 151
Europium 152	Eu 152	13Y		180	0.74 0.12	Gd 152
Gadolinium 153	Gd 153	242D		3,500	- 0.097	Tb 153
Europium 154	Eu 154	16Y		145	0.58 0.12	Gd 154
Europium 155	Eu 155	4.8Y		480	0.16 0.09	Gd 155
Europium 156	Eu 156	15.2D		160,000	0.49 0.09	Gd 156
Terbium 160	Tb 160	72.3D		11,000	0.57 0.88	Dy 160
Gadolinium 162	Gd 162	10M		1.2×10^8	1.0 0.44	Tb 162
Terbium 162m	Tb 162m	7.5M		1.5×10^8	1.3 0.26	Tb 162

TABLE C-2
CHARACTERISTICS OF THE ACTINIDES
AND THEIR DAUGHTER ELEMENTS
PRESENT IN SPENT FUEL FOR STORAGE

Nuclide	Symbol	Half-Life	Mode of Decay	Specific Activity, Ci/gm	MEV - Major Mode of Decay			Primary Daughter
					α	β	γ	
Thallium-208	Tl 208	3M	β, γ	3×10^8		1.795	2.61	Pb-208
Lead-212	Pb 212	22, 3Y	β, γ	76		0.017	0.046	Bi-210
Bismuth-212	Bi 212	60M	β, γ	1.5×10^7		2.25	0.727	Po-212
Polonium-212	Po 212	45S	α, γ	1.2×10^9	11.7		2.61	Pb-208
Radon-220	Rn 220	55S	α, γ	9.2×10^8	6.8		0.27	Po-215
Radium-224	Ra 224	3.6D	α, γ	1.6×10^5	5.69		0.24	Rn-220
Thorium-228	Th 228	1.9Y	α, γ	830	5.42		0.08	Ra-224
Thorium-231	Th 231	25H	β, γ	5.4×10^5		0.303	0.084	Pa-231
Thorium-234	Th 234	24D	β, γ	2.3×10^4		0.193	0.069	Pa-234
Protactinium-233	Po 233	27D	β, γ	2.1×10^4		0.26	0.31	U-233
Protactinium-234m	Pa 234m	1.17M	γ	6.7×10^8			0.76	Po-234
Protactinium-234	Pa 234	6.7H	β, γ	2.1×10^6		0.49	0.044	U-234
Uranium-232	U 232	72Y	α, γ	21	0.53		0.058	Th-228
Uranium-233	U 233	1.6×10^5 Y	α, γ	2.6×10^{-3}	4.8		0.042	Th-229
Uranium-234	U 234	2.4×10^5 Y	α, γ	6.4×10^{-3}	4.8		0.05	Th-230
Uranium-235	U 235	7.0×10^8 Y	α, γ	2.2×10^{-6}	4.4		0.19	Th-231
Uranium-236	U 236	2.34×10^7 Y	α, γ	6.5×10^{-5}	4.5		0.05	Th-232
Uranium-238	U 238	4.47×10^9 Y	α, γ	3.3×10^{-7}	4.2		0.048	Th-234
Neptunium-237	Np 237	4.1×10^6 Y	α, γ	3.7×10^{-4}	4.8		0.029	Pa-233
Neptunium-239	Np 239	2.35D	β, γ	2.3×10^5		0.33	0.28	Pn-239
Plutonium-236	Pu 236	2.85Y	α, γ	530	5.8		0.048	U-232
Plutonium-238	Pu 238	87.8Y	α, γ	17	5.5		0.043	U-234
Plutonium-239	Pu 239	2.4×10^4 Y	α, γ	0.6	5.2		0.052	U-235
Plutonium-240	Pu 240	6.54×10^3 Y	α, γ	0.23	5.2		0.045	U-236
Plutonium-241	Pu 241	15Y	α, β	99	4.9	0.02	0.15	Am-241, U-237
Plutonium-242	Pu 242	2.87×10^5 Y	α, γ	3.8×10^{-3}	4.9		0.045	U-238
Americium-241	Am 241	433Y	α, γ	3.4	5.5		0.06	Np-237
Americium-242M	Am 242m	41.mx	γ	3.3×10^{12}			0.049	Am-242
Americium-242	Am 242	16H	β, γ	4.8×10^5	0.63		0.042	Cm-242
Americium-243	Am 243	7.37×10^3 Y	α, γ	0.2	5.3		0.075	Np-239
Curium-242	Cm 242	163D	α, γ	3.3×10^3	6.1		0.044	Pu-238
Curium-243	Cm 243	28Y	α, γ	53	5.8		0.28	Pu-239
Curium-244	Cm 244	17.9Y	α, γ	82	5.8		0.043	Pu-240

TABLE C-9

CHARACTERISTICS OF RADIOACTIVE LIGHT ELEMENTS AND
MATERIALS OF CONSTRUCTION PRESENT IN SPENT FUEL FOR STORAGE
(More Than 0.001 Ci/MTU After 180 Days Decay)

Nuclide	Symbol	Half-Life	Mode of Decay	Specific Activity Ci/gm	Mev - Major Mode of Decay		Primary Daughter
					β	γ	
Calcium-45	Ca-45	16.3D	β, γ	1.8×10^5	0.257	0.012	Sc-45
Scandium-46	Sc-46	83.8D	β, γ	3.4×10^4	0.357	0.889	Ti-46
Chromium-51	Cr-51	27.7D	β, γ	9.2×10^3	-	0.32	V-51
Manganese-54	Mn-54	312D	β, γ	7.7×10^3	-	0.835	Cr-54
Iron-55	Fe-55	2.7Y	β	2.4×10^3	0.232	-	Mn-55
Iron-59	Fe-59	44.6D	β, γ	5.0×10^4	0.467	1.1	Co-59
Cobalt-58	Co-58	71.3D	β, γ	3.1×10^4	0.475	0.81	Fe-58
Cobalt-60	Co-60	5.27Y	β, γ	1.1×10^3	0.318	1.33	Ni-60
Nickel	Ni-59	8×10^4 Y	β	0.76	1.107	-	Co-59
Nickel-63	Ni-63	100Y	β	5.6	0.066	-	Cu-63
Strontium-89	Sr-89	50.5D	β, γ	2.9×10^4	1.49	0.909	Y-89
Yttrium-91	Y-91	58.6D	β, γ	2.4×10^4	1.55	1.205	Zn-91
Zirconium-93	Zr-93	9.5×10^5 Y	β, γ	0.004	0.063	0.03	Nb-93
Niobium-93m	Nb-93m	12Y	γ	320	-	0.03	Nb-93
Niobium-95	Nb-95	35.1D ₂	β	3.9×10^4	0.159	0.766	Mo-95
Molybdenum-93	Mo-93	$\approx 3 \times 10^3$ Y	β, γ	13	0.925	0.03	Nb-93
Technetium-99	Tc-99	2.1×10^5 Y	β	0.018	0.292	-	Rn-99
Tin-177m	Sn-177m	14D	γ	7.9×10^4	-	0.159	Sn-117
Tin-119m	Sn-119m	245D	γ	4.4×10^3	-	0.024	Sm-119
Tin-121m	Sn-121m	50Y	β, γ	59	0.354	0.037	Sb-121
Tin-123m	Sn-123m	40M	β, γ	3.8×10^7	1.26	0.16	Sn-123
Antimony-124	Sb-124	60D	β, γ	1.7×10^4	0.61	0.60	Te-124
Antimony-125	Sb-125	2.7Y	β, γ	1.1×10^3	0.30	0.428	Te-125
Tellurium-125m	Te-125m	58D	γ	1.8×10^4	-	0.035	Te-125

APPENDIX D
ORIGEN CALCULATIONS

Power 35.00 MW/MTU

Burnup 33,000 MWD/MTU

TERA CORPORATION

TABLE D-1

ACTIVITIES OF FISSION PRODUCTS IN SPENT FUEL VS. DECAY TIMES

Power: 35,000W, Burnup: 33000MWD, Fuel: 3.44+33W/cm+2-SEC

NUCLIDE RADIOACTIVITY, CURIES
BASIS : #1 OF HEAVY METAL CHANGED TO REACTOR

	CHARAC	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
H 3	.00	7.19+02	7.09+02	7.03+02	6.79+02	6.42+02	5.42+02	4.09+02	2.33+02	9.29+01	2.56+00
Zn 72	.00	2.38+01	2.47+13	3.30+24	.00	.00	.00	.00	.00	.00	.00
Ge 72	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Ge 73	.00	4.73+01	.00	.00	.00	.00	.00	.00	.00	.00	.00
Ge 73	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Ge 74	.00	1.80+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
Ge 74	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Ge 75	.00	2.23+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
Ge 75M	.00	2.74+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
Ge 75	.00	2.23+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
As 75	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Se 76	.00	7.89+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
Ge 76	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
As 76	.00	1.13+01	.00	.00	.00	.00	.00	.00	.00	.00	.00
Se 76	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Ge 77M	.00	2.15+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
Ge 77	.00	1.01+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
As 77	.00	2.64+03	4.82+14	.00	.00	.00	.00	.00	.00	.00	.00
Se 77M	.00	8.14+00	1.45+14	.00	.00	.00	.00	.00	.00	.00	.00
Se 77	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Ge 78	.00	6.58+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
As 78P	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
As 78	.00	6.59+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
Se 78	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
As 79	.00	1.30+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
Se 79M	.00	1.32+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
Se 79	.00	3.98+01	3.98+01	3.98+01	3.98+01	3.98+01	3.98+01	3.98+01	3.98+01	3.98+01	3.98+01
Br 79	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
As 80	.00	2.18+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
Se 80	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Br 80M	.00	2.24+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
Br 80	.00	1.37+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
Br 82	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
As 81	.00	4.56+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
Se 81M	.00	4.57+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
Se 81	.00	3.66+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
Br 81	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Br 81M	.00	3.87+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
Kr 81	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Se 82	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Br 82M	.00	2.56+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
Br 82	.00	2.78+03	1.06+15	.00	.00	.00	.00	.00	.00	.00	.00
Kr 82	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Se 83M	.00	3.51+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
Se 83	.00	3.76+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
Kr 83	.00	6.77+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
Br 83M	.00	6.77+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
Br 83	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Se 84	.00	1.74+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
Br 84M	.00	3.49+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
Kr 84	.00	1.74+05	.00	.00	.00	.00	.00	.00	.00	.00	.00

FOR - CASE 4 - 33,000 MW(DT) BURHUP - FUEL DECAY TIMES
 POWER: 35,000W. BURHUP: 3300D.MW.D. FLUTE: 3.00+33N/CM+02-SEC

NUCLIDE RADIOACTIVITY, CURIES
 BASIS = MT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	30. Y	100. Y
RR 84	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SL 85	.00	1.93+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
RR 86	.00	1.84+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
RR 85N	.00	2.18+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
RR 85	.00	1.14+04	1.13+04	1.11+04	1.07+04	1.03+04	8.33+03	6.03+03	3.33+03	4.62+02	1.67+01
RR 85	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
RR 84	.00	3.20+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
RR 84	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
RR 84N	.00	5.32+01	.00	.00	.00	.00	.00	.00	.00	.00	.00
RR 84	.00	3.72+02	2.06+01	1.52+00	7.58+04	9.93+10	.00	.00	.00	.00	.00
SR 84	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
RR 87	.00	3.82+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
RR 87	.00	1.14+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
RR 87	.00	1.76+05	1.96+05	1.96+05	1.96+05	1.96+05	1.96+05	1.96+05	1.96+05	1.96+05	1.96+05
SR 87N	.00	0.06+01	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 87	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
RR 88	.00	5.80+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
RR 88	.00	6.13+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
RR 88	.00	0.13+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 88	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
RR 89	.00	1.12+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
RR 89	.00	1.02+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
RR 89	.00	7.00+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 89	.00	4.19+05	2.53+05	9.94+00	6.44+03	4.95+01	2.74+05	5.74+16	.00	.00	.00
Y 89	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
RR 90	.00	8.68+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
RR 90	.00	8.61+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 90	.00	7.78+04	7.73+04	7.70+04	7.59+04	7.41+04	6.88+04	6.00+04	4.74+04	2.77+04	6.66+03
Y 90N	.00	1.51+00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Y 90	.00	8.13+04	7.74+04	7.70+04	7.59+04	7.41+04	6.88+04	6.00+04	4.74+04	2.77+04	6.66+03
RR 91	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
RR 91	.00	6.34+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
RR 91	.00	7.73+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 91	.00	1.00+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
Y 91N	.00	6.15+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
Y 91	.00	1.10+06	3.82+05	1.67+05	1.49+04	2.01+02	4.93+04	2.20+13	.00	.00	.00
RR 91	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
RR 92	.00	3.96+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
RR 92	.00	1.05+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 92	.00	1.05+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
RR 92	.00	1.17+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
RR 92	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
RR 93	.00	1.41+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
RR 93	.00	1.10+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
Y 93	.00	1.11+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
RR 93	.00	1.18+00	1.18+00	1.18+00	1.18+00	1.18+00	1.18+00	1.18+00	1.18+00	1.18+00	1.18+00
RR 93N	.00	1.25+01	1.47+01	1.63+01	2.12+01	2.95+01	5.20+01	8.27+01	1.24+00	1.75+00	1.67+00
RR 93	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
RR 94	.00	5.13+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
RR 94	.00	6.11+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 94	.00	1.24+06	.00	.00	.00	.00	.00	.00	.00	.00	.00

POWER= 15.00MW, BURNDUP= 33000-RWD, FLOW= 3.44*10⁶CM³-SEC

NUCLIDE RADIOACTIVITY, CURIES
BASES : Wt OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	30. Y	100. Y
PH105	.00	1.11+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
PH105M	.00	1.11+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
PH105	.00	1.90+05	1.92-13	.00	.00	.00	.00	.00	.00	.00	.00
PH105	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
IC106	.00	9.15+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
PH106	.00	5.97+05	5.08+05	4.41+05	2.99+05	1.50+05	1.90+04	6.02+02	6.08-01	6.24-10	6.52-25
PH106M	.00	1.15+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
PH106	.00	1.52+05	5.64+05	4.41+05	2.99+05	1.50+05	1.90+04	6.02+02	6.08-01	6.24-10	6.52-25
PH106	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PH107	.00	6.80+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
PH107	.00	6.80+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
PH107M	.00	1.90+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
IC107	.00	1.11-01	1.11-01	1.11-01	1.11-01	1.11-01	1.11-01	1.11-01	1.11-01	1.11-01	1.11-01
PH107	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PH108	.00	6.74+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
PH108	.00	6.74+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
PH108	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PH108	.00	1.13+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
PH108	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PH108	.00	1.13+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
PH108	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PH108	.00	2.63+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
PH108	.00	1.19+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
PH108	.00	3.20+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
PH108	.00	3.20+05	1.39+06	3.04+06	2.22+06	1.27+06	2.38+07	1.45+08	5.43+11	2.84+18	.00
PH108	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PH108	.00	3.69+06	3.39+06	3.04+06	2.22+06	1.27+06	2.38+07	1.45+08	5.43+11	2.84+18	.00
PH108	.00	9.54+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
PH108	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PH108	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PH108	.00	6.54+03	1.15+03	2.60+03	1.48+03	5.85+02	2.71+03	1.48+03	8.19+04	7.49+19	.00
PH108	.00	1.88+05	4.10+02	3.38+02	1.93+02	7.04+01	3.52+00	2.36+02	1.04+04	9.74+20	.00
PH108	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PH108	.00	1.81+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
PH108	.00	6.58+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
PH108	.00	6.65+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
PH108	.00	6.65+04	1.14+03	1.77+02	1.02+10	2.22+25	.00	.00	.00	.00	.00
PH108	.00	7.91+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
PH108	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PH108	.00	2.41+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
PH108	.00	2.41+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
PH108	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PH108	.00	1.44+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
PH108	.00	1.44+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
PH108	.00	9.48+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
PH108	.00	1.07+03	1.06+03	1.05+03	1.02+03	9.73+00	8.38+00	6.54+00	3.99+00	9.03+03	7.59+02
PH108	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PH108	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PH108	.00	1.12+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
PH108	.00	1.12+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
PH108	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PH108	.00	1.55+00	4.41-01	1.67-01	9.71-03	6.14-05	1.55-11	1.57-22	.00	.00	.00
PH108	.00	2.22+00	6.26-01	1.61-01	9.71-03	5.73-05	1.50-11	1.51-22	.00	.00	.00
PH108	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PH108	.00	9.15+03	.00	.00	.00	.00	.00	.00	.00	.00	.00

POWER= 35.00MW, BURNUP= 13000.MWD, FLUX= 5.44E+13W/CMS-SEC

NUCLIDE RADIOACTIVITY, CMRTS
GASIS = MT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
AG115M	.00	2.54E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
AG115	.00	6.57E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
CO115P	.00	6.44E+02	1.51E+02	4.88E+01	1.78E+00	4.95E-03	1.05E-10	1.77E-23	.00	.00	.00
CO115	.00	9.06E+03	6.38E+09	2.26E+18	.00	.00	.00	.00	.00	.00	.00
IN115M	.00	9.06E+03	6.38E+09	2.26E+18	.00	.00	.00	.00	.00	.00	.00
IN115	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SA115	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AG116	.00	8.45E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
CO116	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN116M	.00	8.77E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN116	.00	1.80E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
SA116	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AG117	.00	8.61E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
CO117M	.00	1.21E+01	.00	.00	.00	.00	.00	.00	.00	.00	.00
CO117	.00	4.69E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN117M	.00	6.70E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN117	.00	4.00E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
SA117M	.00	7.01E+01	8.18E+01	2.55E+02	9.81E+07	1.37E+14	.00	.00	.00	.00	.00
SA117	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CO118	.00	8.61E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN118M	.00	1.31E+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN118	.00	8.67E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
SA118	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CO119M	.00	4.47E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
CO119	.00	4.47E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN119M	.00	4.74E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN119	.00	4.47E+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
SA119M	.00	1.85E+01	1.44E+01	1.18E+01	1.70E+00	2.43E+00	1.17E-01	1.37E-04	2.94E-08	1.88E-23	.00
SA119	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CO120	.00	4.53E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN120M	.00	4.51E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN120	.00	4.51E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
SA120	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CO121	.00	4.82E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN121M	.00	9.82E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN121	.00	1.24E+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
SA121M	.00	5.40E+04	5.54E+04	5.58E+04	5.55E+04	5.50E+04	5.35E+04	5.11E+04	4.44E+04	3.55E+04	2.25E+04
SA121	.00	9.97E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
SA122	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN122	.00	9.48E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
SA122	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SA122M	.00	1.27E+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
SA122	.00	1.27E+03	2.48E+07	4.00E+15	.00	.00	.00	.00	.00	.00	.00
IN123M	.00	1.03E+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN123	.00	1.34E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
SA123M	.00	1.34E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
SA123	.00	1.03E+04	6.23E+03	4.23E+03	1.35E+03	1.79E+02	4.10E-01	1.44E-05	2.62E-14	.00	.00
IN123M	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN123	.00	8.85E+01	4.02E+01	2.45E+01	7.88E+02	9.03E+03	1.37E+05	2.74E+10	1.04E+19	.00	.00
SA124	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN124	.00	1.48E+04	.00	.00	.00	.00	.00	.00	.00	.00	.00

POWER= 55.00MW, BURUP= 33000-RWD, FLUX= 3.9E+13N/CM^2-SEC

NUCLIDE RADIOACTIVITY, CURIES
BASIS = WT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	D. Y	D. F	J. Y	J. Y	S. Y	SO. Y	20. Y	50. Y	100. Y
SN124	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SB124M	.00	1.92+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
SB124	.00	6.84+02	1.46+02	6.52+01	6.09+00	6.95+02	2.86+07	1.95+16	.00	.00	.00
TE124	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN125M	.00	8.78+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN125	.00	1.40+00	2.04+01	1.20+01	3.20+08	6.42+20	.00	.00	.00	.00	.00
SB125	.00	9.13+03	8.72+03	8.30+03	7.18+03	5.56+03	2.57+03	1.13+02	5.47+01	2.47+02	6.57+04
TE125M	.00	3.21+03	3.39+03	3.34+03	2.97+03	7.30+03	1.07+03	2.95+02	2.27+01	1.07+02	2.72+08
TE125	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN126	.00	5.50+01	5.50+01	5.50+01	5.50+01	5.50+01	5.50+01	5.50+01	5.50+01	5.50+01	5.50+01
SB126M	.00	2.74+03	5.50+01	5.50+01	5.50+01	5.50+01	5.50+01	5.50+01	5.50+01	5.50+01	5.50+01
SB126	.00	6.91+01	1.63+00	5.58+01	5.44+01	5.44+01	5.44+01	5.44+01	5.44+01	5.44+01	5.44+01
TE126	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN127M	.00	1.33+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN127	.00	4.42+00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE127M	.00	8.54+06	8.89+03	3.25+08	3.67+24	.00	.00	.00	.00	.00	.00
TE127	.00	1.78+06	1.04+04	6.70+03	1.81+03	1.78+02	1.67+01	1.53+06	1.23+16	.00	.00
TE127	.00	4.42+06	1.23+04	6.62+03	1.78+03	1.76+02	1.65+01	1.49+06	1.22+16	.00	.00
J127	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN128	.00	2.40+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
SB128M	.00	2.32+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
SB128	.00	3.17+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE128	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
J128	.00	1.24+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
KE128	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SB129M	.00	4.27+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
SB129	.00	5.54+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN129	.00	4.13+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE129M	.00	6.88+04	1.09+04	2.58+03	1.93+01	2.29+02	4.55+12	.00	.00	.00	.00
TE129	.00	3.94+05	6.88+03	1.45+03	1.52+01	1.47+02	2.91+12	.00	.00	.00	.00
J129	.00	1.71+02	3.75+02	1.75+02	3.75+02	3.75+02	3.75+02	3.75+02	3.75+02	3.75+02	3.75+02
KE129M	.00	1.47+01	6.05+03	1.41+05	2.65+13	.00	.00	.00	.00	.00	.00
KE129	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SB130	.00	6.74+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
SB130M	.00	6.08+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
SB130	.00	7.55+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE130	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
J130M	.00	2.72+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
J130	.00	4.02+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
KE130	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN131	.00	9.85+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
SB131	.00	1.20+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE131M	.00	3.50+05	3.23+07	.00	.00	.00	.00	.00	.00	.00	.00
TE131	.00	8.83+05	5.89+18	.00	.00	.00	.00	.00	.00	.00	.00
J131	.00	1.03+06	4.47+02	1.08+00	2.27+08	4.98+22	.00	.00	.00	.00	.00
KE131M	.00	7.38+03	1.22+02	2.07+00	1.21+03	5.20+15	.00	.00	.00	.00	.00
KE131	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SB132	.00	1.35+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
SB132M	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SB132	.00	1.39+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE132	.00	1.39+06	6.38+03	2.10+09	.00	.00	.00	.00	.00	.00	.00
J132	.00	1.43+06	6.57+03	2.16+09	.00	.00	.00	.00	.00	.00	.00

POWER= 35.00W, BURRPP= 33000.HZ, FLUX= 3.44E+13N/CM^2-SEC

NUCLIDE RADIOACTIVITY, CURIES
BASED ON 1% OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
NE132	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SB133	.00	1.14E+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE133M	.00	1.44E+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE133	.00	5.30E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE133	.00	1.00E+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE133M	.00	4.55E+04	7.69E+04	3.44E+17	.00	.00	.00	.00	.00	.00	.00
TE133	.00	1.47E+06	1.66E+01	1.67E+03	3.14E+14	.00	.00	.00	.00	.00	.00
CS133	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SB134	.00	1.05E+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE134	.00	1.88E+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE134	.00	2.13E+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE134	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS134M	.00	7.28E+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS134	.00	2.57E+05	2.37E+05	2.22E+05	1.83E+05	1.31E+05	4.74E+04	8.74E+03	2.97E+02	1.17E+02	5.30E+01
EA134	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE135	.00	1.04E+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE135	.00	1.88E+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE135M	.00	5.03E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE135	.00	1.84E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS135M	.00	5.17E+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS135	.00	2.55E+01	2.54E+01	2.54E+01	2.54E+01	2.54E+01	2.54E+01	2.54E+01	2.54E+01	2.54E+01	2.54E+01
EA135M	.00	5.05E+01	.00	.00	.00	.00	.00	.00	.00	.00	.00
EA135	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE136	.00	6.62E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE136	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS136	.00	6.59E+04	5.42E+02	1.30E+01	2.24E+04	7.97E+13	.00	.00	.00	.00	.00
EA136	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE137	.00	1.72E+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE137	.00	1.82E+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS137	.00	1.08E+05	1.08E+05	1.07E+05	1.06E+05	1.04E+05	9.64E+04	8.47E+04	6.43E+04	3.41E+04	1.09E+04
EA137M	.00	1.01E+05	1.01E+05	1.00E+05	9.97E+04	9.88E+04	9.03E+04	8.05E+04	6.39E+04	3.19E+04	1.03E+04
EA137	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE138	.00	1.67E+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE138	.00	1.76E+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS138	.00	1.77E+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
EA138	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE139	.00	1.37E+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE139	.00	1.45E+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS139	.00	1.73E+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
EA139	.00	1.76E+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
EA139	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE140	.00	1.01E+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS140	.00	1.55E+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
EA140	.00	1.70E+06	1.00E+04	2.93E+02	4.16E+03	1.17E+11	.00	.00	.00	.00	.00
EA140	.00	1.75E+06	1.44E+04	3.39E+02	5.01E+03	1.29E+11	.00	.00	.00	.00	.00
CS140	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
EA141	.00	1.73E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS141	.00	1.13E+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
EA141	.00	1.57E+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
EA141	.00	1.59E+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE142	.00	1.62E+06	2.38E+05	5.32E+04	6.59E+02	2.44E+01	1.75E+11	.00	.00	.00	.00
EA142	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

POWER= 35.00MW, BURNUP= 33000.MWD, FLUX= 3.44E+13N/CM^2-SEC

NUCLEAR RADIOACTIVITY, CURIES
BASES = WT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
KE1A2	.00	1.06E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS1A2	.00	8.97E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
PA1A2	.00	1.46E+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
LA1A2	.00	1.56E+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
CE1A2	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PR1A2	.00	4.66E+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
ND1A2	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
KE1A5	.00	2.08E+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS1A5	.00	1.80E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
PA1A5	.00	1.15E+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
LA1A5	.00	1.42E+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
CE1A5	.00	1.42E+06	2.43E-14	.00	.00	.00	.00	.00	.00	.00	.00
PR1A5	.00	1.40E+06	1.48E+04	8.74E-02	1.47E-02	1.18E-10	.00	.00	.00	.00	.00
ND1A5	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
KE1A8	.00	1.29E+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
CE1A8	.00	1.26E+06	1.01E+06	8.51E+05	5.15E+05	2.11E+05	1.46E+04	1.49E+02	2.27E-02	5.50E-14	.00
PR1A8	.00	1.27E+06	1.01E+06	8.51E+05	5.15E+05	2.11E+05	1.46E+04	1.49E+02	2.27E-02	5.50E-14	.00
ND1A8	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CE1A5	.00	1.88E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
PR1A5	.00	1.88E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
ND1A5	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CE1A6	.00	8.02E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
PR1A6	.00	8.02E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
AC1A6	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CE1A7	.00	6.36E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
PR1A7	.00	6.36E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
ND1A7	.00	6.87E+05	2.44E+03	3.15E+01	8.53E-05	1.06E-14	.00	.00	.00	.00	.00
PR1A7	.00	1.04E+05	1.05E+05	1.00E+05	8.63E+04	8.62E+04	2.99E+04	7.98E+03	5.66E+02	2.07E-01	3.43E-01
SR1A7	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CE1A8	.00	1.99E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
PR1A8	.00	5.01E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
ND1A8	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PR1A8M	.00	4.06E+04	9.18E+03	2.89E+03	9.77E+01	2.16E-01	3.29E-04	2.67E-22	.00	.00	.00
PA1A8	.00	2.27E+05	3.80E+02	2.32E+02	7.85E+00	3.88E-02	2.65E-10	2.15E-23	.00	.00	.00
SR1A8	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PR1A8	.00	3.43E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
ND1A8	.00	3.91E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
PR1A8	.00	7.06E+05	4.33E-07	1.30E-16	.00	.00	.00	.00	.00	.00	.00
SR1A8	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
ND1A8	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PR1A8	.00	8.94E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR1A8	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
ND1A8	.00	2.06E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
PR1A8	.00	2.06E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR1A8	.00	1.26E+03	1.27E+03	1.27E+03	1.26E+03	1.25E+03	1.22E+03	1.17E+03	1.0E+03	8.53E+02	5.72E+02
CE1A5	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PR1A2	.00	1.49E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR1A2	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU1A2M	.00	4.34E+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU1A2	.00	1.08E+01	1.07E+01	1.06E+01	1.05E+01	9.44E+00	8.11E+00	6.08E+00	3.49E+00	8.01E-01	3.15E-02
EU1A2	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PR1A5	.00	8.12E+04	.00	.00	.00	.00	.00	.00	.00	.00	.00

POWER: 35.00MW, BURUP: 3300.MWD, FLUX: 3.44E+13N/CM^2-SEC

NUCLIDE RADIOACTIVITY, CURIES
BASIS = MT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	30. Y	100. Y
SR153	.00	5.74E+05	8.33E-09	1.46E-19	.00	.00	.00	.00	.00	.00	.00
EU153	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
GD153	.00	3.31E+01	2.56E+01	2.07E+01	1.11E+01	6.08E+00	1.77E-01	9.47E-04	2.71E-08	6.32E-22	.00
PR154	.00	6.39E+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR154	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU154	.00	7.08E+03	7.01E+03	6.95E+03	6.78E+03	6.49E+03	5.70E+03	4.59E+03	2.98E+03	8.12E+02	9.30E+01
GD154	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR155	.00	4.93E+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU155	.00	7.60E+03	6.92E+03	6.43E+03	5.19E+03	3.54E+03	1.12E+03	1.65E+02	1.55E+00	3.67E-05	1.77E-13
GD155	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR156	.00	2.26E+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU156	.00	2.68E+05	4.19E+03	1.65E+02	1.25E-02	5.85E-10	.00	.00	.00	.00	.00
GD156	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR157	.00	1.60E+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU157	.00	1.60E+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
GD157	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU158	.00	7.79E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
GD158	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU159	.00	4.04E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
GD159	.00	4.76E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
TR159	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU160	.00	1.67E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
GD160	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TR160	.00	1.88E+03	6.22E+02	3.18E+02	6.91E+01	1.32E+00	3.50E-05	9.29E-13	.00	.00	.00
TR160	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
GD161	.00	7.52E+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
TR161	.00	7.52E+02	8.90E-02	7.87E-05	8.71E-14	.00	.00	.00	.00	.00	.00
GT161	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
GD162	.00	3.70E+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
TR162M	.00	3.70E+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
TR162	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
GT162	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TR163M	.00	8.43E+01	.00	.00	.00	.00	.00	.00	.00	.00	.00
TR163	.00	8.24E+01	.00	.00	.00	.00	.00	.00	.00	.00	.00
GT163	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TR164	.00	5.57E+01	.00	.00	.00	.00	.00	.00	.00	.00	.00
GT164	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TR165M	.00	3.84E+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
TR165	.00	1.27E+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
MD165	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
GT166	.00	1.28E+01	1.35E-03	8.43E-14	.00	.00	.00	.00	.00	.00	.00
MD166M	.00	7.11E-04	7.11E-04	7.11E-04	7.10E-04	7.10E-04	7.09E-04	7.07E-04	7.01E-04	6.90E-04	6.71E-04
MD166	.00	1.45E+02	2.01E-07	1.26E-13	.00	.00	.00	.00	.00	.00	.00
EU166	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU167	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TOTAL	.00	1.61E+08	6.99E+06	4.66E+06	2.47E+06	1.30E+06	4.90E+05	3.27E+05	2.36E+05	1.14E+05	3.47E+04

POWER: 35.00MW, BURNUP: 33000 MWd, FUEL: 3.44*15W/CN=2-6CC

ELEMENTAL ACTIVITY, CURIES
BASES = MT OF HEAVY METAL CHARGED TO REACTOR

	CHANGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
H	.00	7.10+02	2.09+02	7.01+02	6.79+02	6.42+02	5.42+02	4.04+02	2.33+02	4.29+01	2.36+00
Zn	.00	2.38+01	2.41+13	3.30+24	.00	.00	.00	.00	.00	.00	.00
Ca	.00	1.28+03	3.34+13	4.73+24	.00	.00	.00	.00	.00	.00	.00
Sc	.00	4.89+04	4.82+14	.00	.00	.00	.00	.00	.00	.00	.00
Se	.00	4.89+05	3.98+01	3.98+01	3.98+01	3.98+01	3.98+01	3.98+01	3.98+01	3.98+01	3.98+01
Br	.00	2.45+06	1.04+15	.00	.00	.00	.00	.00	.00	.00	.00
Rb	.00	6.37+06	1.13+04	1.13+04	1.07+04	1.03+04	8.31+03	6.23+03	3.12+03	4.62+02	1.87+01
Kr	.00	4.61+06	2.04+01	1.52+00	1.74+04	1.94+05	1.94+05	1.94+05	1.94+05	1.94+05	1.94+05
Sr	.00	6.74+06	3.30+05	1.74+05	4.24+04	7.41+04	6.48+04	6.03+04	4.75+04	2.27+04	6.40+03
Y	.00	1.03+07	4.40+05	2.44+05	9.28+04	7.03+04	6.88+04	6.28+04	4.75+04	2.27+04	6.40+03
Zr	.00	4.47+06	6.14+05	2.91+05	3.26+04	6.65+02	1.89+00	1.88+00	1.88+00	1.88+00	1.88+00
Nb	.00	1.19+07	1.03+04	5.59+05	1.00+04	1.49+03	5.33+01	8.27+01	1.25+00	1.75+00	1.47+00
Mo	.00	8.27+06	3.50+04	9.95+12	.00	.00	.00	.00	.00	.00	.00
Tc	.00	9.76+06	1.43+01	1.43+01	1.43+01	1.43+01	1.43+01	1.43+01	1.43+01	1.43+01	1.43+01
Ru	.00	4.28+06	7.98+05	5.28+05	3.02+05	1.50+05	1.40+04	6.02+02	6.08+01	6.24+10	6.72+25
Rh	.00	6.82+06	7.99+05	5.28+05	3.02+05	1.50+05	1.40+04	6.02+02	6.08+01	6.24+10	6.72+25
Pd	.00	5.69+05	1.11+01	1.11+01	1.11+01	1.11+01	1.11+01	1.11+01	1.11+01	1.11+01	1.11+01
Ag	.00	6.83+05	3.53+03	2.44+03	1.68+03	3.08+01	2.05+01	9.24+06	3.94+00	9.03+03	7.55+02
Cd	.00	5.49+04	1.63+02	5.93+01	1.20+01	9.73+00	4.38+00	6.54+00	3.94+00	.00	.00
In	.00	1.24+05	8.67+01	3.29+01	1.97+02	1.23+04	3.05+11	3.08+22	.00	.00	.00
Sn	.00	3.80+06	4.23+03	9.24+03	1.36+03	1.87+02	1.04+00	5.35+01	5.05+01	5.50+03	5.50+03
Sb	.00	1.84+06	8.87+03	9.24+03	1.36+03	1.87+02	1.04+00	5.35+01	5.05+01	5.50+03	5.50+03
Te	.00	1.56+06	4.18+04	2.09+04	4.44+03	2.64+03	1.07+03	2.95+02	2.27+01	1.02+02	2.72+06
I	.00	1.36+07	4.47+02	1.32+00	3.75+02	3.75+02	3.75+02	3.75+02	3.75+02	3.75+02	3.75+02
Xe	.00	9.33+06	1.36+02	2.07+00	1.21+05	5.80+15	.00	.00	.00	.00	.00
Cs	.00	4.13+06	3.45+05	3.29+05	2.84+05	2.34+05	1.44+05	9.48+04	4.86+04	3.41+04	1.08+04
Ba	.00	1.74+06	1.14+05	1.01+05	9.41+04	9.66+04	9.05+04	6.05+04	6.33+04	3.29+04	1.01+04
La	.00	7.59+06	1.49+04	3.32+02	5.01+03	1.29+11	.00	.00	.00	.00	.00
Ce	.00	7.23+06	1.25+04	9.04+05	3.16+05	2.11+05	1.46+04	1.44+02	2.27+02	5.50+14	.00
Pr	.00	6.21+06	1.03+04	8.51+05	5.15+05	2.11+05	1.46+04	1.44+02	2.27+02	5.50+14	.00
Nd	.00	1.28+06	2.49+03	3.35+01	8.53+05	1.06+16	.00	.00	.00	.00	.00
Pm	.00	1.63+06	1.15+05	1.03+05	8.44+04	6.62+04	2.99+04	7.98+03	5.66+02	2.02+03	3.62+07
Sm	.00	6.63+05	1.27+03	1.27+03	1.26+03	1.25+03	1.22+03	1.17+03	1.04+03	8.53+02	5.72+02
Eu	.00	3.13+05	1.63+04	1.36+04	1.20+04	1.00+04	6.43+03	4.76+03	2.98+03	8.12+02	9.30+01
Gd	.00	5.93+03	2.54+01	2.09+01	1.16+01	9.09+00	1.77+01	9.47+04	2.71+08	6.32+22	.00
Tb	.00	2.82+03	6.22+02	3.18+02	4.41+01	1.32+00	3.50+05	8.29+13	.00	.00	.00
Dy	.00	5.24+02	1.35+01	8.43+14	.00	.00	.00	.00	.00	.00	.00
Ho	.00	1.43+02	7.17+04	7.11+04	7.10+04	7.10+04	7.09+04	7.07+04	7.07+04	6.90+04	6.71+04
TOTALS	.00	1.41+08	6.99+06	6.66+06	2.43+06	1.30+06	4.90+05	3.22+05	2.16+05	1.14+05	5.47+04
SUBTOT	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TOTALS	.00	1.41+08	6.99+06	6.66+06	2.43+06	1.30+06	4.90+05	3.22+05	2.16+05	1.14+05	5.47+04

TABLE D-2

QUANTITIES OF FISSION PRODUCTS IN SPENT FUEL VS. DECAY TIMES

POWER: 35.0MW, BURNUP: 33000.0WD, FUEL: 3.00*13M/CMO2-SEC

NUCLIDE CONCENTRATIONS, GRAMS
BASES = G1 OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	3. Y	10. Y	20. Y	50. Y	100. Y
H 3	.00	1.41-02	1.41-02	1.23-02	1.01-02	6.62-02	5.59-02	6.22-02	2.40-02	4.43-03	2.65-04
He 32	.00	2.54-05	2.69-05	3.32-05	.00	.00	.00	.00	.00	.00	.00
He 72	.00	1.70-04	1.15-03	1.55-03	.00	.00	.00	.00	.00	.00	.00
He 72	.00	5.87-03	5.90-03	5.90-03	5.90-03	5.90-03	5.90-03	5.90-03	5.90-03	5.90-03	5.90-03
He 73	.00	5.40-06	.00	.00	.00	.00	.00	.00	.00	.00	.00
He 73	.00	1.51-02	1.51-02	1.51-02	1.51-02	1.51-02	1.51-02	1.51-02	1.51-02	1.51-02	1.51-02
He 74	.00	5.58-07	.00	.00	.00	.00	.00	.00	.00	.00	.00
He 74	.00	5.59-02	5.59-02	5.59-02	5.59-02	5.59-02	5.59-02	5.59-02	5.59-02	5.59-02	5.59-02
He 75	.00	1.78-07	.00	.00	.00	.00	.00	.00	.00	.00	.00
He 75M	.00	6.83-08	.00	.00	.00	.00	.00	.00	.00	.00	.00
He 75	.00	7.29-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
As 75	.00	8.46-02	8.46-02	8.46-02	8.46-02	8.46-02	8.46-02	8.46-02	8.46-02	8.46-02	8.46-02
As 76	.00	1.70-07	.00	.00	.00	.00	.00	.00	.00	.00	.00
Ge 76	.00	2.94-01	2.94-01	2.94-01	2.94-01	2.94-01	2.94-01	2.94-01	2.94-01	2.94-01	2.94-01
As 76	.00	7.27-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
Se 76	.00	1.85-03	1.85-03	1.85-03	1.85-03	1.85-03	1.85-03	1.85-03	1.85-03	1.85-03	1.85-03
Se 77M	.00	7.90-07	.00	.00	.00	.00	.00	.00	.00	.00	.00
Ge 77	.00	2.80-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
As 77	.00	4.58-02	4.58-02	4.58-02	4.58-02	4.58-02	4.58-02	4.58-02	4.58-02	4.58-02	4.58-02
Se 77M	.00	9.72-10	1.73-04	.00	.00	.00	.00	.00	.00	.00	.00
Se 77	.00	9.45-01	9.45-01	9.45-01	9.45-01	9.45-01	9.45-01	9.45-01	9.45-01	9.45-01	9.45-01
Ge 78	.00	2.41-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
As 78M	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
As 78	.00	2.49-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
Se 78	.00	2.54-00	2.54-00	2.54-00	2.54-00	2.54-00	2.54-00	2.54-00	2.54-00	2.54-00	2.54-00
As 79	.00	4.93-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
Se 79M	.00	2.13-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
Se 79	.00	5.71-00	5.71-00	5.71-00	5.71-00	5.71-00	5.71-00	5.71-00	5.71-00	5.71-00	5.71-00
Se 79	.00	5.46-04	5.46-04	5.46-04	5.46-04	5.46-04	5.46-04	5.46-04	5.46-04	5.46-04	5.46-04
As 80	.00	2.36-06	.00	.00	.00	.00	.00	.00	.00	.00	.00
Se 80	.00	9.97-00	9.97-00	9.97-00	9.97-00	9.97-00	9.97-00	9.97-00	9.97-00	9.97-00	9.97-00
Br 80M	.00	2.51-07	.00	.00	.00	.00	.00	.00	.00	.00	.00
Br 80	.00	1.03-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
Br 80	.00	2.83-01	2.83-01	2.83-01	2.83-01	2.83-01	2.83-01	2.83-01	2.83-01	2.83-01	2.83-01
As 81	.00	1.08-06	.00	.00	.00	.00	.00	.00	.00	.00	.00
Se 81M	.00	1.82-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
Se 81	.00	2.93-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
Br 81	.00	1.53-01	1.53-01	1.53-01	1.53-01	1.53-01	1.53-01	1.53-01	1.53-01	1.53-01	1.53-01
Kr 81M	.00	3.61-08	.00	.00	.00	.00	.00	.00	.00	.00	.00
Kr 81	.00	1.55-01	1.55-01	1.55-01	1.55-01	1.55-01	1.55-01	1.55-01	1.55-01	1.55-01	1.55-01
Se 82	.00	3.28-01	3.28-01	3.28-01	3.28-01	3.28-01	3.28-01	3.28-01	3.28-01	3.28-01	3.28-01
Br 82M	.00	6.81-06	.00	.00	.00	.00	.00	.00	.00	.00	.00
Se 82	.00	2.57-05	9.78-22	4.64-04	.00	.00	.00	.00	.00	.00	.00
Kr 82	.00	4.63-01	4.63-01	4.63-01	4.63-01	4.63-01	4.63-01	4.63-01	4.63-01	4.63-01	4.63-01
Se 83M	.00	1.81-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
Se 83	.00	3.40-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
Br 83	.00	4.12-03	.00	.00	.00	.00	.00	.00	.00	.00	.00
Kr 83M	.00	3.14-03	.00	.00	.00	.00	.00	.00	.00	.00	.00
Br 83	.00	4.04-01	4.04-01	4.04-01	4.04-01	4.04-01	4.04-01	4.04-01	4.04-01	4.04-01	4.04-01
Se 84	.00	2.57-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
Br 84M	.00	9.15-06	.00	.00	.00	.00	.00	.00	.00	.00	.00
Br 84	.00	2.48-03	.00	.00	.00	.00	.00	.00	.00	.00	.00

POWER= 35.00MW, BURNUP= 33880.MWD, FLUX= 3.44E+13N/CM^2-SEC

NUCLIDE CONCENTRATIONS, GRAMS
BASIS = PT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
SR 84	.00	1.11E+02	1.11E+02	1.11E+02	1.11E+02	1.11E+02	1.11E+02	1.11E+02	1.11E+02	1.11E+02	1.11E+02
SE 85	.00	5.67E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
OR 85	.00	2.62E+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 85H	.00	2.60E+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 85	.00	2.76E+02	2.89E+01	2.86E+01	2.76E+01	2.59E+01	2.13E+01	1.55E+01	8.18E+00	1.19E+00	4.79E-02
NR 85	.00	9.37E+01	9.42E+01	9.46E+01	9.56E+01	9.73E+01	1.02E+02	1.08E+02	1.15E+02	1.22E+02	1.23E+02
NR 86	.00	1.32E+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 86H	.00	1.92E+02	1.92E+02	1.92E+02	1.92E+02	1.92E+02	1.92E+02	1.92E+02	1.92E+02	1.92E+02	1.92E+02
NR 86H	.00	2.33E+08	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 86	.00	7.04E+03	7.51E+04	1.87E+05	9.28E+09	1.22E+11	2.80E+12	.00	.00	.00	.00
SR 86	.00	1.15E+01	1.22E+01	1.22E+01	1.22E+01	1.22E+01	1.22E+01	1.22E+01	1.22E+01	1.22E+01	1.22E+01
NR 87	.00	1.66E+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 87	.00	1.47E+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 87	.00	2.38E+02	2.38E+02	2.38E+02	2.38E+02	2.38E+02	2.38E+02	2.38E+02	2.38E+02	2.38E+02	2.38E+02
SR 87H	.00	3.50E+08	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 87	.00	5.72E+05	5.73E+05	5.73E+05	5.73E+05	5.73E+05	5.73E+05	5.73E+05	5.73E+05	5.73E+05	5.73E+05
NR 88	.00	7.23E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 88	.00	4.82E+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 88	.00	5.11E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 88	.00	3.49E+02	3.49E+02	3.49E+02	3.49E+02	3.49E+02	3.49E+02	3.49E+02	3.49E+02	3.49E+02	3.49E+02
NR 89	.00	2.53E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 89	.00	1.15E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 89	.00	5.56E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 89	.00	2.97E+01	8.95E+00	3.52E+00	2.28E+01	1.75E+03	7.98E+10	2.12E+20	.00	.00	.00
NR 89	.00	4.36E+02	4.56E+02	4.62E+02	4.65E+02	4.65E+02	4.65E+02	4.65E+02	4.65E+02	4.65E+02	4.65E+02
NR 90	.00	2.26E+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 90	.00	1.19E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 90	.00	5.60E+02	5.67E+02	5.64E+02	5.57E+02	5.28E+02	4.88E+02	4.30E+02	3.56E+02	1.60E+02	4.63E+01
NR 90H	.00	2.12E+07	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 90	.00	1.49E+01	1.42E+01	1.41E+01	1.40E+01	1.36E+01	1.24E+01	1.17E+01	8.77E+00	4.18E+00	1.21E+00
NR 90	.00	1.99E+01	2.32E+01	2.58E+01	3.33E+01	4.68E+01	6.37E+01	1.40E+02	2.39E+02	4.10E+02	5.24E+02
NR 91	.00	5.11E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 91	.00	5.45E+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 91	.00	2.93E+01	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 91H	.00	1.49E+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 91	.00	4.49E+01	1.57E+01	6.86E+00	6.10E+01	8.23E+03	2.02E+08	9.01E+18	1.79E+36	.00	.00
NR 91	.00	5.49E+02	5.99E+02	6.03E+02	6.09E+02	6.09E+02	6.09E+02	6.09E+02	6.09E+02	6.09E+02	6.09E+02
NR 92	.00	9.69E+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 92	.00	4.53E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 92	.00	6.35E+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 92	.00	1.23E+01	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 92	.00	6.62E+02	6.62E+02	6.62E+02	6.62E+02	6.62E+02	6.62E+02	6.62E+02	6.62E+02	6.62E+02	6.62E+02
NR 93	.00	7.32E+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 93	.00	6.02E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 93	.00	5.19E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 93	.00	3.97E+01	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 93	.00	7.34E+02	7.35E+02	7.35E+02	7.35E+02	7.35E+02	7.35E+02	7.35E+02	7.35E+02	7.35E+02	7.35E+02
NR 93H	.00	4.61E+04	5.18E+04	5.78E+04	7.50E+04	1.04E+05	1.44E+05	2.92E+05	4.47E+05	6.17E+05	8.67E+05
NR 93	.00	2.00E+05	2.02E+05	3.14E+05	5.05E+05	9.82E+05	3.18E+06	9.31E+06	2.83E+07	1.13E+08	2.78E+08
NR 94	.00	6.03E+07	.00	.00	.00	.00	.00	.00	.00	.00	.00
NR 94	.00	1.47E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 94	.00	6.17E+04	.00	.00	.00	.00	.00	.00	.00	.00	.00

POWER: 35.00MW, BURNUP: 33000.MWD, FLUX: 3.40E+13M/CM2-SEC

NUCLIDE CONCENTRATIONS, GRAMS
BASIS: 1 MT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
Y 99	.00	1.28E-02	.00	.00	.00	.00	.00	.00	.00	.00	.00
ZR 94	.00	7.90E-02	7.90E-02	7.90E-02	7.90E-02	7.90E-02	7.90E-02	7.90E-02	7.90E-02	7.90E-02	7.90E-02
RB 95	.00	9.13E-06	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 95	.00	4.71E-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
Y 95	.00	8.57E-03	.00	.00	.00	.00	.00	.00	.00	.00	.00
ZR 95	.00	7.58E-01	2.90E-01	1.38E-01	1.54E-01	5.13E-02	2.64E-01	9.17E-16	1.11E-32	.00	.00
NB 95M	.00	8.98E-02	3.55E-02	1.68E-02	1.69E-03	3.68E-05	3.23E-10	1.12E-18	.00	.00	.00
NB 95	.00	4.11E-01	2.59E-01	1.41E-01	1.74E-01	3.75E-02	3.08E-01	1.07E-15	2.75E-34	.00	.00
MO 95	.00	3.56E-02	7.18E-02	7.45E-02	7.64E-02	7.72E-02	7.75E-02	7.73E-02	7.73E-02	7.73E-02	7.73E-02
Y 96	.00	1.08E-03	.00	.00	.00	.00	.00	.00	.00	.00	.00
ZR 96	.00	8.31E-02	8.31E-02	8.31E-02	8.31E-02	8.31E-02	8.31E-02	8.31E-02	8.31E-02	8.31E-02	8.31E-02
NB 96	.00	1.14E-03	.00	.00	.00	.00	.00	.00	.00	.00	.00
MO 96	.00	3.84E-01	3.84E-01	3.84E-01	3.84E-01	3.84E-01	3.84E-01	3.84E-01	3.84E-01	3.84E-01	3.84E-01
Y 97	.00	8.31E-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
ZR 97	.00	8.44E-01	.00	.00	.00	.00	.00	.00	.00	.00	.00
NB 97M	.00	7.99E-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
NB 97	.00	5.99E-02	.00	.00	.00	.00	.00	.00	.00	.00	.00
MO 97	.00	8.33E-02	8.33E-02	8.33E-02	8.33E-02	8.33E-02	8.33E-02	8.33E-02	8.33E-02	8.33E-02	8.33E-02
ZR 98	.00	6.59E-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
NB 98M	.00	3.7E-03	.00	.00	.00	.00	.00	.00	.00	.00	.00
NB 98	.00	1.13E-03	.00	.00	.00	.00	.00	.00	.00	.00	.00
MO 98	.00	8.50E-02	8.50E-02	8.50E-02	8.50E-02	8.50E-02	8.50E-02	8.50E-02	8.50E-02	8.50E-02	8.50E-02
NB 99	.00	2.23E-03	.00	.00	.00	.00	.00	.00	.00	.00	.00
MO 99	.00	3.76E-01	7.42E-10	2.11E-17	.00	.00	.00	.00	.00	.00	.00
IC 99M	.00	2.93E-03	4.35E-11	1.80E-18	.00	.00	.00	.00	.00	.00	.00
IC 99	.00	8.18E-02	4.82E-02	4.42E-02	4.42E-02	4.42E-02	4.42E-02	4.42E-02	4.42E-02	4.42E-02	4.42E-02
TC 94	.00	3.59E-03	4.23E-03	4.79E-03	4.63E-03	4.63E-03	4.63E-03	4.63E-03	4.63E-03	4.63E-03	4.63E-03
MO 100	.00	9.73E-02	9.73E-02	9.73E-02	9.73E-02	9.73E-02	9.73E-02	9.73E-02	9.73E-02	9.73E-02	9.73E-02
TC 100	.00	5.74E-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
MO 100	.00	5.64E-01	5.64E-01	5.64E-01	5.64E-01	5.64E-01	5.64E-01	5.64E-01	5.64E-01	5.64E-01	5.64E-01
MO 101	.00	8.73E-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
MO 101	.00	1.29E-07	.00	.00	.00	.00	.00	.00	.00	.00	.00
TC 101	.00	1.23E-02	.00	.00	.00	.00	.00	.00	.00	.00	.00
MO 101	.00	7.77E-02	7.77E-02	7.77E-02	7.77E-02	7.77E-02	7.77E-02	7.77E-02	7.77E-02	7.77E-02	7.77E-02
MO 102	.00	9.34E-03	.00	.00	.00	.00	.00	.00	.00	.00	.00
TC 102M	.00	1.91E-03	.00	.00	.00	.00	.00	.00	.00	.00	.00
TC 102	.00	3.54E-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
MO 102	.00	7.70E-02	7.70E-02	7.70E-02	7.70E-02	7.70E-02	7.70E-02	7.70E-02	7.70E-02	7.70E-02	7.70E-02
MO 103	.00	7.92E-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
TC 103	.00	6.38E-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
MO 103	.00	4.45E-01	9.20E-01	2.70E-01	7.44E-01	1.24E-04	5.81E-11	7.59E-27	.00	.00	.00
MO 103M	.00	4.45E-02	9.21E-01	2.71E-01	7.44E-01	1.24E-01	5.81E-16	7.60E-30	.00	.00	.00
MO 103	.00	3.47E-02	3.83E-02	3.89E-02	3.92E-02	3.92E-02	3.92E-02	3.92E-02	3.92E-02	3.92E-02	3.92E-02
MO 104	.00	9.00E-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
TC 104	.00	3.33E-02	.00	.00	.00	.00	.00	.00	.00	.00	.00
MO 104	.00	5.48E-02	5.48E-02	5.48E-02	5.48E-02	5.48E-02	5.48E-02	5.48E-02	5.48E-02	5.48E-02	5.48E-02
MO 104M	.00	3.77E-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
MO 104	.00	3.94E-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
MO 104	.00	2.47E-02	2.43E-02	2.43E-02	2.43E-02	2.43E-02	2.43E-02	2.43E-02	2.43E-02	2.43E-02	2.43E-02
MO 105	.00	4.04E-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
TC 105	.00	4.21E-05	.00	.00	.00	.00	.00	.00	.00	.00	.00

POWER: 35.00MW, BURUPP: 3300g.MWD, FLUX: 3.44E+13N/C/M2-SEC

NUCLIDE CONCENTRATIONS, GRAMS
04515 = RT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
RU105	.00	3.65-01	.00	.00	.00	.00	.00	.00	.00	.00	.00
RU105N	.00	4.65-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
RU105	.00	8.90-01	8.32-19	6.85-33	.00	.00	.00	.00	.00	.00	.00
PD105	.00	2.63-02	2.84-02	1.84-02	2.84-02	2.84-02	2.84-02	2.84-02	2.84-02	2.84-02	2.84-02
YD104	.00	3.18-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
RU104	.00	1.78-02	1.50-02	1.33-02	0.92-01	0.97-01	5.65-00	1.79-01	1.87-04	1.86-13	1.94-28
RU104N	.00	8.80-03	.00	.00	.00	.00	.00	.00	.00	.00	.00
PM106	.00	2.40-04	1.42-04	1.24-04	0.44-05	0.23-05	5.34-06	1.70-07	1.71-10	1.76-19	1.84-34
PD106	.00	2.89-02	3.17-02	3.35-02	3.78-02	4.22-02	4.61-02	4.67-02	4.67-02	4.67-02	4.67-02
RU107	.00	1.62-03	.00	.00	.00	.00	.00	.00	.00	.00	.00
RU107	.00	8.50-03	.00	.00	.00	.00	.00	.00	.00	.00	.00
PD107N	.00	2.92-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
PD107	.00	2.33-02	2.33-02	2.33-02	2.33-02	2.33-02	2.33-02	2.33-02	2.33-02	2.33-02	2.33-02
AG107	.00	2.30-05	2.81-05	3.31-05	4.61-05	6.92-05	1.34-04	2.34-04	4.85-04	1.18-03	2.33-03
KU108	.00	1.22-03	.00	.00	.00	.00	.00	.00	.00	.00	.00
RU108	.00	7.71-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
PD108	.00	1.57-02	1.57-02	1.57-02	1.57-02	1.57-02	1.57-02	1.57-02	1.57-02	1.57-02	1.57-02
AG108	.00	4.33-12	.00	.00	.00	.00	.00	.00	.00	.00	.00
CO108	.00	4.37-07	4.37-07	4.37-07	4.37-07	4.37-07	4.37-07	4.37-07	4.37-07	4.37-07	4.37-07
RU109	.00	1.63-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
PD109N	.00	3.14-06	.00	.00	.00	.00	.00	.00	.00	.00	.00
PD109	.00	1.56-01	.00	.00	.00	.00	.00	.00	.00	.00	.00
AG109N	.00	1.24-04	1.31-15	1.19-15	0.59-16	0.93-16	9.19-17	5.62-19	2.10-20	1.10-21	.00
AG109	.00	6.03-03	6.02-03	6.02-03	6.02-03	6.02-03	6.02-03	6.02-03	6.02-03	6.02-03	6.02-03
CU109	.00	1.47-09	1.28-09	1.15-09	0.61-10	0.61-10	0.99-11	5.50-12	2.05-14	1.07-15	7.03-16
PM110	.00	0.61-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
PD110	.00	3.38-01	3.38-01	3.38-01	3.38-01	3.38-01	3.38-01	3.38-01	3.38-01	3.38-01	3.38-01
AG110N	.00	0.60-01	6.72-03	5.55-03	3.16-03	1.16-03	5.77-03	3.07-05	1.75-09	1.60-12	.00
AG110	.00	4.47-05	9.25-08	8.05-08	4.59-06	1.69-08	8.37-10	5.62-12	2.53-16	2.32-19	.00
CO110	.00	4.08-01	4.10-01	4.11-01	4.14-01	4.16-01	4.17-01	4.17-01	4.17-01	4.17-01	4.17-01
PD111N	.00	3.52-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
PD111	.00	5.95-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
AG111N	.00	3.19-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
AG111	.00	2.96-01	7.26-05	1.13-07	6.49-16	1.43-30	.00	.00	.00	.00	.00
CO111N	.00	2.27-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
CO111	.00	3.72-01	1.75-01	1.75-01	1.75-01	1.75-01	1.75-01	1.75-01	1.75-01	1.75-01	1.75-01
PD112	.00	0.81-02	.00	.00	.00	.00	.00	.00	.00	.00	.00
AG112	.00	2.75-03	.00	.00	.00	.00	.00	.00	.00	.00	.00
CO112	.00	9.43-00	9.43-00	9.43-00	9.43-00	9.43-00	9.43-00	9.43-00	9.43-00	9.43-00	9.43-00
PD113	.00	1.38-03	.00	.00	.00	.00	.00	.00	.00	.00	.00
AG113N	.00	1.14-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
AG113	.00	2.82-03	.00	.00	.00	.00	.00	.00	.00	.00	.00
CO113N	.00	4.75-02	4.69-02	4.65-02	4.52-02	4.30-02	1.71-02	2.49-02	1.76-02	3.99-03	3.34-04
CO113	.00	2.20-01	2.22-01	2.22-01	2.22-01	2.22-01	2.22-01	2.22-01	2.22-01	2.22-01	2.22-01
YD113	.00	1.31-03	1.48-03	2.13-03	3.60-03	5.18-03	1.17-02	1.94-02	3.11-02	4.48-02	4.84-02
PD114	.00	1.63-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
PD114	.00	5.64-07	.00	.00	.00	.00	.00	.00	.00	.00	.00
CO114	.00	1.24-01	1.24-01	1.24-01	1.24-01	1.24-01	1.24-01	1.24-01	1.24-01	1.24-01	1.24-01
IN114N	.00	6.71-05	5.93-05	7.30-06	4.24-07	2.68-09	4.77-14	4.63-27	.00	.00	.00
IN114	.00	1.61-09	3.10-10	3.17-10	6.82-12	4.31-14	1.09-20	1.10-31	.00	.00	.00
SM114	.00	2.54-04	2.49-04	3.10-04	3.17-04	3.17-04	3.17-04	3.17-04	3.17-04	3.17-04	3.17-04
PD115	.00	4.20-06	.00	.00	.00	.00	.00	.00	.00	.00	.00

POWER: 35.00MW, BURHUP: 13000.MWD, FLUX: 3.00E+15N/CM^2-SEC

NUCLIDE CONCENTRATIONS, GRAMS
BASIS : MT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
AB115M	.00	5.27-07	.00	.00	.00	.00	.00	.00	.00	.00	.00
AB115	.00	8.06-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
CD115M	.00	2.44-02	5.71-03	1.45-03	6.75-03	1.87-07	3.49-15	6.53-24	.00	.00	.00
CD115	.00	1.78-02	1.25-14	4.43-24	.00	.00	.00	.00	.00	.00	.00
IN115M	.00	3.50-03	1.15-15	4.03-24	.00	.00	.00	.00	.00	.00	.00
IN115	.00	1.19-00	1.23-00	3.73-00	1.24-00	1.24-00	1.24-00	1.24-00	1.24-00	1.24-00	1.24-00
SN115	.00	1.94-01	1.95-01	1.95-01	1.95-01	1.95-01	1.95-01	1.95-01	1.95-01	1.95-01	1.95-01
AB116	.00	1.30-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
CD116	.00	3.78-00	3.78-00	3.78-00	3.78-00	3.78-00	3.78-00	3.78-00	3.78-00	3.78-00	3.78-00
IN116M	.00	2.24-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN116	.00	2.60-07	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN116	.00	2.75-00	2.76-00	2.76-00	2.76-00	2.76-00	2.76-00	2.76-00	2.76-00	2.76-00	2.76-00
AB117	.00	5.93-06	.00	.00	.00	.00	.00	.00	.00	.00	.00
CD117M	.00	1.57-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
CD117	.00	7.78-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN117M	.00	6.26-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN117	.00	1.12-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN117M	.00	8.60-04	1.02-05	3.19-07	1.23-11	1.72-19	.00	.00	.00	.00	.00
SN117	.00	3.92-00	3.92-00	3.92-00	3.92-00	3.92-00	3.92-00	3.92-00	3.92-00	3.92-00	3.92-00
CD118	.00	2.66-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN118M	.00	3.62-11	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN118	.00	4.53-07	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN118	.00	4.30-00	4.30-00	4.30-00	4.30-00	4.30-00	4.30-00	4.30-00	4.30-00	4.30-00	4.30-00
CD119M	.00	7.44-06	.00	.00	.00	.00	.00	.00	.00	.00	.00
CD119	.00	2.83-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN119M	.00	1.02-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN119	.00	5.44-07	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN119M	.00	4.20-03	3.27-03	2.70-03	1.53-03	5.54-04	2.46-05	1.68-07	6.73-12	4.28-25	.00
SN119	.00	4.14-00	4.14-00	4.14-00	4.14-00	4.15-00	4.15-00	4.15-00	4.15-00	4.15-00	4.15-00
CD120	.00	5.76-06	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN120M	.00	1.54-07	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN120	.00	2.71-06	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN120	.00	4.32-00	4.32-00	4.32-00	4.32-00	4.32-00	4.32-00	4.32-00	4.32-00	4.32-00	4.32-00
CD121	.00	2.21-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN121M	.00	1.96-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN121	.00	4.05-08	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN121M	.00	1.44-05	1.44-05	1.43-05	1.43-05	1.43-05	1.43-05	1.43-05	1.43-05	1.43-05	1.43-05
SN121	.00	1.34-07	.00	.00	.00	.00	.00	.00	.00	.00	.00
SE121	.00	4.51-00	4.52-00	4.52-00	4.52-00	4.52-00	4.52-00	4.52-00	4.52-00	4.52-00	4.52-00
IN122	.00	8.37-07	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN122	.00	5.06-00	5.06-00	5.06-00	5.06-00	5.06-00	5.06-00	5.06-00	5.06-00	5.06-00	5.06-00
SE122M	.00	3.46-07	.00	.00	.00	.00	.00	.00	.00	.00	.00
SE122	.00	3.32-03	7.00-13	2.09-20	.00	.00	.00	.00	.00	.00	.00
TE122	.00	3.08-03	3.11-03	3.11-03	3.11-03	3.11-03	3.11-03	3.11-03	3.11-03	3.11-03	3.11-03
IN123M	.00	4.28-08	.00	.00	.00	.00	.00	.00	.00	.00	.00
IN123	.00	1.46-07	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN123M	.00	3.51-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN123	.00	1.23-00	7.33-01	4.93-01	1.54-01	2.10-02	4.83-05	1.93-09	5.04-18	.00	.00
SE123	.00	4.40-00	4.40-00	4.40-00	4.40-00	4.40-00	4.40-00	4.40-00	4.40-00	4.40-00	4.40-00
TE123M	.00	1.54-05	4.43-05	2.82-05	1.44-06	4.95-07	1.51-09	3.02-14	1.21-23	.00	.00
TE123	.00	3.93-04	4.24-04	4.39-04	4.63-04	4.67-04	4.68-04	4.68-04	4.68-04	4.68-04	4.68-04
IN124	.00	8.50-07	.00	.00	.00	.00	.00	.00	.00	.00	.00

POWER: 35.00W, BURMP: 33000.HUD, FLUX: 3.00E+13W/CM^2-SEC

NUCLIDE CONCENTRATIONS, MUONS
BASIS: RT OF HEAVY METAL CHARGED TO REACTION

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
SM124	.00	7.55E+00	7.55E+00	7.55E+00	7.55E+00	7.55E+00	7.55E+00	7.55E+00	7.55E+00	7.55E+00	7.55E+00
SM124M	.00	3.96E+08	.00	.00	.00	.00	.00	.00	.00	.00	.00
SM124	.00	2.36E+07	8.34E+03	3.71E+03	3.47E+03	5.16E+04	1.62E+11	1.33E+20	.00	.00	.00
TE124	.00	9.69E+02	1.12E+01	1.17E+01	1.20E+01	1.20E+01	1.20E+01	1.20E+01	1.20E+01	1.20E+01	1.20E+01
SM125M	.00	5.66E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
SM125	.00	1.04E+01	1.09E+04	1.09E+04	2.09E+13	5.10E+25	.00	.00	.00	.00	.00
SM125	.00	8.02E+00	8.23E+00	8.23E+00	6.78E+00	5.24E+00	2.43E+00	6.72E+01	3.16E+02	2.33E+03	6.20E+11
TE125M	.00	1.18E+01	1.68E+01	1.86E+01	1.65E+01	1.28E+01	3.92E+02	1.0E+02	1.28E+03	5.08E+07	1.53E+12
TE125	.00	2.18E+00	2.92E+00	3.31E+00	4.18E+00	5.95E+00	8.64E+00	1.06E+01	1.67E+01	3.13E+01	1.13E+01
SM126	.00	1.98E+01	1.94E+01	1.94E+01	1.94E+01	1.94E+01	1.94E+01	1.94E+01	1.94E+01	1.94E+01	1.94E+01
SM126M	.00	5.51E+07	7.00E+09	7.00E+09	7.00E+09	7.00E+09	7.00E+09	7.00E+09	7.00E+09	7.00E+09	7.00E+09
SM126	.00	8.33E+04	1.27E+05	6.83E+04	6.56E+04	6.56E+04	6.56E+04	6.56E+04	6.56E+04	6.56E+04	6.56E+04
TE126	.00	4.17E+02	4.25E+02	4.26E+02	4.27E+02	4.28E+02	4.32E+02	4.38E+02	4.52E+02	4.92E+02	5.59E+02
SM127M	.00	2.19E+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
SM127	.00	7.16E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
SM127	.00	3.27E+01	3.35E+08	1.32E+13	1.38E+29	.00	.00	.00	.00	.00	.00
TE127M	.00	1.89E+00	1.11E+00	7.10E+01	1.92E+01	1.88E+02	1.77E+05	1.40E+10	1.31E+20	.00	.00
TE127	.00	3.20E+02	3.93E+03	2.52E+03	6.83E+04	6.69E+05	6.30E+09	5.69E+13	4.06E+23	.00	.00
TE127	.00	3.81E+01	3.93E+01	3.97E+01	4.02E+01	4.03E+01	4.04E+01	4.04E+01	4.04E+01	4.04E+01	4.04E+01
SM128	.00	9.62E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
SM128M	.00	1.14E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
SM128	.00	1.16E+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE128	.00	1.34E+02	1.34E+02	1.34E+02	1.34E+02	1.34E+02	1.34E+02	1.34E+02	1.34E+02	1.34E+02	1.34E+02
TE128	.00	2.12E+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE128	.00	3.02E+00	3.02E+00	3.02E+00	3.02E+00	3.02E+00	3.02E+00	3.02E+00	3.02E+00	3.02E+00	3.02E+00
SM129M	.00	1.67E+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
SM129	.00	1.45E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
SM129	.00	7.34E+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE129M	.00	2.25E+00	3.61E+01	6.87E+02	1.37E+03	7.70E+07	1.53E+16	1.03E+32	.00	.00	.00
TE129	.00	1.89E+02	3.29E+04	7.83E+05	3.19E+06	6.95E+10	3.39E+19	.00	.00	.00	.00
TE129	.00	2.28E+02	2.30E+02	2.30E+02	2.30E+02	2.30E+02	2.30E+02	2.30E+02	2.30E+02	2.30E+02	2.30E+02
TE129M	.00	1.16E+04	4.79E+08	2.11E+10	2.09E+14	3.77E+32	.00	.00	.00	.00	.00
TE129	.00	9.07E+02	9.08E+02	9.08E+02	9.08E+02	9.08E+02	9.08E+02	9.08E+02	9.13E+02	9.13E+02	9.13E+02
SM130	.00	1.21E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
SM130M	.00	2.94E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
SM130	.00	1.72E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE130	.00	4.26E+02	4.26E+02	4.26E+02	4.26E+02	4.26E+02	4.26E+02	4.26E+02	4.26E+02	4.26E+02	4.26E+02
TE130M	.00	1.13E+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE130	.00	2.07E+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
SM130	.00	1.13E+01	1.13E+01	1.13E+01	1.13E+01	1.13E+01	1.13E+01	1.13E+01	1.13E+01	1.13E+01	1.13E+01
SM131	.00	2.33E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
SM131	.00	1.61E+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE131M	.00	1.09E+01	4.04E+23	.00	.00	.00	.00	.00	.00	.00	.00
TE131	.00	1.54E+02	1.02E+25	.00	.00	.00	.00	.00	.00	.00	.00
TE131	.00	6.12E+00	3.61E+03	8.72E+04	3.83E+13	6.02E+27	.00	.00	.00	.00	.00
TE131M	.00	8.73E+02	1.42E+03	2.45E+05	1.47E+10	6.67E+20	.00	.00	.00	.00	.00
TE131	.00	4.02E+02	4.10E+02	4.10E+02	4.10E+02	4.10E+02	4.10E+02	4.10E+02	4.10E+02	4.10E+02	4.10E+02
SM132	.00	2.09E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
SM132M	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SM132	.00	2.03E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE132	.00	4.54E+00	2.10E+03	6.90E+13	6.67E+34	.00	.00	.00	.00	.00	.00
TE132	.00	1.19E+01	6.37E+10	2.10E+14	.00	.00	.00	.00	.00	.00	.00

POWER = 35.00MW, BURNUP = 33000.MWD, PLUE = 3.00E+13M/CMO2-SEC

NUCLIDE CONCENTRATIONS, GRAMS
BASIS = MI OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	D. Y	O. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
FE132	.00	1.15E+03	1.16E+03	1.16E+03	1.16E+03	1.16E+03	1.16E+03	1.16E+03	1.16E+03	1.16E+03	1.16E+03
SR133	.00	3.44E-03	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE133M	.00	5.17E-02	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE133	.00	4.89E-03	.00	.00	.00	.00	.00	.00	.00	.00	.00
TI133	.00	1.67E+00	.00	.00	.00	.00	.00	.00	.00	.00	.00
FE133M	.00	1.05E-01	1.07E-13	8.43E-23	.00	.00	.00	.00	.00	.00	.00
FE133	.00	1.01E-01	8.92E-05	8.99E-09	1.68E-20	.00	.00	.00	.00	.00	.00
CS133	.00	9.99E-02	1.03E+03	1.01E+03	1.01E+03	1.01E+03	1.01E+03	1.01E+03	1.01E+03	1.01E+03	1.01E+03
SR134	.00	3.29E-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE134	.00	5.44E-02	.00	.00	.00	.00	.00	.00	.00	.00	.00
TI134	.00	7.99E-02	.00	.00	.00	.00	.00	.00	.00	.00	.00
FE134	.00	1.54E+03	1.54E+03	1.54E+03	1.54E+03	1.54E+03	1.54E+03	1.54E+03	1.54E+03	1.54E+03	1.54E+03
CS134M	.00	9.02E-03	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS134	.00	1.97E-02	1.62E+02	1.70E+02	1.41E+02	1.00E+02	3.64E+01	6.71E+00	2.28E+00	8.97E-06	4.07E-13
BA134	.00	6.14E-01	7.72E+01	4.86E+01	1.18E+02	1.59E+02	2.23E+02	2.52E+02	2.55E+02	2.59E+02	2.54E+02
TI135	.00	5.68E-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
TI135	.00	4.79E-03	.00	.00	.00	.00	.00	.00	.00	.00	.00
FE135M	.00	5.64E-03	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS135	.00	1.44E-01	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS135M	.00	1.97E-03	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS135	.00	2.89E-02	2.89E+02	2.89E+02	2.89E+02	2.89E+02	2.89E+02	2.89E+02	2.89E+02	2.89E+02	2.89E+02
BA135M	.00	3.77E-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
BA135	.00	3.15E-02	3.15E-02	3.16E-02	3.16E-02	3.17E-02	3.19E-02	3.22E-02	3.22E-02	3.49E-02	3.62E-02
TI136	.00	6.63E-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
FE136	.00	2.35E+03	2.35E+03	2.35E+03	2.35E+03	2.35E+03	2.35E+03	2.35E+03	2.35E+03	2.35E+03	2.35E+03
CS136	.00	8.91E-01	2.34E+03	1.76E+04	3.10E+04	1.02E+17	.00	.00	.00	.00	.00
BA136	.00	2.26E+01	2.34E+01	2.34E+01	2.34E+01	2.34E+01	2.34E+01	2.34E+01	2.34E+01	2.34E+01	2.34E+01
TI137	.00	4.81E-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
FE137	.00	5.16E-03	.00	.00	.00	.00	.00	.00	.00	.00	.00
FE137	.00	1.25E+03	1.25E+03	1.22E+03	1.22E+03	1.19E+03	9.89E+01	7.65E+02	3.92E+02	1.24E+02	1.24E+02
CS137	.00	1.88E-04	1.89E-04	1.86E-04	1.86E-04	1.86E-04	1.86E-04	1.19E-04	5.93E-05	1.87E-05	1.87E-05
BA137M	.00	3.72E+01	4.93E+01	4.97E+01	4.53E+01	9.35E+01	1.73E+02	2.99E+02	4.91E+02	8.93E+02	1.16E+03
TI138	.00	1.20E-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
FE138	.00	2.19E-02	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS138	.00	4.17E-02	.00	.00	.00	.00	.00	.00	.00	.00	.00
BA138	.00	1.22E+03	1.22E+03	1.22E+03	1.22E+03	1.22E+03	1.22E+03	1.22E+03	1.22E+03	1.22E+03	1.22E+03
TI139	.00	3.38E-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
FE139	.00	7.66E-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS139	.00	1.22E-02	.00	.00	.00	.00	.00	.00	.00	.00	.00
BA139	.00	1.06E-01	.00	.00	.00	.00	.00	.00	.00	.00	.00
LA139	.00	1.27E+03	1.27E+03	1.27E+03	1.27E+03	1.27E+03	1.27E+03	1.27E+03	1.27E+03	1.27E+03	1.27E+03
SL140	.00	2.00E-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS140	.00	1.30E-03	.00	.00	.00	.00	.00	.00	.00	.00	.00
FE140	.00	2.33E+01	1.79E-01	4.02E-03	5.98E-04	1.53E-16	.00	.00	.00	.00	.00
LA140	.00	3.15E+00	2.68E-02	6.35E-04	9.00E-09	2.31E-17	.00	.00	.00	.00	.00
CE140	.00	1.28E+03	1.31E+03	1.31E+03	1.31E+03	1.31E+03	1.31E+03	1.31E+03	1.31E+03	1.31E+03	1.31E+03
FE141	.00	7.32E-06	.00	.00	.00	.00	.00	.00	.00	.00	.00
CS141	.00	3.37E-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
BA141	.00	2.12E-02	.00	.00	.00	.00	.00	.00	.00	.00	.00
LA141	.00	2.79E+01	.00	.00	.00	.00	.00	.00	.00	.00	.00
CE141	.00	5.67E+01	8.32E+00	1.65E+00	2.30E-02	9.30E-06	6.12E-16	6.57E-33	.00	.00	.00
LA141	.00	1.14E+03	1.14E+03	1.20E+03	1.20E+03	1.20E+03	1.20E+03	1.20E+03	1.20E+03	1.20E+03	1.20E+03

POWER = 55.00MW, BURNUP = 33000 MW-D, FUEL = 3.74*10E+02-SEC

NUCLIDE CONCENTRATIONS, GRAMS
BASIS = KG OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
ZE92	0.00	2.01+06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CS142	0.00	2.60+05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B1142	0.00	1.01+02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LA142	0.00	1.07+01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CE142	0.00	1.13+03	1.17+03	1.17+03	1.17+03	1.17+03	1.17+03	1.17+03	1.17+03	1.17+03	1.17+03
PR142	0.00	5.79+02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NO142	0.00	2.06+01	2.06+01	2.06+01	2.06+01	2.06+01	2.06+01	2.06+01	2.06+01	2.06+01	2.06+01
SC143	0.00	2.54+07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CL143	0.00	1.17+05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BA143	0.00	1.75+04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LA143	0.00	1.51+02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CE143	0.00	2.14+00	4.75+20	2.03+35	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR143	0.00	2.10+01	2.44+01	1.14+03	2.20+01	2.07+35	0.00	0.00	0.00	0.00	0.00
NO143	0.00	7.81+02	8.04+02	8.04+02	8.04+02	8.04+02	8.04+02	8.04+02	8.04+02	8.04+02	8.04+02
LA144	0.00	6.59+05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CE144	0.00	3.93+02	3.16+02	2.66+02	1.61+02	6.62+01	4.56+00	5.29+02	1.17+06	1.72+17	7.52+37
PR144	0.00	1.68+02	3.39+02	3.33+02	6.93+03	2.80+03	3.19+04	2.24+06	3.00+10	7.78+22	0.00
NO144	0.00	9.49+02	1.03+03	1.28+03	1.18+03	1.28+03	1.38+03	1.38+03	1.38+03	1.38+03	1.38+03
CL145	0.00	2.78+03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR145	0.00	2.73+01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NO145	0.00	6.95+02	6.95+02	6.95+02	6.95+02	6.95+02	6.95+02	6.95+02	6.95+02	6.95+02	6.95+02
CE146	0.00	8.71+03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR146	0.00	1.49+02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NO146	0.00	2.02+02	7.62+02	7.62+02	7.62+02	7.62+02	7.62+02	7.62+02	7.62+02	7.62+02	7.62+02
CE147	0.00	5.39+04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR147	0.00	5.97+03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NO147	0.00	8.58+00	3.11+02	3.94+04	1.07+09	1.17+19	0.00	0.00	0.00	0.00	0.00
PR147	0.00	1.12+02	1.13+02	1.08+02	9.29+01	7.13+01	3.22+01	6.56+00	6.09+01	2.18+04	3.93+10
NO147	0.00	4.49+01	5.24+01	5.80+01	7.29+01	9.45+01	1.34+02	1.57+02	1.66+02	1.66+02	1.66+02
CE148	0.00	2.81+04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR148	0.00	7.88+04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NO148	0.00	3.73+02	3.73+02	3.73+02	3.73+02	3.73+02	3.73+02	3.73+02	3.73+02	3.73+02	3.73+02
PR148	0.00	1.93+00	4.37+01	1.38+01	4.65+03	1.12+05	1.57+13	3.27+26	0.00	0.00	0.00
NO148	0.00	1.39+00	4.53+03	1.42+03	9.80+05	1.16+07	1.62+15	1.31+28	0.00	0.00	0.00
CE148	0.00	1.60+02	1.63+02	1.64+02	1.64+02	1.64+02	1.64+02	1.64+02	1.64+02	1.64+02	1.64+02
PR149	0.00	6.25+04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NO149	0.00	3.35+02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR149	0.00	1.88+00	1.07+12	5.27+22	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NO149	0.00	6.23+00	8.14+00	8.14+00	8.14+00	8.14+00	8.14+00	8.14+00	8.14+00	8.14+00	8.14+00
NO150	0.00	1.77+02	1.77+02	1.77+02	1.77+02	1.77+02	1.77+02	1.77+02	1.77+02	1.77+02	1.77+02
PR150	0.00	1.15+03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NO150	0.00	3.96+02	3.96+02	3.96+02	3.96+02	3.96+02	3.96+02	3.96+02	3.96+02	3.96+02	3.96+02
CE151	0.00	1.99+02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR151	0.00	2.76+01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NO151	0.00	4.66+01	4.66+01	4.66+01	4.66+01	4.66+01	4.66+01	4.66+01	4.66+01	4.66+01	4.66+01
CE151	0.00	5.08+02	1.42+01	2.13+01	4.23+01	7.88+01	1.87+00	3.62+00	6.5+00	1.54+01	2.57+01
PR152	0.00	7.21+04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NO152	0.00	9.62+01	9.62+01	9.62+01	9.62+01	9.62+01	9.62+01	9.62+01	9.62+01	9.62+01	9.62+01
CE152	0.00	1.96+04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NO152	0.00	5.57+02	5.44+02	5.38+02	5.21+02	4.92+02	4.14+02	3.17+02	1.74+02	3.07+03	1.11+04
CE152	0.00	1.30+01	1.30+01	1.30+01	1.31+01	1.31+01	1.31+01	1.31+01	1.31+01	1.31+01	1.31+01
PR153	0.00	5.63+04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

POWER= 35.00MW, BURNUP= 33000.MWD, FLUX= 3.44E+13N/CM^2-SEC

NUCLIDE CONCENTRATIONS, GRAMS
BASIS = 1% OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
SM153	.00	1.32E+00	1.43E+04	3.36E-25	.00	.00	.00	.00	.00	.00	.00
EU153	.00	1.30E+02	1.32E+02	1.32E+02	1.32E+02	1.32E+02	1.32E+02	1.32E+02	1.32E+02	1.32E+02	1.32E+02
GO153	.00	9.34E-03	7.25E-03	5.93E-03	3.30E-03	1.16E-03	5.02E-05	7.68E-07	7.67E-12	1.79E-25	.00
PM154	.00	1.31E-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
SM154	.00	3.71E+01	3.71E+01	3.71E+01	3.71E+01	3.71E+01	3.71E+01	3.71E+01	3.71E+01	3.71E+01	3.71E+01
EU154	.00	4.61E+01	4.63E+01	4.79E+01	4.67E+01	4.47E+01	3.93E+01	3.16E+01	2.09E+01	5.59E+00	6.41E+01
GO154	.00	1.48E+00	2.00E+00	2.40E+00	3.55E+00	5.53E+00	1.10E+01	1.86E+01	2.98E+01	4.47E+01	4.98E+01
SM155	.00	9.35E-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU155	.00	5.96E+00	5.43E+00	5.04E+00	4.07E+00	2.77E+00	1.30E+01	1.30E+01	2.88E+03	1.34E+16	1.34E+16
GO155	.00	6.20E-02	5.99E-01	4.83E-01	1.96E+00	3.25E+00	5.15E+00	5.90E+00	8.03E+00	6.03E+00	6.03E+00
SM156	.00	1.04E+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU156	.00	4.79E+00	7.31E+02	2.94E+03	2.24E+07	1.05E+14	.00	.00	.00	.00	.00
GO156	.00	8.04E+01	8.51E+01	8.52E+01	8.52E+01	8.52E+01	8.52E+01	8.52E+01	8.52E+01	8.52E+01	8.52E+01
SM157	.00	6.67E-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
EU157	.00	1.22E-02	.00	.00	.00	.00	.00	.00	.00	.00	.00
GO157	.00	3.12E-02	4.34E-02	4.38E-02	4.38E-02	4.38E-02	4.38E-02	4.38E-02	4.38E-02	4.38E-02	4.38E-02
EU158	.00	3.01E-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
GO158	.00	1.36E+01	1.36E+01	1.36E+01	1.36E+01	1.36E+01	1.36E+01	1.36E+01	1.36E+01	1.36E+01	1.36E+01
EU159	.00	5.27E-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
GO159	.00	4.34E-03	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE159	.00	1.79E+00	1.79E+00	1.79E+00	1.79E+00	1.79E+00	1.79E+00	1.79E+00	1.79E+00	1.79E+00	1.79E+00
EU160	.00	3.99E-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
GO160	.00	9.61E-01	9.61E-01	9.61E-01	9.61E-01	9.61E-01	9.61E-01	9.61E-01	9.61E-01	9.61E-01	9.61E-01
TE160	.00	1.31E+01	5.50E+02	2.80E+02	3.90E+03	1.16E+04	3.09E+09	7.37E+17	9.11E+32	.00	.00
DF160	.00	2.97E-03	3.92E-01	3.99E-03	4.23E-03	4.27E-03	4.27E-03	4.27E-03	4.27E-03	4.27E-03	4.27E-03
GO161	.00	2.38E-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE161	.00	6.39E-03	7.57E-07	6.70E-10	7.41E-19	8.58E-35	.00	.00	.00	.00	.00
DF161	.00	2.25E-01	2.31E-01	2.31E-01	2.31E-01	2.31E-01	2.31E-01	2.31E-01	2.31E-01	2.31E-01	2.31E-01
GO162	.00	3.31E+04	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE162M	.00	2.36E+06	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE162	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
DF162	.00	1.87E+01	1.87E-01	1.87E-01	1.87E-01	1.87E-01	1.87E-01	1.87E-01	1.87E-01	1.87E-01	1.87E-01
TE153M	.00	5.10E+07	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE163	.00	2.79E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
GO163	.00	2.05E-01	2.05E-01	2.05E-01	2.05E-01	2.05E-01	2.05E-01	2.05E-01	2.05E-01	2.05E-01	2.05E-01
TE164	.00	6.71E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
DF164	.00	6.63E+02	6.63E+02	6.63E+02	6.63E+02	6.63E+02	6.63E+02	6.63E+02	6.63E+02	6.63E+02	6.63E+02
GO165M	.00	4.25E-01	.00	.00	.00	.00	.00	.00	.00	.00	.00
DF165	.00	1.54E+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
GO165	.00	1.02E-01	1.02E-01	1.02E-01	1.02E-01	1.02E-01	1.02E-01	1.02E-01	1.02E-01	1.02E-01	1.02E-01
GO166	.00	5.54E+05	5.62E+13	5.64E+19	.00	.00	.00	.00	.00	.00	.00
GO166M	.00	3.96E+04	1.96E+04	3.96E+04	3.96E+04	3.96E+04	3.96E+04	3.96E+04	3.96E+04	3.96E+04	3.96E+04
GO166	.00	2.07E+04	2.67E+13	1.79E+19	.00	.00	.00	.00	.00	.00	.00
TE166	.00	2.64E+02	2.67E+02	2.67E+02	2.67E+02	2.67E+02	2.67E+02	2.67E+02	2.67E+02	2.67E+02	2.67E+02
GO167	.00	4.66E+03	4.66E+03	4.66E+03	4.66E+03	4.66E+03	4.66E+03	4.66E+03	4.66E+03	4.66E+03	4.66E+03
TOTAL	.00	3.49E+04	3.49E+04	3.49E+04	3.49E+04	3.49E+04	3.49E+04	3.49E+04	3.49E+04	3.49E+04	3.49E+04

POWER= 35.00MW, BURHUP= 33000.MWD, FLUX= 3.44E+13n/cm^2-SEC

ELEMENT CONCENTRATIONS, GRAMS
BASIS = MT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
H	.00	7.41E-02	7.33E-02	7.23E-02	7.01E-02	6.62E-02	5.59E-02	4.22E-02	2.40E-02	4.43E-03	2.65E-04
Zn	.00	2.54E-05	2.44E-19	5.52E-30	.00	.00	.00	.00	.00	.00	.00
GA	.00	1.40E-05	1.15E-19	1.53E-30	.00	.00	.00	.00	.00	.00	.00
GE	.00	3.72E-01	3.71E-01	3.71E-01	3.71E-01	3.71E-01	3.71E-01	3.71E-01	3.71E-01	3.71E-01	3.71E-01
AS	.00	8.74E-02	8.46E-02	8.46E-02	8.46E-02	8.46E-02	8.46E-02	8.46E-02	8.46E-02	8.46E-02	8.46E-02
SC	.00	5.20E-01	5.20E-01	5.20E-01	5.20E-01	5.20E-01	5.20E-01	5.20E-01	5.20E-01	5.20E-01	5.20E-01
BR	.00	1.53E-01	1.53E-01	1.53E-01	1.53E-01	1.53E-01	1.53E-01	1.53E-01	1.53E-01	1.53E-01	1.53E-01
NR	.00	3.74E-02	3.74E-02	3.74E-02	3.73E-02	3.73E-02	3.66E-02	3.60E-02	3.53E-02	3.46E-02	3.41E-02
RS	.00	3.32E-02	3.32E-02	3.33E-02	3.34E-02	3.36E-02	3.40E-02	3.46E-02	3.53E-02	3.60E-02	3.65E-02
SR	.00	9.29E-02	9.05E-02	8.97E-02	8.86E-02	8.72E-02	8.35E-02	7.74E-02	6.85E-02	5.45E-02	4.45E-02
Y	.00	4.61E-02	4.72E-02	4.69E-02	4.66E-02	4.65E-02	4.65E-02	4.65E-02	4.65E-02	4.65E-02	4.65E-02
ZR	.00	3.66E-03	3.66E-03	3.66E-03	3.67E-03	3.67E-03	3.71E-03	3.77E-03	3.86E-03	3.94E-03	4.01E-03
NB	.00	4.13E-01	2.59E-01	1.44E-01	1.77E-00	3.67E-02	2.16E-03	3.66E-03	7.25E-03	1.74E-02	3.44E-02
MO	.00	3.35E-03	3.41E-03	3.44E-03	3.46E-03	3.47E-03	3.47E-03	3.47E-03	3.47E-03	3.47E-03	3.47E-03
TC	.00	8.16E-02	8.42E-02	8.42E-02	8.42E-02	8.42E-02	8.42E-02	8.42E-02	8.42E-02	8.42E-02	8.42E-02
MU	.00	2.37E-03	2.31E-03	2.29E-03	2.24E-03	2.20E-03	2.16E-03	2.15E-03	2.14E-03	2.13E-03	2.13E-03
RH	.00	3.48E-02	3.83E-02	3.89E-02	3.92E-02	3.92E-02	3.92E-02	3.92E-02	3.92E-02	3.92E-02	3.92E-02
PD	.00	1.24E-03	1.27E-03	1.29E-03	1.33E-03	1.37E-03	1.44E-03	1.42E-03	1.42E-03	1.42E-03	1.42E-03
AG	.00	6.12E-01	6.09E-01	6.06E-01	6.05E-01	6.03E-01	6.02E-01	6.02E-01	6.02E-01	6.02E-01	6.02E-01
CD	.00	8.38E-01	8.43E-01	8.44E-01	8.47E-01	8.49E-01	8.50E-01	8.50E-01	8.49E-01	8.49E-01	8.49E-01
IN	.00	1.20E-00	1.23E-00	1.24E-00	1.24E-00	1.24E-00	1.24E-00	1.24E-00	1.24E-00	1.24E-00	1.24E-00
SH	.00	5.27E-01	5.21E-01	5.18E-01	5.15E-01	5.13E-01	5.13E-01	5.13E-01	5.13E-01	5.13E-01	5.13E-01
SB	.00	1.60E-01	1.36E-01	1.75E-01	1.46E-01	1.54E-01	1.26E-01	1.09E-01	1.07E-01	1.01E-01	1.01E-01
TC	.00	5.72E-02	5.65E-02	5.65E-02	5.66E-02	5.67E-02	5.70E-02	5.72E-02	5.72E-02	5.72E-02	5.72E-02
I	.00	7.74E-02	2.44E-02	2.10E-02	2.37E-02	2.30E-02	2.20E-02	2.17E-02	2.70E-02	2.70E-02	2.70E-02
FE	.00	5.47E-03	5.48E-03	5.48E-03	5.48E-03	5.48E-03	5.48E-03	5.48E-03	5.48E-03	5.48E-03	5.48E-03
CS	.00	2.71E-03	2.32E-03	2.71E-03	2.66E-03	2.59E-03	2.45E-03	2.30E-03	2.04E-03	1.69E-03	1.42E-03
BA	.00	1.34E-03	1.36E-03	1.37E-03	1.42E-03	1.44E-03	1.46E-03	1.49E-03	1.50E-03	1.50E-03	1.50E-03
LA	.00	1.27E-03	1.27E-03	1.27E-03	1.27E-03	1.27E-03	1.27E-03	1.27E-03	1.27E-03	1.27E-03	1.27E-03
CE	.00	2.91E-03	2.41E-03	2.35E-03	2.44E-03	2.45E-03	2.49E-03	2.44E-03	2.44E-03	2.44E-03	2.44E-03
PA	.00	1.16E-03	1.19E-03	1.20E-03	1.20E-03	1.20E-03	1.20E-03	1.20E-03	1.20E-03	1.20E-03	1.20E-03
ND	.00	3.71E-03	3.80E-03	3.83E-03	3.85E-03	4.05E-03	4.11E-03	4.12E-03	4.12E-03	4.12E-03	4.12E-03
PM	.00	1.16E-02	1.18E-02	1.08E-02	9.24E-01	7.13E-01	3.22E-01	8.59E-00	6.09E-01	2.18E-04	3.91E-10
SV	.00	7.88E-02	7.99E-02	8.05E-02	8.20E-02	8.41E-02	8.74E-02	9.01E-02	9.06E-02	8.96E-02	8.89E-02
EU	.00	1.90E-02	1.86E-02	1.85E-02	1.83E-02	1.80E-02	1.74E-02	1.67E-02	1.59E-02	1.53E-02	1.58E-02
GD	.00	9.64E-01	1.02E-02	1.03E-02	1.05E-02	1.04E-02	1.16E-02	1.24E-02	1.36E-02	1.51E-02	1.54E-02
YB	.00	1.92E-00	1.45E-00	1.82E-00	1.40E-00	1.79E-00	1.79E-00	1.79E-00	1.79E-00	1.79E-00	1.79E-00
DY	.00	9.80E-01	1.06E-00	1.09E-00	1.11E-00	1.12E-00	1.12E-00	1.12E-00	1.12E-00	1.12E-00	1.12E-00
NO	.00	1.03E-01	1.03E-01	1.03E-01	1.03E-01	1.03E-01	1.03E-01	1.03E-01	1.03E-01	1.03E-01	1.03E-01
ER	.00	5.11E-02	5.14E-02	5.14E-02	5.14E-02	5.14E-02	5.14E-02	5.14E-02	5.14E-02	5.14E-02	5.14E-02
TOTALS	.00	3.44E+04	3.44E+04	3.44E+04	3.44E+04	3.44E+04	3.44E+04	3.44E+04	3.44E+04	3.44E+04	3.44E+04
SUBTOT	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TOTALS	.00	3.44E+04	3.44E+04	3.44E+04	3.44E+04	3.44E+04	3.44E+04	3.44E+04	3.44E+04	3.44E+04	3.44E+04

TABLE D-3

ACTIVITIES OF TRANSURANIC NUCLIDES
IN SPENT FUEL VS. DECAY TIMESPWR: SS-BMW, BURNUP: 31000 MWD, FLUX: 3.4e+13 n/cm²-secNUCLIDE RADIOACTIVITY, Curies
0.01 Ci = 10⁶ Bq of heavy metal charged to reactor

ME	Q	CVANCE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
ME	Q	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
U235	.00	8.58-07	1.07-06	1.24-06	1.83-06	2.69-06	5.17-06	9.02-06	1.58-05	3.18-05	5.23-05	
U238	.00	5.30-06	7.00-06	8.40-06	1.27-03	2.07-03	4.19-03	6.02-03	6.61-03	6.91-03	3.03-03	
U236	.00	4.50-09	9.31-10	7.97-10	8.68-10	9.89-10	1.37-09	2.07-09	3.70-09	1.05-08	2.86-08	
Pl206	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	
Pl207	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	
Pl208	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	
Am241	.00	2.04-07	4.23-04	3.62-03	3.95-03	4.50-03	6.24-03	9.42-03	1.69-07	4.78-07	1.30-06	
Am242	.00	5.76-10	6.68-10	7.84-10	1.21-09	2.29-09	9.03-09	3.87-08	2.07-07	2.29-06	1.38-05	
Am243	.00	8.61-07	1.07-06	1.24-06	1.84-06	2.70-06	5.18-06	9.04-06	1.59-05	3.19-05	5.24-05	
Am244	.00	1.47-03	1.94-03	2.33-03	3.53-03	5.73-03	1.16-02	1.67-02	1.78-02	1.38-02	6.47-03	
Pl224	.00	1.45-08	1.88-08	2.08-08	2.74-08	4.23-08	1.10-07	3.04-07	1.07-06	5.82-06	2.41-05	
Am245	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	
Am246	.00	5.76-10	6.68-10	7.84-10	1.21-09	2.29-09	9.03-09	3.87-08	2.07-07	2.29-06	1.38-05	
Am247	.00	8.61-07	1.07-06	1.24-06	1.84-06	2.70-06	5.18-06	9.04-06	1.59-05	3.19-05	5.24-05	
Am248	.00	1.47-03	1.94-03	2.33-03	3.53-03	5.73-03	1.16-02	1.67-02	1.78-02	1.38-02	6.47-03	
Pl228	.00	1.45-08	1.88-08	2.08-08	2.74-08	4.23-08	1.10-07	3.04-07	1.07-06	5.82-06	2.41-05	
Am249	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	
Am250	.00	5.76-10	6.68-10	7.84-10	1.21-09	2.29-09	9.03-09	3.87-08	2.07-07	2.29-06	1.38-05	
Am251	.00	8.61-07	1.07-06	1.24-06	1.84-06	2.70-06	5.18-06	9.04-06	1.59-05	3.19-05	5.24-05	
Am252	.00	1.47-03	1.94-03	2.33-03	3.53-03	5.73-03	1.16-02	1.67-02	1.78-02	1.38-02	6.47-03	
Am253	.00	1.45-08	1.88-08	2.08-08	2.74-08	4.23-08	1.10-07	3.04-07	1.07-06	5.82-06	2.41-05	
Am254	.00	1.45-08	1.88-08	2.08-08	2.74-08	4.23-08	1.10-07	3.04-07	1.07-06	5.82-06	2.41-05	
Am255	.00	1.45-08	1.88-08	2.08-08	2.74-08	4.23-08	1.10-07	3.04-07	1.07-06	5.82-06	2.41-05	
Am256	.00	1.45-08	1.88-08	2.08-08	2.74-08	4.23-08	1.10-07	3.04-07	1.07-06	5.82-06	2.41-05	
Am257	.00	1.45-08	1.88-08	2.08-08	2.74-08	4.23-08	1.10-07	3.04-07	1.07-06	5.82-06	2.41-05	
Am258	.00	1.45-08	1.88-08	2.08-08	2.74-08	4.23-08	1.10-07	3.04-07	1.07-06	5.82-06	2.41-05	
Am259	.00	1.45-08	1.88-08	2.08-08	2.74-08	4.23-08	1.10-07	3.04-07	1.07-06	5.82-06	2.41-05	
Am260	.00	1.45-08	1.88-08	2.08-08	2.74-08	4.23-08	1.10-07	3.04-07	1.07-06	5.82-06	2.41-05	
Am261	.00	1.45-08	1.88-08	2.08-08	2.74-08	4.23-08	1.10-07	3.04-07	1.07-06	5.82-06	2.41-05	
Am262	.00	1.45-08	1.88-08	2.08-08	2.74-08	4.23-08	1.10-07	3.04-07	1.07-06	5.82-06	2.41-05	
Am263	.00	1.45-08	1.88-08	2.08-08	2.74-08	4.23-08	1.10-07	3.04-07	1.07-06	5.82-06	2.41-05	
Am264	.00	1.45-08	1.88-08	2.08-08	2.74-08	4.23-08	1.10-07	3.04-07	1.07-06	5.82-06	2.41-05	
Am265	.00	1.45-08	1.88-08	2.08-08	2.74-08	4.23-08	1.10-07	3.04-07	1.07-06	5.82-06	2.41-05	
Am266	.00	1.45-08	1.88-08	2.08-08	2.74-08	4.23-08	1.10-07	3.04-07	1.07-06	5.82-06	2.41-05	
Am267	.00	1.45-08	1.88-08	2.08-08	2.74-08	4.23-08	1.10-07	3.04-07	1.07-06	5.82-06	2.41-05	
Am268	.00	1.45-08	1.88-08	2.08-08	2.74-08	4.23-08	1.10-07	3.04-07	1.07-06	5.82-06	2.41-05	
Am269	.00	1.45-08	1.88-08	2.08-08	2.74-08	4.23-08	1.10-07	3.04-07	1.07-06	5.82-06	2.41-05	
Am270	.00	1.45-08	1.88-08	2.08-08	2.74-08	4.23-08	1.10-07	3.04-07	1.07-06	5.82-06	2.41-05	
Am271	.00	1.45-08	1.88-08	2.08-08	2.74-08	4.23-08	1.10-07	3.04-07	1.07-06	5.82-06	2.41-05	
Am272	.00	1.45-08	1.88-08	2.08-08	2.74-08	4.23-08	1.10-07	3.04-07	1.07-06	5.82-06	2.41-05	
Am273	.00	1.45-08	1.88-08	2.08-08	2.74-08	4.23-08	1.10-07	3.04-07	1.07-06	5.82-06	2.41-05	
Am274	.00	1.45-08	1.88-08	2.08-08	2.74-08	4.23-08	1.10-07	3.04-07	1.07-06	5.82-06	2.41-05	
Am275	.00	1.45-08	1.88-08	2.08-08	2.74-08	4.23-08	1.10-07	3.04-07	1.07-06	5.82-06	2.41-05	
Am276	.00	1.45-08	1.88-08	2.08-08	2.74-08	4.23-08	1.10-07	3.04-07	1.07-06	5.82-06	2.41-05	
Am277	.00	1.45-08	1.88-08	2.08-08	2.74-08	4.23-08	1.10-07	3.04-07	1.07-06	5.82-06	2.41-05	
Am278	.00	1.45-08	1.88-08	2.08-08	2.74-08	4.23-08	1.10-07	3.04-07	1.07-06	5.82-06	2.41-05	
Am279	.00	1.45-08	1.88-08	2.08-08	2.74-08	4.23-08	1.10-07	3.04-07	1.07-06	5.82-06	2.41-05	
Am280	.00	1.45-08	1.88-08	2.08-08	2.74-08	4.23-08	1.10-07	3.04-07	1.07-06	5.82-06	2.41-05	
Am281	.00	1.45-08	1.88-08	2.08-08	2.74-08	4.23-08	1.10-07	3.04-07	1.07-06	5.82-06	2.41-05	
Am282	.00	1.45-08	1.88-08	2.08-08	2.74-08	4.23-08	1.10-07	3.04-07	1.07-06	5.82-06	2.41-05	
Am283	.00	1.45-08	1.88-08	2.08-08	2.74-08	4.23-08	1.10-07	3.04-07	1.07-06	5.82-06	2.41-05	
Am284	.00	1.45-08	1.88-08	2.08-08	2.74-08	4.23-08	1.10-07	3.04-07	1.07-06	5.82-06	2.41-05	
Am285	.00	1.45-08	1.88-08	2.08-08	2.74-08	4.23-08	1.10-07	3.04-07	1.07-06	5.82-06	2.41-05	
Am286	.00	1.45-08	1.88-08	2.08-08	2.74-08	4.23-08	1.10-07	3.04-07	1.07-06	5.82-06	2.41-05	
Am287	.00	1.45-08	1.88-08	2.08-08	2.74-08	4.23-08	1.10-07	3.04-07	1.07-06	5.82-06	2.41-05	
Am288	.00	1.45-08	1.88-08	2.08-08	2.74-08	4.23-08	1.10-07	3.04-07	1.07-06	5.82-06	2.41-05	
Am289	.00	1.45-08	1.88-08	2.08-08	2.74-08	4.23-08	1.10-07	3.04-07	1.07-06	5.82-06	2.41-05	
Am290	.00	1.45-08	1.88-08	2.08-08	2.74-08	4.23-08	1.10-07	3.04-07	1.07-06	5.82-06	2.41-05	
Am291	.00	1.45-08	1.88-08	2.08-08	2.74-08	4.23-08	1.10-07	3.04-07	1.07-06	5.82-06	2.41-05	
Am292	.00	1.45-08	1.88-08	2.08-08	2.74-08	4.23-08	1.10-07	3.04-07	1.07-06	5.82-06	2.41-05	
Am293	.00	1.45-08	1.88-08	2.08-08	2.74-08	4.23-08	1.10-07	3.04-07	1.07-06	5.82-06	2.41-05	
Am294	.00	1.45-08	1.88-08	2.08-08	2.74-08	4.23-08	1.10-07	3.04-07	1.07-06	5.82-06	2.41-05	
Am295	.00	1.45-08	1.88-08	2.08-08	2.74-08	4.23-08	1.10-07	3.04-07	1.07-06	5.82-06	2.41-05	
Am296	.00	1.45-08	1.88-08	2.08-08	2.74-08	4.23-08	1.10-07	3.04-07	1.07-06	5.82-06	2.41-05	
Am297	.00	1.45-08	1.88-08	2.08-08	2.74-08	4.23-08	1.10-07	3.04-07	1.07-06	5.82-06	2.41-05	
Am298	.00	1.45-08	1.88-08	2.08-08	2.74-08	4.23-08	1.10-07	3.04-07	1.07-06	5.82-06	2.41-05	
Am299	.00	1.45-08	1.88-08	2.08-08	2.74-08	4.23-08	1.10-07	3.04-07	1.07-06	5.82-06	2.41-05	
Am300	.00	1.45-08	1.88-08	2.08-08	2.74-08	4.23-08	1.10-07	3.04-07	1.07-06	5.82-06	2.41-05

POWER: 35.00MW, BURNDUP: 33000.HUD, FLUX: 3.00E+13N/CM^2-SEC

NUCLIDE RADIOACTIVITY, CURTES
BASIS: - WT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
PA238	.00	7.49E-03	3.19E-04	3.19E-04	3.19E-04	3.19E-04	3.19E-04	3.19E-04	3.19E-04	3.19E-04	3.19E-04
U233	.00	6.52E-03	7.37E-03	7.97E-03	9.57E-03	1.14E-02	1.60E-02	1.82E-02	1.76E-02	1.33E-02	8.20E-03
U235	.00	5.58E-03	5.61E-03	5.64E-03	5.72E-03	5.88E-03	6.36E-03	7.07E-03	8.55E-03	1.32E-02	2.78E-02
U238	2.20E+00	1.03E+00	1.03E+00	1.03E+00	1.04E+00	1.04E+00	1.07E+00	1.11E+00	1.16E+00	1.36E+00	1.59E+00
U235	6.99E-02	1.68E-02	1.68E-02	1.68E-02	1.68E-02	1.68E-02	1.68E-02	1.68E-02	1.68E-02	1.68E-02	1.68E-02
U238	.00	2.86E-01	2.86E-01	2.86E-01	2.86E-01	2.86E-01	2.86E-01	2.86E-01	2.86E-01	2.86E-01	2.86E-01
U237	.00	1.01E+04	1.00E+02	2.58E+00	2.93E+00	2.32E+00	2.01E+00	1.59E+00	9.68E-01	2.38E-01	2.71E-02
U238	3.22E-01	3.19E-01	3.19E-01	3.19E-01	3.19E-01	3.19E-01	3.19E-01	3.19E-01	3.19E-01	3.19E-01	3.19E-01
U239	.00	2.18E-07	.00	.00	.00	.00	.00	.00	.00	.00	.00
U240	.00	1.53E-15	3.13E-15	4.37E-15	8.02E-15	1.45E-14	3.40E-14	6.68E-14	1.31E-13	3.26E-13	6.50E-13
NP236	.00	5.40E+00	.00	.00	.00	.00	.00	.00	.00	.00	.00
NP237	.00	3.32E-01	3.40E-01	3.40E-01	3.40E-01	3.40E-01	3.40E-01	3.40E-01	3.40E-01	3.40E-01	3.40E-01
NP238	.00	4.88E+05	5.89E+08	5.91E+08	.00	.00	.00	.00	.00	.00	.00
NP239	.00	2.17E+07	1.96E+01	1.96E+01	1.96E+01	1.96E+01	1.96E+01	1.96E+01	1.96E+01	1.96E+01	1.96E+01
NP240	.00	1.53E-15	3.13E-15	4.37E-15	8.02E-15	1.45E-14	3.40E-14	6.68E-14	1.31E-13	3.26E-13	6.50E-13
NP241	.00	4.58E+00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PU236	.00	3.40E-01	3.40E-01	3.40E-01	3.40E-01	3.40E-01	3.40E-01	3.40E-01	3.40E-01	3.40E-01	3.40E-01
PU238	.00	2.71E-03	2.78E-03	2.81E-03	2.84E-03	2.88E-03	2.99E-03	3.08E-03	3.08E-03	3.08E-03	3.08E-03
PU239	.00	3.18E-02	3.24E-02	3.24E-02	3.24E-02	3.24E-02	3.24E-02	3.24E-02	3.24E-02	3.24E-02	3.24E-02
PU240	.00	4.80E-02	4.80E-02	4.80E-02	4.80E-02	4.80E-02	4.80E-02	4.80E-02	4.80E-02	4.80E-02	4.80E-02
PU241	.00	1.06E-05	1.05E+05	1.05E+05	1.01E+05	9.66E+04	8.38E+04	6.61E+04	4.11E+04	9.69E+03	9.71E+02
PU242	.00	1.40E+00	1.40E+00	1.40E+00	1.40E+00	1.40E+00	1.40E+00	1.40E+00	1.40E+00	1.40E+00	1.40E+00
PU243	.00	4.29E+05	2.68E-07	2.68E-07	2.68E-07	2.68E-07	2.68E-07	2.68E-07	2.68E-07	2.68E-07	2.68E-07
PU244	.00	3.54E-15	3.19E-15	4.38E-15	8.03E-15	1.45E-14	3.40E-14	6.65E-14	1.31E-13	3.26E-13	6.51E-13
PU245	.00	2.31E-10	.00	.00	.00	.00	.00	.00	.00	.00	.00
AP241	.00	7.49E-03	1.16E-02	1.48E-02	2.40E-02	3.98E-02	8.28E-02	1.42E-01	2.27E-01	3.15E-01	3.19E-01
AP242	.00	7.95E+00	7.99E+00	7.93E+00	7.93E+00	7.87E+00	7.77E+00	7.59E+00	7.25E+00	6.33E+00	5.06E+00
AP243	.00	6.44E-04	7.94E+00	7.93E+00	7.93E+00	7.86E+00	7.77E+00	7.59E+00	7.25E+00	6.33E+00	5.06E+00
AP244	.00	1.86E-01	1.86E-01	1.86E-01	1.86E-01	1.86E-01	1.86E-01	1.86E-01	1.86E-01	1.86E-01	1.86E-01
AP245	.00	1.48E-05	4.08E-18	5.69E-18	1.04E-17	1.69E-17	4.42E-17	8.64E-17	1.71E-16	4.24E-16	8.46E-16
AP246	.00	5.92E-08	4.88E-08	4.15E-08	2.68E-08	1.18E-08	1.05E-09	1.86E-11	5.48E-15	1.63E-25	.00
CP242	.00	3.17E-07	2.19E+04	1.67E+04	6.76E+03	1.64E+03	1.99E+01	6.23E+00	5.95E+00	5.19E+00	4.13E+00
CP243	.00	5.52E+00	5.50E+00	5.49E+00	5.45E+00	5.37E+00	5.16E+00	4.84E+00	4.27E+00	3.19E+00	1.19E+00
CP244	.00	2.53E-03	2.51E-03	2.49E-03	2.48E-03	2.45E-03	2.39E-03	1.73E-03	1.14E-03	3.73E-02	5.50E-01
CP245	.00	3.56E-01	3.56E-01	3.56E-01	3.56E-01	3.56E-01	3.56E-01	3.56E-01	3.56E-01	3.56E-01	3.56E-01
CP246	.00	7.19E-02	7.19E-02	7.19E-02	7.19E-02	7.19E-02	7.19E-02	7.19E-02	7.19E-02	7.19E-02	7.19E-02
CP247	.00	2.68E-07	2.68E-07	2.68E-07	2.68E-07	2.68E-07	2.68E-07	2.68E-07	2.68E-07	2.68E-07	2.68E-07
CP248	.00	8.46E-07	8.46E-07	8.46E-07	8.46E-07	8.46E-07	8.46E-07	8.46E-07	8.46E-07	8.46E-07	8.46E-07
CP249	.00	5.23E-02	4.85E-10	3.18E-11	1.00E-14	7.22E-24	.00	.00	.00	.00	.00
CR250	.00	1.17E-13	1.17E-13	1.17E-13	1.17E-13	1.17E-13	1.17E-13	1.17E-13	1.17E-13	1.17E-13	1.17E-13
CR246	.00	3.63E-03	1.23E-03	2.76E-03	1.76E-03	7.65E-04	4.98E-05	1.24E-06	3.90E-10	1.22E-20	.00
CR250	.00	8.24E-03	1.17E-13	1.17E-13	1.17E-13	1.17E-13	1.17E-13	1.17E-13	1.17E-13	1.17E-13	1.17E-13
CF249	.00	1.05E-06	2.78E-06	3.91E-06	6.36E-06	8.72E-06	1.04E-05	1.05E-05	1.07E-05	9.68E-06	8.18E-06
CF250	.00	6.12E-05	4.09E-05	4.05E-05	3.97E-05	3.73E-05	2.18E-05	2.44E-05	1.44E-05	2.93E-06	2.67E-07
CF251	.00	3.02E-07	3.02E-07	3.01E-07	3.01E-07	3.01E-07	3.00E-07	2.99E-07	2.97E-07	2.90E-07	2.74E-07
CF252	.00	5.64E-05	5.29E-05	5.03E-05	4.34E-05	3.34E-05	1.52E-05	4.12E-06	2.99E-07	1.15E-10	2.36E-16
CF253	.00	5.18E-06	1.56E-07	1.02E-08	3.47E-12	2.32E-18	.00	.00	.00	.00	.00
CF254	.00	1.48E-09	5.28E-10	2.37E-10	2.26E-11	3.43E-13	1.21E-18	.00	.00	.00	.00
CS253	.00	3.53E-06	7.79E-07	1.04E-07	1.53E-10	4.57E-16	.00	.00	.00	.00	.00
IC248	2.65E+00	4.58E-07	1.33E+05	1.27E+05	1.14E+05	1.05E+05	9.04E+04	7.28E+04	4.74E+04	1.67E+04	4.36E+03

POWER= 35.00MW, BURNUP= 33000.MWD, FLUX= 3.64E+13N/CM^2-SEC

ELEMENTAL ACTIVITY, CURIES
BASIS = 1G OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
TL	.00	5.51E-04	7.01E-04	8.41E-04	1.27E-03	2.08E-03	4.20E-03	6.03E-03	6.45E-03	6.44E-03	5.08E-03
PD	.00	1.47E-03	1.45E-03	2.33E-03	3.53E-03	5.77E-03	1.16E-02	1.67E-02	1.79E-02	1.57E-02	8.52E-03
DI	.00	1.47E-03	1.45E-03	2.33E-03	3.53E-03	5.77E-03	1.16E-02	1.67E-02	1.79E-02	1.57E-02	8.52E-03
PO	.00	2.42E-03	3.31E-03	3.85E-03	5.79E-03	9.44E-03	1.81E-02	2.74E-02	2.93E-02	2.24E-02	1.33E-02
AT	.00	2.04E-07	4.23E-08	3.42E-08	3.95E-08	4.50E-08	6.24E-08	9.42E-08	1.48E-07	4.76E-07	1.30E-06
PH	.00	1.47E-03	1.45E-03	2.33E-03	3.53E-03	5.77E-03	1.16E-02	1.67E-02	1.79E-02	1.57E-02	8.50E-03
VR	.00	2.18E-07	5.88E-08	5.50E-08	6.51E-08	4.27E-08	1.35E-07	2.21E-07	3.44E-07	9.23E-07	2.03E-06
PA	.00	1.47E-03	1.45E-03	2.33E-03	3.53E-03	5.77E-03	1.16E-02	1.67E-02	1.79E-02	1.57E-02	8.50E-03
AC	.00	3.16E-06	1.22E-06	1.38E-06	1.87E-06	2.74E-06	5.28E-06	9.13E-06	1.60E-05	3.24E-05	5.37E-05
TH	.00	1.42E-02	3.33E-01	3.33E-01	3.35E-01	3.37E-01	3.43E-01	3.48E-01	3.49E-01	3.45E-01	3.41E-01
PA	.00	1.14E-02	6.53E-01	6.54E-01	6.55E-01	6.55E-01	6.56E-01	6.57E-01	6.49E-01	6.41E-01	7.43E-01
U	2.65E+00	2.24E-07	1.02E-02	4.23E-02	4.10E-02	3.99E-02	3.71E-02	3.37E-02	2.87E-02	2.23E-02	7.24E-02
HP	.00	2.23E-07	1.50E-01	1.40E-01	1.39E-01	1.40E-01	1.40E-01	1.40E-01	1.40E-01	1.40E-01	1.40E-01
PV	.00	5.39E-05	1.04E-05	1.04E-05	1.05E-05	1.00E-05	8.74E-06	6.44E-06	4.44E-06	1.27E-06	3.06E-06
HP	.00	2.13E-05	1.50E-02	1.43E-02	2.75E-02	4.33E-02	8.62E-02	1.45E-01	2.26E-01	3.38E-01	3.27E-01
CM	.00	5.43E-04	2.43E-04	3.47E-04	5.20E-04	3.74E-03	7.12E-03	1.74E-03	1.14E-03	3.80E-02	6.00E-01
EN	.00	1.22E-02	1.73E-03	2.74E-03	1.74E-03	3.05E-04	6.98E-05	1.24E-06	5.00E-10	1.17E-13	1.18E-13
CF	.00	1.04E-08	9.70E-05	4.53E-05	8.95E-05	7.97E-05	5.77E-05	3.93E-05	2.52E-05	1.79E-05	9.24E-06
ES	.00	3.53E-08	7.79E-07	1.04E-07	1.53E-10	8.57E-16	.00	.00	.00	.00	.00
TOTALS	2.65E+00	4.58E-07	1.27E+05	1.05E+05	7.28E+04	4.42E+04	9.04E+04	7.28E+04	4.74E+04	1.62E+04	4.36E+03
SUBTOT	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

TOTALS 2.65E+00 4.58E-07 1.27E+05 1.05E+05 7.28E+04 4.42E+04

TABLE D-4

QUANTITIES OF TRANSURANIC NUCLIDES
IN SPENT FUEL VS. DECAY TIMES

POWER = 35,000W, BURNUP = 33000-MWD, FUEL = 5.44-13M/CMPXZ-SEC

NUCLIDE CONCENTRATIONS, GRAMS
BASIS = MT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
MC 4	.00	1.84-01	2.57-01	2.89-01	3.63-01	4.40-01	5.98-01	8.54-01	1.37+00	2.90+00	5.17+00
TL201	.00	4.52-15	8.44-15	8.53-15	9.66-15	1.07-14	2.72-14	4.75-14	8.35-14	1.68-13	2.74-13
TL209	.00	1.02-12	2.40-12	2.88-12	4.38-12	7.31-12	1.40-11	2.08-11	2.21-11	1.89-11	1.02-11
TL209	.00	1.10-17	2.78-18	1.95-18	2.32-18	2.92-18	3.36-18	5.07-18	9.05-18	2.35-17	6.99-17
PR206	.00	1.90-16	1.16-15	1.52-15	3.02-15	1.99-15	5.72-12	4.56-11	4.64-10	1.23-09	1.51-07
PR207	.00	2.45-10	1.49-10	4.10-10	7.73-10	1.66-09	4.16-09	2.06-08	7.09-08	5.64-07	1.22-06
PR208	.00	4.30-07	5.67-07	7.31-07	1.35-06	3.25-06	1.40-05	4.35-05	1.15-04	3.04-04	5.24-04
PR209	.00	4.50-14	9.31-15	7.47-15	8.68-15	9.89-15	1.71-14	2.07-14	3.20-14	1.05-13	2.86-13
PR210	.00	4.48-12	4.16-12	9.63-12	1.49-11	2.82-11	1.11-10	4.72-10	2.55-09	2.77-08	1.67-07
PR211	.00	3.49-14	4.35-14	5.03-14	7.44-14	1.09-13	2.10-13	3.66-13	6.43-13	1.79-12	2.12-12
PR212	.00	1.06-09	1.37-09	1.67-09	2.53-09	4.13-09	4.34-09	1.20-08	1.28-08	9.77-09	6.04-09
PR214	.00	5.02-16	5.74-16	4.36-16	4.36-16	1.29-15	3.34-15	9.27-15	3.05-14	1.74-13	1.34-13
PR209	.00	5.46-13	6.49-13	6.76-13	1.64-11	9.34-11	1.58-10	3.14-10	4.41-10	4.62-09	3.19-08
EL200	.00	4.24-15	5.35-15	6.32-15	9.74-15	1.64-14	2.27-14	3.08-13	1.66-12	1.81-11	1.09-10
EL211	.00	2.08-15	2.69-15	3.00-15	4.83-15	6.50-15	1.25-14	2.18-14	1.63-14	7.70-14	1.24-13
EL212	.00	1.01-10	1.33-10	1.59-10	2.41-10	3.44-10	7.95-10	1.14-09	1.22-09	9.31-10	5.15-10
EL213	.00	1.09-14	2.25-15	1.93-15	2.10-15	2.39-15	3.37-15	5.03-15	8.96-15	2.46-14	6.97-14
EL214	.00	3.69-16	4.27-16	4.66-16	6.15-16	9.47-16	2.67-15	4.81-15	2.25-14	1.30-13	5.40-13
PR210	.00	4.96-14	4.10-14	1.12-13	1.84-13	3.74-13	1.64-12	8.49-12	4.59-11	4.99-10	3.01-09
PR211	.00	2.51-20	3.13-20	3.62-20	5.36-20	7.86-20	1.51-19	2.64-19	4.63-19	9.31-19	1.53-18
PR212	.00	5.31-21	7.01-21	8.41-21	1.27-20	2.04-20	4.20-20	6.03-20	6.44-20	4.72-20	3.04-20
PR213	.00	1.59-23	3.28-24	2.81-24	5.06-24	3.49-24	4.84-24	7.10-24	1.30-23	3.69-23	1.01-22
PR214	.00	6.25-23	7.13-23	7.89-23	1.04-22	1.60-22	4.18-22	1.15-21	3.83-21	2.21-20	4.13-20
PR215	.00	2.95-20	3.68-20	4.28-20	6.30-20	9.25-20	1.78-19	3.10-19	5.45-19	1.10-18	1.80-18
PR216	.00	4.23-15	5.59-15	6.68-15	1.01-14	1.65-14	3.34-14	4.40-14	5.17-14	3.91-14	2.42-14
PR218	.00	5.02-17	6.65-17	7.35-17	9.70-17	1.49-16	3.90-16	1.07-15	3.55-15	2.04-14	4.51-14
EL217	.00	1.24-19	2.60-20	2.23-20	2.83-20	2.77-20	3.84-20	5.40-20	1.04-19	2.93-19	7.99-19
PR219	.00	6.68-17	9.34-17	9.66-17	1.41-16	2.69-16	4.02-16	7.02-16	1.23-15	2.46-15	4.07-15
PR220	.00	1.61-12	2.12-12	2.55-12	3.85-12	6.29-12	1.27-11	1.63-11	1.45-11	1.49-11	9.20-12
PR221	.00	1.07-13	1.22-13	1.35-13	1.78-13	2.74-13	7.16-13	1.47-12	6.52-12	3.74-11	1.56-10
PR222	.00	1.15-15	2.39-16	2.04-16	2.23-16	2.54-16	3.52-16	5.11-16	4.44-16	2.69-15	7.33-15
PR223	.00	3.50-16	4.79-16	4.93-16	6.70-16	7.83-16	1.89-15	3.30-15	5.80-15	1.17-14	1.93-14
PR224	.00	1.64-11	2.09-11	2.42-11	3.58-11	5.25-11	1.01-10	1.74-10	3.04-10	6.22-10	1.02-09
PR225	.00	9.19-09	1.21-08	1.44-08	2.20-08	3.60-08	7.26-08	1.04-07	1.17-07	8.51-08	5.24-08
PR226	.00	5.43-12	9.67-13	9.25-13	1.01-12	1.15-12	1.59-12	2.44-12	4.24-12	1.21-11	3.31-11
PR228	.00	1.67-08	1.90-08	2.10-08	2.77-08	4.27-08	1.12-07	3.07-07	1.02-06	5.89-06	2.83-05
PR229	.00	8.63-15	1.09-14	1.30-14	1.89-14	3.60-14	1.08-13	2.89-13	7.16-13	2.52-12	5.53-12
AC225	.00	3.52-12	7.29-13	6.74-13	6.80-13	7.75-13	1.07-12	1.62-12	2.90-12	8.21-12	2.24-11
AC227	.00	1.31-08	1.61-08	1.84-08	2.51-08	3.69-08	7.10-08	1.24-07	2.18-07	4.16-07	7.19-07
AC228	.00	9.01-09	1.14-08	1.35-08	2.07-08	3.74-08	1.13-17	3.02-17	8.10-17	2.43-16	5.77-16
PR227	.00	2.80-11	3.47-11	3.99-11	5.73-11	8.41-11	1.62-10	2.87-10	4.95-10	9.96-10	1.64-09
PR228	.00	1.79-06	2.36-06	2.83-06	4.29-06	7.00-06	1.42-05	2.04-05	2.14-05	1.66-05	1.03-05
PR229	.00	1.59-07	1.65-07	1.76-07	1.84-07	2.10-07	2.92-07	4.40-07	7.47-07	2.23-06	4.07-06
PR230	.00	1.37-03	1.19-03	1.27-03	1.53-03	2.00-03	3.41-03	5.49-03	1.09-02	2.80-02	4.11-02
PR231	.00	2.05-06	3.16-06	3.16-06	3.16-06	3.16-06	3.16-06	3.16-06	3.16-06	3.16-06	3.16-06
PR232	.00	1.99-04	2.33-04	2.55-04	3.27-04	4.54-04	8.42-04	1.44-03	2.77-03	6.17-03	1.11-02
PR233	.00	4.49-10	.00	.00	.00	.00	.00	.00	.00	.00	.00
PR234	.00	1.36-05	1.34-05	1.34-05	1.34-05	1.34-05	1.34-05	1.34-05	1.34-05	1.34-05	1.34-05
PR231	.00	5.96-04	6.00-04	6.01-04	6.05-04	6.13-04	6.35-04	6.73-04	7.44-04	9.73-04	1.33-03
PR232	.00	1.14-04	3.40-27	.00	.00	.00	.00	.00	.00	.00	.00
PR233	.00	1.56-05	1.65-05	1.66-05	1.66-05	1.66-05	1.67-05	1.68-05	1.69-05	1.69-05	2.04-05
PR234	.00	4.67-10	4.67-10	4.67-10	4.67-10	4.67-10	4.67-10	4.67-10	4.67-10	4.67-10	4.67-10

POWER: 35.00MW, BURUPP: 33000-RWG, FLOW: 3.44*10M/GH002-SEC

NUCLIDE CONCENTRATIONS, GRAMS
BASIS : MT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
PA234	.00	3.77-09	1.58-10	1.58-10	1.58-10	1.58-10	1.58-10	1.58-10	1.58-10	1.58-10	1.58-10
U232	.00	3.05-04	3.44-04	3.72-04	4.47-04	5.55-04	7.44-04	8.50-04	8.27-04	6.70-04	3.43-04
U233	.00	5.89-03	5.92-03	5.95-03	6.04-03	6.21-03	6.44-03	7.44-03	9.07-03	1.39-02	2.10-02
U234	3.66-02	3.66-02	3.66-02	3.67-02	3.67-02	3.67-02	3.67-02	3.67-02	3.67-02	2.79-02	2.57-02
U235	1.24-04	7.82-03	7.82-03	7.82-03	7.82-03	7.83-03	7.83-03	7.83-03	7.83-03	7.83-03	7.83-03
U236	.00	4.51-03	4.51-03	4.51-03	4.51-03	4.51-03	4.51-03	4.51-03	4.51-03	4.52-03	4.53-03
U277	.00	1.23-01	1.23-01	3.16-05	2.49-05	2.49-05	2.49-05	1.94-05	1.27-05	2.91-04	2.71-07
U250	9.47-05	9.43-05	9.43-05	9.43-05	9.43-05	9.43-05	9.43-05	9.43-05	9.43-05	9.43-05	9.43-05
U259	.00	6.51-01	.00	.00	.00	.00	.00	.00	.00	.00	.00
U260	.00	3.66-21	3.38-21	4.72-21	6.65-21	1.57-20	3.66-20	7.16-20	1.42-19	3.52-19	7.02-19
NP236	.00	5.43-06	.00	.00	.00	.00	.00	.00	.00	.00	.00
NP237	.00	4.70-02	4.83-02	4.83-02	4.83-02	4.83-02	4.84-02	4.86-02	4.95-02	5.34-02	6.08-02
NP238	.00	1.78-00	2.23-13	2.07-23	.00	.00	.00	.00	.00	.00	.00
NP239	.00	9.35-01	8.01-05	8.01-05	8.01-05	8.01-05	8.01-05	8.00-05	7.99-05	7.97-05	7.94-05
NP240	.00	1.33-23	2.42-23	4.07-23	7.47-23	1.35-22	3.16-22	6.18-22	1.62-21	3.03-21	6.05-21
NP241	.00	3.65-03	.00	.00	.00	.00	.00	.00	.00	.00	.00
NP242	.00	6.78-04	6.42-04	6.12-04	5.38-04	4.19-04	2.02-04	5.98-05	5.25-06	3.56-06	1.64-06
NP243	.00	1.60-02	1.65-02	1.64-02	1.64-02	1.65-02	1.65-02	1.67-02	1.74-02	1.74-02	1.74-02
NP244	.00	5.18-03	5.28-03	5.28-03	5.28-03	5.28-03	5.28-03	5.27-03	5.27-03	5.27-03	5.26-03
NP245	.00	2.18-03	2.18-03	2.18-03	2.18-03	2.18-03	2.18-03	2.19-03	2.19-03	2.19-03	2.18-03
NP246	.00	1.05-03	1.05-03	1.05-03	1.05-03	1.05-03	1.05-03	1.05-03	1.05-03	1.05-03	1.05-03
NP247	.00	3.60-02	3.60-02	3.60-02	3.60-02	3.60-02	3.60-02	3.60-02	3.60-02	3.60-02	3.60-02
NP248	.00	1.64-01	1.03-13	1.03-13	1.03-13	1.03-13	1.03-13	1.03-13	1.03-13	1.03-13	1.03-13
NP249	.00	4.98-11	1.72-10	2.47-10	4.53-10	6.20-10	1.92-09	3.75-09	2.47-09	1.84-09	3.68-09
NP250	.00	1.96-16	.00	.00	.00	.00	.00	.00	.00	.00	.00
NP251	.00	2.17-01	3.38-01	4.37-01	7.01-01	1.14-02	2.41-02	4.13-02	6.51-02	9.18-02	9.31-02
NP252	.00	8.17-01	8.16-01	8.16-01	8.16-01	8.16-01	8.16-01	8.16-01	8.16-01	8.16-01	8.16-01
NP253	.00	7.95-02	9.40-06	9.40-06	9.77-06	9.73-06	9.36-06	9.36-06	8.94-06	7.81-06	6.22-06
NP254	.00	9.67-01	9.68-01	9.68-01	9.68-01	9.68-01	9.68-01	9.67-01	9.68-01	9.68-01	9.68-01
NP255	.00	5.00-03	1.38-25	1.42-25	3.52-25	6.37-25	1.44-24	2.91-24	5.76-24	1.43-23	2.85-23
NP256	.00	9.58-15	7.81-15	6.71-15	4.26-15	1.40-15	1.69-16	3.01-16	9.47-22	2.95-12	.00
NP257	.00	9.58-00	6.58-00	4.89-00	2.04-00	4.33-01	6.01-03	1.88-03	1.88-03	1.57-03	1.25-03
NP258	.00	7.66-02	7.62-02	7.58-02	7.49-02	7.33-02	6.87-02	6.16-02	4.96-02	2.54-02	8.77-03
NP259	.00	3.13-01	3.10-01	3.08-01	3.03-01	2.90-01	2.58-01	2.13-01	1.45-01	4.61-00	6.79-01
NP260	.00	2.01-00	2.01-00	2.01-00	2.01-00	2.01-00	2.01-00	2.01-00	2.01-00	2.01-00	2.00-00
NP261	.00	2.33-01	2.33-01	2.33-01	2.33-01	2.33-01	2.33-01	2.33-01	2.33-01	2.31-01	2.30-01
NP262	.00	3.03-03	3.03-03	3.03-03	3.03-03	3.03-03	3.03-03	3.03-03	3.03-03	3.03-03	3.03-03
NP263	.00	2.06-04	2.06-04	2.06-04	2.06-04	2.06-04	2.06-04	2.07-04	2.07-04	2.06-04	2.06-04
NP264	.00	4.11-17	7.69-18	9.13-22	6.12-24	.00	.00	.00	.00	.00	.00
NP265	.00	1.42-12	1.42-12	1.42-12	1.42-12	1.42-12	1.42-12	1.42-12	1.42-12	1.42-12	1.42-12
NP266	.00	2.35-06	3.93-06	1.65-06	1.04-06	4.70-07	4.18-08	1.47-10	2.33-11	1.26-04	.00
NP267	.00	2.62-09	3.00-20	3.00-20	3.00-20	3.00-20	3.00-20	3.00-20	3.00-20	3.00-20	2.99-20
NP268	.00	3.73-07	3.73-07	3.73-07	3.73-07	3.73-07	3.73-07	3.73-07	3.73-07	3.73-07	3.73-07
NP269	.00	1.90-07	1.90-07	1.90-07	1.90-07	1.90-07	1.90-07	1.90-07	1.90-07	1.90-07	1.90-07
NP270	.00	1.05-07	1.05-07	1.05-07	1.05-07	1.05-07	1.05-07	1.05-07	1.05-07	1.05-07	1.05-07
NP271	.00	1.79-10	5.18-12	3.53-13	1.27-16	5.02-23	.00	.00	.00	.00	.00
NP272	.00	1.74-13	6.28-14	2.79-14	2.65-15	4.04-17	1.42-22	1.16-31	.00	.00	.00
NP273	.00	1.47-10	3.13-11	4.19-12	6.16-15	3.44-20	4.28-26	.00	.00	.00	.00
TOTAL	1.00-06	9.65-05	9.65-05	9.65-05	9.65-05	9.65-05	9.65-05	9.65-05	9.65-05	9.65-05	9.65-05

POWER= 35.00KW, BURNUP= 33000,WD, FLOW= 3.4433M3/HR=2-SEC

ELEMENT CONCENTRATIONS, GRAMS
BASIS : MT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
MC	.00	3.89-01	2.52-01	2.89-01	3.63-01	4.40-01	5.98-01	8.54-01	1.33+00	2.40+00	3.17+00
TL	.00	1.87-12	2.41-12	2.88-12	4.33-12	7.13-12	1.44-11	2.07-11	2.21-11	1.70-11	1.07-11
PD	.00	4.02-07	5.69-07	7.33-07	1.19-06	3.26-06	7.40-05	4.35-05	2.15-05	3.07-05	5.28-05
SI	.00	1.55-10	1.98-10	2.27-10	3.18-10	4.87-10	7.53-10	1.46-09	2.06-09	5.57-09	2.28-08
PO	.00	7.39-14	9.75-14	1.18-13	3.48-13	3.70-13	1.67-12	8.56-12	4.94-11	4.49-10	3.01-09
AT	.00	1.24-19	2.40-20	2.73-20	2.43-20	2.17-20	3.88-20	5.80-20	1.04-19	2.95-19	7.48-19
BN	.00	1.71-12	2.78-12	2.68-12	4.03-12	6.57-12	1.34-11	2.07-11	2.47-11	5.27-11	1.44-10
FR	.00	1.50-15	6.68-16	6.95-16	8.92-16	1.24-15	3.83-15	6.74-15	1.43-14	2.65-14	2.65-14
WA	.00	2.54-08	3.12-08	3.56-08	4.98-08	7.88-08	1.84-07	4.12-07	1.17-06	9.97-06	2.44-05
AC	.00	1.11-08	1.61-08	1.84-08	2.51-08	3.68-08	7.10-08	1.24-07	2.18-07	4.38-07	7.19-07
TH	.00	8.29-03	1.43-03	1.55-03	1.89-03	2.47-03	4.28-03	7.35-03	1.37-02	3.46-02	7.41-02
PA	.00	6.12-09	6.16-04	6.18-04	6.22-04	6.30-04	4.52-04	6.97-04	7.65-04	9.91-04	1.33-03
U	1.00+06	9.55+05	9.55+05	9.55+05	9.55+05	9.55+05	9.55+05	9.55+05	9.55+05	9.55+05	9.55+05
MP	.00	8.66+02	4.83+02	4.63+02	4.83+02	4.83+02	4.84+02	4.84+02	4.95+02	5.34+02	6.04+02
PU	.00	8.92+03	9.01+03	9.00+03	8.99+03	8.93+03	8.80+03	8.63+03	8.37+03	8.03+03	7.69+03
BN	.00	1.19+02	1.31+02	1.41+02	1.68+02	2.14+02	3.39+02	5.13+02	7.48+02	1.01+03	1.03+03
CH	.00	4.32+01	3.99+01	3.80+01	3.45+01	3.17+01	2.82+01	2.36+01	1.68+01	6.88+00	2.97+00
BN	.00	2.35-06	1.97-06	1.65-06	1.05-06	4.70-07	4.19-08	7.42-10	2.33-13	3.00-20	2.99-20
CF	.00	9.30-07	1.36-06	1.61-06	2.19-06	2.13-06	3.06-06	2.99-06	2.89-06	2.58-06	2.33-06
ES	.00	1.42-10	3.13-11	4.19-12	8.16-15	5.44-20	4.28-36	.00	.00	.00	.00
TOTALS	1.00+06	9.65+05	9.65+05	9.65+05	9.65+05	9.65+05	9.65+05	9.65+05	9.65+05	9.65+05	9.65+05
SUBST-1	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TOTALS	1.00+06	9.65+05	9.65+05	9.65+05	9.65+05	9.65+05	9.65+05	9.65+05	9.65+05	9.65+05	9.65+05

TABLE D-5

ACTIVITIES OF LIGHT ELEMENTS AND
MATERIALS OF CONSTRUCTION
PRESENT IN SPENT FUEL
VS. DECAY TIMES

POWER = 35.00MW, BURNUP = 33000 MWd, FUEL = 3.44*10²⁴ ATOMS/G

RADIOLIC SUBTRACTIVITY, CURIES
MUSIS = MT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
H 1	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
H 2	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
H 3	.00	9.58-05	9.88-05	9.39-05	9.05-05	8.55-05	7.27-05	5.45-05	3.10-05	1.72-06	9.82-07
H 4	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
HE 3	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
HE 4	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
HE 6	.00	3.88-03	.00	.00	.00	.00	.00	.00	.00	.00	.00
LI 6	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
LI 7	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
LI 8	.00	1.18-11	.00	.00	.00	.00	.00	.00	.00	.00	.00
BE 8	.00	6.31-03	.00	.00	.00	.00	.00	.00	.00	.00	.00
BE 9	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
BE 10	.00	8.88-07	8.88-07	8.88-07	8.88-07	8.88-07	8.88-07	8.88-07	8.88-07	8.88-07	8.88-07
BE 13	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
B 10	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
B 11	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
B 12	.00	1.32-12	.00	.00	.00	.00	.00	.00	.00	.00	.00
C 12	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
C 13	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
C 14	.00	6.72-03	6.72-03	6.72-03	6.72-03	6.72-03	6.72-03	6.72-03	6.72-03	6.72-03	6.72-03
N 13	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
N 14	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
N 15	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
N 16	.00	2.00-02	.00	.00	.00	.00	.00	.00	.00	.00	.00
O 16	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
O 17	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
O 18	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
O 19	.00	3.98-22	.00	.00	.00	.00	.00	.00	.00	.00	.00
F 19	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
F 20	.00	1.42-10	.00	.00	.00	.00	.00	.00	.00	.00	.00
NE 20	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
NE 21	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
NE 22	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
NE 23	.00	9.19-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
NA 23	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
NA 24	.00	2.55-07	.00	.00	.00	.00	.00	.00	.00	.00	.00
NA 25	.00	1.83-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
MG 24	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
MG 25	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
MG 26	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
MG 27	.00	5.47-02	.00	.00	.00	.00	.00	.00	.00	.00	.00
AL 27	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AL 28	.00	6.93-01	.00	.00	.00	.00	.00	.00	.00	.00	.00
AL 29	.00	2.33-00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SI 28	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SI 29	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SI 30	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SI 31	.00	1.89-01	.00	.00	.00	.00	.00	.00	.00	.00	.00
P 31	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
P 32	.00	7.77-03	9.92-03	3.33-06	1.59-10	3.25-18	.00	.00	.00	.00	.00
P 33	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

PROG: 25.0000, DUR: 3300.000, FLUX: 3.4435E+02-SEC

NUCLIDE RADIOACTIVITY, CURIES
BASIS = MT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	D. Y	D. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
P 30	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
S 32	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
S 33	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
S 34	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
S 35	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
S 36	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
S 37	.00	6.97-23	.00	.00	.00	.00	.00	.00	.00	.00	.00
CL 35	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CL 36	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CL 37	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CL 38	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AR 36	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AR 37	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AR 38	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AR 39	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AR 40	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AR 41	.00	9.22-32	.00	.00	.00	.00	.00	.00	.00	.00	.00
K 39	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
K 40	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
K 41	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
K 42	.00	5.95-35	.00	.00	.00	.00	.00	.00	.00	.00	.00
K 43	.00	1.93-29	.00	.00	.00	.00	.00	.00	.00	.00	.00
K 44	.00	2.58-31	.00	.00	.00	.00	.00	.00	.00	.00	.00
CA 40	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CA 41	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CA 42	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CA 43	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CA 44	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CA 45	.00	1.89-30	6.53-33	3.40-33	7.73-32	7.77-34	5.62-37	7.84-39	.00	.00	.00
CA 46	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CA 47	.00	7.27-08	7.59-14	1.70-38	.00	.00	.00	.00	.00	.00	.00
CA 48	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CA 49	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SC 45	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SC 46	.00	1.63-32	7.75-33	4.35-33	1.98-38	3.90-35	4.56-39	1.28-25	.00	.00	.00
SC 47	.00	3.70-04	4.48-12	1.03-37	.00	.00	.00	.00	.00	.00	.00
SC 48	.00	4.64-04	7.32-19	.00	.00	.00	.00	.00	.00	.00	.00
SC 49	.00	8.21-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
SC 50	.00	8.04-06	.00	.00	.00	.00	.00	.00	.00	.00	.00
TI 46	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TI 47	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TI 48	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TI 49	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TI 50	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TI 51	.00	1.43-01	.00	.00	.00	.00	.00	.00	.00	.00	.00
Y 49	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Y 50	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Y 51	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Y 52	.00	2.81-02	.00	.00	.00	.00	.00	.00	.00	.00	.00
Y 53	.00	9.42-03	.00	.00	.00	.00	.00	.00	.00	.00	.00
Y 54	.00	1.07-02	.00	.00	.00	.00	.00	.00	.00	.00	.00
EN 50	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

PAGE: 35-0000, CURRUP: 33000.MWD, FLUT: 3.44+13MCH002-51C

NUCLIDE RADIOACTIVITY CURVES
BASIS = MT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	30. Y	100. Y
CR 51	.00	7.63+00	2.60+03	4.53+02	2.71+00	3.01+00	4.09+16	.00	.00	.00	.00
CR 52	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CR 53	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CR 54	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CR 55	.00	3.40+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
RM 56	.00	1.13+03	9.18+02	7.82+02	4.88+02	2.12+02	1.73+01	2.63+01	6.22+01	8.01+16	.00
RM 56	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
RM 56	.00	3.24+05	.00	.00	.00	.00	.00	.00	.00	.00	.00
RM 57	.00	3.59+00	.00	.00	.00	.00	.00	.00	.00	.00	.00
RM 58	.00	1.27+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
FE 54	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
FE 55	.00	8.51+03	1.97+03	7.58+03	6.52+03	5.00+03	2.24+03	5.42+02	4.11+01	1.38+02	2.24+08
FE 56	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
FE 57	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
FE 58	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
FE 59	.00	1.09+02	1.77+02	6.03+01	2.55+00	9.19+03	4.29+10	2.60+22	.00	.00	.00
CO 50M	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CO 58	.00	3.07+04	1.20+04	4.44+03	8.81+02	2.53+01	5.97+04	1.16+11	.00	.00	.00
CO 59	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CO 60M	.00	1.04+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
CO 60	.00	3.12+02	3.02+02	2.94+02	2.73+02	2.19+02	1.61+02	8.34+01	2.23+01	4.28+01	5.90+04
CU 61	.00	2.41+01	.00	.00	.00	.00	.00	.00	.00	.00	.00
CU 62	.00	2.10+00	.00	.00	.00	.00	.00	.00	.00	.00	.00
NI 58	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
NI 59	.00	1.15+01	1.15+01	1.19+01	1.15+01	1.15+01	1.15+01	1.15+01	1.15+01	1.15+01	1.15+01
NI 60	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
NI 61	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
NI 62	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
NI 63	.00	1.65+03	1.65+03	1.65+03	1.64+03	1.63+03	1.59+03	1.53+03	1.42+03	1.13+03	7.78+02
NI 64	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
NI 65	.00	2.47+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
CU 62	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CU 63	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CU 64	.00	1.16+01	.00	.00	.00	.00	.00	.00	.00	.00	.00
CU 65	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CU 66	.00	1.60+01	.00	.00	.00	.00	.00	.00	.00	.00	.00
Zn 64	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Zn 65	.00	1.02+03	7.90+04	1.68+04	3.62+04	1.29+04	5.61+04	3.31+08	1.08+12	3.69+26	.00
Zn 66	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Zn 67	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Zn 68	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Zn 69M	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Zn 69	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Zn 70	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Zn 71M	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Zn 71	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
GA 69	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
GA 70	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
GA 71	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE 70	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SR 68	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

POWER= 55.00MW, BURNUP= 33000-MWD, FLUX= 3.44E13W/CM^2-SEC

NUCLIDE RADIOACTIVITY, CURIES
BASES = WT OF HEAVY METAL CHARGED TO REACTOR

	CHANGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
SR 87	.00	4.12E-01	1.24E-01	4.88E-00	3.31E-01	2.43E-03	1.30E-09	2.94E-20	.00	.00	.00
SR 90	.00	3.81E-04	8.76E-04	8.72E-04	8.40E-04	8.37E-04	7.79E-04	6.89E-04	5.38E-04	2.57E-04	7.44E-05
SR 91	.00	3.88E-00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Y 90M	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Y 90	.00	1.56E-03	8.76E-04	8.72E-04	8.40E-04	8.34E-04	7.79E-04	6.89E-04	5.38E-04	2.57E-04	7.44E-05
Y 91M	.00	4.66E-00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Y 91	.00	3.09E-02	3.77E-01	1.45E-01	1.47E-01	1.98E-02	4.87E-08	2.17E-17	.00	.00	.00
Zr 90	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Zr 91	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Zr 92	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Zr 93	.00	9.63E-02	9.63E-02	9.63E-02	9.63E-02	9.63E-02	9.63E-02	9.63E-02	9.63E-02	9.63E-02	9.63E-02
Zr 94	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Zr 95	.00	3.14E-04	1.20E-04	5.70E-05	4.39E-02	1.30E-01	1.04E-04	1.80E-11	.00	.00	.00
Zr 96	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Nb 92	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Nb 93M	.00	5.75E-03	6.88E-03	7.75E-03	1.03E-02	1.45E-02	2.61E-02	4.39E-02	6.38E-02	8.92E-02	9.58E-02
Nb 93	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Nb 94	.00	9.02E-14	9.02E-14	9.02E-14	9.02E-14	9.02E-14	9.02E-14	9.02E-14	9.02E-14	9.02E-14	9.02E-14
Nb 95	.00	3.02E-04	1.64E-04	1.06E-04	1.13E-03	2.85E-02	2.32E-04	8.08E-13	.00	.00	.00
Nb 96	.00	1.49E-03	.00	.00	.00	.00	.00	.00	.00	.00	.00
Nb 97	.00	5.20E-07	.00	.00	.00	.00	.00	.00	.00	.00	.00
Mo 92	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Mo 93	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Mo 93M	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Mo 94	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Mo 95	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Mo 96	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Mo 97	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Mo 98	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Mo 99	.00	3.72E-04	7.34E-14	2.00E-23	.00	.00	.00	.00	.00	.00	.00
Mo 100	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Mo 101	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Tc 99M	.00	3.24E-06	7.62E-14	1.99E-23	.00	.00	.00	.00	.00	.00	.00
Tc 99	.00	4.75E-12	4.90E-12	4.90E-12	4.90E-12	4.90E-12	4.90E-12	4.90E-12	4.90E-12	4.90E-12	4.90E-12
Tc 101	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Ru 101	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Co 113M	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Co 113	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Co 113M	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Co 115	.00	1.93E-02	1.36E-15	4.80E-23	.00	.00	.00	.00	.00	.00	.00
Co 116M	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Co 119	.00	7.10E-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
Co 121	.00	2.13E-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
Co 113M	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Co 119M	.00	2.10E-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
Co 119	.00	6.40E-02	.00	.00	.00	.00	.00	.00	.00	.00	.00
Co 121M	.00	2.16E-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
Co 121	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Co 116	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Co 115	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Co 116	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Co 117M	.00	1.37E-04	1.33E-02	4.78E-00	1.84E-06	2.56E-12	.00	.00	.00	.00	.00

POWER= 35.00MW, SHUTDOWN= 33000.MWD, FLUX= 3.44E+13W/CM**2-SEC

NUCLIDE RADIOACTIVITY, CURIES
BASIS = WT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
SN117	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN118	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN119M	.00	2.52E+01	1.46E+01	1.62E+01	9.15E+00	3.32E+00	1.55E+01	1.01E+03	4.02E+08	2.57E+21	.00
SN119	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN120	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN121M	.00	3.14E+01	3.13E+01	3.12E+01	3.11E+01	3.08E+01	3.00E+01	2.88E+01	2.61E+01	1.99E+01	1.24E+01
SN121	.00	2.25E+03	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN122	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN123M	.00	1.01E+02	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN123	.00	4.76E+01	2.89E+01	1.46E+01	6.29E+00	8.29E+00	1.90E+01	7.61E+01	1.21E+18	.00	.00
SN124	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN125M	.00	9.16E+01	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN125	.00	3.82E+00	3.61E+03	2.87E+05	7.46E+12	1.53E+23	.00	.00	.00	.00	.00
SN126	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN127	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN128M	.00	2.33E+01	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN128	.00	4.40E+00	1.63E+00	7.25E+01	6.76E+02	9.84E+06	3.16E+09	2.11E+18	.00	.00	.00
SN129	.00	1.25E+01	3.99E+01	1.80E+01	3.29E+01	2.54E+01	1.18E+01	3.24E+00	2.50E+01	1.13E+04	3.01E+10
SN126M	.00	1.26E+01	.00	.00	.00	.00	.00	.00	.00	.00	.00
SN126	.00	2.86E+01	1.67E+03	3.45E+05	3.62E+10	6.27E+19	.00	.00	.00	.00	.00
TE124	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE125M	.00	1.51E+01	1.57E+01	1.54E+01	1.36E+01	1.05E+01	4.88E+00	1.35E+00	1.04E+01	4.69E+05	1.25E+10
TE125	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TE126	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
FA18C	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
FA18J	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
FA182M	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
FA182	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
W120	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
W18J	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
W182	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
W185M	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
W185	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
W194	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
W194M	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
W185	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
W166	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
W167	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TOTAL	.00	4.77E+05	5.61E+06	3.37E+04	1.18E+06	7.19E+03	4.08E+03	2.23E+03	1.50E+03	1.15E+03	7.90E+02

POWER: 35.00MW, Burnup: 33000.MWD, FLUX: 3.44E+13N/CMO2-SEC

ELEMENTAL ACTIVITY, CURIES
BASIS : WT OF HEAVY METAL CHARGED TO REACTION

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
N	.00	9.58-05	9.44-05	9.34-05	9.05-05	8.55-05	7.22-05	5.45-05	3.10-05	5.72-06	3.42-07
BE	.00	6.31-03	4.84-07	4.84-07	4.84-07	4.84-07	4.84-07	4.84-07	4.84-07	4.84-07	4.84-07
C	.00	6.72-03	6.72-03	6.72-03	6.72-03	6.72-03	6.72-03	6.71-03	6.71-03	6.68-03	6.64-03
P	.00	7.77-03	9.91-05	3.33-06	1.54-10	5.25-18	.00	.00	.00	.00	.00
CA	.00	7.28-04	1.15-10	4.53-11	3.60-11	7.16-12	7.77-14	3.62-17	7.64-24	.00	.00
SC	.00	9.28-04	3.76-12	4.35-13	7.98-14	3.90-15	4.56-19	1.28-25	.00	.00	.00
CR	.00	2.48-04	2.60-03	4.53-02	2.71-00	3.03-04	4.04-16	.00	.00	.00	.00
PH	.00	3.27-05	9.18-02	7.82-02	4.89-02	2.12-02	1.73-01	2.85-01	4.22-05	8.07-16	.00
FE	.00	4.22-03	8.15-03	7.64-03	4.32-03	5.00-03	2.24-03	3.92-02	4.11-01	1.34-02	2.24-08
CO	.00	3.21-04	1.33-04	4.77-05	1.15-05	2.65-02	2.61-02	8.34-01	2.23-01	4.24-03	5.92-04
NI	.00	4.13-03	1.66-03	1.66-03	1.65-03	1.64-03	1.60-03	1.55-03	1.43-03	1.15-03	7.90-02
ZN	.00	1.02-01	7.90-04	4.48-04	3.67-04	1.29-04	5.61-04	3.11-08	1.07-12	3.69-26	.00
SR	.00	4.93-01	1.24-01	4.89-00	3.17-01	3.27-03	7.79-04	6.84-04	5.34-04	2.57-04	7.48-05
Y	.00	1.67-03	3.77-01	1.65-01	1.47-00	2.07-02	7.79-04	6.84-04	5.34-04	2.57-04	7.48-05
ZP	.00	1.14-04	1.20-04	5.70-03	4.39-02	1.31-01	9.64-02	4.19-02	4.63-02	9.63-02	9.63-02
MO	.00	3.02-04	1.94-04	1.04-04	1.33-03	2.84-01	2.64-02	4.19-02	6.36-02	6.92-02	9.58-02
NO	.00	3.72-04	7.34-16	2.08-23	.00	.00	.00	.00	.00	.00	.00
TC	.00	3.24-06	4.90-12	4.90-12	4.90-12	4.90-12	4.90-12	4.90-12	4.90-12	4.90-12	4.90-12
CD	.00	2.86-03	1.36-15	4.80-25	.00	.00	.00	.00	.00	.00	.00
SM	.00	1.54-04	1.73-02	2.35-01	9.53-00	3.44-00	4.59-01	2.67-01	2.61-01	1.99-01	1.24-01
S3	.00	4.77-03	4.15-03	3.87-01	3.30-01	2.54-01	3.18-01	3.26-00	2.50-01	1.13-04	3.03-10
TE	.00	1.51-03	1.37-01	1.54-01	1.36-01	1.05-01	4.88-00	1.35-00	1.04-01	4.64-05	1.25-10
TOTALS	.00	4.77-05	5.81-04	3.37-04	1.18-04	7.19-03	4.04-03	2.23-03	1.50-03	1.15-03	7.96-02
SUBTOT	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TOTALS	.00	4.77-05	5.81-04	3.37-04	1.18-04	7.19-03	4.04-03	2.23-03	1.50-03	1.15-03	7.96-02

TABLE D-6

QUANTITIES OF LIGHT ELEMENTS AND
MATERIALS OF CONSTRUCTION
PRESENT IN SPENT FUEL
VS. DECAY TIMES

POWER: 35.00MW, BURNUP: 33000.MWD, FLUX: 3.00E+15N/CM^2-SEC

NUCLIDE CONCENTRATIONS, GRAMS
BASIS : WT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
M 1	.00	2.25-01	2.25-01	2.25-01	2.25-01	2.25-01	2.25-01	2.25-01	2.25-01	2.25-01	2.25-01
M 2	.00	1.67-04	1.67-04	1.67-04	1.67-04	1.67-04	1.67-04	1.67-04	1.67-04	1.67-04	1.67-04
M 3	.00	9.00-09	9.74-09	9.04-09	9.34-09	8.83-09	7.95-09	5.67-09	3.20-09	5.00-10	3.57-11
M 4	.00	7.24-25	7.24-25	7.24-25	7.24-25	7.24-25	7.24-25	7.24-25	7.24-25	7.24-25	7.24-25
MC 3	.00	1.00-10	2.36-10	3.41-10	6.49-10	1.15-08	1.15-08	2.53-09	4.34-09	6.79-09	9.94-09
MC 4	.00	1.15+00	1.15+00	1.15+00	1.15+00	1.15+00	1.15+00	1.15+00	1.15+00	1.15+00	1.15+00
MC 6	.00	1.57-15	.00	.00	.00	.00	.00	.00	.00	.00	.00
LI 6	.00	2.69-08	2.69-08	2.69-08	2.69-08	2.69-08	2.69-08	2.69-08	2.69-08	2.69-08	2.69-08
LI 7	.00	4.86-12	4.86-12	4.86-12	4.86-12	4.86-12	4.86-12	4.86-12	4.86-12	4.86-12	4.86-12
LI 8	.00	7.34-24	.00	.00	.00	.00	.00	.00	.00	.00	.00
EE 8	.00	1.34-30	.00	.00	.00	.00	.00	.00	.00	.00	.00
EE 9	.00	2.00-04	2.00-04	2.00-04	2.00-04	2.00-04	2.00-04	2.00-04	2.00-04	2.00-04	2.00-04
EL 10	.00	3.38-05	3.38-05	3.38-05	3.38-05	3.38-05	3.38-05	3.38-05	3.38-05	3.38-05	3.38-05
EL 11	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
U 10	.00	2.03-12	4.39-12	6.14-12	1.14-11	2.08-11	4.90-11	9.59-11	1.90-10	4.71-10	9.44-10
U 11	.00	6.94-12	6.94-12	6.94-12	6.94-12	6.94-12	6.94-12	6.94-12	6.94-12	6.94-12	6.94-12
U 12	.00	2.80-24	.00	.00	.00	.00	.00	.00	.00	.00	.00
C 12	1.06+02	1.06+02	1.06+02	1.06+02	1.06+02	1.06+02	1.06+02	1.06+02	1.06+02	1.06+02	1.06+02
C 13	1.18+00	4.86+00	4.86+00	4.86+00	4.86+00	4.86+00	4.86+00	4.86+00	4.86+00	4.86+00	4.86+00
C 14	.00	1.51-03	1.51-03	1.51-03	1.51-03	1.51-03	1.51-03	1.51-03	1.51-03	1.51-03	1.51-03
M 13	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
M 14	.00	1.43-07	1.43-07	2.23-07	3.26-07	5.08-07	1.06-06	1.97-06	3.74-06	9.24-06	1.83-05
M 15	.00	5.41-12	5.41-12	5.41-12	5.41-12	5.41-12	5.41-12	5.41-12	5.41-12	5.41-12	5.41-12
M 16	.00	2.01-09	.00	.00	.00	.00	.00	.00	.00	.00	.00
D 16	1.34+05	1.34+05	1.34+05	1.34+05	1.34+05	1.34+05	1.34+05	1.34+05	1.34+05	1.34+05	1.34+05
D 17	.00	8.77+00	8.77+00	8.77+00	8.77+00	8.77+00	8.77+00	8.77+00	8.77+00	8.77+00	8.77+00
D 18	.00	1.29-19	1.29-19	1.29-19	1.29-19	1.29-19	1.29-19	1.29-19	1.29-19	1.29-19	1.29-19
D 19	.00	2.92-32	.00	.00	.00	.00	.00	.00	.00	.00	.00
F 19	.00	6.38-32	6.38-32	6.38-32	6.38-32	6.38-32	6.38-32	6.38-32	6.38-32	6.38-32	6.38-32
F 20	.00	2.76-21	.00	.00	.00	.00	.00	.00	.00	.00	.00
HE 20	.00	4.03-15	4.03-15	4.03-15	4.03-15	4.03-15	4.03-15	4.03-15	4.03-15	4.03-15	4.03-15
HE 21	.00	2.82-17	2.82-17	2.82-17	2.82-17	2.82-17	2.82-17	2.82-17	2.82-17	2.82-17	2.82-17
HE 22	.00	5.71-08	5.71-08	5.71-08	5.71-08	5.71-08	5.71-08	5.71-08	5.71-08	5.71-08	5.71-08
HE 23	.00	7.04-15	.00	.00	.00	.00	.00	.00	.00	.00	.00
HA 22	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
HA 23	.00	4.49-09	4.49-09	4.49-09	4.49-09	4.49-09	4.49-09	4.49-09	4.49-09	4.49-09	4.49-09
HA 24	.00	2.93-14	.00	.00	.00	.00	.00	.00	.00	.00	.00
HA 25	.00	1.90-14	.00	.00	.00	.00	.00	.00	.00	.00	.00
MG 24	.00	1.20-11	1.21-11	1.21-11	1.21-11	1.21-11	1.21-11	1.21-11	1.21-11	1.21-11	1.21-11
PG 25	.00	1.36-03	1.36-03	1.36-03	1.36-03	1.36-03	1.36-03	1.36-03	1.36-03	1.36-03	1.36-03
MG 26	.00	6.05-04	6.05-04	6.05-04	6.05-04	6.05-04	6.05-04	6.05-04	6.05-04	6.05-04	6.05-04
PG 27	.00	2.46-11	.00	.00	.00	.00	.00	.00	.00	.00	.00
AL 27	.00	6.27-06	6.27-06	6.27-06	6.27-06	6.27-06	6.27-06	6.27-06	6.27-06	6.27-06	6.27-06
AL 28	.00	2.36-08	.00	.00	.00	.00	.00	.00	.00	.00	.00
AL 29	.00	2.35-09	.00	.00	.00	.00	.00	.00	.00	.00	.00
SI 28	3.69+02	3.69+02	3.69+02	3.69+02	3.69+02	3.69+02	3.69+02	3.69+02	3.69+02	3.69+02	3.69+02
SI 29	1.88+01	1.88+01	1.88+01	1.88+01	1.88+01	1.88+01	1.88+01	1.88+01	1.88+01	1.88+01	1.88+01
SI 30	1.24+01	1.24+01	1.24+01	1.24+01	1.24+01	1.24+01	1.24+01	1.24+01	1.24+01	1.24+01	1.24+01
SI 31	.00	4.90-07	.00	.00	.00	.00	.00	.00	.00	.00	.00
P 31	.00	2.49-03	2.49-03	2.49-03	2.49-03	2.49-03	2.49-03	2.49-03	2.49-03	2.49-03	2.49-03
P 32	.00	2.72-08	3.47-10	1.17-11	5.57-16	2.14-23	.00	.00	.00	.00	.00
P 33	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

PER - CASE 6 - 33,000 MWd/MTU BURNUP - FUEL DECAY TIMES
 PWR: 33,000, BURNUP: 32000, MWD, PLUF: 3.04E-13N/CN007-SEC

NUCLIDE CONCENTRATIONS, GRAMS
 BASIS = MT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0- Y	0- Y	1- Y	2- Y	5- Y	10- Y	20- Y	50- Y	100- Y
P 34	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
S 32	.00	5.14E-07	5.43E-07	5.43E-07	5.43E-07	5.43E-07	5.43E-07	5.43E-07	5.43E-07	5.43E-07	5.43E-07
S 33	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
S 34	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
S 35	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
S 36	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
S 37	.00	6.99E-32	.00	.00	.00	.00	.00	.00	.00	.00	.00
CL 35	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CL 36	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CL 37	.00	2.40E-32	9.34E-32	9.34E-32	9.34E-32	9.34E-32	9.34E-32	9.34E-32	9.34E-32	9.34E-32	9.34E-32
CL 38	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AM 34	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AM 35	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AM 36	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AM 37	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AM 38	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AM 39	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AM 40	.00	1.06E-23	1.06E-23	1.06E-23	1.06E-23	1.06E-23	1.06E-23	1.06E-23	1.06E-23	1.06E-23	1.06E-23
AM 41	.00	2.19E-19	.00	.00	.00	.00	.00	.00	.00	.00	.00
A 39	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
A 40	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
A 41	.00	5.32E-16	5.32E-16	5.32E-16	5.32E-16	5.32E-16	5.32E-16	5.32E-16	5.32E-16	5.32E-16	5.32E-16
A 42	.00	9.88E-22	.00	.00	.00	.00	.00	.00	.00	.00	.00
A 43	.00	5.84E-26	.00	.00	.00	.00	.00	.00	.00	.00	.00
A 44	.00	1.07E-19	.00	.00	.00	.00	.00	.00	.00	.00	.00
CA 40	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CA 41	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CA 42	.00	2.66E-19	2.67E-19	2.67E-19	2.67E-19	2.67E-19	2.67E-19	2.67E-19	2.67E-19	2.67E-19	2.67E-19
CA 43	.00	1.83E-18	1.83E-18	1.83E-18	1.83E-18	1.83E-18	1.83E-18	1.83E-18	1.83E-18	1.83E-18	1.83E-18
CA 44	.00	8.71E-09	8.71E-09	8.71E-09	8.71E-09	8.71E-09	8.71E-09	8.71E-09	8.71E-09	8.71E-09	8.71E-09
CA 45	.00	9.49E-15	6.50E-15	4.85E-15	2.05E-15	4.41E-16	4.42E-16	2.06E-21	4.46E-26	.00	.00
CA 46	.00	2.82E-09	2.82E-09	2.82E-09	2.82E-09	2.82E-09	2.82E-09	2.82E-09	2.82E-09	2.82E-09	2.82E-09
CA 47	.00	1.18E-13	1.24E-13	2.76E-24	.00	.00	.00	.00	.00	.00	.00
CA 48	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CA 49	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
SC 45	.00	9.23E-25	1.22E-24	1.39E-24	1.67E-24	1.83E-24	1.87E-24	1.87E-24	1.87E-24	1.87E-24	1.87E-24
SC 46	.00	4.82E-17	2.29E-17	1.29E-17	2.38E-18	1.15E-19	1.35E-23	5.77E-30	.00	.00	.00
SC 47	.00	4.57E-10	6.15E-10	7.25E-23	.00	.00	.00	.00	.00	.00	.00
SC 48	.00	3.14E-10	4.92E-25	1.51E-36	.00	.00	.00	.00	.00	.00	.00
SC 49	.00	1.23E-12	.00	.00	.00	.00	.00	.00	.00	.00	.00
SC 50	.00	3.68E-15	.00	.00	.00	.00	.00	.00	.00	.00	.00
TI 46	.00	4.81E-17	9.14E-17	1.03E-16	1.12E-16	1.14E-16	1.14E-16	1.14E-16	1.14E-16	1.14E-16	1.14E-16
TI 47	.00	6.01E-04	6.01E-04	6.01E-04	6.01E-04	6.01E-04	6.01E-04	6.01E-04	6.01E-04	6.01E-04	6.01E-04
TI 48	.00	9.70E-07	9.70E-07	9.70E-07	9.70E-07	9.70E-07	9.70E-07	9.70E-07	9.70E-07	9.70E-07	9.70E-07
TI 49	.00	1.33E-03	1.33E-03	1.33E-03	1.33E-03	1.33E-03	1.33E-03	1.33E-03	1.33E-03	1.33E-03	1.33E-03
TI 50	.00	6.12E-03	6.12E-03	6.12E-03	6.12E-03	6.12E-03	6.12E-03	6.12E-03	6.12E-03	6.12E-03	6.12E-03
TI 51	.00	2.25E-10	.00	.00	.00	.00	.00	.00	.00	.00	.00
V 49	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
V 50	.00	2.33E-02	2.33E-02	2.33E-02	2.33E-02	2.33E-02	2.33E-02	2.33E-02	2.33E-02	2.33E-02	2.33E-02
V 51	.00	5.12E-00	5.34E-00	5.38E-00	5.39E-00	5.35E-00	5.39E-00	5.39E-00	5.39E-00	5.39E-00	5.39E-00
V 52	.00	2.62E-07	.00	.00	.00	.00	.00	.00	.00	.00	.00
V 53	.00	5.31E-10	.00	.00	.00	.00	.00	.00	.00	.00	.00
V 54	.00	2.81E-12	.00	.00	.00	.00	.00	.00	.00	.00	.00
CO 50	1.74E-02	1.73E-02	1.73E-02	1.73E-02	1.73E-02	1.73E-02	1.73E-02	1.73E-02	1.73E-02	1.73E-02	1.73E-02

POWER: 35-mW, BATHTEMP: 3300.MM0, FLUIC: 3.44+13N/CM002-5(C

NUCLOE CONCENTRATIONS, GRAMS
BASIS = WT OF HEAVY METAL CHARGE TO REACTOR

[illegible]

POWER: 35.00MW, BURNUP: 55000.MWD, FLUX: 3.44E+13n/cm2-SEC

NUCLIDE CONCENTRATIONS, GRAMS
BASIS = RI OF HEAVY METAL CHARGED TO REACTOR

	EMPHASE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	80. Y	100. Y
SR 84	.00	3.64E-03	4.80E-04	1.73E-04	1.12E-03	8.47E-04	3.90E-04	1.04E-04	.00	.00	.00
SR 90	.00	6.23E-04	6.19E-04	6.17E-04	6.04E-04	5.93E-04	5.81E-04	4.87E-04	3.63E-04	1.82E-04	5.79E-07
SR 91	.00	2.21E-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
Y 90H	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Y 90	.00	2.84E-03	1.61E-04	1.40E-04	1.58E-04	1.54E-04	1.43E-04	1.27E-04	9.44E-05	4.72E-05	1.37E-10
Y 91H	.00	1.40E-04	.00	.00	.00	.00	.00	.00	.00	.00	.00
Y 91	.00	6.46E-07	1.55E-03	6.77E-04	6.02E-03	8.12E-03	3.99E-02	8.89E-02	.00	.00	.00
ZR 90	3.38E+05	1.18E+05	1.18E+05	1.18E+05	1.18E+05	1.18E+05	1.18E+05	1.18E+05	1.18E+05	1.18E+05	1.18E+05
ZR 91	2.57E+04	2.55E+04	2.55E+04	2.55E+04	2.55E+04	2.55E+04	2.55E+04	2.55E+04	2.55E+04	2.55E+04	2.55E+04
ZR 92	3.93E+04	3.94E+04	3.94E+04	3.94E+04	3.94E+04	3.94E+04	3.94E+04	3.94E+04	3.94E+04	3.94E+04	3.94E+04
ZR 93	.00	3.76E+01	3.76E+01	3.76E+01	3.76E+01	3.76E+01	3.76E+01	3.76E+01	3.76E+01	3.76E+01	3.76E+01
ZR 94	4.02E+04	4.02E+04	4.02E+04	4.02E+04	4.02E+04	4.02E+04	4.02E+04	4.02E+04	4.02E+04	4.02E+04	4.02E+04
ZR 95	.00	1.48E+00	5.69E+03	2.70E+01	3.02E+02	6.01E+04	5.17E+04	1.80E+07	2.14E+04	.00	.00
ZR 96	6.44E+03	6.44E+03	6.44E+03	6.44E+03	6.44E+03	6.44E+03	6.44E+03	6.44E+03	6.44E+03	6.44E+03	6.44E+03
XB 97	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
XB 99H	.00	2.03E-05	2.43E-05	2.74E-05	3.63E-05	5.14E-05	9.24E-05	1.44E-04	2.24E-04	3.16E-04	3.39E-04
XB 99	.00	4.79E-07	1.16E-06	1.41E-06	2.33E-06	4.54E-06	1.51E-05	4.66E-05	1.49E-04	5.74E-04	1.47E+03
XB 94	.00	4.74E-10	6.74E-10	4.74E-10	4.74E-10	4.74E-10	4.74E-10	4.74E-10	4.74E-10	4.74E-10	4.74E-10
XB 95	.00	1.69E-01	9.94E-01	2.69E-01	3.39E-02	1.27E-04	5.91E-04	2.04E-07	.00	.00	.00
XB 96	.00	1.19E-05	.00	.00	.00	.00	.00	.00	.00	.00	.00
XB 97	.00	1.13E-14	.00	.00	.00	.00	.00	.00	.00	.00	.00
XD 92	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
XD 93	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
XD 93H	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
XD 94	.00	8.35E-14	1.24E-17	1.52E-17	2.45E-17	4.09E-17	4.02E-17	1.77E-16	3.19E-16	4.30E-16	3.44E-15
XD 95	.00	9.96E+00	1.13E+04	1.16E+03	1.21E+01	1.22E+01	1.22E+01	1.22E+01	1.22E+01	1.22E+01	1.22E+01
XD 96	.00	5.47E-03	5.47E-03	5.47E-03	5.47E-03	5.47E-03	5.47E-03	5.47E-03	5.47E-03	5.47E-03	5.47E-03
XD 97	.00	2.94E-04	2.94E-04	2.94E-04	2.94E-04	2.94E-04	2.94E-04	2.94E-04	2.94E-04	2.94E-04	2.94E-04
XD 98	.00	2.38E-07	2.38E-07	2.38E-07	2.38E-07	2.38E-07	2.38E-07	2.38E-07	2.38E-07	2.38E-07	2.38E-07
XD 99	.00	7.68E-12	1.55E-21	4.41E-24	.00	.00	.00	.00	.00	.00	.00
XD100	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
PL101	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TC 99H	.00	6.34E-13	1.33E-22	3.77E-30	.00	.00	.00	.00	.00	.00	.00
TC 99	.00	2.74E-10	2.45E-10	2.85E-10	2.85E-10	2.85E-10	2.85E-10	2.85E-10	2.85E-10	2.85E-10	2.85E-10
TC101	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
NU101	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CD113H	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CD113	.00	1.57E-07	1.57E-07	1.57E-07	1.57E-07	1.57E-07	1.57E-07	1.57E-07	1.57E-07	1.57E-07	1.57E-07
CD115H	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CD115	.00	1.79E-09	2.66E-21	9.41E-31	.00	.00	.00	.00	.00	.00	.00
CD119H	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
CD119	.00	6.44E-12	.00	.00	.00	.00	.00	.00	.00	.00	.00
CU121	.00	4.82E-13	.00	.00	.00	.00	.00	.00	.00	.00	.00
BN113	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
BN119H	.00	8.09E-12	.00	.00	.00	.00	.00	.00	.00	.00	.00
BN119	.00	8.77E-11	.00	.00	.00	.00	.00	.00	.00	.00	.00
BN129H	.00	6.30E-13	.00	.00	.00	.00	.00	.00	.00	.00	.00
BN129	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
BN121	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
BN114	3.31E+01	7.31E+01	2.31E+01	2.31E+01	2.31E+01	2.31E+01	2.31E+01	2.31E+01	2.31E+01	2.31E+01	2.31E+01
BN115	1.23E+03	1.23E+03	1.23E+03	1.23E+03	1.23E+03	1.23E+03	1.23E+03	1.23E+03	1.23E+03	1.23E+03	1.23E+03
BN116	5.04E+02	4.98E+02	4.98E+02	4.98E+02	4.98E+02	4.98E+02	4.98E+02	4.98E+02	4.98E+02	4.98E+02	4.98E+02
BN117H	.00	1.63E-03	1.92E-03	6.80E-05	2.37E-09	3.23E-17	.00	.00	.00	.00	.00

POWER: 35.00MW, BURRUP: 13000.HRD, FLUX: 5.44E+15N/CM2-SEC

NUCLIDE CONCENTRATIONS, GRAMS
BASIS : WT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
SM117	2.66E+02	2.67E+02	2.67E+02	2.67E+02	2.67E+02	2.67E+02	2.67E+02	2.67E+02	2.67E+02	2.67E+02	2.67E+02
SM118	8.44E+02	8.44E+02	8.44E+02	8.44E+02	8.44E+02	8.44E+02	8.44E+02	8.44E+02	8.44E+02	8.44E+02	8.44E+02
SM119M	.00	5.74E-03	6.47E-03	3.64E-03	2.04E-03	1.57E-04	3.63E-05	2.29E-07	9.16E-12	5.85E-25	.00
SM119	3.03E+02	2.98E+02	2.98E+02	2.98E+02	2.98E+02	2.98E+02	2.98E+02	2.98E+02	2.98E+02	2.98E+02	2.98E+02
SM120	1.15E+03	1.15E+03	1.15E+03	1.15E+03	1.15E+03	1.15E+03	1.15E+03	1.15E+03	1.15E+03	1.15E+03	1.15E+03
SM121M	.00	8.07E-03	8.05E-03	8.03E-03	7.99E-03	7.97E-03	7.71E-03	7.36E-03	6.77E-03	5.11E-03	3.24E-03
SM121	.00	2.34E-03	.00	.00	.00	.00	.00	.00	.00	.00	.00
SM122	1.65E+02	1.65E+02	1.65E+02	1.65E+02	1.65E+02	1.65E+02	1.65E+02	1.65E+02	1.65E+02	1.65E+02	1.65E+02
SM123M	.00	2.63E-06	.00	.00	.00	.00	.00	.00	.00	.00	.00
SM123	.00	5.61E-05	3.40E-05	2.31E-05	1.40E-06	4.76E-07	2.24E-09	8.45E-14	1.43E-22	.00	.00
SM124	2.03E+02	2.03E+02	2.03E+02	2.03E+02	2.03E+02	2.03E+02	2.03E+02	2.03E+02	2.03E+02	2.03E+02	2.03E+02
SM125M	.00	5.90E-07	.00	.00	.00	.00	.00	.00	.00	.00	.00
SM125	.00	3.44E-05	4.50E-08	2.58E-10	6.89E-17	1.38E-28	.00	.00	.00	.00	.00
SM121	.00	1.08E+00	1.08E+00	1.08E+00	1.08E+00	1.08E+00	1.08E+00	1.08E+00	1.08E+00	1.08E+00	1.08E+00
SM123	.00	4.84E-02	4.85E-02	4.85E-02	4.85E-02	4.85E-02	4.85E-02	4.85E-02	4.85E-02	4.85E-02	4.85E-02
SM124M	.00	2.18E-10	.00	.00	.00	.00	.00	.00	.00	.00	.00
SM124	.00	2.69E-04	9.78E-05	4.13E-05	3.85E-06	5.66E-08	1.40E-13	1.23E-22	.00	.00	.00
SM125	.00	4.01E-02	3.77E-02	3.59E-02	3.10E-02	2.40E-02	1.11E-02	3.08E-03	2.36E-04	1.07E-07	2.88E-13
SM126M	.00	1.60E-09	.00	.00	.00	.00	.00	.00	.00	.00	.00
SM126	.00	2.96E-06	2.02E-06	4.36E-10	4.73E-15	1.55E-24	.00	.00	.00	.00	.00
TC124	.00	1.30E-03	1.47E-03	1.52E-03	1.58E-03	1.56E-03	1.56E-03	1.56E-03	1.56E-03	1.56E-03	1.56E-03
TC125M	.00	8.37E-04	4.70E-04	4.53E-04	7.55E-04	5.85E-04	2.71E-04	7.50E-05	5.76E-06	2.60E-09	6.97E-15
TC125	.00	1.25E-02	1.49E-02	1.67E-02	2.10E-02	2.88E-02	4.20E-02	5.03E-02	5.32E-02	5.34E-02	5.34E-02
TC126	.00	1.82E-04	1.85E-04	1.85E-04	1.85E-04	1.85E-04	1.85E-04	1.85E-04	1.85E-04	1.85E-04	1.85E-04
TA180	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TA181	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TA182M	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TA182	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
U180	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
U181	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
U182	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
U183M	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
U183	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
U184	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
U185	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
U186	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
U187	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TOTAL	4.18E+05	4.18E+05	4.18E+05	4.18E+05	4.18E+05	4.18E+05	4.18E+05	4.18E+05	4.18E+05	4.18E+05	4.18E+05

POWER= 35.00MW, BURNUP= 13000.MWD, FLUX= 3.0E+13N/CM2-SEC

ELEMENT CONCENTRATIONS, GRAMS
BASIS = MT OF HEAVY METAL CHARGED TO REACTOR

	CHARGE	DISCHARGE	0. Y	0. Y	1. Y	2. Y	5. Y	10. Y	20. Y	50. Y	100. Y
H	.00	1.25-01	2.25-01	2.25-01	2.25-01	2.25-01	2.25-01	2.25-01	2.25-01	2.25-01	2.25-01
HE	.00	1.15+00	1.15+00	1.15+00	1.15+00	1.15+00	1.15+00	1.15+00	1.15+00	1.15+00	1.15+00
LI	.00	2.69-08	2.69-08	2.69-08	2.69-08	2.69-08	2.69-08	2.69-08	2.69-08	2.69-08	2.69-08
BE	.00	2.30-04	2.30-04	2.30-04	2.30-04	2.30-04	2.30-04	2.30-04	2.30-04	2.30-04	2.30-04
B	.00	0.97-12	1.13-11	1.13-11	1.00+11	2.77-11	5.59-11	1.03-10	1.97-10	4.78-10	9.40-10
C	1.07+02	1.11+02	1.11+02	1.11+02	1.11+02	1.11+02	1.11+02	1.11+02	1.11+02	1.11+02	1.11+02
N	.00	1.45-07	1.80-07	2.23-07	3.26-07	5.08-07	1.06-06	1.97-06	3.79-06	9.20-06	1.83+05
O	1.34+05	1.34+05	1.34+05	1.34+05	1.34+05	1.34+05	1.34+05	1.34+05	1.34+05	1.34+05	1.34+05
F	.00	2.76-21	6.38-32	6.38-32	6.38-32	6.38-32	6.38-32	6.38-32	6.38-32	6.38-32	6.38-32
NE	.00	5.71-08	5.71-08	5.71-08	5.71-08	5.71-08	5.71-08	5.71-08	5.71-08	5.71-08	5.71-08
NA	.00	4.49-09	4.49-09	4.49-09	4.49-09	4.49-09	4.49-09	4.49-09	4.49-09	4.49-09	4.49-09
MG	.00	1.97-03	1.97-03	1.97-03	1.97-03	1.97-03	1.97-03	1.97-03	1.97-03	1.97-03	1.97-03
AL	.00	6.27-06	6.27-06	6.27-06	6.27-06	6.27-06	6.27-06	6.27-06	6.27-06	6.27-06	6.27-06
SI	0.00+02	4.00+02	4.00+02	4.00+02	4.00+02	4.00+02	4.00+02	4.00+02	4.00+02	4.00+02	4.00+02
P	.00	2.49-03	2.49-03	2.49-03	2.49-03	2.49-03	2.49-03	2.49-03	2.49-03	2.49-03	2.49-03
S	.00	5.43-07	5.43-07	5.43-07	5.43-07	5.43-07	5.43-07	5.43-07	5.43-07	5.43-07	5.43-07
CL	.00	2.60-32	9.54-32	9.54-32	9.54-32	9.54-32	9.54-32	9.54-32	9.54-32	9.54-32	9.54-32
PR	.00	2.18-17	1.06-23	1.06-23	1.06-23	1.06-23	1.06-23	1.06-23	1.06-23	1.06-23	1.06-23
K	.00	5.32-16	5.32-16	5.32-16	5.32-16	5.32-16	5.32-16	5.32-16	5.32-16	5.32-16	5.32-16
CA	.00	1.15-08	1.15-08	1.15-08	1.15-08	1.15-08	1.15-08	1.15-08	1.15-08	1.15-08	1.15-08
SC	.00	1.73-10	1.73-10	1.73-10	1.73-10	1.73-10	1.73-10	1.73-10	1.73-10	1.73-10	1.73-10
TI	.00	4.05-03	4.05-03	4.05-03	4.05-03	4.05-03	4.05-03	4.05-03	4.05-03	4.05-03	4.05-03
V	.00	5.15+00	5.15+00	5.15+00	5.15+00	5.15+00	5.15+00	5.15+00	5.15+00	5.15+00	5.15+00
CR	4.10+03	4.10+03	4.10+03	4.10+03	4.10+03	4.10+03	4.10+03	4.10+03	4.10+03	4.10+03	4.10+03
MV	2.16+03	2.08+03	2.08+03	2.08+03	2.08+03	2.08+03	2.08+03	2.08+03	2.08+03	2.08+03	2.08+03
FE	1.52+04	1.53+04	1.53+04	1.53+04	1.53+04	1.53+04	1.53+04	1.53+04	1.53+04	1.53+04	1.53+04
CO	.00	4.67+00	4.30+00	4.30+00	3.91+00	3.45+00	3.78+00	3.72+00	3.46+00	3.70+00	3.77+00
NI	2.82+04	2.82+04	2.82+04	2.82+04	2.82+04	2.82+04	2.82+04	2.82+04	2.82+04	2.82+04	2.82+04
CU	.00	9.78-01	9.78-01	1.02+00	1.13+00	1.33+00	1.92+00	2.87+00	4.68+00	9.34+00	1.51+01
ZN	.00	2.68-03	2.68-03	2.68-03	2.68-03	2.68-03	2.68-03	2.68-03	2.68-03	2.68-03	2.68-03
SR	.00	2.10-01	2.09-01	2.08-01	2.08-01	2.08-01	2.08-01	2.08-01	2.08-01	2.08-01	2.08-01
Y	.00	1.32-03	1.35-03	1.35-03	1.35-03	1.35-03	1.35-03	1.35-03	1.35-03	1.35-03	1.35-03
ZR	2.30+05	2.30+05	2.30+05	2.30+05	2.30+05	2.30+05	2.30+05	2.30+05	2.30+05	2.30+05	2.30+05
MO	.00	7.69-01	4.94-01	2.49-01	3.34-02	7.83-04	1.08-04	1.95-04	3.68-04	6.89-04	1.74-03
RH	.00	1.05+01	1.17+01	1.22+01	1.27+01	1.27+01	1.27+01	1.27+01	1.27+01	1.27+01	1.27+01
TC	.00	2.77-10	2.85-10	2.85-10	2.85-10	2.85-10	2.85-10	2.85-10	2.85-10	2.85-10	2.85-10
CD	.00	1.57-07	1.57-07	1.57-07	1.57-07	1.57-07	1.57-07	1.57-07	1.57-07	1.57-07	1.57-07
SN	1.47+03	1.47+03	1.47+03	1.47+03	1.47+03	1.47+03	1.47+03	1.47+03	1.47+03	1.47+03	1.47+03
SB	.00	1.16+00	1.16+00	1.16+00	1.16+00	1.16+00	1.16+00	1.16+00	1.16+00	1.16+00	1.16+00
TE	.00	1.68-02	1.74-02	1.83-02	2.41-02	3.12-02	4.81-02	5.21-02	5.44-02	5.52-02	5.52-02
TOTALS	4.18+05	4.18+05	4.18+05	4.18+05	4.18+05	4.18+05	4.18+05	4.18+05	4.18+05	4.18+05	4.18+05
SURTOT	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

TOTALS 4.18+05 4.18+05 4.18+05 4.18+05 4.18+05 4.18+05 4.18+05

APPENDIX E
REACTOR SPENT FUEL POOL AND FUEL
HANDLING DESIGN/MATERIALS

TERA CORPORATION

REACTOR SPENT FUEL POOL AND FUEL HANDLING DESIGN/MATERIALS

The following sections are intended to provide a summary of the in-plant physical and chemical environment and methods of handling of most spent reactor fuel.

E.1 SPENT FUEL POOL DESIGN*

The present-generation nuclear power plants were designed and constructed during the late 1950's and the 1960's. Reactor manufacturers maintained organizational components that performed internal design reviews and audits to ensure the safety and reliability of the nuclear power plants being built. As a part of the information provided to various utilities, a "Technical Description" describing the plant design in detail was developed. For each proposed station this information was reconstituted into a second document called a "Preliminary Safety Analysis Report" (PSAR) and ultimately into a "Final Safety Analysis Report" (FSAR). These were submitted to the Atomic Energy Commission (AEC) for review and approval. There followed a permit to construct and later a license to operate the plant. The PSAR and FSAR concentrated primarily on the safety aspects of nuclear power plants and included analyses of the most severe accidents postulated. The design basis for fuel storage pools underwent a series of judgments and evaluations starting with the designer, reviewed by the internal safety committees, and finally reviewed by the AEC, the Advisory Committee on Reactor Safeguards (ACRS), and the Atomic Safety and Licensing Board (ASLB) in public hearings. From this design basis information and operating experience, many standards and criteria have been developed for use by those who are designing fuel storage pools today or who are providing for increased capacity in fuel storage pools in operating nuclear power plants.

Reactors of the current generation typically have storage space for about one and one-third cores. The spent fuel racks were not designed for spacing as close as is possible. An equivalent of one core's discharge capability is preferred to be

* Extracted from References 1 and 9

unused and available for a complete maintenance or emergency discharge of the operating core, termed full core reserve (FCR). Each reactor pool typically stores only fuel used in its own reactor.

E.1.1 SPENT FUEL POOL CONFIGURATION AND STORAGE CAPACITY

The water-filled fuel storage pool has been chosen for storage of spent fuel assemblies at reactor stations primarily because of the convenience and effectiveness provided. Water is used for shielding and cooling and as a transparent medium to facilitate fuel handling operations.

The configuration of the fuel storage pools is essentially the same for all nuclear power plants. The pools are rectangular in horizontal cross section and 39 to 40 feet deep. Fuel assemblies are placed in storage racks at the bottom of the pool. The racks hold the fuel assemblies in a vertical position and maintain the spacing between assemblies. Insertion or removal of fuel assemblies is accomplished typically from above the racks. The 13.5 to 14.5 foot long fuel rods must remain submerged during fuel removal from or insertion into the racks; thus, for this reason alone, the water must be at least 28 to 30 feet deep. An additional 8 to 10 feet of water is required for shielding. This amount of shielding water is needed for a high burnup fuel assembly just removed from the reactor. The total depth of most pools thus must be about 40 feet. The direct radiation at the pool surface from the fuel stored at the bottom of the pool is very low because the water depth of about 25 feet is equivalent to about 10 or 11 feet of concrete in shielding value.

The pool is filled with pure, demineralized water (for BWRs), or demineralized water to which borate (usually in the form of boric acid) has been added (for PWRs). The reason for the difference is that a PWR uses the "chemical shim" neutron absorber (borate) in the primary system, and the fuel storage pool is also borated in order to match the primary system during refueling. The BWR does not use the chemical shim in the primary system and therefore borate is not added to BWR storage pools. The PWR pool is slightly acidic (pH of 5-6), and the BWR pool is neutral (pH of 7). Both storage media effectively provide the three

basic requirements of shielding, cooling, and transparency for fuel handling. Design temperatures are 120-125°F maximum for normal operation and 150°F for abnormal operation. Experience to date shows pools are operating at 100°F or less. Consequently, the fuel is stored in a low-temperature, low-corrosion environment. The corrosiveness of the neutral to slightly acidic fluid is acceptably low for the three major materials used--stainless steel, zircaloy, and aluminum.

The pools are constructed of reinforced concrete with sufficient thickness to meet radiation shielding and structural requirements. Each pool is lined with stainless steel plates (3/16" to 1/4" thick) welded together to ensure a leak-tight system. The liners are provided with various leak detection systems. Skimmer systems and filter-demineralizer systems are provided to clean the pool water. These cleanup systems are in addition to the pool cooling system that removes decay heat from the stored fuel.

BWR refueling systems are designed with the fuel storage pool on the reactor operating floor. In most cases the operating floor is elevated in the reactor building above ground level (about 90 to 95 feet), while the bottom of the pool is 50 to 55 feet above ground level. This feature necessitates some additional requirements over those for pools located at ground level. Primarily, the pool and rack structure is designed for higher seismic loadings because of the amplification factors that are caused by the movement of the building in a seismic event. Also, the pool loadings require additional evaluations when the ground support is not available. More recent BWR designs provide for ground-level storage pools. When the BWR is shut down for refueling, the reactor is cooled, opened, and filled with water to the same level as the refueling pool. A second pool adjacent to the reactor is used to store internal reactor components (dryer and separator). With this system a single refueling bridge and grapple is used to carry out all refueling operations from removal of the spent fuel from the reactor to its placement in storage positions in the fuel storage pool.

The PWR refueling system uses a ground-level fuel storage pool that is exterior to the reactor building in the fuel or auxiliary building. When the reactor is shut down for refueling, it is opened and the water level is raised to the refueling level. Fuel is removed from the reactor by a fuel handling grapple system. Fuel assemblies are passed horizontally through a transfer tube into a transfer canal. In the canal, the fuel is again raised to a vertical position, picked up by a second grapple system, and moved to the fuel storage pool where it is placed in a rack.

The storage pool ranges from 30 to 60 feet long and from 20 to 40 feet wide. The storage area varies with the amount of fuel to be stored, which in turn depends on the type and size of reactor. In addition, the pool must accommodate the amount of non-fuel equipment to be stored in the pool and the number of fuel handling operations to be carried out in the pool. Physically, the cross-sectional area of a fuel assembly for a BWR is smaller than for a PWR. Both assemblies are about the same length, but the BWR assembly is about 5½ inches square, while the PWR assembly is 7½ to 8½ inches square. The net result is that there are more fuel assemblies in a BWR than in a PWR for the same size reactor.

Reactivity is greater in a PWR assembly than in a BWR assembly. Because of this, PWR fuel requires greater spacing (assembly to assembly) in the fuel storage pool than is required for BWR fuel for the same criticality limits. Separate storage space is not required in the PWR pools for control clusters or for burnable neutron absorbers. These items are stored in the fuel assemblies themselves; in BWR pools separate storage is required for control blades and poison curtains plus fuel channels. Space is also needed in the BWR fuel storage pool for equipment to remove or install fuel channels. Pool size is influenced as well by the number of fuel assemblies that are discharged at each refueling. A PWR discharges 1/3 of the core with each refueling and a BWR discharges approximately 1/4 of the core. Table E-1 summarizes the number of fuel assemblies that are stored for a range of reactor sizes and for the two reactor types.

TABLE E-1
FUEL ASSEMBLY STORAGE REQUIREMENTS
IN RELATION TO REACTOR SIZE AND TYPE

Rated Power	Reactor Type	Number of Assemblies		
		Reactor Core Size	Fuel Discharged per Refueling	Fuel Storage Pool Capacity
500-600 MWe	PWR	121	40	162
700-800 MWe	PWR	157	52	210
1000-1100 MWe	PWR	193	64	260
500-600 MWe	BWR	484	90-120	740
700-800 MWe	BWR	724	100-170	1160
1000-1100 MWe	BWR	764	150-190	1160

E.1.2 FUEL RACK DESIGN

BWR and PWR racks are designed differently. The BWR uses a rack design (see Figure E-1) which is supplied by the reactor manufacturer. The outline dimensions are 14.5 feet high by 5.5 feet long by 1.5 feet wide. Individual rack positions have a 6-inch-square opening to receive the 5.5-inch square fuel assembly. The two rows of fuel assemblies are separated by a distance of 5.5 inches. Racks are supported at the base by four one-inch diameter swing bolts. In high seismic areas, the racks are provided with cross-pool supports that reduce the rack loading in the short dimension. The BWR pool also has special racks for storage of control blades and fuel channels.

The PWR racks are generally provided by the architect-engineer (AE) or purchased by the utility to specifications of the reactor manufacturer. This arrangement allows a number of rack design variations. However, most racks are made of stainless steel using preformed angles to form corners for support of the fuel. A typical rack is shown in Figure E-2. The racks are normally 14 to 14.5 feet high and may have a one or two foot base. Most of the racks have a 20- to 21-inch center-to-center spacing for the fuel assemblies in a square array. The individual spaces in the rack are 8 to 9 inches square to receive fuel assemblies 7.5 to 8.5 inches square. Individual racks may be square or rectangular in cross section, with a maximum square dimension of about 8 feet. This dimension is dictated by shipping considerations.

Racks are designed with various methods of support for seismic restraint. The BWR uses swing bolts mounted to the floor of the pool with or without horizontal restraints. The floor mountings are supported by anchors in the concrete. These anchors are welded to the pool liner and are capable of taking the tension, compression, and shear loads that result from a seismic event. Some PWR racks are also mounted to the floor with anchors in the concrete. Other attachments used for seismic support in PWR pools include racks welded to pool floor embedments, horizontal supports welded to pool wall embedments, spring-loaded wall supports resting against (not attached to) the wall, friction-loaded supports with threaded adjustments that rest against the pool walls, and various

FIGURE E-1
TYPICAL BWR SPENT FUEL STORAGE RACK

FIGURE E-2

TYPICAL PWR OPEN FRAME FUEL STORAGE RACK

combinations of these methods of restraint. Where the loading is in tension anchors are required. Where the loading is compressive it can be borne by the pool liner as backed up by reinforced concrete. In case of pool modifications, it is required that the original design loads of the anchors not be exceeded when new racks are installed.

All racks are designed to allow water to flow under them in order to ensure adequate cooling of irradiated fuel. Sufficient space is provided underneath and around the rack so that the natural circulation of the water is not restricted under normal or abnormal circumstances. In this way, there is no significant increase in fuel temperature whether or not the pool cooling system is operating.

All racks are designed to Seismic Category I requirements to ensure that they remain functional during a seismic event. Specifically, the fuel is to remain vertical and the spacing between assemblies is to be maintained in order to provide a continued limitation on the neutron multiplication factor (k_{eff}). The rack is designed to maintain fuel spacing even when objects are dropped onto the racks.

The dimensions and tolerances for the fuel storage spaces are so arranged that fuel assemblies can be easily inserted and withdrawn. Manufacturing tolerances usually allow for a maximum bow from top to bottom of the storage space of about 1/8 inch. Tight tolerances are also maintained for twist and parallelism within the storage spaces in order to facilitate fuel movement.

The materials used for construction of fuel storage racks (stainless steel and aluminum) are compatible with the fuel storage medium (pure or borated water). Consequently, very little maintenance is required. BWR racks are readily removable. PWR racks are removable in some plants, but are welded in place at others.

E.2 FUEL HANDLING

E.2.1 GENERAL

General Design Criterion 61, "Fuel Storage and Handling Criteria for Nuclear Power Plants," of Appendix A to 10 CFR Part 50 requires that the spent fuel storage and handling systems be designed to ensure adequate safety under normal and postulated accident conditions. The requirements to meet "adequate safety" are given in NRC Regulatory Guide 1.26 which specifies failures of safety-related systems shall not result in off-site dose to an individual greater than 0.5 rem. NRC Regulatory Guide 1.13, "Spent Fuel Storage Facility Design Basis," calls for certain design features to ensure compliance with Design Criterion 61 of Appendix A to 10 CFR Part 50.

These features result in the requirements for a controlled leakage system for the fuel pool, with the design of the ventilation and filtration system based on an inventory of radioactive materials available for leakage from the building after an accident, as given in NRC Regulatory Guide 1.25, "Assumptions Used for Evaluating the Potential Radiological Consequences of a Fuel Handling Accident in the Fuel Handling and Storage Facility for Boiling and Pressurized Water Reactors."

Since the fuel handling equipment handles only one fuel assembly at a time, the maximum consequence of an accident is limited. A fuel assembly has been dropped at several reactor sites and no radioactivity increase was measured at, or within, the site boundary.

Most fuel handling accidents consist of dropping the fuel assembly as a consequence of improper fuel grapple finger engagement. If the drop occurs over the reactor core, the fuel in the core or the core grid plate may be damaged. Accidents of this nature have occurred and no radioactive material was released. Fuel assemblies can be damaged during removal from the core when the spacer grid snags an adjacent fuel assembly spacer grid and the grids are torn. This can only occur in a PWR. There has been no radioactive material released as a result of this type of accident.

E.2.2 EQUIPMENT DESIGN

The major BWR fuel handling equipment and facilities are identified on Figures E-3 and E-4. The equipment and facilities associated with PWR fuel handling are shown in Figures E-5 through E-7. The main function of the equipment is to move fuel into and out of the reactor and to store it in the fuel storage pool. From the safety standpoint there are three main considerations:

- Maintenance of shielding over the fuel
- Prevention of fission product release
- Prevention of loss of water from the fuel storage pool

The equipment is somewhat similar for both the BWR and the PWR in that grapples and refueling bridges are used to move the fuel. The refueling operation for the BWR is carried out in one building with a single refueling bridge. The PWR requires transfer of fuel from the reactor building to the refueling or auxiliary building. For this operation, two refueling bridges are required, one in each building.

In order to maintain shielding, grapples are designed so that if equipment fails, the fuel assemblies will come no closer to the water surface than eight or ten feet. This limits the radiation level at the surface to less than the maximum 2.5 mR per hour allowed per ANSI N210. The equipment is designed so that the minimum water depth over the fuel is maintained even if the hoist or grapple mechanism is at the top of its travel.

The second requirement is related mainly to possible damage to fuel that is dropped. To prevent the dropping of fuel, the grapples are positive latching devices that cannot be released while the fuel is being transported. Electrical interlocks are provided to prevent fuel movement when the latch is not properly engaged. Fuel has been dropped on occasion without serious damage to the fuel or measurable off-site release of radioactivity. The experience has resulted in improved grapple designs.

FIGURE E-4

FIGURE E-3
FUEL HANDLING FACILITIES PLAN - BWR

FIGURE E-4
FUEL HANDLING FACILITIES CROSS-SECTION - BWR

FIGURE E-5
 ARRANGEMENTS OF MAJOR COMPONENTS OF THE
 FUEL HANDLING SYSTEM
 PWR

FIGURE 3-7

FIGURE E-6

FUEL HANDLING FACILITIES PLAN - PWR

E-16

FIGURE E-7

REFUELING HANDLING SYSTEM SECTION - PWR

The third requirement is to ensure water supply for shielding the fuel and for cooling. The potential for significant water loss is evaluated and the appropriate design and procedural methods are used to prevent or mitigate the effects of potential accidents. The main consideration is the shipping cask and its movement. Provisions are made to limit damage from a cask drop or to provide redundant crane features to prevent the cask drop.

E.2.3 BWR REFUELING OPERATION

The major facilities required for fuel handling at BWRs consist of the following (all are in the reactor building, accessible from the refueling floor level, except as noted):

- Reactor refueling cavity
- Spent fuel storage pool with storage racks
- New fuel storage vault with storage racks
- Shipping cask pad area (located in pool)
- New fuel inspection area
- Fuel preparation area (located in pool)
- Shipping cask decontamination area (located at ground level)

The principal items of equipment required to perform a refueling cycle are as follows:

- Fuel preparation machine
- New fuel inspection stand
- Refueling platform
- Reactor building crane
- Jib crane

There also is a complement of other equipment to facilitate the refueling process. These items include slings, grapples, actuating poles, wrenches, underwater lights, viewing aids, and an underwater TV system.

Before the start of a refueling operation, new fuel must be received and inspected. It must also be prepared for final assembly into the reactor. This is accomplished by first placing it in the new fuel racks in the pool. It is then channeled and stored in the assembled new fuel rack in the pool where it is ready for use.

To start refueling operations, the reactor is shut down and allowed to cool, both thermally and radioactively. During the cooldown period, the reactor shield blocks and the drywell head are removed.

After cooldown, first the reactor vessel head insulation and then the vessel head are removed. The water is raised to the refueling level, the pool gates are removed, and the steam dryers and separator are placed in a pool provided for them. At this time the fuel assemblies are free from equipment interferences and are ready for removal from the reactor. The water has been adjusted to the correct height and all refueling equipment has been operationally tested.

To start the refueling sequence, the refueling platform is positioned over the fuel assembly to be removed using predetermined coordinates read from position indicators on the refueling platform. The fuel grapple is united with the spent fuel assembly, then raised to a predetermined height to clear the reactor vessel and still leave sufficient water depth over the fuel assembly to eliminate any radiation hazard to personnel.

The refueling platform then moves the spent fuel assembly through the refueling canal to the spent fuel storage pool. The spent fuel is positioned over a designated vacant cavity in the spent fuel storage rack, lowered into the rack, and the fuel grapple is disengaged.

To install new fuel, the processes are carried out in reverse order. The reactor is then returned to an operating condition, thus completing the refueling cycle.

Reusable fuel channels are removed from the fuel prior to off-site shipment. A section of the fuel storage pool is designated as a work area during refueling. The equipment in the work area is used for dechanneling the spent fuel and installing channels (new or used) on the new fuel.

The equipment used for preparing new and spent fuel includes a monorail jib hoist with trolley, grapple poles, hand-actuated grapples, portable underwater lights, underwater work table, and a channel handling boom located between the two fuel preparation machines.

To ship spent fuel off-site, spent fuel assemblies are loaded into a specially designed, shielded, and cooled shipping cask. To load spent fuel, the reactor building crane is used to lower the shipping cask into the fuel pool and set it on the cask pad area in a vertical position. The cask closure is then removed. Through use of the refueling platform, the spent fuel assemblies are placed in the shipping cask. The cask closure is then reinstalled and sealed. The reactor building crane is used to move the cask from the pool to the shipping cask decontamination area. The cask is washed down to remove any contamination that may have been picked up in the pool. The cask is then loaded onto rail or truck transportation for shipment off the site.

E.2.4 PWR REFUELING OPERATION

The PWR refueling operation is fundamentally the same as that for the BWR except for the transfer between the reactor and refueling, or auxiliary, building. For this operation the fuel is placed in a container located on the transfer carriage, lowered to a horizontal position, driven through the fuel transfer tube to the transfer canal by an air motor, and raised to a vertical position for transfer to the fuel storage pool.

There are only two basic differences between PWR and BWR refueling procedures: (1) the removal of control clusters from PWR fuel prior to the transfer tube operation, and (2) the stripping of fuel channels from BWR fuel assemblies.

E.3 FUEL POOL MATERIALS*

E.3.1 FUEL POOL WATER CHEMISTRIES

Table E-2 compares water chemistries for fuel storage pools at five representative sites. Tables E-3 and E-4 compare water chemistry specifications for several pools. Pool chemistries are similar for pools at BWRs, independent spent fuel storage installations (ISFSIs), and most research and development facilities. The chemistries comprise oxygen-saturated deionized water. Some attempts have been made to reduce oxygen concentrations with hydrazine, without success due to the low reaction rates at pool temperatures except in radiation fields near the fuel bundles. However, hydrazine is added to some pools to convert iodine to water-soluble species, thereby reducing the concentration of airborne iodine. The pH ranges of the deionized water basins are slightly acid to mildly basic (6.0 to 8.5). Some pools allow pH to reach the natural equilibrium with CO_2 (~5.8); at least one pool (NFS) used caustic additions to control pH in the range of 6 to 8.

Major deviations from the water chemistry cited above occur at PWR pools. Boric acid is used as a chemical shim and lithium hydroxide as a pH control agent in PWR primary coolants. Boric acid also is added to PWR spent fuel storage pools. The PWR primary coolant and pool water mix during fuel discharges and refueling, so it is easier to maintain balanced chemistries if both systems have similar compositions. Boric acid has similar concentrations in PWR pool and primary systems; lithium frequently is added to the primary system, but not to the pool water. The pHs of PWR pools are in the acidic range (4.5 to 5.5), even though some PWR pool specifications permit basic pool chemistries (Table E-3).

* Extracted from Reference 4.

TABLE E-2
CHARACTERISTICS OF U.S. FUEL STORAGE POOLS

	AGNS ^(a)	GE Morris	NFS	Dresden BWR	Three-Mile Island PWR
Water Volume, gal	1.3 x 10 ⁶ (4 pools)	675,000	830,000	1.04 x 10 ⁶ (3 pools)	260,000
Pool Dimensions:					
length, ft			75		210
width, ft		48	44		30
depth - fuel transfer, ft		29	29	38	30
fuel storage, ft		750	2,400	700 x 2 per pool	
Water Flow Rate to Heat Exchanger, gpm	2,000	25-35 norm	27-32	27-32 norm	
Pool Temperature Range, °C	(a)	41 max	41 max		
Water Chemistry	6-8	4.4-9 (5.8 mean)	6-8	6.5-8.5	5.2-5.5
pH range		0.02 (norm)		< 0.1	0.01
Cl ⁻ , ppm		~1	20	0.5-1	8.15-8.50
Conductivity, mmho/cm		~1			2,120-2,140
Boron, ppm					low (n.a.)
Lithium, ppm				< 0.1	n.a.
Heavy Metals (Fe, Cu, Mg, Ni), ppm					
Radioactivity Control - Pool Water			(100 gpm)	Ion Exchange	Ion Exchange
Dissolved	Ion Exchange	Ion Exchange	Ion Exchange	Precoat	Carl. &
Particulate	Etched Disk	Precoat Filter	Diatom Earth	Filter	Precoat*
	300 gpm	250 gpm	500 gpm		
Radioactivity Concentrations					
Total, pCi/cm ³	5 x 10 ⁻² (max) ^(a)	4 x 10 ⁻⁴ (norm)	8 x 10 ⁻⁴ (Norm)		5 x 10 ⁻² (b)
I ¹³¹ Cs, pCi/cm ³		2.8 x 10 ⁻⁴			4 x 10 ⁻³
I ¹³⁴ Cs, pCi/cm ³		0.8 x 10 ⁻⁴			2 x 10 ⁻² (b)
I ¹³⁷ Cs, pCi/cm ³					
I ¹³⁵ Cs, pCi/cm ³					
Pool Storage Materials					
Crabpots	304 SS	SS	SS	Cr-plated steel	SS
Canisters	5083 Al	SS	Al	Al & SS	Al & SS
Storage Racks	6061 Al	Concrete	SS	Al	Concrete
Pool Structure	Concrete	Concrete	Concrete	Concrete	Concrete
Pool Liner	304 SS	SS	Paint & SS	SS	SS
Pool Bolting	Concrete	Concrete	Steel	Concrete	Concrete
Heat Exchanger	316 SS		Finned	SS	SS
Pool Storage Capacity					
Metric Tons	360	750	280	3,184	~300
Equivalent BWR Assemblies		3,735			
Equivalent PWR Assemblies		1,560			
Current Inventory, Metric Tons	0	225 (Mar. 1, 1977)	162	1960	1976
First Fuel Storage		1972	1965		
	AGNS ^(a)	GE Morris	NFS	Dresden BWR	Three-Mile Island PWR
Fuel Storage Rack Spacings					
Original, inches			20	10.0	21.0
Stainless Steel, inches				7.3	13.0
Stainless Steel & Boron, inches				6.5	10.5

(a) Has not begun to receive fuel.

(b) Maximum during refuelling.

n.a. = not analyzed

TABLE E-3
SPENT FUEL POOL WATER QUALITY SPECIFICATIONS^(a)

	PWR	
	Normal	Transient Limits
pH (77°F)	4.5 - 6.0 ^(b)	—
Conductivity @25°C (μ mho/cm)	1 - 30	—
Chloride ion (ppm, max)	0.15	1.5
Fluoride ion (ppm, max)	0.1	1.5
Oxygen	Saturated	Saturated
Total suspended solids (ppm, max)	1.0	—
Temperature (°C)	50	100
Boric acid ^(c) (as ppm-B)	0 - 2,000 1,950 - 2,250	—
Activity level (μ Ci/ml)	0.05 varies with tech spec.	—
Solid filtration (microns)	1 - 5	—

(a) May vary somewhat from pool to pool.

(b) Some fuel pool pH range specifications are 4.5 - 8.0; a few pools have a range of 4.0 - 10.6.

(c) Some PWR fuel pool specifications also indicate a lithium concentration range of 0.2 - 2.0 ppm, corresponding to values for PWR primary systems.

TABLE E-4
FUEL POOL WATER CHEMISTRY SPECIFICATIONS

	<u>BWR</u>	<u>Bruce Station Ontario Hydro</u>			<u>GE-Morris</u>
		<u>Optimum</u>	<u>Action Limits</u>	<u>Unacceptable Range</u>	
Conductivity, μ mho/cm, 25°C	$\leq 3^*$	2	5	10	--
Chloride (as Cl^-), ppm	≤ 0.5	< 0.3	< 0.5	> 1	10
pH	5.3-7.5	5.5-8.0	< 5, < 8	< 4, < 9	4.5-9.0
Heavy Elements, ppm	< 0.1	--	--	--	--
Total Insolubles, ppm	< 1	--	--	--	--
Radioactivity $\mu\text{Ci/ml}$, max					0.02 ^(a)

(a) Transient limit, 0.1 $\mu\text{Ci/ml}$

* ≤ 1.5 at some pools

The boric acid presents some problems regarding water purity control by ion exchange. Cleanup trains consisting of filters and boron-loaded ion exchange resins are used at PWR pools.

Particulate and dissolved impurities are controlled by combinations of ion exchange and filters. Filter types are indicated in Table E-2. Skimmers remove materials which float on the water surface to maintain visual clarity and reduce radioactivity.

Table E-4 provides water chemistry specifications for U. S. BWR, Bruce (Canadian), and GE-Morris pools, all using deionized water.

The usual sampling frequencies for pool water chemistry are weekly or twice per week. Conductivity, chloride, and pH are the analyses commonly performed. Boron and sometimes lithium are analyzed for PWR pools. Analyses seldom include heavy metals. When analyzed, heavy metal concentrations were low (<0.1 ppm).

E.3.2 FUEL POOL AND FUEL ROD TEMPERATURES

Heat generated in spent fuel by radioactive decay is dissipated in the fuel pools, elevating the water temperatures. The decay heat at three days after discharge is about 0.3 percent of the full power heat release. After five years the value is only 0.06 percent of the full power value.

Reactor pool specifications generally call for fuel pool temperatures of $\leq 120^{\circ}\text{F}$ (40°C) with full heat exchange capacity; $\leq 150^{\circ}\text{F}$ (66°C) with one heat exchanger and aged fuel and 212°F (100°C) with freshly discharged fuel and loss of heat exchange capacity. However, there are no reports that pool temperatures have approached 100°C .

E.3.3 FUEL POOL MATERIALS

The fuel pool materials identified in the survey are summarized in Table E-5. After irradiation, the fuel bundles are contacted with steel grapples, used to remove them from the reactor core. The bundles are transferred to stainless steel viewing trays where they are inspected, then transferred to storage canisters. Canisters are constructed of alloy 304 stainless steel pipes with a solid steel plate/welded across the bottom. The pipes are welded together into modules of either nine 8-inch schedule 10 pipes for BWR bundle storage or four 12-inch schedule 5 pipes for PWR bundle storage. The modules have locking devices which fix them to stainless steel racks mounted to the bottom of the pool. Both modules fit the same rack position. During pool residence, the only materials likely to contact the stored fuel would be the stainless steel canisters and trace impurities transported in the water. There is natural convective circulation through canisters.

E.3.4 FUEL BUNDLE MATERIALS

The range of materials interactions between the fuel bundle and materials in the storage pool are potentially important to define possible degradation mechanisms. Equally important is the range of materials interactions within the fuel bundle. Table 3-1 in the main report summarizes the range of materials in stainless- and zircaloy-clad fuel bundles.

E.3.5 RADIOCHEMICAL CHARACTERIZATION OF FUEL POOL WATERS

The radioactive species in fuel pool waters are monitored periodically (normally once or twice per week) for beta and gamma activity, and some analyses are made for alpha activity. Rates of radioactivity buildup on filters and ion exchange resins also are monitored. Monitors for airborne radioactivity operate continuously above the pools.

TABLE E-5
SUMMARY OF MATERIALS IN FUEL POOLS

Component	Sub-Components	Material ^(a)	Alloy
Wall	--	Reinforced Concrete	--
Pool Liner:	--	Stainless Steel Epoxy, Fiberglass	304
Heat Exchanger ^(b)	--	Stainless Steel	304/316
Filter:	Vessel Filter Elements:	Stainless Steel Stainless Steel Diatomaceous Earth, Fiber	304L 304L
Recirculating Pumps:	Casing, Shaft Impeller	Stainless Steel Bronze	316
Demin Water Return Pump	Casing, Impeller, Shaft	Stainless Steel	316
Deionization Unit	Tank	Stainless Steel	304L
Cask Head Support Racks	--	Stainless Steel	304L
Gates and Guides	--	Stainless Steel	304L
Canister Storage Racks:	Racks:	Stainless Steel Aluminum	304L 6061-T6
	Embedded Supports	Stainless Steel	304L
Fuel Storage Canisters ^(c)	--	Stainless Steel Aluminum	304L 5083/5086/6063
Leaker Can Support Racks:	--	Stainless Steel Carbon Steel, Epoxy-Coated	-- --
Control Rod Cluster Storage Racks	--	Stainless Steel	--
Portable Offgas Hoods:	--	Stainless Steel Aluminum	--
Cask Handling Crane	Cable & Grapple	Stainless Steel	--

TABLE E-5

(CONT.)

<u>Component</u>	<u>Sub-Components</u>	<u>Material^(a)</u>	<u>Alloy</u>
Canister Crane	Cable & Grapple	Stainless Steel	--
Fuel Transfer Conveyor	--	Stainless Steel	304L
Insulators	--	Tygon, Neoprene	
Cask Impact Pad:	Cladding Pad (not exposed to H ₂ O)	Stainless Steel Carbon Steel (3-1/2-in. thick)	
	Honeycomb (not exposed to H ₂ O)	Aluminum	

- (a) Types identified in survey; other types may be used in some pools.
- (b) Carbon steel tubes were originally installed in heat exchangers at one pool; severe rusting caused a visibility problem in the pool water, resulting in retubing with stainless steel. Copper alloy tubes are used at one R&D facility pool.
- (c) Some canister walls contain boron-impregnated aluminum for reactivity control, clad with stainless steel or aluminum.

The sources of radioactivity in pool waters are activation products and fission products. The sources of the activation products are crud deposits and corrosion films on the fuel bundle surfaces. The fission products arise from bundles with rods which failed in-reactor or from intact bundles which adsorbed circulating fission products. The principal activation products released to pool waters, their half lives and source reactions are given in Table E-6. The principal fission products in pool waters appear in Table E-7. Cesium, tritium, cerium, strontium and the iodines from the spent fuel are the principal fission products in reactor pools. For aged fuel, the most significant isotopes from the standpoint of pool waste management are: Cs-137, H-3, Co-60, Sr-90, and Ce-144 Pr.

There are substantial differences in the inventories of radioactive species at reactor pools and at other pool facilities. During fuel discharges, reactor pool contamination levels rise from a combination of dissolved and particulate species in the reactor primary coolant, which mixes with pool water, and from species released from fuel bundle surfaces. Short-lived species such as iodine isotopes appear in reactor pools, but rarely at other pools. Tritium also is substantially higher in reactor pools. Loose crud is released from the fuel bundle surfaces during handling in the reactor pool. Radiation levels at reactor pools often rise to $\sim 10^{-2}$ $\mu\text{Ci/ml}$ during discharges, but can be controlled at 10^{-3} to 10^{-4} $\mu\text{Ci/ml}$ after fuel discharges are completed. Radiation levels at reprocessing plant and R&D facility pools rise corresponding to receipt of fuel shipments, but are controlled at levels between 10^{-3} and 10^{-4} $\mu\text{Ci/ml}$ most of the time. Filtration and ion exchange are the principal methods for controlling radioactivity.

TABLE E-6

PRINCIPAL ACTIVATION PRODUCTS RELEASED FROM FUEL BUNDLES
DURING POOL STORAGE

<u>Nuclide</u>	<u>Half-Life</u>	<u>Production Reaction</u>
Co-60	5.3 y	Co-59 (n- γ)
Co-58	72 d	Ni-58 (n-p)
Cr-51	28 d	Cr-50 (n- γ)
Fe-59	45 d	Fe-58 (n- γ)
Mn-54	310 d	Fe-54 (n-p)
Zn-65	243 d	Zn-64 (n- γ)
Ni-65*	2.5 d	Ni-64 (n- γ)
W-187*	24 h	W-186 (n- γ)

* Only significant at reactor pools.

TABLE E-7

PRINCIPAL FISSION PRODUCTS RELEASED
TO FUEL POOL WATERS

<u>Isotope</u>	<u>Half-Life</u>
I-131	8.05 d
Cs-134	2.1 y
Cs-137	30 y
H-3	12.3 y
Sr-90	28.8 y
Ce-144	285 d
Ru-106 Rh-106	1.0 y - 2.2 hr
Zr-95 Nb-95	65 d - 35 d

APPENDIX F

SAFETY GUIDE 25

**ASSUMPTIONS USED FOR EVALUATING THE
POTENTIAL RADIOLOGICAL CONSEQUENCES OF A FUEL HANDLING
ACCIDENT IN THE FUEL HANDLING AND STORAGE FACILITY
FOR BOILING AND PRESSURIZED WATER REACTORS**

TERA CORPORATION

SAFETY GUIDE 25

ASSUMPTIONS USED FOR EVALUATING THE POTENTIAL RADIOLOGICAL CONSEQUENCES OF A FUEL HANDLING ACCIDENT IN THE FUEL HANDLING AND STORAGE FACILITY FOR BOILING AND PRESSURIZED WATER REACTORS

A. Introduction

Section 50.34 of 10 CFR Part 50, "Contents of Applications: Technical Information," requires that each applicant for a construction permit or operating license provide an analysis and evaluation of the design and performance of structures, systems, and components of the facility with the objective of assessing the risk to public health and safety resulting from operation of the facility. A fuel handling accident in the fuel handling and storage facility resulting in damage to fuel cladding and subsequent release of radioactive material is one of the postulated accidents used to evaluate the adequacy of these structures, systems, and components with respect to the public health and safety. This safety guide gives acceptable assumptions that may be used in evaluating the radiological consequences of this accident for boiling and pressurized water reactors.

B. Discussion

A fuel handling accident during refueling operations could release a fraction of the fission product inventory in a nuclear power plant to the environment. An illustrative accident sequence consists of the dropping of a fuel assembly, resulting in breaching of the fuel rod cladding, release of a portion of the volatile fission gases from the damaged fuel rods, absorption of water soluble gases in and transport of soluble and insoluble gases through the water, air filtration (if provided) prior to release into the environment, and dispersion of the released fission products into the atmosphere.

The number and exposure histories of fuel assemblies assumed to be damaged determine the total amount of radioactive material available for immediate release into the water

during a fuel handling accident. Although the design of the fuel, the fuel transfer equipment, the fuel pool, and the methods used to handle discharged fuel should all be considered in arriving at the number of fuel assemblies or rods assumed to be damaged, this guide rather than being addressed to this determination is addressed to the determination of the radiological consequences of a handling accident once an assumption as to the number of assemblies or rods damaged has been made.

A conservative approach to determining the quantity of radioactive material available for release from a fuel assembly is to assume that the assembly with the peak inventory is the one damaged. The inventory for the peak assembly represents an upper limit value and is not expected to be exceeded. The inventory should be calculated assuming maximum full power operation at the end of core life immediately preceding shutdown and such calculation should include an appropriate radial peaking factor.

Only that fraction of the fission products which migrates from the fuel matrix to the gap and plenum regions during normal operation would be available for immediate release into the water in the event of clad damage. (Migration of fission products is a function of several variables including operating temperature, burnup, and isotopic half life taken into consideration in establishing the release fractions listed in this guide.) As compared to the quantity immediately released, the quantity of radioactive material released subsequent to the immediate release is considered for the purposes of this guide to be negligible.

The assumptions set forth in this guide are based on engineering judgment and results from safety research programs conducted by the AEC and the nuclear industry and are believed to be appropriately conservative. In some cases unusual site characteristics, plant design features, or other factors may require different

assumptions which will be considered on an individual case basis. Major changes in fuel composition or management may also require alterations of these assumptions.

C. Regulatory Position

1. The assumptions¹ related to the release of radioactive material from the fuel and fuel storage facility as a result of a fuel handling accident are:
 - a. The accident occurs at a time after shutdown identified in the technical specifications as the earliest time fuel handling operations may begin. Radioactive decay of the fission product inventory during the interval between shutdown and commencement of fuel handling operations is taken into consideration.
 - b. The maximum fuel rod pressurization² is 1200 psig.
 - c. The minimum water depth² between the top of the damaged fuel rods and the fuel pool surface is 23 feet.
 - d. All of the gap activity in the damaged rods is released and consists of 10% of the total noble gases other than Kr-85, 30% of the Kr-85, and 10% of the total radioactive iodine in the rods at the time of the accident. For the purpose of sizing filters for the fuel handling accident addressed in this guide, 30% of the I-127 and I-129 inventory is assumed to be released from the damaged rods.

¹ The assumptions given are valid only for oxide fuels of the types currently in use and in cases where the following conditions are not exceeded:

- a. Peak linear power density of 20.5 kW/ft for the high power assembly discharged.
- b. Maximum center-line operating fuel temperature less than 4500°F for this assembly.
- c. Average burnup for the peak assembly of 25,000 MWD/ton or less (this corresponds to a peak local burnup of about 45,000 MWD/ton).

²For release pressures greater than 1200 psig and water depths less than 23 feet, the iodine decontamination factors will be less than those assumed in this guide and must be calculated on an individual case basis using assumptions comparable in conservatism to those of this guide.

- e. The values assumed for individual fission product inventories are calculated assuming full power operation at the end of core life immediately preceding shutdown and such calculation should include an appropriate radial peaking factor. The minimum acceptable radial peaking factors are 1.5 for BWR's and 1.65 for PWR's.
- f. The iodine gap inventory is composed of inorganic species (99.75%) and organic species (.25%).
- g. The pool decontamination factors for the inorganic and organic species are 133 and 1, respectively, giving an overall effective decontamination factor of 100 (i.e., 99% of the total iodine released from the damaged rods is retained by the pool water). This difference in decontamination factors for inorganic and organic iodine species results in the iodine above the fuel pool being composed of 75% inorganic and 25% organic species.
- h. The retention of noble gases in the pool is negligible (i.e., decontamination factor of 1).
- i. The radioactive material that escapes from the pool to the building is released from the building³ over a two hour time period.
- j. If it can be shown that the building atmosphere is exhausted through adsorbers designed to remove iodine, the removal efficiency is 90% for inorganic species and 70% for organic species.⁴
- k. The effluent from the filter system passes directly to the emergency exhaust system without mixing⁵ in

³The effectiveness of features provided to reduce the amount of radioactive material available for release to the environment will be evaluated on an individual case basis.

⁴These efficiencies are based upon a 2-inch charcoal bed depth with $\frac{1}{4}$ second residence time. Efficiencies may be different for other systems and must be calculated on an individual case basis.

⁵ Credit for mixing will be allowed in some cases; the amount of credit will be evaluated on an individual case basis.

the surrounding building atmosphere and is then released (as an elevated plume for those facilities with stacks⁶).

2. The assumptions for atmospheric diffusion are:

a. Ground Level Releases

- (1) The basic equation for atmospheric diffusion from a ground level point source is:

$$x/Q = \frac{1}{\pi u \sigma_y \sigma_z}$$

Where:

x = the short term average centerline value of the ground level concentration (curies/m³)

Q = amount of material released (curies/sec)

u = windspeed (meters/sec)

σ_y = the horizontal standard deviation of the plume (meters) [See Figure V-1, Page 48, Nuclear Safety, June 1961, Volume 2, Number 4, "Use of Routine Meteorological Observations for Estimating Atmospheric Dispersion," F. A. Gifford, Jr.]

σ_z = the vertical standard deviation of the plume (meters) [See Figure V-2, Page 48, Nuclear Safety, June 1961, Volume 2, Number 4, "Use of Routine Meteorological Observations for Estimating Atmospheric Dispersion," F. A. Gifford, Jr.]

⁶Credit for an elevated release will be given only if the point of release is (a) more than two and one-half times the height of any structure close enough to affect the dispersion of the plume or (b) located far enough from any structure which could affect the dispersion of the plume. For those plants without stacks the atmospheric diffusion factors assuming ground level release given in regulatory position 2.b. should be used.

- (2) For ground level releases, atmospheric diffusion factors⁷ used in evaluating the radiological consequences of the accident addressed in this guide are based on the following assumptions:

- (a) windspeed of 1 meter/sec;
(b) uniform wind direction;
(c) Pasquill diffusion category F.

- (3) Figure 1 is a plot of atmospheric diffusion factors (x/Q) versus distance derived by use of the equation for a ground level release given in regulatory position 2.a.(1) above under the meteorological conditions given in regulatory position 2.a.(2) above.

- (4) Atmospheric diffusion factors for ground level releases may be reduced by a factor ranging from one to a maximum of three (see Figure 2) for additional dispersion produced by the turbulent wake of the reactor building. The volumetric building wake correction as defined in Subdivision 3-3.5.2 of Meteorology and Atomic Energy-1968, is used with a shape factor of 1/2 and the minimum cross-sectional area of the reactor building only.

b. Elevated Releases

- (1) The basic equation for atmospheric diffusion from an elevated release is:

$$x/Q = \frac{e^{-h^2/2\sigma_z^2}}{\pi u \sigma_y \sigma_z}$$

Where:

x = the short term average centerline value of the ground level concentration (curies/m³)

⁷These diffusion factors should be used until adequate site meteorological data are obtained. In some cases, available information on such site conditions as meteorology, topography and geographical location may dictate the use of more restrictive parameters to insure a conservative estimate of potential offsite exposures.

Q = amount of material released (curies/sec)

u = windspeed (meters/sec)

σ_y = the horizontal standard deviation of the plume (meters) [See Figure V-1, Page 48, Nuclear Safety, June 1961, Volume 2, Number 4, "Use of Routine Meteorological Observations for Estimating Atmospheric Dispersion." F. A. Gifford, Jr.]

σ_z = the vertical standard deviation of the plume (meters) [See Figure V-2, Page 48, Nuclear Safety, June 1961, Volume 2, Number 4, "Use of Routine Meteorological Observations for Estimating Atmospheric Dispersion." F. A. Gifford, Jr.]

h = effective height of release (meters)

- (2) For elevated releases, atmospheric diffusion factors⁷ used in evaluating the radiological consequences of the accident addressed in this guide are based on the following assumptions:

- (a) windspeed of 1 meter/sec;
- (b) uniform wind direction;
- (c) envelope of Pasquill diffusion categories for various release heights;
- (d) a fumigation condition exists at the time of the accident.⁸

- (3) Figure 3 is a plot of atmospheric diffusion factors versus distance for an elevated release assuming no fumigation, and Figure 4 is for an elevated release with fumigation.

- (4) Elevated releases are considered to be at a height equal to no more than the actual stack height. Certain site conditions may exist, such as surrounding elevated topography or nearby structures, which will have the effect of reducing the effective stack height. The degree of stack height reduction will be evaluated on an individual case basis.

3. The following assumptions and equations may be used to obtain conservative approximations of thyroid dose from the inhalation of radioiodine and external whole body dose from radioactive clouds:

- a. The assumptions relative to inhalation thyroid dose approximations are:

- (1) The receptor is located at a point on or beyond the site boundary where the maximum ground level concentration is expected to occur.
- (2) No correction is made for depletion of the effluent plume of radioiodine due to deposition on the ground, or for the radiological decay of radioiodine in transit.
- (3) Inhalation thyroid doses may be approximated by use of the following equation:

$$D = \frac{F_g \text{ JFPBR}(X/Q)}{(DF_p)(DF_f)}$$

Where:

D = thyroid dose (rads)

F_g = fraction of fuel rod iodine inventory in fuel rod void space (0.1)

I = core iodine inventory at time of accident (curies)

⁸For sites located more than 2 miles from large bodies of water such as oceans or one of the Great Lakes, a fumigation condition is assumed to exist at the time of the accident and continue for one-half hour. For sites located less than 2 miles from large bodies of water a fumigation condition is assumed to exist at the time of the accident and continue for the duration of the release (2 hours).

F = fraction of core damaged so as to release void space iodine

P = fuel peaking factor

B = breathing rate = 3.47×10^4 cubic meters per second (i.e., 10 cubic meters per 8 hour work day as recommended by the ICRP)

DF_p = effective iodine decontamination factor for pool water

DF_f = effective iodine decontamination factor for filters (if present)

χ/Q = atmospheric diffusion factor at receptor location (sec/m^3)

R = adult thyroid dose conversion factor for the iodine isotope of interest (rads per curie). Dose conversion factors for Iodine 131-135 are listed in Table I.⁹ These values were derived from "standard man" parameters recommended in ICRP Publication 2.¹⁰

TABLE I

Adult Inhalation Thyroid Dose Conversion Factors

Iodine Isotope	Conversion Factor (R) (Rads/curie inhaled)
131	1.48×10^6
132	5.35×10^4
133	4.0×10^5
134	2.5×10^4
135	1.24×10^5

⁹Dose conversion factors taken from "Calculation of Distance Factors for Power and Test Reactor Sites." TID-14844, J. J. DiNunzio, R. E. Baker, F. D. Anderson, and R. L. Waterfield (1962).

¹⁰Recommendations of the International Commission on Radiological Protection. "Report of Committee II on Permissible Dose for Internal Radiation (1959)." ICRP Publication 2, (New York: Pergamon Press, 1960).

b. The assumptions relative to external whole body dose approximations are:

- (1) The receptor is located at a point on or beyond the site boundary where the maximum ground level concentration is expected to occur.
- (2) External whole body doses are calculated using "Infinite Cloud" assumptions, i.e., the dimensions of the cloud are assumed to be large compared to the distances that the gamma rays and beta particles travel. The dose at any distance from the reactor is calculated based on the maximum ground level concentration at that distance.

For an infinite uniform cloud containing χ curies of beta radioactivity per cubic meter, the beta dose rate in air at the cloud center is:¹¹

$$\beta D'_{\infty} = 0.457 \bar{E}_{\beta} \chi$$

Where:

$\beta D'_{\infty}$ = beta dose rate from an infinite cloud (rad/sec)

$\bar{E}_{\beta}$ = average beta energy per disintegration (Mev/dis)

χ = concentration of beta or gamma emitting isotope in the cloud (curie/ m^3)

Because of the limited range of beta particles in tissue, the surface body dose rate from beta emitters in the infinite cloud can be approximated as being one-half this amount or:

$$\beta D'_{\infty} = 0.23 \bar{E}_{\beta} \chi$$

For gamma emitting material the dose rate in tissue at the cloud center is:

$$\gamma D'_{\infty} = 0.507 \bar{E}_{\gamma} \chi$$

Where:

$\gamma D'_{\infty}$ = gamma dose rate from an infinite cloud (rad/sec)

¹¹ Meteorology and Atomic Energy-1968, Chapter 7.

$\bar{E}_\gamma$ = average gamma energy
per disintegration
(Mev/dis)

However, because of the presence of the ground, the receptor is assumed to be exposed to only one-half of the cloud (semi-infinite) and the equation becomes:

$$\gamma D' = 0.25 \bar{E}_\gamma \chi$$

Thus, the total beta or gamma dose to an individual located at the center of the cloud path may be approximated as:

$$\beta D = 0.23 \bar{E}_\beta \psi \text{ or}$$

$$\gamma D = 0.25 \bar{E}_\gamma \psi$$

Where ψ is the concentration time integral for the cloud (curie sec/m³).

- (3) The beta and gamma energies emitted per disintegration, as given in Table of Isotopes,¹² are averaged and used according to the methods described in ICRP Publication 2.

¹²C. M. Lederer, J. M. Hollander, and I. Perlman, Table of Isotopes, Sixth Edition (New York: John Wiley and Sons, Inc. 1967).

FIGURE 1
GROUND LEVEL RELEASE
ATMOSPHERIC DIFFUSION FACTORS

FIGURE 4

ELEVATED RELEASE
ATMOSPHERIC DISPERSION FACTORS
FOR FUMIGATION CONDITIONS
- ATMOSPHERIC CONDITIONS-
PASQUILL TYPE F
WINDSPEED 1 METER/SEC
UNIFORM WIND DIRECTION

UNITED STATES NUCLEAR REGULATORY COMMISSION

RULES and REGULATIONS

TITLE 10, CHAPTER 1, CODE OF FEDERAL REGULATIONS—ENERGY

PART 20

STANDARDS FOR PROTECTION AGAINST RADIATION

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Appendix A—[Reserved]
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Appendix C.
Appendix D—United States Nuclear Regulatory Commission Inspection and Enforcement Regional Offices.

AUTHORITY: The provisions of this Part 20 issued under secs. 53, 63, 65, 81, 103, 104, 161, 68 Stat. 930, 933, 935, 936, 937, 948, as amended; 42 U.S.C. 2073, 2093, 2095, 2101, 2133, 2134, 2201. For the purposes of sec. 223, 68 Stat. 954, as amended; 42 U.S.C. 2273, § 520.401-20.409, issued under sec. 161 (a), 68 Stat. 950, as amended; 42 U.S.C. 2201 (a). Secs. 202, 206, Pub. L. 93-438, 88 Stat. 1244, 1245 (42 U.S.C. 5842, 5846).

§ 20.1 Purpose.

(a) The regulations in this part establish standards for protection against radiation hazards arising out of activities under licenses issued by the Nuclear Regulatory Commission and are issued pursuant to the Atomic Energy Act of 1954, as amended, and the Energy Reorganization Act of 1974.

(b) The use of radioactive material or other sources of radiation not licensed by the Commission is not subject to the regulations in this part. However it is the purpose of the regulations in this part to control the possession, use, and transfer of licensed material by any licensee in such a manner that exposure to such material and to radiation from such material, when added to exposures to unlicensed radioactive material and to other unlicensed sources of radiation in the possession of the licensee, and to radiation therefrom, does not exceed the standards of radiation protection prescribed in the regulations in this part.

(c) In accordance with recommendations of the Federal Radiation Council, approved by the President, persons engaged in activities under licenses issued by the Nuclear Regulatory Commission pursuant to the Atomic Energy Act of 1954, as amended, and the Energy Reorganization Act of 1974 should, in addition to complying with the require-

ments set forth in this part, make every reasonable effort to maintain radiation exposures, and releases of radioactive materials in effluents to unrestricted areas, as low as is reasonably achievable. The term "as low as is reasonably achievable" means as low as is reasonably achievable taking into account the state of technology, and the economics of improvements in relation to benefits to the public health and safety, and other societal and socioeconomic considerations, and in relation to the utilization of atomic energy in the public interest.

§ 20.2 Scope.

The regulations in this part apply to all persons who receive, possess, use, or transfer material licensed pursuant to the regulations in Parts 30 through 35, 40 or 70 of this chapter, including persons licensed to operate a production or utilization facility pursuant to Part 50 of this chapter.

§ 20.3 Definitions.

(a) As used in this part:

(1) "Act" means the Atomic Energy Act of 1954 (68 Stat. 819) including any amendments thereto;

(2) "Airborne radioactive material" means any radioactive material dispersed in the air in the form of dusts, fumes, mists, vapors, or gases;

(3) "Byproduct material" means any radioactive material (except special nuclear material) yielded in or made radioactive by exposure to the radiation incident to the process of producing or utilizing special nuclear material;

(4) "Calendar quarter" means not less than 13 consecutive weeks nor more than 14 consecutive weeks. The first calendar quarter of each year shall begin in January and subsequent calendar quarters shall be such that no day is included in more than one calendar quarter or omitted from inclusion within a calendar quarter. No licensee shall change the method observed by him of determining calendar quarters except at the beginning of a calendar year.

(5) "Commission" means the Nuclear Regulatory Commission or its duly authorized representatives;

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(6) "Government agency" means any executive department, commission, independent establishment, corporation, wholly or partly owned by the United States of America which is an instrumentality of the United States, or any board, bureau, division, service, office, officer, authority, administration, or other establishment in the executive branch of the Government;

(7) "Individual" means any human being;

(8) "Licensed material" means source material, special nuclear material, or by-product material received, possessed, used, or transferred under a general or specific license issued by the Commission pursuant to the regulations in this chapter;

(9) "License" means a license issued under the regulations in Part 30, 40, or 70 of this chapter. "Licensee" means the holder of such license;

(10) "Occupational dose" includes exposure of an individual to radiation (i) in a restricted area; or (ii) in the course of employment in which the individual's duties involve exposure to radiation; provided, that "occupational dose" shall not be deemed to include any exposure of an individual to radiation for the purpose of medical diagnosis or medical therapy of such individual.

(11) "Person" means (i) any individual, corporation, partnership, firm, association, trust, estate, public or private institution, group, Government agency other than the Commission or the Administration (except that the Administration shall be considered a person within the meaning of the regulations in this part to the extent that its facilities and activities are subject to the licensing and related regulatory authority of the Commission pursuant to section 202 of the Energy Reorganization Act of 1974 (88 Stat. 1244)), any State, any foreign government or nation or any political subdivision of any such government or nation, or other entity; and (ii) any legal successor, representative, agent, or agency of the foregoing.

(12) "Radiation" means any or all of the following: alpha rays, beta rays, gamma rays, X-rays, neutrons, high-speed electrons, high-speed protons, and other atomic particles; but not sound or radio waves, or visible, infrared, or ultraviolet light;

(13) "Radioactive material" includes any such material whether or not subject to licensing control by the Commission;

(14) "Restricted area" means any area access to which is controlled by the licensee for purposes of protection of individuals from exposure to radiation and radioactive materials. "Restricted area" shall not include any area used as residential quarters, although a separate room or rooms in a residential building may be set apart as a restricted area;

(15) "Source material" means (i) uranium or thorium, or any combination thereof, in any physical or chemical form; or (ii) ores which contain by

weight one-twentieth of one percent (0.5%) or more of a. uranium, b. thorium or c. any combination thereof. Source material does not include special nuclear material.

(16) "Special nuclear material" means (i) plutonium, uranium 233, uranium enriched in the isotope 233 or in the isotope 235, and any other material which the Commission, pursuant to the provisions of section 51 of the act, determines to be special nuclear material, but does not include source material; or (ii) any material artificially enriched by any of the foregoing but does not include source material;

(17) "Unrestricted area" means any area access to which is not controlled by the licensee for purposes of protection of individuals from exposure to radiation and radioactive materials, and any area used for residential quarters.

(18) "Administration" means the Energy Research and Development Administration or its duly authorized representatives.

(b) Definitions of certain other words and phrases as used in this part are set forth in other sections, including:

(1) "Airborne radioactivity area" defined in § 20.203;

(2) "Radiation area" and "high radiation area" defined in § 20.202;

(3) "Personal monitoring equipment" defined in § 20.202;

(4) "Survey" defined in § 20.201;

(5) Units of measurement of dose (rad, rem) defined in § 20.4;

(6) Units of measurement of radioactivity defined in § 20.5.

§ 20.4 Units of radiative dose.

(a) "Dose," as used in this part, is the quantity of radiation absorbed, per unit of mass, by the body or by any portion of the body. When the regulations in this part specify a dose during a period of time, the dose means the total quantity of radiation absorbed, per unit of mass, by the body or by any portion of the body during such period of time. Several different units of dose are in current use. Definitions of units as used in this part are set forth in paragraphs (b) and (c) of this section.

(b) The rad, as used in this part, is a unit of the dose of any ionizing radiation absorbed by body tissue in terms of the dose absorbed per unit mass of the tissue. One rad is the dose corresponding to the absorption of 100 ergs per gram of tissue. (One millirad (mrad) = 0.001 rad.)

(c) The rem, as used in this part, is a measure of the dose of any ionizing radiation to body tissue in terms of its estimated biological effect relative to a dose of one roentgen (r) of X-rays. (One millirem (mrem) = 0.001 rem.) The relation of the rem to other dose units depends upon the biological effect under consideration and upon the conditions of irradiation. For the purpose of the reg-

ulations in this part, any of the following is considered to be equivalent to a dose of one rem:

(1) A dose of 1 r due to X- or gamma radiation;

(2) A dose of 1 rad due to X-, gamma, or beta radiation;

(3) A dose of 0.1 rad due to neutrons or high energy protons;

(4) A dose of 0.06 rad due to particles heavier than protons and with sufficient energy to reach the lens of the eye; if it is more convenient to measure the neutron flux, or equivalent, than to determine the neutron dose in rads, as provided in subparagraph (3) of this paragraph, one rem of neutron radiation may, for purposes of the regulations in this part, be assumed to be equivalent to 14 million neutrons per square centimeter incident upon the body; or, if there exists sufficient information to estimate with reasonable accuracy the approximate distribution in energy of the neutrons, the incident number of neutrons per square centimeter equivalent to one rem may be estimated from the following table:

NEUTRON FLOW DOSE EQUIVALENT

Neutron energy (MeV)	Number of neutrons per square centimeter equivalent to a dose of 1 rem (see paragraph 3)	Average dose to lens of eye in 60 hours (millirem per day)
Thermal	500X10 ¹⁰	60
0.025	720X10 ¹⁰	80
0.05	880X10 ¹⁰	90
0.1	980X10 ¹⁰	98
0.2	1050X10 ¹⁰	105
0.5	1150X10 ¹⁰	115
1.0	1250X10 ¹⁰	125
2.0	1350X10 ¹⁰	135
5.0	1450X10 ¹⁰	145
10.0	1550X10 ¹⁰	155
20 to 30	1650X10 ¹⁰	165

(d) For determining exposures to X or gamma rays up to 5 Mr, the dose limits specified in §§ 20.101 to 20.104, inclusive, may be assumed to be equivalent to the "air dose". For the purpose of this part "air dose" means that the dose is measured by a properly calibrated appropriate instrument in air at or near the body surface in the region of highest dose rate.

§ 20.5 Units of radioactivity.

(a) Radioactivity is commonly, and for purposes of the regulations in this part shall be, measured in terms of disintegrations per unit time or in curies. One curie = 3.7×10^{10} disintegrations per second (dps) = 3.7×10^4 disintegrations per minute (dpm). Commonly used submultiples of the curie are the millicurie and the microcurie:

(1) One millicurie (mCi) = 0.001 curie

(2) One microcurie (μ Ci) = 0.000001 curie = 3.7×10^4 dps.

(3) One microcurie (μ Ci) = 0.000001 curie = 3.7×10^4 dps.

Wherever possible, the appropriate unit should be written out as "curie(s)," "millicurie(s)," or "microcurie(s)," and the abbreviations should not be used.

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(b) [Deleted 40 FR 50704.]

(c) [Deleted 39 FR 23990.]

section, provided:

(1) During any calendar quarter the dose to the whole body from radioactive material and other sources of radiation in the licensee's possession shall not exceed 5 rems; and

(2) The dose to the whole body, when added to the accumulated occupational dose to the whole body, shall not exceed 5 (N-18) rems where "N" equals the individual's age in years at his last birthday; and

(3) The licensee has determined the individual's accumulated occupational dose to the whole body on Form NRC-4, or on a clear and legible record containing all the information required in that form; and has otherwise complied with the requirements of § 20.102. As used in paragraph (b), "Dose to the whole body" shall be deemed to include any dose to the whole body, gonads, active blood-forming organs, head and trunk, or lens of eye.

§ 20.102 Determination of accumulated dose.

(a) This section contains requirements which must be satisfied by licensees who propose, pursuant to paragraph (b) of § 20.101, to permit individuals in a restricted area to receive exposure to radiation in excess of the limits specified in paragraph (a) of § 20.101.

(b) Before permitting any individual in a restricted area to receive exposure to radiation in excess of the limits specified in paragraph (a) of § 20.101, each licensee shall:

(1) Obtain a certificate on Form NRC-4, or on a clear and legible record containing all the information required in that form, signed by the individual showing each period of time after the individual attained the age of 18 in which the individual received an occupational dose of radiation; and

(2) Calculate on Form NRC-4 in accordance with the instructions appearing therein, or on a clear and legible record containing all the information required in that form, the previously accumulated occupational dose received by the individual and the additional dose allowed for that individual under § 20.101(b).

(c)(1) In the preparation of Form NRC-4, or a clear and legible record containing all the information required in that form, the licensee shall make a reasonable effort to obtain reports of the individual's previously accumulated occupational dose. For each period for which the licensee obtains such reports the licensee shall use the dose shown in the report in preparing the form. In any case where a licensee is unable to obtain reports of the individual's occupational dose for a previous complete calendar quarter, it shall be assumed that the individual has received the occupational dose specified in whichever of the following columns apply:

Part of body	Column 1	Column 2
	Assumed exposure in rems for calendar quarter prior to Jan 1, 1961	Assumed exposure in rems for calendar quarter beginning on Jan 1, 1961
Whole body, gonads, active blood-forming organs, head and trunk, lens of eye.	3%	1%

(2) The licensee shall retain and preserve records used in preparing Form NRC-4 until the Commission authorizes their disposition.

If calculation of the individual's accumulated occupational dose for all periods prior to January 1, 1961 yields a result higher than the applicable accumulated dose value for the individual as of that date, as specified in paragraph (b) of § 20.101, the excess may be disregarded.

§ 20.103 Exposure of individuals to concentrations of radioactive material in air in restricted areas.

(a)(1) No licensee shall possess, use, or transfer licensed material in such a manner as to permit any individual in a restricted area to inhale a quantity of radioactive material in any period of one calendar quarter greater than the quantity which would result from inhalation for 40 hours per week for 13 weeks at uniform concentrations of radioactive material in air specified in Appendix B, Table I, Column 1.^{1,2} If the radioactive material is of such form that intake by absorption through the skin is likely, individual exposures to radioactive material shall be controlled so that the uptake of radioactive material by any organ from either inhalation or absorption or both routes of intake in any calendar quarter does not exceed that which would result from inhaling such radioactive material for 40 hours per week for 13 weeks at uniform concentrations specified in Appendix B, Table I, Column 1.

(2) No licensee shall possess, use, or transfer mixtures of U-234, U-235, and

³ Since the concentration specified for tritium oxide vapor assumes equal intakes by skin absorption and inhalation, the total intake permitted is twice that which would result from inhalation alone at the concentration specified for H 3 S in Appendix B, Table I, Column 1 for 40 hours per week for 13 weeks.

⁴ For radon-222, the limiting quantity is that inhaled in a period of one calendar year. For radioactive materials designated "Sub" in the "Isotope" column of the table, the concentration value specified is based upon exposure to the material as an external radiation source. Individual exposures to these materials may be accounted for as part of the limitation on individual dose in § 20.101. These nuclides shall be subject to the precautionary procedures required by § 20.103(b)(1).

⁵ Multiply the concentration values specified in appendix B, table I, column 1, by 6.3×10^3 ml to obtain the quarterly quantity limit. Multiply the concentration value specified in appendix B, table I, column 1, by 2.5×10^3 ml to obtain the annual quantity limit for Rn-222.

Footnotes 4 and 5 on page 20-4

⁶ Amended 42 FR 2, 134.

§ 20.6 Interpretations.

Except as specifically authorized by the Commission in writing, no interpretation of the meaning of the regulations in this part by any officer or employee of the Commission other than a written interpretation by the General Counsel will be recognized to be binding upon the Commission.

§ 20.7 Communications.

Except where otherwise specified in this part, all communications and reports concerning the regulations in this part should be addressed to the Executive Director for Operations, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555. Communications, reports, and applications may be delivered in person at the Commission's offices at 1717 H Street NW., Washington, D.C.; or at 7920 Norfolk Avenue, Bethesda, Maryland.

APPENDIX B. DOSES, LEVELS, AND CONCENTRATIONS

§ 20.101 Exposure of individuals to radiation in restricted areas.

(a) Except as provided in paragraph (b) of this section, no licensee shall possess, use, or transfer licensed material in such a manner as to cause any individual in a restricted area to receive in any period of one calendar quarter from radioactive material and other sources of radiation in the licensee's possession a dose in excess of the limits specified in the following table:

Rems per calendar quarter

1. Whole body, head and trunk; active blood-forming organs; lens of eye; or gonads.....	1%
2. Hands and forearm; feet and ankles.....	18%
3. Skin of whole body.....	7%

(b) A licensee may permit an individual in a restricted area to receive a dose to the whole body greater than that permitted under paragraph (a) of this

⁷⁷ Amended 36 FR 1466.

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U-238 in soluble form in such a manner as to permit any individual in a restricted area to inhale a quantity of such material in excess of the intake limits specified in Appendix B, Table I, Column 1 of this part. If such soluble uranium is of a form such that absorption through the skin is likely, individual exposures to such material shall be controlled so that the uptake of such material by any organ from either inhalation or absorption or both routes of intake does not exceed that which would result from inhaling such material at the limits specified in Appendix B, Table I, Column 1 and footnote 4 thereto.

(3) For purposes of determining compliance with the requirements of this section the licensee shall use suitable measurements of concentrations of radioactive materials in air for detecting and evaluating airborne radioactivity in restricted areas and in addition, as appropriate, shall use measurements of radioactivity in the body, measurements of radioactivity excreted from the body, or any combination of such measurements as may be necessary for timely detection and assessment of individual intakes of radioactivity by exposed individuals. It is assumed that an individual inhales radioactive material at the airborne concentration in which he is present unless he uses respiratory protective equipment pursuant to paragraph (c) of this section. When assessment of a particular individual's intake of radioactive material is necessary, intakes less than those which would result from inhalation for 2 hours in any one day or for 10 hours in any one week at uniform concentrations specified in Appendix B, Table I, Column 1 need not be included in such assessment, provided that for any assessment in excess of these amounts the entire amount is included.

(b)(1) The licensee shall, as a precautionary procedure, use process or other engineering controls, to the extent practicable, to limit concentrations of radioactive materials in air to levels below those which delimit an airborne radioactivity area as defined in § 20.103(d)(1).

(2) When it is impracticable to apply process or other engineering controls to limit concentrations of radioactive material in air below those defined in § 20.103(d)(1)(i), other precautionary

procedures, such as increased surveillance, limitation of working times, or revision of respiratory protective equipment, shall be used to maintain intake of radioactive material by any individual within any period of seven consecutive days as far below that intake of radioactive material which would result from inhalation of such material for 40 hours at the uniform concentrations specified in Appendix B, Table I, Column 1 as is reasonably achievable. Whenever the intake of radioactive material by any individual exceeds this 40-hour control measure, the licensee shall make such evaluations and take such actions as are necessary to assure against recurrence. The licensee shall maintain records of such occurrences, evaluations, and actions taken in a clear and readily identifiable form suitable for summary review and evaluation.

(c) When respiratory protective equipment is used to limit the inhalation of airborne radioactive material pursuant to paragraph (b)(2) of this section, the licensee may make allowance for such use in estimating exposures of individuals to such materials provided that such equipment is used as stipulated in Regulatory Guide 8.15, "Acceptable Programs for Respiratory Protection."

(d) Notwithstanding the provisions of paragraphs (b) and (c) of this section, the Commission may impose further restrictions:

(1) On the extent to which a licensee may make allowance for use of respirators in lieu of provision of process, containment, ventilation, or other engineering controls, if application of such controls is found to be practicable; and

(2) As might be necessary to assure that the respiratory protective program of the licensee is adequate in limiting exposures of personnel to airborne radioactive materials.

(e) The licensee shall notify, in writing, the Director of the appropriate Nuclear Regulatory Commission Inspection and Enforcement Regional Office listed in Appendix D at least 30 days before the date that respiratory protective equipment is first used under the provisions of this section.

(f) A licensee who was authorized to make allowance for use of respiratory protective equipment prior to December 29, 1976 shall bring his respiratory protective program into conformance with the requirements of paragraph (c) of this section within one year of that date, and is exempt from the requirement of paragraph (e) of this section.

§ 20.101 Exposure of minors.

(a) No licensee shall possess, use or transfer licensed material in such a manner as to cause any individual within a restricted area who is under 18 years of age to receive in any period of one calendar quarter from radioactive material and other sources of radiation in the licensee's possession a dose in excess of 10 percent of the limits specified in the table in paragraph (a) of § 20.101.

(b) No licensee shall possess, use or transfer licensed material in such a manner as to cause any individual within a restricted area, who is under 18 years of age to be exposed to airborne radioactive material possessed by the licensee in an average concentration in excess of the limits specified in Appendix B, Table II of this part. For purposes of this paragraph concentrations may be averaged over periods not greater than a week.

(c) The provisions of §§ 20.103(b)(2) and 20.103(c) shall apply to exposures subject to paragraph (b) of this section except that the references in §§ 20.103(b)(2) and 20.103(c) to Appendix B, Table I, Column 1 shall be deemed to be references to Appendix B, Table II, Column 1.

§ 20.105 Permissible levels of radiation in unrestricted areas.

(a) There may be included in any application for a license or for amendment of a license proposed limits upon levels of radiation in unrestricted areas resulting from the applicant's possession or use of radioactive material and other sources of radiation. Such applications should include information as to anticipated average radiation levels and anticipated occupancy times for each unrestricted area involved. The Commission will approve the proposed limits if the applicant demonstrates that the proposed limits are not likely to cause any individual to receive a dose to the whole body in any period of one calendar year in excess of 0.5 rem.

(b) Except as authorized by the Commission pursuant to paragraph (a) of this section, no licensee shall possess, use or transfer licensed material in such a manner as to create in any unrestricted area from radioactive material and other sources of radiation in his possession:

(1) Radiation levels which, if an individual were continuously present in the area, could result in his receiving a dose in excess of two millirems in any one hour; or

(2) Radiation levels which, if an individual were continuously present in the area, could result in his receiving a dose in excess of 100 millirems in any seven consecutive days.

§ 20.106 Radioactivity in effluents to unrestricted areas.

(a) A licensee shall not possess, use, or transfer licensed material so as to release to an unrestricted area radioactive material in concentrations which exceed

*Significant intake of ingestion or injection is presumed to occur only as a result of circumstances such as accident, inadvertence, poor procedure, or similar special conditions. Such intakes must be evaluated and accounted for by techniques and procedures as may be appropriate to the circumstances of the occurrence. Exposures so evaluated shall be included in determining whether the limitation on individual exposures in § 20.103(a) has been exceeded.

Regulatory guidance on assessment of individual intakes of radioactive material is given in Regulatory Guide 8.9, "Acceptable Concepts, Models, Equations and Assumptions for a Bioassay Program," single copies of which are available from the Office of Standards Development, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, upon written request.

*This incorporation by reference provision was approved by the Director of the Federal Register on October 19, 1976. Single copies of Regulatory Guide 8.15 are available from the Office of Standards Development, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, upon written request.

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The limits specified in Appendix "B", Table II of this part, except as authorized pursuant to § 20.202 or paragraph (b) of this section. For purposes of this section concentrations may be averaged over a period not greater than one year.

(b) An application for a license or amendment may include proposed limits higher than those specified in paragraph (a) of this section. The Commission will approve the proposed limits if the applicant demonstrates:

(1) That the applicant has made a reasonable effort to minimize the radioactivity contained in effluents to unrestricted areas; and

(2) That it is not likely that radioactive material discharged in the effluent would result in the exposure of an individual to concentrations of radioactive material in air or water exceeding the limits specified in Appendix "B", Table II of this part.

(c) An application for higher limits pursuant to paragraph (b) of this section shall include information demonstrating that the applicant has made a reasonable effort to minimize the radioactivity discharged in effluents to unrestricted areas, and shall include, as pertinent:

(1) Information as to flow rates, total volume of effluent, peak concentration of each radionuclide in the effluent, and concentration of each radionuclide in the effluent averaged over a period of one year at the point where the effluent leaves a stack, tube, pipe, or similar conduit;

(2) A description of the properties of the effluents, including:

(i) chemical composition;

(ii) physical characteristics, including suspended solids content in liquid effluents, and nature of gas or aerosol for air effluents;

(iii) the hydrogen ion concentrations (pH) of liquid effluents; and

(iv) the size range of particulates in effluents released into air.

(3) A description of the anticipated human occupancy in the unrestricted area where the highest concentration of radioactive material from the effluent is expected, and, in the case of a river or stream, a description of water uses downstream from the point of release of the effluent.

(4) Information as to the highest concentration of each radionuclide in an unrestricted area, including anticipated concentrations averaged over a period of one year:

(i) In air at any point of human occupancy; or

(ii) In water at points of use downstream from the point of release of the effluent.

(5) The background concentration of radionuclides in the receiving river or stream prior to the release of liquid effluent.

(6) A description of the environmental monitoring equipment, including sensitivity of the system, and procedures and calculations to determine concentrations of radionuclides in the unrestricted area and possible reconcentrations of radionuclides.

(7) A description of the waste treatment facilities and procedures used to

reduce the concentration of radionuclides in effluents prior to their release.

(d) For the purposes of this section the concentration limits in Appendix "B", Table II of this part shall apply at the boundary of the restricted area. The concentration of radioactive material discharged through a stack, pipe or similar conduit may be determined with respect to the point where the material leaves the conduit. If the conduit discharges within the restricted area, the concentration at the boundary may be determined by applying appropriate factors for dilution, dispersion, or decay between the point of discharge and the boundary.

(e) In addition to limiting concentrations in effluent streams, the Commission may limit quantities of radioactive materials released in air or water during a specified period of time if it appears that the daily intake of radioactive material from air, water, or food by a suitable sample of an exposed population group, averaged over a period not exceeding one year, would otherwise exceed the daily intake resulting from continuous exposure to air or water containing one-third the concentration of radioactive materials specified in Appendix "B", Table II of this part.

(f) The provisions of this section do not apply to disposal of radioactive material into sanitary sewerage systems, which is governed by § 20.303

§ 20.107 Medical diagnosis and therapy.

Nothing in the regulations in this part shall be interpreted as limiting the intentional exposure of patients to radiation for the purpose of medical diagnosis or medical therapy.

§ 20.108 Orders requiring furnishing of bio-assay services.

Where necessary or desirable in order to aid in determining the extent of an individual's exposure to concentrations of radioactive material, the Commission may incorporate appropriate provisions in any license, directing the licensee to make available to the individual appropriate bio-assay services and to furnish a copy of the reports of such services to the Commission.

PRECAUTIONARY PROCEDURES

§ 20.201 Surveys.

(a) As used in the regulations in this part, "survey" means an evaluation of the radiation hazards incident to the production, use, release, disposal, or presence of radioactive materials or other sources of radiation under a specific set of conditions. When appropriate, such evaluation includes a physical survey of the location of materials and equipment, and measurements of levels of radiation or concentrations of radioactive material present.

(b) Each licensee shall make or cause to be made such surveys as may be necessary for him to comply with the regulations in this part.

§ 20.202 Personnel monitoring.

(a) Each licensee shall supply appropriate personnel monitoring equipment to, and shall require the use of such

equipment by:

(1) Each individual who enters a restricted area under such circumstances that he receives, or is likely to receive, a dose in any calendar quarter in excess of 25 percent of the applicable value specified in paragraph (a) of § 20.101.

(2) Each individual under 18 years of age who enters a restricted area under such circumstances that he receives, or is likely to receive, a dose in any calendar quarter in excess of 5 percent of the applicable value specified in paragraph (a) of § 20.101.

(3) Each individual who enters a high radiation area.

(b) As used in this part,

(1) "Personnel monitoring equipment" means devices designed to be worn or carried by an individual for the purpose of measuring the dose received (e. g. film badges, pocket chambers, pocket dosimeters, film rings, etc.);

(2) "Radiation area" means any area, accessible to personnel, in which there exists radiation, originating in whole or in part within licensed material, at such levels that a major portion of the body could receive in any one hour a dose in excess of 5 millirem, or in any 5 consecutive days a dose in excess of 100 millirems;

(3) "High radiation area" means any area, accessible to personnel, in which there exists radiation originating in whole or in part within licensed material at such levels that a major portion of the body could receive in any one hour a dose in excess of 100 millirem.

§ 20.303 Caution signs, labels, signals, and controls.

(a) General. (1) Except as otherwise authorized by the Commission, symbols prescribed by this section shall use the conventional radiation caution colors (magenta or purple on yellow background). The symbol prescribed by this section is the conventional three-bladed design:

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RADIATION SYMBOL

1. Cross-hatched area is to be magenta or purple.
2. Background is to be yellow.

(2) In addition to the contents of sign and labels prescribed in this section, licensees may provide on or near such signs and labels any additional information which may be appropriate in aiding individuals to minimize exposure to radiation or to radioactive material.

(b) **Radiation areas.** Each radiation area shall be conspicuously posted with a sign or signs bearing the radiation caution symbol and the words:

CAUTION RADIATION AREA

(c) **High radiation areas.** (1) Each high radiation area shall be conspicuously posted with a sign or signs bearing the radiation caution symbol and the words:

CAUTION HIGH RADIATION AREA

(2) Each entrance or access point to a high radiation area shall be:

(i) Equipped with a control device which shall cause the level of radiation to be reduced below that at which an individual might receive a dose of 100 millirems in 1 hour upon entry into the area; or

(ii) Equipped with a control device which shall energize a conspicuous visible or audible alarm signal in such a manner that the individual entering the high radiation area and the licensee or a supervisor of the activity are made aware of the entry; or

(iii) Maintained locked except during periods when access to the area is required, with positive control over each individual entry.

(3) The controls required by subparagraph (2) of this paragraph shall be established in such a way that no individual will be prevented from leaving a high radiation area.

(4) In the case of a high radiation

area established for a period of 30 days or less, direct surveillance to prevent unauthorized entry may be substituted for the controls required by subparagraph (2) of this paragraph.

(5) Any licensee, or applicant for a license, may apply to the Commission for approval of methods not included in subparagraphs (2) and (4) of this paragraph for controlling access to high radiation areas. The Commission will approve the proposed alternatives if the licensee or applicant demonstrates that the alternative methods of control will prevent unauthorized entry into a high radiation area, and that the requirement of subparagraph (3) of this paragraph is met.

(6) Each area in which there may exist radiation levels in excess of 500 rems in one hour at one meter from a sealed radio-active source¹ that is used to irradiate materials shall:

- (i) Have each entrance or access point equipped with entry control devices which shall function automatically to prevent any individual from inadvertently entering the area when such radiation levels exist; permit deliberate entry into the area only after a control device is actuated that shall cause the radiation level within the area, from the sealed source, to be reduced below that at which it would be possible for an individual to receive a dose in excess of 100 mrem in one hour; and prevent operation of the source if the source would produce radiation levels in the area that could result in a dose to an individual in excess of 100 mrem in one hour. The entry control devices required by this paragraph (c)(6) shall be established in such a way that no individual will be prevented from leaving the area.
- (ii) Be equipped with additional con-

¹ This paragraph (c)(6) does not apply to radioactive sources that are used in teletherapy, in radiography, or in completely self-shielded irradiators in which the source is both stored and operated within the same shielding radiation barrier and, in the designed configuration of the irradiator, is always physically inaccessible to any individual and cannot create high levels of radiation in an area that is accessible to any individual. This paragraph (c)(6) also does not apply to sources from which the radiation is incidental to some other use not to nuclear reactor generated radiation other than radiation from byproduct, source, or special nuclear materials that are used in sealed sources in non-self-shielded irradiators.

² These requirements apply after Mar. 14, 1978. Each person licensed to conduct activities to which this paragraph (c)(6) applies and who is not in compliance with the provisions of this paragraph on Mar. 14, 1978, shall file with the Director, Office of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, on or before June 14, 1978, information describing in detail the actions taken or to be taken to achieve compliance with this paragraph by Dec. 14, 1978, and may continue activities in conformance with present license conditions and the provisions of the previously effective §20.203 until such compliance is achieved. For such persons compliance must be achieved not later than Dec. 14, 1978.

³ Amended 43 FR 2167.

trol devices such that upon failure of the entry control devices to function as required by paragraph (c)(6)(i) of this section the radiation level within the area, from the sealed source, shall be reduced below that at which it would be possible for an individual to receive a dose in excess of 100 mrem in one hour; and visible and audible alarm signals shall be generated to make an individual attempting to enter the area aware of the hazard and the licensee or at least one other individual, who is familiar with the activity and prepared to render or summon assistance, aware of such failure of the entry control devices.

(iii) Be equipped with control devices such that upon failure or removal of physical radiation barriers other than the source's shielded storage container the radiation level from the source shall be reduced below that at which it would be possible for an individual to receive a dose in excess of 100 mrem in one hour; and visible and audible alarm signals shall be generated to make potentially affected individuals aware of the hazard and the licensee or at least one other individual, who is familiar with the activity and prepared to render or summon assistance, aware of the failure or removal of the physical barrier. When the shield for the stored source is a liquid, means shall be provided to monitor the integrity of the shield and to signal, automatically, loss of adequate shielding. Physical radiation barriers that comprise permanent structural components, such as walls, that have no credible probability of failure or removal in ordinary circumstances need not meet the requirements of this paragraph (c)(6)(iii).

(iv) Be equipped with devices that will automatically generate visible and audible alarm signals to alert personnel in the area before the source can be put into operation and in sufficient time for any individual in the area to operate a clearly identified control device which shall be installed in the area and which can prevent the source from being put into operation.

(v) Be controlled by use of such administrative procedures^{*} and such devices as are necessary to assure that the area is cleared of personnel prior to each use of the source preceding which use it might have been possible for an individual to have entered the area.

(vi) Be checked by a physical radiation measurement to assure that prior to the first individual's entry into the area after any use of the source, the radiation level from the source in the area is below that at which it would be possible for an individual to receive a dose in excess of 100 mrem in one hour.

(vii) Have entry control devices required in paragraph (c)(6)(i) of this section which have been tested for proper functioning prior to initial operation with such source of radiation on any day that operations are not interruptedly continued from the previous day or before resuming operations after any unintended interruption, and for which records are kept of the dates, times, and results of such tests of func-

^{*} Amended.

¹ Or "Director"

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tion. No operations other than those necessary to place the source in safe condition or to effect repairs on controls shall be conducted with such source unless control devices are functioning properly. The licensee shall submit an acceptable schedule for more complete periodic tests of the entry control and warning systems to be established and adhered to as a condition of the license.

(viii) Have those entry and exit portals that are used in transporting materials to and from the irradiation area, and that are not intended for use by individuals, controlled by such devices and administrative procedures as are necessary to physically protect and warn against inadvertent entry by any individual through such portals. Exit portals for processed materials shall be equipped to detect and signal the presence of loose radiation sources that are carried toward such an exit and to automatically prevent such loose sources from being carried out of the area.

(7) Licensees with, or applicants for, licenses for radiation sources that are within the purview of paragraph (c) (6) of this section, and that must be used in a variety of positions or in peculiar locations, such as open fields or forests, that make it impracticable to comply with certain requirements of paragraph (c) (6) of this section, such as those for the automatic control of radiation levels, may apply to the Director, Office of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, for approval, prior to use of safety measures that are alternative to those specified in paragraph (c) (6) of this section, and that will provide at least an equivalent degree of personnel protection in the use of such sources. At least one of the alternative measures must include an entry-preventing interlock control based on a physical measurement of radiation that assures the absence of high radiation levels before an individual can gain access to an area where such sources are used.

(d) *Airborne radioactivity area.* (1) As used in the regulations in this part, "airborne radioactivity area" means (i) any room, enclosure, or operating area in which airborne radioactive materials, composed wholly or partly of licensed material, exist in concentrations in excess of the amounts specified in Appendix B, Table I, Column 1 of this part; or (ii) any room, enclosure, or operating area in which airborne radioactive material composed wholly or partly of licensed material exists in concentrations which, averaged over the number of hours in any week during which individuals are in the area, exceed 25 percent of the amounts specified in Appendix B, Table I, Column 1 of this part.

(2) Each airborne radioactivity area shall be conspicuously posted with a sign or signs bearing the radiation caution symbol and the words:

CAUTION:

AIRBORNE RADIOACTIVITY AREA

¹ Or "Danger"

² Amended.

(e) *Additional requirements.* (1) Each area or room in which licensed material is used or stored and which contains any radioactive material (other than natural uranium or thorium) in an amount exceeding 10 times the quantity of such material specified in Appendix C of this part shall be conspicuously posted with a sign or signs bearing the radiation caution symbol and the words:

CAUTION:

RADIOACTIVE MATERIAL(S)

(2) Each area or room in which natural uranium or thorium is used or stored in an amount exceeding one-hundred times the quantity specified in Appendix C of this part shall be conspicuously posted with a sign or signs bearing the radiation caution symbol and the words:

CAUTION:

RADIOACTIVE MATERIAL(S)

(f) *Containers.* (1) Except as provided in subparagraph (3) of this paragraph, each container of licensed material shall bear a durable, clearly visible label identifying the radioactive contents.

(2) A label required pursuant to subparagraph (1) of this paragraph shall bear the radiation caution symbol and the words "CAUTION, RADIOACTIVE MATERIAL" or "DANGER, RADIOACTIVE MATERIAL". It shall also provide sufficient information¹ to permit individuals handling or using the containers, or working in the vicinity thereof, to take precautions to avoid or minimize exposures.

(3) Notwithstanding the provisions of subparagraph (1) of this paragraph, labeling is not required:

(i) For containers that do not contain licensed materials in quantities greater than the applicable quantities listed in Appendix C of this part.

(ii) For containers containing only natural uranium or thorium in quantities no greater than 10 times the applicable quantities listed in Appendix C of this part.

(iii) For containers that do not contain licensed materials in concentrations greater than the applicable concentrations listed in Column 2, Table I, Appendix B of this part.

(iv) For containers when they are attended by an individual who takes the precautions necessary to prevent the exposure of any individual to radiation or radioactive materials in excess of the limits established by the regulations in this part.

(v) For containers when they are in transport and packaged and labeled in accordance with regulations of the Department of Transportation.

(vi) For containers which are accessible only to individuals authorized to handle or use them, or to work in the vicinity thereof, provided that the contents are identified to such individuals by a readily available written record.

(vii) For manufacturing or process equipment, such as nuclear reactors, reactor components, piping, and tanks.

(4) Each licensee shall, prior to disposal of an empty uncontaminated container to unrestricted areas, remove or deface the radioactive material label or otherwise clearly indicate that the container no longer contains radioactive materials.

¹ As appropriate, the information will include radiation levels, kinds of material, estimate of activity, date for which activity is estimated, mass enrichment, etc.

² For example, containers in locations such as water-filled canals, storage vaults, or hot cells.

* Amended 34 FR 19546.

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patients containing byproduct material provided that there are personnel in attendance who will take the precautions necessary to prevent the exposure of any individual to radiation or radioactive material in excess of the limits established in the regulations in this part.

(c) Caution signs are not required to be posted at areas or rooms containing radioactive materials for periods of less than eight hours provided that (1) the materials are constantly attended during such periods by an individual who shall take the precautions necessary to prevent the exposure of any individual to radiation or radioactive materials in excess of the limits established in the regulations in this part and; (2) such area or room is subject to the licensee's control

(d) A room or other area is not required to be posted with a caution sign, and control is not required for each entrance or access point to a room or other area which is a high radiation area solely because of the presence of radioactive materials prepared for transport and packaged and labeled in accordance with regulations of the Department of Transportation.

§ 20.205 Procedures for picking up, receiving, and opening packages.

(a) (1) Each licensee who expects to receive a package containing quantities of radioactive material in excess of the Type A quantities specified in paragraph (b) of this section shall:

(i) If the package is to be delivered to the licensee's facility by the carrier, make arrangements to receive the package when it is offered for delivery by the carrier; or

(ii) If the package is to be picked up by the licensee at the carrier's terminal, make arrangements to receive notification from the carrier of the arrival of the package, at the time of arrival.

(2) Each licensee who picks up a package of radioactive material from a carrier's terminal shall pick up the package expeditiously upon receipt of notification from the carrier of its arrival.

(b) (1) Each licensee, upon receipt of a package of radioactive material, shall monitor the external surfaces of the package for radioactive contamination caused by leakage of the radioactive contents; except:

(i) Packages containing no more than the exempt quantity specified in the table in this paragraph;

(ii) Packages containing no more than 10 millicuries of radioactive material consisting solely of tritium, carbon-14, sulfur-35, or iodine-125;

(iii) Packages containing only radioactive material as gases or in special form;

(iv) Packages containing only radioactive material in other than liquid form (including Mo-99/Tc-99m generators) and not exceeding the Type A quantity limit specified in the table in this paragraph; and

(v) Packages containing only radionuclides with half-lives of less than 30

days and a total quantity of no more than 100 millicuries.

The monitoring shall be performed as soon as practicable after receipt, but no later than three hours after the package is received at the licensee's facility if received during the licensee's normal working hours, or eighteen hours if received after normal working hours.

(2) If removable radioactive contamination in excess of 0.01 microcuries (22,000 disintegrations per minute) per 100 square centimeters of package surface is found on the external surfaces of the package, the licensee shall immediately notify the final delivering carrier and, by telephone and telegraph, mailgram, or facsimile, the appropriate Nuclear Regulatory Commission Inspection and Enforcement Regional Office shown in Appendix D.

TABLE OF EXEMPT AND TYPE A QUANTITIES

Transport group ¹	Exempt quantity limit (Ci)	Type A quantity limit (50 curies)
I.....	0.1	0.001
II.....	1	0.006
III.....	1	3
IV.....	1	20
V.....	1	20
VI.....	1	100
VII.....	21,000	1000
Special Form.....	1	20

(c) (1) Each licensee, upon receipt of a package containing quantities of radioactive material in excess of the Type A quantities specified in paragraph (b) of this section, other than those transported by exclusive use vehicle, shall monitor the radiation levels external to the package. The package shall be monitored as soon as practicable after receipt, but no later than three hours after the package is received at the licensee's facility if received during the licensee's normal working hours, or 18 hours if received after normal working hours.

(2) If radiation levels are found on the external surface of the package in excess of 200 millirem per hour, or at three feet from the external surface of the package in excess of 10 millirem per hour,

the licensee shall immediately notify by telephone and telegraph, mailgram, or facsimile, the director of the appropriate NRC Regional Office listed in Appendix D, and the final delivering carrier.

(d) Each licensee shall establish and maintain procedures for safely opening packages in which licensed material is received, and shall assure that such procedures are followed and that due consideration is given to special instructions for the type of package being opened.

§ 20.206 Instruction of personnel.

Instructions required for individuals working in or frequenting any portion of a restricted area are specified in § 19.12 of this chapter.

¹The definitions of "transport group" and "special form" are specified in § 17.1 of this chapter.

†Amended 41 FR 16-15.

§ 20.204 Same: exceptions.

Notwithstanding the provisions of § 20.203,

(a) A room or area is not required to be posted with a caution sign because of the presence of a sealed source provided the radiation level twelve inches from the surface of the source container or housing does not exceed five millirem per hour.

(b) Rooms or other areas in hospitals are not required to be posted with caution signs, and control of entrance or access thereto pursuant to § 20.203(c) is not required, because of the presence of

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§ 20.297 Storage and control of licensed materials in unrestricted areas.

(a) Licensed materials stored in an unrestricted area shall be stored from unauthorized removal from the place of storage.

(b) Licensed materials in an unrestricted area and not in storage shall be handled under the constant surveillance and immediate control of the licensee.

Water Disposal

§ 20.301 General requirements.

No licensee shall dispose of licensed material except:

(a) By transfer to an authorized recipient as provided in the regulations to Part 20, 40, or 70 of this chapter, whichever may be applicable; or

(b) As authorized pursuant to § 20.303; or

(c) As provided in § 20.303 or § 20.304, applicable respectively to the disposal of licensed material by release into sanitary sewerage systems or burial in soil, or in § 20.106 (Radioactivity in Effluents to Unrestricted Areas).

§ 20.303 Method for obtaining approval of proposed disposal procedure.

(a) Any licensee or applicant for a license may apply to the Commission for approval of proposed procedures to dispose of licensed material in a manner not otherwise authorized in the regulations in this chapter. Each application should include a description of the licensed material and any other radioactive material involved, including the quantities and kinds of such material and the levels of radioactivity involved, and the proposed manner and conditions of disposal. The application should also include an analysis and evaluation of pertinent information as to the nature of the environment, including topographical, geological, meteorological, and hydrological characteristics; usage of ground and surface waters in the general area; the nature and location of other potentially affected facilities; and procedures to be observed to minimize the risk of unexpected or hazardous exposures.

(b) The Commission will not approve any application for a license to receive licensed material from other persons for disposal on land not owned by the Federal government or by a State government.

(c) The Commission will not approve any application for a license for disposal of licensed material at sea unless the applicant shows that sea disposal offers less harm to man or the environment than other practical alternative methods of disposal.

§ 20.304 Disposal by release into sanitary sewerage systems.

No licensee shall discharge licensed material into a sanitary sewerage system unless:

(a) It is readily soluble or dispersible in water; and

(b) The quantity of any licensed or other radioactive material released into the system by the licensee in any one

day does not exceed the larger of sub-paragraphs (1) or (2) of this paragraph:

(1) The quantity which, if diluted by the average daily quantity of sewage released into the sewer by the licensee, will result in an average concentration equal to the limits specified in Appendix B, Table 1, Column 3 of this part; or

(2) Ten times the quantity of such material specified in Appendix C of this part; and

(c) The quantity of any licensed or other radioactive material released in any one month, if diluted by the average monthly quantity of water released to the licensee, will not result in an average concentration exceeding the limits specified in Appendix B, Table 1, Column 2 of this part; and

(d) The gross quantity of licensed and other radioactive material released into the sewerage system by the licensee does not exceed one curie per year.

Records from individuals undergoing medical diagnosis or therapy with radioactive material shall be exempt from any limitations contained in this section.

§ 20.305 Disposal by burial in soil.

No licensee shall dispose of licensed material by burial in soil unless:

(a) The total quantity of licensed and other radioactive materials buried at any one location and time does not exceed, at the time of burial, 1,000 times the amount specified in Appendix C of this part; and

(b) Burial is at a minimum depth of four feet; and

(c) Successive burials are separated by distances of at least six feet and not more than 12 burials are made in any year.

§ 20.305 Treatment or disposal by incineration.

No licensee shall treat or dispose of licensed material by incineration except as specifically approved by the Commission pursuant to §§ 20.106(b) and 20.302.

REPORTS, RECORDS, AND NOTIFICATION

§ 20.401 Records of surveys, radiation monitoring, and disposal.

(a) Each licensee shall maintain records showing the radiation exposures of all individuals for whom personnel monitoring is required under § 20.202 of the regulations in this part. Such records shall be kept on Form NRC-5, in accordance with the instructions contained in that form or on clear and legible records containing all the information required by Form NRC-5. The doses entered on the forms or records shall be for periods of time not exceeding one calendar quarter.

(b) Each licensee shall maintain records in the same units used in this part, showing the results of surveys required by § 20.201(b), monitoring required by §§ 20.205(b) and 20.205(c), and disposals made under §§ 20.302, 20.303, and 20.304.

(c) (1) Records of individual exposure to radiation and to radioactive material

which must be maintained pursuant to the provisions of paragraph (a) of this section and records of disposals, including results of whole body counting examinations, made pursuant to § 20.106, shall be preserved until the Commission authorizes disposition.

(2) Records of the results of surveys and monitoring which must be maintained pursuant to paragraph (b) of this section shall be preserved for two years after completion of the survey except that the following records shall be maintained until the Commission authorizes their disposition: (i) records of the results of surveys to determine compliance with § 20.103(a); (ii) in the absence of personnel monitoring data, records of the results of surveys to determine external radiation dose; and (iii) records of the results of surveys used to evaluate the release of radioactive effluents to the environment.

(3) Records of disposal of licensed material made pursuant to §§ 20.302, 20.303, or 20.304 shall be maintained until the Commission authorizes their disposition.

(4) Records which must be maintained pursuant to this part may be the original or a reproduced copy or microform if such reproduced copy or microform is duly authenticated by authorized personnel and the microform is capable of producing a clear and legible copy after storage for the period specified by Commission regulations.

(b) If there is a conflict between the Commission's regulations in this part, license condition, or technical specification, or other written Commission approval or authorization pertaining to the retention period for the same type of record, the retention period specified in the regulations in this part for such records shall apply unless the Commission pursuant to § 20.501 has granted a specific exemption from record retention requirements specified in the regulations in this part.

§ 20.402 Reports of theft or loss of licensed material.

(a) Each licensee shall report by telephone to the Director of the appropriate Nuclear Regulatory Commission Inspection and Enforcement Regional Office listed

in Appendix D, immediately after its occurrence becomes known to the licensee, any loss or theft of licensed material in such quantities and under such circumstances that it appears to the licensee that a substantial hazard may result to persons in unrestricted areas.

(b) Each licensee who is required to make a report pursuant to paragraph (a) of this section shall, within thirty (30) days after he learns of the loss or theft, make a report in writing to the appropriate NRC Regional Office listed in Appendix D with copies to the Director of Inspection and Enforcement, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, setting forth the following information:

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Notice is hereby given that the reporting requirements set out in the rule have been approved by the U.S. General Accounting Office.

EFFECTIVE DATE: December 13, 1978.

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(1) A description of the licensed material involved, including kind, quantity, chemical, and physical form;

(2) A description of the circumstances under which the loss or theft occurred;

(3) A statement of disposition or probable disposition of the licensed material involved;

(4) Radiation exposures to individuals, circumstances under which the exposures occurred, and the extent of possible hazard to persons in unrestricted areas;

(5) Actions which have been taken, or will be taken, to recover the material; and

(6) Procedures or measures which have been or will be adopted to prevent a recurrence of the loss or theft of licensed material.

(c) Subsequent to filing the written report the licensee shall also report any substantive additional information on the loss or theft which becomes available to the licensee, within 30 days after he learns of such information.

(d) Any report filed with the Commission pursuant to this section shall be so prepared that names of individuals who may have received exposure to radiation are stated in a separate part of the report.

§ 20.403 Notifications of incidents.

(a) *Immediate notification.* Each licensee shall immediately notify by telephone and telegraph, mailgram, or facsimile, the Director of the appropriate NRC Regional Office listed in Appendix

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D of any incident involving byproduct, source, or special nuclear material possessed by him and which may have caused or threatens to cause:

(1) Exposure of the whole body of any individual to 25 rems or more of radiation; exposure of the skin of the whole body of any individual of 150 rems or more of radiation; or exposure of the feet, ankles, hands, or forearms of any individual to 375 rems or more of radiation; or

(2) The release of radioactive material in concentrations which, if averaged over a period of 24 hours, would exceed 5,000 times the limits specified for such materials in Appendix B, Table II; or

(3) A loss of one working week or more of the operation of any facilities affected; or

(4) Damage to property in excess of \$200,000.⁴

(b) **Twenty-four hour notification**
Each licensee shall within 24 hours notify by telephone and telegraph, mailgram, or facsimile, the Director of the appropriate NRC Regional Office listed in Appendix D of any incident involving licensed material possessed by him and which may have caused or threatens to cause:

(1) Exposure of the whole body of any individual to 5 rems or more of radiation; exposure of the skin of the whole body of any individual to 30 rems or more of radiation; or exposure of the feet, ankles, hands, or forearms to 75 rems or more of radiation; or

(2) The release of radioactive material in concentrations which, if averaged over a period of 24 hours, would exceed 500 times the limits specified for such materials in Appendix B, Table II; or

(3) A loss of one day or more of the operation of any facilities affected; or

(4) Damage to property in excess of \$2,000.⁴

(c) Any report filed with the Commission pursuant to this section shall be prepared so that names of individuals who have received exposure to radiation will be stated in a separate part of the report.

§ 20.404 [Deleted 38 FR 22220.]

§ 20.405 Reports of overexposures and excessive levels and concentrations.

(a) In addition to any notification required by § 20.403, each licensee shall make a report in writing within 30 days to the appropriate NRC Regional Office listed in Appendix D with a copy to the Director of Inspection and Enforcement, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, of:

(1) each exposure of an individual to radiation in excess of the applicable limits in § 20.101 or 20.104 (a) or the licensee; (2) each exposure of an individual to radioactive material in excess of the applicable limits in § 20.103(a)(1), 20.103(a)(2), 20.104(b) or the licensee; (3) levels of radiation or concentrations of radioactive material in a restricted area in excess of any other applicable limit in the licensee; (4) any incident for which notification is required by § 20.403; and (5) levels of radiation or concentrations of radioactive material (whether or not involving excessive exposure of any individual) in an unrestricted area in excess of ten times any applicable limit set forth in this part or in the licensee. Each report required under this paragraph shall describe the extent of exposure of individuals to radiation or to radioactive material, including estimates of each individual's exposure as required by paragraph (b) of this section; levels of radiation and concentrations of radioactive material involved; the cause of the exposure, levels or concentrations; and corrective steps taken or planned to assure against a recurrence.

(b) Any report filed with the Commission pursuant to this section shall include for each individual exposed the name, social security number, and date of birth; and an estimate of the individual's exposure. The report shall be prepared so that this information is stated in a separate part of the report

(c) [Deleted 38 FR 22220.]

§ 20.406 [Deleted 38 FR 22220.]

§ 20.407 Personnel exposure and monitoring reports.

(a) This section applies to each person licensed by the Commission or the Atomic Energy Commission to:

(1) Operate a nuclear reactor designed to produce electrical or heat energy pursuant to § 50.21(b) or § 50.22 of this chapter or a testing facility as defined in § 50.2(r) of this chapter;

(2) Possess or use byproduct material for purposes of radiography pursuant to Parts 30 and 34 of this chapter;

(3) Possess or use at any one time for purposes of fuel processing, fabrication, or reprocessing, special nuclear material in a quantity exceeding 5,000 grams of contained uranium-235, uranium-233, or plutonium or any combination thereof pursuant to Part 70 of this chapter; or

(4) Possess or use at any one time for processing or manufacturing for distribution pursuant to Part 30, 32, or 33 of this chapter, byproduct material in quantities exceeding anyone of the following quantities:

Radionuclide ¹	Quantity in curies
Cesium-137	1
Cobalt-60	1
Gold-198	100
Iodine-131	1
Iridium-192	10
Krypton-85	1,000
Promethium-147	10
Technetium-99m	1,000

(b) Each person described in paragraph (a) of this section shall, within the first quarter of each calendar year submit to the Director of Inspection and Enforcement, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, the following reports, applicable to the described licensee:

¹ The Commission may require, as a licensee condition, or by rule, regulation or order pursuant to § 20.802, reports from licensees who are licensed to use radionuclides not on this list in quantities sufficient to cause comparable radiation levels.

Amended 41 FR 16445.

Amended 42 FR 43965.

activities covering the preceding calendar year.²

(1) A report of either (i) the total number of individuals for whom personnel monitoring was required under § 20.302(a) or 24.30(a) of this chapter during the calendar year, or (ii) the total number of individuals for whom personnel monitoring was provided during the calendar year; *Provided*, that each total includes at least the number of individuals required to be reported under paragraph (b) (1) (i) of this section. The report shall indicate whether it is submitted in accordance with paragraph (b) (1) (i) or (ii) of this section.

(2) A statistical summary report of the personnel monitoring information recorded by the licensee for individuals for whom personnel monitoring was either required or provided, as described in § 20.407(b)(1), indicating the number of individuals whose total whole body exposure recorded during the previous calendar year was in each of the following estimated exposure ranges:

Estimated Whole Body Exposure Range (Rems) ³	Number of Individuals in each range
No measurable exposure.....	
Measurable exposure less than 0.1.....	
0.1 to 0.2.....	
0.2 to 0.3.....	
0.3 to 0.5.....	
0.5 to 0.7.....	
0.7 to 1.....	
1 to 2.....	
2 to 3.....	
3 to 4.....	
4 to 5.....	
5 to 6.....	
6 to 7.....	
7 to 8.....	
8 to 9.....	
9 to 10.....	
10 to 11.....	
11 to 12.....	
12+.....	

The low exposure range data are required in order to obtain better information about the exposure actually recorded. This section does not require improved measurements.

§ 20.408 Reports of personnel exposure on termination of employment or work.

When an individual terminates employment with a licensee subject to § 20.407, or an individual assigned to work in such a licensee's facility, but not employed by the licensee, completes his work assignment in the licensee's facility, the licensee shall furnish⁴ to the Director of Inspection and Enforcement, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, a report of the individual's exposure to radiation and radioactive material, incurred during the

² A licensee whose license expires or terminates prior to, or on the last day of the calendar year, shall submit reports at the expiration or termination of the license, covering that part of the year during which the license was in effect.

³ Individual values exactly equal to the values separating exposure ranges shall be reported in the higher range.

⁴ Amended 38 FR 22220.

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APPENDIX A [Reserved]

period of employment or work assignment in the licensee's facility, containing information recorded by the licensee pursuant to §§ 20.401(a) and 20.108. Such report shall be furnished within 30 days after the exposure of the individual has been determined by the licensee or 90 days after the date of termination of employment or work assignment, whichever is earlier.

§ 20.409 Notifications and reports to individuals.

(a) Requirements for notifications and reports to individuals of exposure to radiation or radioactive material are specified in § 19.13 of this chapter.

(b) When a licensee is required pursuant to §§ 20.405 or 20.406 to report to the Commission any exposure of an individual to radiation or radioactive material, the licensee shall also notify the individual. Such notice shall be transmitted at a time not later than the transmittal to the Commission, and shall comply with the provisions of § 19.13(a) of this chapter.

EXCEPTIONS AND ADDITIONAL REQUIREMENTS

§ 20.501 Applications for exemptions.

The Commission may, upon application by any licensee or upon its own initiative, grant such exemptions from the requirements of the regulations in this part as it determines are authorized by law and will not result in undue hazard to life or property.

§ 20.502 Additional requirements.

The Commission may, by rule, regulation, or order, impose upon any licensee such requirements, in addition to those established in the regulations in this part, as it deems appropriate or necessary to protect health or to minimize danger to life or property.

§ 20.601 Violations.

An injunction or other court order may be obtained prohibiting any violation of any provision of the Atomic Energy Act of 1954, as amended, or Title II of the Energy Reorganization Act of 1974, or any regulation or order issued thereunder. A court order may be obtained for the payment of a civil penalty imposed pursuant to section 234 of the Act for violation of section 53, 57, 82, 63, 81, 82, 101, 103, 104, 107, or 109 of the Act, or section 206 of the Energy Reorganization Act of 1974, or any rule, regulation, or order issued thereunder, or any term, condition, or limitation of any license issued thereunder, or for any violation for which a license may be revoked under section 186 of the Act. Any person who willfully violates any provision of the Act or any regulation or order issued thereunder may be guilty of a crime and, upon conviction, may be punished by fine or imprisonment or both, as provided by law.

NOTE—The reporting and record keeping requirements contained in this part have been approved by the General Accounting Office under B-180228 (R2048), (R2044), and (R2084).

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APPENDIX B
Concentrations in Air and Water Above Natural Background
(See footnotes on page 20-15)

APPENDIX B
Concentrations in Air and Water Above Natural Background—Continued
(See footnotes on page 20-15)

Element (atomic number)	Isotope	Table 1		Isotope	Table 2		Table 3	
		Column 1	Column 2		Column 1	Column 2	Column 1	Column 2
		Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)		Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)
Actinium (89)	Ac 227	2×10^{-11}	6×10^{-13}	Bromine (83)	Br 82	1×10^{-4}	4×10^{-4}	3×10^{-4}
	Ac 228	8×10^{-11}	2×10^{-11}		Cd 109	2×10^{-7}	4×10^{-7}	4×10^{-7}
	Am 241	2×10^{-10}	3×10^{-10}		Cd 115	3×10^{-7}	2×10^{-7}	2×10^{-7}
	Am 243m	1×10^{-10}	1×10^{-10}		Cd 115	3×10^{-7}	2×10^{-7}	2×10^{-7}
Americium (95)	Am 241	6×10^{-10}	3×10^{-10}	Calcium (20)	Ca 45	3×10^{-7}	1×10^{-7}	3×10^{-7}
	Am 243	3×10^{-10}	1×10^{-10}		Ca 47	3×10^{-7}	1×10^{-7}	3×10^{-7}
	Am 243	3×10^{-10}	1×10^{-10}		Ca 47	3×10^{-7}	1×10^{-7}	3×10^{-7}
	Am 244	4×10^{-10}	1×10^{-10}		Ca 47	3×10^{-7}	1×10^{-7}	3×10^{-7}
Antimony (51)	Sb 122	2×10^{-10}	1×10^{-10}	Californium (98)	Cf 249	2×10^{-11}	3×10^{-11}	3×10^{-11}
	Sb 124	1×10^{-10}	1×10^{-10}		Cf 250	2×10^{-11}	3×10^{-11}	3×10^{-11}
	Sb 125	2×10^{-10}	1×10^{-10}		Cf 251	2×10^{-11}	3×10^{-11}	3×10^{-11}
	Sb 125	2×10^{-10}	1×10^{-10}		Cf 252	2×10^{-11}	3×10^{-11}	3×10^{-11}
Argon (18)	Ar 37	2×10^{-10}	1×10^{-10}	Carbon (6)	C 14	3×10^{-11}	4×10^{-11}	4×10^{-11}
	Ar 41	2×10^{-10}	1×10^{-10}		C 14	3×10^{-11}	4×10^{-11}	4×10^{-11}
	Ar 41	2×10^{-10}	1×10^{-10}		C 14	3×10^{-11}	4×10^{-11}	4×10^{-11}
	Ar 42	2×10^{-10}	1×10^{-10}		C 14	3×10^{-11}	4×10^{-11}	4×10^{-11}
Arsenic (33)	As 74	3×10^{-7}	2×10^{-7}	Cesium (55)	Cs 131	2×10^{-7}	3×10^{-7}	3×10^{-7}
	As 76	1×10^{-7}	1×10^{-7}		Cs 134m	2×10^{-7}	3×10^{-7}	3×10^{-7}
	As 77	3×10^{-7}	2×10^{-7}		Cs 134	2×10^{-7}	3×10^{-7}	3×10^{-7}
	As 77	3×10^{-7}	2×10^{-7}		Cs 134	2×10^{-7}	3×10^{-7}	3×10^{-7}
Astatine (85)	At 211	3×10^{-10}	1×10^{-10}	Chlorine (17)	Cl 36	2×10^{-7}	3×10^{-7}	3×10^{-7}
	At 211	3×10^{-10}	1×10^{-10}		Cl 38	2×10^{-7}	3×10^{-7}	3×10^{-7}
	At 211	3×10^{-10}	1×10^{-10}		Cl 38	2×10^{-7}	3×10^{-7}	3×10^{-7}
	At 212	2×10^{-10}	1×10^{-10}		Cl 38	2×10^{-7}	3×10^{-7}	3×10^{-7}
Barium (56)	Ba 131	3×10^{-7}	2×10^{-7}	Chromium (24)	Cr 51	1×10^{-4}	2×10^{-4}	2×10^{-4}
	Ba 140	3×10^{-7}	2×10^{-7}		Cr 51	1×10^{-4}	2×10^{-4}	2×10^{-4}
	Ba 140	3×10^{-7}	2×10^{-7}		Cr 51	1×10^{-4}	2×10^{-4}	2×10^{-4}
	Ba 140	3×10^{-7}	2×10^{-7}		Cr 51	1×10^{-4}	2×10^{-4}	2×10^{-4}
Berkelium (97)	Bk 249	3×10^{-10}	1×10^{-10}	Cobalt (27)	Co 57	2×10^{-7}	3×10^{-7}	3×10^{-7}
	Bk 249	3×10^{-10}	1×10^{-10}		Co 58	2×10^{-7}	3×10^{-7}	3×10^{-7}
	Bk 249	3×10^{-10}	1×10^{-10}		Co 58	2×10^{-7}	3×10^{-7}	3×10^{-7}
	Bk 249	3×10^{-10}	1×10^{-10}		Co 58	2×10^{-7}	3×10^{-7}	3×10^{-7}
Beryllium (4)	Be 7	4×10^{-10}	1×10^{-10}	Copper (29)	Cu 64	2×10^{-7}	3×10^{-7}	3×10^{-7}
	Be 7	4×10^{-10}	1×10^{-10}		Cu 66	2×10^{-7}	3×10^{-7}	3×10^{-7}
	Be 7	4×10^{-10}	1×10^{-10}		Cu 66	2×10^{-7}	3×10^{-7}	3×10^{-7}
	Be 7	4×10^{-10}	1×10^{-10}		Cu 66	2×10^{-7}	3×10^{-7}	3×10^{-7}
Bismuth (83)	Bi 206	3×10^{-7}	2×10^{-7}	Dysprosium (63)	Dy 165	2×10^{-7}	3×10^{-7}	3×10^{-7}
	Bi 207	3×10^{-7}	2×10^{-7}		Dy 167	2×10^{-7}	3×10^{-7}	3×10^{-7}
	Bi 210	3×10^{-7}	2×10^{-7}		Dy 167	2×10^{-7}	3×10^{-7}	3×10^{-7}
	Bi 212	2×10^{-7}	1×10^{-7}		Dy 167	2×10^{-7}	3×10^{-7}	3×10^{-7}

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APPENDIX B

Concentrations in Air and Water Above Natural Background—Continued
(See footnotes on page 20-15)

Element (atomic number)	Isotope [†]	Table 1			Table 2		
		Column 1	Column 2	Column 3	Column 1	Column 2	Column 3
		Al ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	Al ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)
Calcium (20)	Ca 37	2×10^{-4}	2×10^{-2}	2×10^{-4}	2×10^{-4}	2×10^{-2}	2×10^{-4}
	Ca 38m	2×10^{-4}	2×10^{-2}	2×10^{-4}	2×10^{-4}	2×10^{-2}	2×10^{-4}
	Ca 38	2×10^{-4}	2×10^{-2}	2×10^{-4}	2×10^{-4}	2×10^{-2}	2×10^{-4}
	Ca 39	2×10^{-4}	2×10^{-2}	2×10^{-4}	2×10^{-4}	2×10^{-2}	2×10^{-4}
Copper (29)	Cu 64	2×10^{-4}	2×10^{-2}	2×10^{-4}	2×10^{-4}	2×10^{-2}	2×10^{-4}
	Cu 64	2×10^{-4}	2×10^{-2}	2×10^{-4}	2×10^{-4}	2×10^{-2}	2×10^{-4}
	Cu 64	2×10^{-4}	2×10^{-2}	2×10^{-4}	2×10^{-4}	2×10^{-2}	2×10^{-4}
	Cu 64	2×10^{-4}	2×10^{-2}	2×10^{-4}	2×10^{-4}	2×10^{-2}	2×10^{-4}
Carbon (6)	Cm 242	2×10^{-4}	2×10^{-2}	2×10^{-4}	2×10^{-4}	2×10^{-2}	2×10^{-4}
	Cm 242	2×10^{-4}	2×10^{-2}	2×10^{-4}	2×10^{-4}	2×10^{-2}	2×10^{-4}
	Cm 242	2×10^{-4}	2×10^{-2}	2×10^{-4}	2×10^{-4}	2×10^{-2}	2×10^{-4}
	Cm 242	2×10^{-4}	2×10^{-2}	2×10^{-4}	2×10^{-4}	2×10^{-2}	2×10^{-4}
Dysprosium (66)	Dy 163	2×10^{-4}	2×10^{-2}	2×10^{-4}	2×10^{-4}	2×10^{-2}	2×10^{-4}
	Dy 163	2×10^{-4}	2×10^{-2}	2×10^{-4}	2×10^{-4}	2×10^{-2}	2×10^{-4}
	Dy 163	2×10^{-4}	2×10^{-2}	2×10^{-4}	2×10^{-4}	2×10^{-2}	2×10^{-4}
	Dy 163	2×10^{-4}	2×10^{-2}	2×10^{-4}	2×10^{-4}	2×10^{-2}	2×10^{-4}
Europium (63)	Eu 152	2×10^{-4}	2×10^{-2}	2×10^{-4}	2×10^{-4}	2×10^{-2}	2×10^{-4}
	Eu 152	2×10^{-4}	2×10^{-2}	2×10^{-4}	2×10^{-4}	2×10^{-2}	2×10^{-4}
	Eu 152	2×10^{-4}	2×10^{-2}	2×10^{-4}	2×10^{-4}	2×10^{-2}	2×10^{-4}
	Eu 152	2×10^{-4}	2×10^{-2}	2×10^{-4}	2×10^{-4}	2×10^{-2}	2×10^{-4}
Barium (56)	Ba 137	2×10^{-4}	2×10^{-2}	2×10^{-4}	2×10^{-4}	2×10^{-2}	2×10^{-4}
	Ba 137	2×10^{-4}	2×10^{-2}	2×10^{-4}	2×10^{-4}	2×10^{-2}	2×10^{-4}
	Ba 137	2×10^{-4}	2×10^{-2}	2×10^{-4}	2×10^{-4}	2×10^{-2}	2×10^{-4}
	Ba 137	2×10^{-4}	2×10^{-2}	2×10^{-4}	2×10^{-4}	2×10^{-2}	2×10^{-4}
Strontium (38)	Sr 87	2×10^{-4}	2×10^{-2}	2×10^{-4}	2×10^{-4}	2×10^{-2}	2×10^{-4}
	Sr 87	2×10^{-4}	2×10^{-2}	2×10^{-4}	2×10^{-4}	2×10^{-2}	2×10^{-4}
	Sr 87	2×10^{-4}	2×10^{-2}	2×10^{-4}	2×10^{-4}	2×10^{-2}	2×10^{-4}
	Sr 87	2×10^{-4}	2×10^{-2}	2×10^{-4}	2×10^{-4}	2×10^{-2}	2×10^{-4}

APPENDIX B

(See footnotes on page 20-15)

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APPENDIX B

Concentrations in Air and Water Above Natural Background—Continued
(See footnotes on page 20-15)

APPENDIX B

Concentrations in Air and Water Above Natural Background—Continued
(See footnotes on page 20-15)

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Element (atomic number)	Isotope	Table I		Isotope	Table II		Table I		Table II
		Column 1	Column 2		Column 1	Column 2	Column 1	Column 2	Column 1
		Al ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)		Al ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	Al ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)
Potassium (19)	K 42	2×10^{-12}	1×10^{-12}	Rhenium (44)	2×10^{-4}	1×10^{-3}	2×10^{-4}	1×10^{-3}	1×10^{-3}
	K 40	4×10^{-11}	1×10^{-11}		2×10^{-4}	1×10^{-3}	2×10^{-4}	1×10^{-3}	1×10^{-3}
	K 41	2×10^{-11}	1×10^{-11}		2×10^{-4}	1×10^{-3}	2×10^{-4}	1×10^{-3}	1×10^{-3}
	K 42	2×10^{-11}	1×10^{-11}		2×10^{-4}	1×10^{-3}	2×10^{-4}	1×10^{-3}	1×10^{-3}
Rubidium (37)	Rb 85	2×10^{-11}	1×10^{-11}	Selenium (34)	2×10^{-4}	1×10^{-3}	2×10^{-4}	1×10^{-3}	1×10^{-3}
	Rb 86	2×10^{-11}	1×10^{-11}		2×10^{-4}	1×10^{-3}	2×10^{-4}	1×10^{-3}	1×10^{-3}
	Rb 87	2×10^{-11}	1×10^{-11}		2×10^{-4}	1×10^{-3}	2×10^{-4}	1×10^{-3}	1×10^{-3}
	Rb 88	2×10^{-11}	1×10^{-11}		2×10^{-4}	1×10^{-3}	2×10^{-4}	1×10^{-3}	1×10^{-3}
Strontium (38)	Sr 88	2×10^{-11}	1×10^{-11}	Selenium (36)	2×10^{-4}	1×10^{-3}	2×10^{-4}	1×10^{-3}	1×10^{-3}
	Sr 89	2×10^{-11}	1×10^{-11}		2×10^{-4}	1×10^{-3}	2×10^{-4}	1×10^{-3}	1×10^{-3}
	Sr 90	2×10^{-11}	1×10^{-11}		2×10^{-4}	1×10^{-3}	2×10^{-4}	1×10^{-3}	1×10^{-3}
	Sr 91	2×10^{-11}	1×10^{-11}		2×10^{-4}	1×10^{-3}	2×10^{-4}	1×10^{-3}	1×10^{-3}
Technetium (43)	Tc 99	2×10^{-11}	1×10^{-11}	Selenium (38)	2×10^{-4}	1×10^{-3}	2×10^{-4}	1×10^{-3}	1×10^{-3}
	Tc 100	2×10^{-11}	1×10^{-11}		2×10^{-4}	1×10^{-3}	2×10^{-4}	1×10^{-3}	1×10^{-3}
	Tc 101	2×10^{-11}	1×10^{-11}		2×10^{-4}	1×10^{-3}	2×10^{-4}	1×10^{-3}	1×10^{-3}
	Tc 102	2×10^{-11}	1×10^{-11}		2×10^{-4}	1×10^{-3}	2×10^{-4}	1×10^{-3}	1×10^{-3}
Uranium (92)	U 235	2×10^{-11}	1×10^{-11}	Selenium (40)	2×10^{-4}	1×10^{-3}	2×10^{-4}	1×10^{-3}	1×10^{-3}
	U 238	2×10^{-11}	1×10^{-11}		2×10^{-4}	1×10^{-3}	2×10^{-4}	1×10^{-3}	1×10^{-3}
	U 239	2×10^{-11}	1×10^{-11}		2×10^{-4}	1×10^{-3}	2×10^{-4}	1×10^{-3}	1×10^{-3}
	U 240	2×10^{-11}	1×10^{-11}		2×10^{-4}	1×10^{-3}	2×10^{-4}	1×10^{-3}	1×10^{-3}

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APPENDIX D
Concentrations in Air and Water Above Natural Background—Continued
(See footnotes on page 20-15)

Element (atomic number)	Isotope	Table 1		Isotope	Table 2	
		Column 1 Air ($\mu\text{Ci}/\text{ml}$)	Column 2 Water ($\mu\text{Ci}/\text{ml}$)		Column 1 Air ($\mu\text{Ci}/\text{ml}$)	Column 2 Water ($\mu\text{Ci}/\text{ml}$)
Table 1						
Table 2						
 						

APPENDIX B

Concentrations in Air and Water Above Natural Background—Continued

(See footnotes on page 20-19)

Element (atomic number)	Isotope ¹		Table I		Table II	
			Column 1	Column 2	Column 1	Column 2
			Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)	Air ($\mu\text{Ci/ml}$)	Water ($\mu\text{Ci/ml}$)
Zinc (20)	Zn 65	1	1×10^{-7}	3×10^{-3}	4×10^{-9}	1×10^{-4}
		1	6×10^{-8}	5×10^{-3}	2×10^{-9}	2×10^{-4}
	Zn 69m	5	4×10^{-7}	3×10^{-3}	1×10^{-9}	7×10^{-4}
Zirconium (40)		1	3×10^{-7}	2×10^{-3}	1×10^{-9}	6×10^{-4}
	Zn 69	5	7×10^{-8}	5×10^{-3}	2×10^{-9}	2×10^{-4}
		1	9×10^{-8}	5×10^{-3}	3×10^{-9}	2×10^{-4}
	Zr 93	5	1×10^{-7}	2×10^{-3}	4×10^{-9}	6×10^{-4}
		1	3×10^{-7}	2×10^{-3}	7×10^{-9}	8×10^{-4}
	Zr 95	5	1×10^{-7}	3×10^{-3}	4×10^{-9}	6×10^{-4}
		1	3×10^{-7}	2×10^{-3}	1×10^{-9}	6×10^{-4}
	Zr 97	5	1×10^{-7}	5×10^{-3}	4×10^{-9}	2×10^{-4}
		1	9×10^{-8}	5×10^{-3}	5×10^{-9}	2×10^{-4}
Any single radionuclide not listed above with decay mode other than alpha emission or spontaneous fission and with radioactive half-life less than 2 hours.		Sub	1×10^{-8}		3×10^{-9}	
Any single radionuclide not listed above with decay mode other than alpha emission or spontaneous fission and with radioactive half-life greater than 2 hours.						
			3×10^{-9}	9×10^{-3}	1×10^{-10}	3×10^{-4}
Any single radionuclide not listed above, which decays by alpha emission or spontaneous fission.						
			6×10^{-11}	4×10^{-7}	2×10^{-14}	3×10^{-9}

¹ Soluble (S); insoluble (I).
² "Sub" means that values given are for submergence in a semaphysical infinite cloud of airborne material.

* These radon concentrations are appropriate for protection from radon-222 combined with its short-lived daughters. Alternatively, the value in Table I may be replaced by one-third (1/3) "working level." (A "working level" is defined as any combination of short-lived radon-222 daughters, polonium-218, lead-214, bismuth-214 and polonium-214, in one liter of air, without regard to the degree of equilibrium, that will result in the ultimate emission of 1.3 ± 10^{-5} MeV of alpha particle energy.) The Table II value may be replaced by one-thirtieth (1/30) of a "working level." The limit on radon-222 concentrations in restricted areas may be based on an annual average.

14. For soluble mixtures of U-238, U-235 and U-233 in air chemical toxicity may be the limiting factor. If the percent by weight (enrichment) of U-235 is less than 8, the concentration value for a 40-hour workweek, Table I, is 0.2 milligrams uranium per cubic meter of air average. For any enrichment, the product of the average concentration and time of exposure during a 40-hour workweek shall not exceed 8×10^{-6} SA, $\mu\text{Ci-hr/ml}$, where SA is the specific activity of the uranium isotope. The concentration value for Table II is 0.007 milligrams uranium per cubic meter of air. The specific activity for natural uranium is 6.77×10^{-4} curies per gram U. The specific activity for other mixtures of U-238, U-235 and U-233, if not known, shall be:
 SA = 6.6×10^{-4} curies/gram U U-depleted
 SA = $(0.44 + 0.38 W + 0.0034 W^2)$ 10^{-4} $W \geq 0.72$
 where W is the percentage by weight of U-235, expressed as percent.

* Amended 37 FR 23319.

** Amended 39 FR 23900; footnote re-designated 40 FR 50704.

*** Amended 40 FR 50704.

† Amended 38 FR 19314.

‡ Amended 39 FR 25463; redesignated 40 FR 50704.

PART 20 • STANDARDS FOR PROTECTION AGAINST RADIATION

NOTE TO APPENDIX B

Note: In any case where there is a mixture in air or water of more than one radionuclide, the limiting values for purposes of this Appendix should be determined as follows:

1. If the identity and concentration of each radionuclide in the mixture are known, the limiting values should be derived as follows: (a) For each radionuclide in the mixture, the ratio between the quantity present in the mixture and the limit otherwise established in Appendix B for the specific radionuclide when not in a mixture. The sum of such ratios for all the radionuclides in the mixture may not exceed "1" (i.e., "unity").

EXAMPLE: If radionuclides A, B, and C are present in concentrations C_A , C_B , and C_C , and if the applicable MPC's are MPC_A , MPC_B , and MPC_C respectively, then the concentrations shall be limited so that the following relationship exists:

$$\frac{C_A}{MPC_A} + \frac{C_B}{MPC_B} + \frac{C_C}{MPC_C} \leq 1$$

2. If either the identity or the concentration of any radionuclide in the mixture is not known, the limiting values for purposes of Appendix B shall be:

- For purposes of Table I, Col. 1— 5×10^{-6}
- For purposes of Table I, Col. 2— 4×10^{-4}
- For purposes of Table II, Col. 1— 2×10^{-4}
- For purposes of Table II, Col. 2— 3×10^{-4}

3. If any of the conditions specified below are met, the corresponding value specified below may be used in lieu of those specified in paragraph 2 above:

a. If the identity of each radionuclide in the mixture is known but the concentration of one or more of the radionuclides in the mixture is not known, the concentration limit for the mixture is the limit specified in Appendix "B" for the radionuclide in the mixture having the lowest concentration limit; or

b. If the identity of each radionuclide in the mixture is not known, but it is known that certain radionuclides specified in Appendix "B" are not present in the mixture, the concentration limit for the mixture is the lowest concentration limit specified in Appendix "B" for any radionuclide which is not known to be absent from the mixture; or

c. Element (atomic number) and isotope

c. Element (atomic number) and isotope	Table I		Table II	
	Column 1 Air ($\mu\text{Ci/ml}$)	Column 2 Water ($\mu\text{Ci/ml}$)	Column 1 Air ($\mu\text{Ci/ml}$)	Column 2 Water ($\mu\text{Ci/ml}$)
If it is known that Sr 90, I 129, I 130, I 131, I 132, I 133, I 134, I 135, I 136, I 137, I 138, I 139, I 140, I 141, I 142, I 143, I 144, I 145, I 146, I 147, I 148, I 149, I 150, I 151, I 152, I 153, I 154, I 155, I 156, I 157, I 158, I 159, I 160, I 161, I 162, I 163, I 164, I 165, I 166, I 167, I 168, I 169, I 170, I 171, I 172, I 173, I 174, I 175, I 176, I 177, I 178, I 179, I 180, I 181, I 182, I 183, I 184, I 185, I 186, I 187, I 188, I 189, I 190, I 191, I 192, I 193, I 194, I 195, I 196, I 197, I 198, I 199, I 200, I 201, I 202, I 203, I 204, I 205, I 206, I 207, I 208, I 209, I 210, I 211, I 212, I 213, I 214, I 215, I 216, I 217, I 218, I 219, I 220, I 221, I 222, I 223, I 224, I 225, I 226, I 227, I 228, I 229, I 230, I 231, I 232, I 233, I 234, I 235, I 236, I 237, I 238, I 239, I 240, I 241, I 242, I 243, I 244, I 245, I 246, I 247, I 248, I 249, I 250, I 251, I 252, I 253, I 254, I 255, I 256, I 257, I 258, I 259, I 260, I 261, I 262, I 263, I 264, I 265, I 266, I 267, 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1985, I 1986, I 1987, I 1988, I 1989, I 1990, I 1991, I 1992, I 1993, I 1994, I 1995, I 1996, I 1997, I 1998, I 1999				

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Appendix C		Materials	Microseries
Isotopes	Microseries		
Americium-241	100	Cesium-137m	100
Antimony-123	100	Cesium-137	100
Antimony-124	100	Cesium-134m	100
Antimony-125	100	Cesium-134	100
Arsenic-73	100	Cesium-132	100
Arsenic-74	100	Cesium-130	100
Arsenic-76	100	Cesium-128	100
Arsenic-77	100	Cesium-126	100
Barium-131	100	Cesium-124	100
Barium-133	100	Cesium-122	100
Barium-135	100	Cesium-120	100
Bismuth-210	100	Cesium-118	100
Bromine-82	100	Cesium-116	100
Cadmium-109	100	Cesium-114	100
Cadmium-115m	100	Cesium-112	100
Cadmium-115	100	Cesium-110	100
Calcium-45	100	Cesium-108	100
Calcium-47	100	Cesium-106	100
Carbon-14	100	Cesium-104	100
Cerium-141	100	Cesium-102	100
Cerium-143	100	Cesium-100	100
Cerium-144	100	Cesium-98	100
Cesium-131	1,000	Cesium-96	100
Cesium-134m	100	Cesium-94	100
Cesium-134	100	Cesium-92	100
Cesium-132	100	Cesium-90	100
Cesium-130	100	Cesium-88	100
Cesium-128	100	Cesium-86	100
Cesium-126	100	Cesium-84	100
Cesium-124	100	Cesium-82	100
Cesium-122	100	Cesium-80	100
Cesium-120	100	Cesium-78	100
Cesium-118	100	Cesium-76	100
Cesium-116	100	Cesium-74	100
Cesium-114	100	Cesium-72	100
Cesium-112	100	Cesium-70	100
Cesium-110	100	Cesium-68	100
Cesium-108	100	Cesium-66	100
Cesium-106	100	Cesium-64	100
Cesium-104	100	Cesium-62	100
Cesium-102	100	Cesium-60	100
Cesium-100	100	Cesium-58	100
Cesium-98	100	Cesium-56	100
Cesium-96	100	Cesium-54	100
Cesium-94	100	Cesium-52	100
Cesium-92	100	Cesium-50	100
Cesium-90	100	Cesium-48	100
 
Cesium-40	100		
Cesium-38	100		
Cesium-36	100		
Cesium-34	100		
Cesium-32	100		
Cesium-30	100		
Cesium-28	100		
Cesium-26	100		
Cesium-24	100		
Cesium-22	100		
Cesium-20	100		
Cesium-18	100		
Cesium-16	100		
Cesium-14	100		
Cesium-12	100		
Cesium-10	100		
Cesium-8	100		
Cesium-6	100		
Cesium-4	100		
Cesium-2	100		
Cesium-0	100		

Any alpha emitting radionuclide not listed above or mixtures of alpha emitters of unknown composition .01

Any radionuclide other than alpha emitting radionuclides, not listed above or mixtures of beta emitters of unknown composition .1

Note: For purposes of §§ 20.202 and 20.204, where there is involved a combination of isotopes in known amounts the limit for the combination should be derived as follows: Determine, for each isotope in the combination, the ratio between the quantity present in the combination and the limit otherwise established for the specific isotope when not in combination. The sum of such ratios for all the isotopes in the combination may not exceed "1" (i.e., "unity"). Example: For purposes of § 20.202, if a particular batch contains 20,000 µCi of Au¹⁹⁸ and 50,000 µCi of C¹⁴, it may also include not more than 200 µCi of I¹³¹. This limit was determined as follows:

$$\frac{20,000 \mu\text{Ci Au}^{198}}{100,000 \mu\text{Ci}} + \frac{50,000 \mu\text{Ci C}^{14}}{100,000 \mu\text{Ci}} + \frac{200 \mu\text{Ci I}^{131}}{100,000 \mu\text{Ci}} = 1$$

The denominator in each of the above ratios was obtained by multiplying the figure in the table by 1,000 as provided in § 20.204.

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Appendix D

UNITED STATES NUCLEAR REGULATORY COMMISSION INSPECTION AND ENFORCEMENT REGIONAL OFFICES

Region	Address	Telephone	
		Daytime	Nights and Weekdays
I Connecticut, Delaware, District of Columbia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont	Region I, USNRC Office of Inspection and Enforcement 411 Park Avenue King of Prussia, Pa. 19406	(215) 337-5000	See text
II Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, Panama Canal Zone, Puerto Rico, South Carolina, Tennessee, Virginia, Virgin Islands, and West Virginia	Region II, USNRC Office of Inspection and Enforcement 181 Marietta Street, Suite 8100 Atlanta, Ga. 30303	(404) 521-4553	(404) 721-4503
III Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio, and Wisconsin	Region III, USNRC Office of Inspection and Enforcement 189 Roosevelt Road Oak Brook, Ill. 60131	(312) 516-3880	(312) 568-3880
IV Arkansas, Colorado, Idaho, Kansas, Louisiana, Montana, Nebraska, New Mexico, North Dakota, Oklahoma, South Dakota, Texas, Utah, and Wyoming	Region IV, USNRC Office of Inspection and Enforcement 511 Ryan Plaza Drive Suite 1000 Arlington, Texas 76012	(817) 334-2841	(817) 334-2841
V Alaska, Arizona, California, Hawaii, Nevada, Oregon, Washington, and U.S. territories and possessions in the Pacific	Region V, USNRC Office of Inspection and Enforcement 1550 N. California Blvd. Suite 202 Upland, Calif. 92596	(615) 932-8300	

*Amended 4/1/84

UNITED STATES NUCLEAR REGULATORY COMMISSION
RULES AND REGULATIONS
TITLE 10, CHAPTER 1, CODE OF FEDERAL REGULATIONS - ENERGY

PART
71

**PACKAGING OF RADIOACTIVE MATERIAL FOR
TRANSPORT AND TRANSPORTATION OF RADIOACTIVE
MATERIAL UNDER CERTAIN CONDITIONS ***

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- 71.1 Purpose
- 71.2 Scope
- 71.3 Requirement for license
- 71.4 Definitions
- 71.5 Transportation of licensed material

EXEMPTIONS

- 71.6 Specific exemptions
- 71.7 Exemption for no more than type A quantities
- 71.8 Exemption of physicians
- 71.9 Exemption of fissile material
- 71.10 Limited exemption for shipment of type B quantities of radioactive material

GENERAL LICENSES

- 71.11 General license for shipment of licensed material
- 71.12 General license for shipment in DOT specification containers, in packages approved for use by another person, and in packages approved by a foreign national competent authority
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- 71.14 Interpretations
- 71.15 Additional requirements
- 71.16 Amendment of existing licenses

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- 71.22 Package description
- 71.23 Package evaluation
- 71.24 Procedural controls
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Subpart C—Package Standards

- 71.31 General standards for all packaging
- 71.32 Structural standards for type B and large quantity packaging
- 71.33 Criterion standards for fissile material packages
- 71.34 Evaluation of a single package
- 71.35 Standards for normal conditions of transport for a single package
- 71.36 Standards for hypothetical accident conditions for a single package
- 71.37 Evaluation of an array of packages of fissile material
- 71.38 Specific standards for a Fissile Class I package
- 71.39 Specific standards for a Fissile Class II package
- 71.40 Specific standards for a Fissile Class III shipment
- 71.41 Previously constructed packages for irradiated solid nuclear fuel

- 71.42 Special requirements for plutonium shipments after June 17, 1978.

Subpart D—Operating Procedures

- 71.51 Establishment and maintenance of procedures
- 71.52 Assumptions as to unknown properties
- 71.53 Preliminary determinations
- 71.54 Routine determinations
- 71.55 Opening instructions
- 71.61 Reports
- 71.62 Records
- 71.63 Inspection and tests
- 71.64 Violations

Appendices

- Appendix A—Normal conditions of transport
 - Appendix B—Hypothetical accident conditions
 - Appendix C—Transport grouping of radionuclides
 - Appendix D—Tests for special form licensed material
 - Appendix E—Quality Assurance Criteria for Shipping Packages for Radioactive Material
- AUTHORITY:** The provisions of this Part 71 issued under secs 53, 63, 81, 161, 182, 183, 68 Stat 930, 933, 935, 948, 953, 954, as amended, 42 U.S.C. 2073, 2093, 2111, 2201, 2232, 2233, unless otherwise noted. For the purposes of sec. 223, 68 Stat. 958, as amended, 42 U.S.C. 2273, §§ 71.61—71.63 issued under sec. 1610, 68 Stat. 950, as amended, 42 U.S.C. 2201(c). Secs. 202, 206, Pub. L. 93-438, 88 Stat. 1244, 1246, 42 U.S.C. 5842, 5846.

§ 71.1 Purpose.

(a) This part establishes requirements for transportation and for preparation for shipment of licensed material and prescribes procedures and standards for approval by the Nuclear Regulatory Commission of packaging and shipping procedures for fissile material (uranium-233, uranium-235, plutonium-238, plutonium-239, and plutonium-241) and for quantities of licensed materials in excess of type A quantities, as defined in § 71.4(q), and prescribes certain requirements governing such packaging and shipping.

(b) The packaging and transport of these materials are also subject to other parts of this chapter and to the regula-

tions of other agencies having jurisdiction over means of transport. The requirements of this part are in addition to, and not in substitution for, other requirements.

§ 71.2 Scope.

The regulations in this part apply to each person authorized by specific license issued by the Commission to receive, possess, use or transfer licensed materials, if he delivers such materials to a carrier for transport or transports such material outside the confines of his plant or other place of use.

§ 71.3 Requirement for license.

No licensee subject to the regulations in this part shall (a) deliver any licensed materials to a carrier for transport or (b) transport licensed material except as authorized in a general license or specific license issued by the Commission, or as exempted in this part.

§ 71.4 Definitions.

As used in this part:

(a) "Carrier" means any person engaged in the transportation of passengers or property, as common, contract, or private carrier, or freight forwarder, as those terms are used in the Interstate Commerce Act, as amended, or the U.S. Post Office;

(b) "Close reflection by water" means immediate contact by water of sufficient thickness to reflect a maximum number of neutrons;

(c) "Containment vessel" means the receptacle on which principal reliance is placed to retain the radioactive material during transport;

(d) "Fissile classification" means classification of a package or shipment of fissile materials according to the controls needed to provide nuclear cri-

*Amended 37 FR 3983.

PART 71 - PACKAGING OF RADIOACTIVE MATERIAL FOR TRANSPORT

criticality safety during transportation as follows:

(1) **Fissile Class I:** Packages which may be transported in unlimited numbers and in any arrangement, and which require no nuclear criticality safety controls during transportation. For purposes of nuclear criticality safety control, a transportation index is not assigned to Fissile Class I packages. However, the external radiation levels may require a transport index number.

(2) **Fissile Class II:** Packages which may be transported together in any arrangement but in numbers which do not exceed an aggregate transport index of 50. For purposes of nuclear criticality safety control, individual packages may have a transport index of not less than 0.1 and not more than 10. However, the external radiation levels may require a higher transport index number but not to exceed 10. Such shipments require no nuclear criticality safety control by the shipper during transportation.

(3) **Fissile Class III:** Shipments of packages which do not meet the requirements of Fissile Classes I or II and which are controlled in transportation by special arrangements between the shipper and the carrier to provide nuclear criticality safety.

(e) "Fissile materials" means uranium-233, uranium-235, plutonium-238, plutonium-239, and plutonium-241;

(f) "Large quantity" means a quantity of radioactive material, the aggregate radioactivity of which exceeds any one of the following:

(1) For transport groups as defined in paragraph (p) of this section:

(i) Group I or II radionuclides: 20 curies;

(ii) Group III or IV radionuclides: 200 curies;

(iii) Group V radionuclides: 5,000 curies;

(iv) Group VI or VII radionuclides: 50,000 curies; and

(2) For special form material as defined in paragraph (c) of this section: 5,000 curies.

(g) "Low specific activity material" means any of the following:

(1) Uranium or thorium ores and physical or chemical concentrates of those ores;

(2) Unirradiated natural or depleted uranium or unirradiated natural thorium;

(3) Tritium oxide in aqueous solutions provided the concentration does not exceed 5.0 millicuries per milliliter;

(4) Material in which the activity is essentially uniformly distributed and in which the estimated average concentra-

tion per gram of contents does not exceed:

(i) 0.0001 millicurie of Group I radionuclides; or

(ii) 0.005 millicurie of Group II radionuclides; or

(iii) 0.3 millicurie of Groups III or IV radionuclides.

NOTE: This includes, but is not limited to, materials of low radioactivity concentration such as residues or solutions from chemical processing, wastes such as building rubble, metal, wood, and fabric scrap, glassware, paper, and cardboard, solid or liquid plant waste, sludges, and ashes.

(5) Objects of nonradioactive material externally contaminated with radioactive material, provided that the radioactive material is not readily dispersible and the surface contamination, when averaged over an area of 1 square meter, does not exceed 0.0001 millicurie (220,000 disintegrations per minute) per square centimeter of Group I radionuclides or 0.001 millicurie (2,200,000 disintegrations per minute) per square centimeter of other radionuclides.

(h) "Maximum normal operating pressure" means the maximum gauge pressure which is expected to develop in the containment vessel under the normal conditions of transport specified in Appendix A of this part;

(i) "Moderator" means a material used to reduce, by scattering collisions and without appreciable capture, the kinetic energy of neutrons;

(j) "Optimum interspersed hydrogenous moderation" means the occurrence of hydrogenous material between containment vessels to such an extent that the maximum nuclear reactivity results;

(k) "Package" means packaging and its radioactive contents;

(l) "Packaging" means one or more receptacles and wrappers and their contents excluding fissile material and other radioactive material, but including absorbent material, spacing structures, thermal insulation, radiation shielding, devices for cooling and for absorbing mechanical shock, external fittings, neutron moderators, nonfissile neutron absorbers, and other supplementary equipment;

(m) "Primary coolant" means a gas, liquid, or solid, or combination of them, in contact with the radioactive material or, if the material is in special form, in contact with its capsule, and used to remove decay heat;

(n) "Sample package" means a package which is fabricated, packed, and closed to fairly represent the proposed package as it would be presented for

transport, simulating the material to be transported, as to weight and physical and chemical form;

(o) "Special form" means any of the following physical forms of licensed material of any transport group:

(1) The material is in solid form having no dimension less than 0.5 millimeter or at least one dimension greater than five millimeters; does not melt, sublime, or ignite in air at a temperature of 1,000° F.; will not shatter or crumble if subjected to the percussion test described in Appendix D of this part; and is not dissolved or converted into dispersible form to the extent of more than 0.005 percent by weight by immersion for 1 week in water at 68° F. or in air at 86° F.; or

(2) The material is securely contained in a capsule having no dimension less than 0.5 millimeter or at least one dimension greater than five millimeters, which will retain its contents if subjected to the tests prescribed in Appendix D of this part; and which is constructed of materials which do not melt, sublime, or ignite in air at 1,475° F., and do not dissolve or convert into dispersible form to the extent of more than 0.005 percent by weight by immersion for 1 week in water at 68° F. or in air at 86° F.

(p) "Transport group" means any one of seven groups into which radionuclides in normal form are classified, according to their toxicity and their relative potential hazard in transport, in Appendix C of this part.

(1) Any radionuclide not specifically listed in one of the groups in Appendix C shall be assigned to one of the Groups in accordance with the following table:

Radionuclide	Radioactive half-life		
	0 to 1000 days	1000 days to 10 ⁴ years	Over 10 ⁴ years
Atomic number 1-81	Group III	Group II	Group III
Atomic number 82 and over	Group I	Group I	Group III

(2) For mixtures of radionuclides the following shall apply:

(i) If the identity and respective activity of each radionuclide are known, the permissible activity of each radionuclide shall be such that the sum, for all groups present, of the ratio between the total activity for each group to the permissible activity for each group will not be greater than unity.

(ii) If the groups of the radionuclides are known but the amount in each group cannot be reasonably determined, the

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mixture shall be assigned to the most restrictive group present.

(iii) If the identity of all or some of the radionuclides cannot be reasonably determined, each of those unidentified radionuclides shall be considered as belonging to the most restrictive group which cannot be positively excluded.

(iv) Mixtures consisting of a single radioactive decay chain where the radionuclides are in the naturally occurring proportions shall be considered as consisting of a single radionuclide. The group and activity shall be that of the first member present in the chain, except that if a radionuclide "x" has a half-life longer than that of that first member and an activity greater than that of any other member, including the first, at any time during transportation, the transport group of the nuclide "x" and the activity of the mixture shall be the maximum activity of that nuclide "x" during transportation.

Terms defined in Parts 20, 30 to 36 inclusive, and 70 of this chapter have the same meaning when used in this part.

(q) "Type A quantity" and "Type B quantity" means a quantity of radioactive material the aggregate radioactivity of which does not exceed that specified in the following table:

Transport Group (see § 71.41p)	Type A quantity (in curies)	Type B quantity (in curies)
I.....	0.001	20
II.....	0.05	20
III.....	3	200
IV.....	20	200
V.....	20	5,000
VI and VII.....	1,000	50,000
Special form.....	120	5,000

§ 71.5 Transportation of licensed material.

(a) No licensee shall transport any licensed material outside of the confines of his plant or other place of use, or deliver any licensed material to a carrier for transport, unless the licensee complies with the applicable requirements of the regulations appropriate to the mode of transport, of the Department of Transportation in 49 CFR Parts 170-189, 14 CFR Part 103 and 46 Part 146, and the U.S. Postal Service in 39 CFR Parts 14 and 15 insofar as such regulations relate to the packaging of byproduct, source, or special nuclear material; marking and labeling of the packages, loading and storage of

packages, phasing of the transportation vehicle, monitoring requirements and accident reporting.

(b) When Department of Transportation regulations are not applicable to shipments of licensed material by rail, highway, or water because the shipment or the transportation of the shipment is not in interstate or foreign commerce, or to shipments of licensed material by air because the shipment is not transported in civil aircraft, the licensee shall conform to the standards and requirements of the Department of Transportation specified in paragraph (a) of this section, to the same extent as if the shipment or transportation were in interstate or foreign commerce or in civil aircraft. Any requests for modifications, waivers, or exemptions from those requirements, and any notifications referred to in those requirements shall be filed with or made to, the Nuclear Regulatory Commission.

(c) Paragraph (a) of this section shall not apply to the transportation of licensed material or to the delivery of licensed material to a carrier for transport, where such transportation is subject to the regulations of the Department of Transportation or the U.S. Postal Service.

EXEMPTIONS

§ 71.6 Specific exemptions.

On application of any interested person or on its own initiative, the Commission may grant such exemptions from the requirements of the regulations in this part as it determines are authorized by law and will not endanger life or property or the common defense and security.

71.7 Exemption for no more than Type A quantities.¹

A licensee is exempt from all the requirements of this part to the extent that he delivers to a carrier for transport:

(a) Packages each of which contains no licensed material having a specific activity in excess of 0.002 microcurie/gram; or

(b) Shipments subject to the regulations of the Department of Transportation in 49 CFR parts 170-189, 14 CFR part 103, or 46 CFR part 146 or the U.S. Postal Service in 39 CFR parts 14 and 15 of packages each of which contains no more than a type A quantity of radioactive material, as defined in § 71.4(q), which may include one of the following:

(1) Not more than 15 grams of fissile material; or

(2) Thorium, or uranium containing not more than 0.72 percent by weight of fissile material; or

(3) Uranium compounds, other than metal (e.g., UF₆, UO₂, or uranium oxide in bulk form, not pelleted or fabricated into shapes) or aqueous solutions of uranium, in which the total amount of uranium-233 and plutonium present does not exceed 1.04 percent by weight of the uranium-235 content, and the total fissile content does not exceed 1.004 percent by weight of the total uranium content; or

(4) Homogenous hydrogenous solutions or mixtures containing not more than:

(i) 500 grams of any fissile material, provided the atomic ratio of hydrogen to fissile material is greater than 7,600; or

(ii) 800 grams of uranium-235: *Provided*, That the atomic ratio of hydrogen to fissile material is greater than 5,200, and the content of other fissile material is not more than 1 percent by weight of the total uranium-235 content; or

(iii) 500 grams of uranium-233 and uranium-235: *Provided*, That the atomic ratio of hydrogen to fissile material is greater than 5,200, and the content of plutonium is not more than 1 percent by weight of the total uranium-233 and uranium-235 content; or

(5) Less than 350 grams of fissile material: *Provided*, That there is not more than 5 grams of fissile material in any cubic foot within the package

§ 71.8 Exemption of physicians.

Physicians, as defined in § 35.3(b) of this chapter, are exempt from the regulations in this part to the extent that they transport licensed material for use in the practice of medicine.

§ 71.9 Exemption for fissile material.

A licensee is exempt from requirements in §§ 71.33, 71.35(b), 71.36(b), 71.37, 71.38, 71.39, and 71.40 to the extent that he delivers to a carrier for transport packages each of which contains one of the following:

(a) Not more than 15 grams of fissile material; or

(b) Thorium, or uranium containing not more than 0.72 percent by weight of fissile material; or

(c) Uranium compounds, other than metal (e.g., UF₆, UO₂, or uranium oxide

¹ Except that for californium-252, the limit is 2 Ci

² Redesignated by 38 FR 10437.

Amended 38 FR 10437

³ This applies to light water and does not apply to heavy water.

⁴ This applies to light hydrogen and does not apply to heavy hydrogen (i.e., deuterium or tritium).

⁵ Amended 38 FR 10437

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in bulk form, not pelleted or fabricated into shapes) or aqueous solutions of uranium, in which the total amount of uranium-233 and plutonium present does not exceed 1.04 percent by weight of the uranium-235 content, and the total fissile content does not exceed 1.042 percent by weight of the total uranium content, or

(d) Homogeneous hydrogenous solutions or mixtures containing not more than

(1) 500 grams of any fissile material, provided the atomic ratio of hydrogen to fissile material is greater than 7,600, or

(2) 800 grams of uranium-235. *Provided*, That the atomic ratio of hydrogen to fissile material is greater than 5,200, and the content of other fissile material is not more than 1 percent by weight of the total uranium-235 content, or

(3) 500 grams of uranium-233 and uranium-235. *Provided*, That the atomic ratio of hydrogen to fissile material is greater than 5,200, and the content of plutonium is not more than 1 percent by weight of the total uranium-233 and uranium-235 content, or

(c) Less than 350 grams of fissile material. *Provided*, That there is not more than 5 grams of fissile material in any cubic foot within the package

§ 71.10 Limited exemption for shipment of type B quantities of radioactive material.

A person delivering a type B quantity of radioactive material, as defined in § 71.4(q), to a carrier for transport in accordance with the provisions of a special permit, which has been issued by the Department of Transportation and is in effect on June 30, 1973, is exempt from the requirements in this part with respect to such shipments. The exemption granted by this section shall terminate on December 31, 1973, or on the date on which the DOT special permit expires, whichever is later, except as to activities described both in the special permit and in an application for a license which the person has, prior to the termination date of the exemption, filed with the Commission. If the person has filed such an application, the exemption granted by this section shall continue until the application has been finally determined by the Commission.

GENERAL LICENSES**

This applies to light water and does not apply to heavy water.

This applies to light hydrogen and does not apply to heavy hydrogen (i.e., deuterium or tritium).

**Added 38 FR 10437

† Amended 38 FR 16347

§ 71.11 General license for shipment of licensed material.

A general license is hereby issued, to persons holding specific licenses issued pursuant to this chapter, to deliver licensed material to a carrier for transport, without complying with the package standards of Subpart C of this part, when either:

(a) The material is shipped as a Fissile Class III shipment with the following limitations on its contents:

(1) No single package contains more than a type A quantity of radioactive material, as defined in § 71.4(q); and

(2) The fissile material contents of the shipment do not exceed:

(i) 500 grams of uranium-235; or
(ii) 300 grams total of uranium-233, plutonium-238, plutonium-239, and plutonium-241; or

(iii) Any combination of uranium-233, uranium-235, and plutonium in such quantities that the sum of the ratios of the quantity of each of them to the quantity specified in subdivisions (i) and (ii) of this subparagraph does not exceed unity; or

(iv) 2500 grams of plutonium-238, plutonium-239, and plutonium-241 encapsulated as plutonium-beryllium neutron sources, with no one package containing in excess of 400 grams of plutonium-238, plutonium-239, and plutonium-241; or

(b) The material is shipped as Fissile Class II packages with the following limitations on the contents of each package:

(1) No single package contains more than a type A quantity of radioactive material, as defined in § 71.4(q); and

(2) No package contains fissile material in excess of the amounts specified in the following table, and each package is labeled with the corresponding transport index:

Maximum quantity of fissile material in a single package				Corresponding transport index
U-235 (grams)	U-233 (grams)	Plutonium (grams)	Plutonium as Pu-Be neutron sources (grams)	
55-40	27-30	23-25	320-400	10
30-35	24-27	21-23	240-320	8
25-30	21-24	19-21	160-240	6

*Redesignated 38 FR 10437

20-25	18-21	17-19	80-160	4
15-20	15-18	15-17	15-80	2

NOTE: Combinations of fissile materials are authorized. For combinations of fissile materials, the transport index is the sum of the individual corresponding transport indices. The total transport index shall not exceed 10.

§ 71.12 General license for shipment in DOT specification containers, in packages approved for use by another person, and in packages approved by a foreign national competent authority.

A general license is hereby issued to persons holding a general or specific license issued pursuant to this chapter, to deliver licensed material to a carrier for transport, provided the licensee has a quality assurance program, whose description has been submitted to and approved by the Commission as satisfying the provisions of § 71.81.

(a) In a specification container for fissile material as specified in § 173.396 (b) or (c) or for a type B quantity of radioactive material as specified in § 173.394(b) or § 173.395(b), or for a large quantity of radioactive material as specified in § 173.394(c) or § 173.395(c) of the regulations of the Department of Transportation, 49 CFR part 173, or

(b) In a package for which a license certificate of compliance or other approval has been issued by the Commission's Director of Nuclear Material Safety and Safeguards or the Atomic Energy Commission, provided that

(1) The person using a package pursuant to the general license provided by this paragraph

(i) Has a copy of the specific license, certificate of compliance, or other approval authorizing use of the package and all documents referred to in the license, certificate, or other approval, as applicable.

(ii) Complies with the terms and conditions of the license, certificate, or other approval, as applicable, and the applicable requirements of this part; and

(iii) Prior to first use of the package submits in writing to the Director of Nuclear Material Safety and Safeguards or the Atomic Energy Commission, his name and license number, the name and license or certificate number of the person to whom the package approval has been issued, and the package identification number specified in the package approval.

(2) The package approval authorizes use of the package under general license provided in this paragraph.

(c) In a package which meets the pertinent requirements in the 1967 regulations of the International Atomic Energy Agency and the use of which has been approved in a foreign national competent

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authority certificate which has been revalidated by the Department of Transportation. *Provided*, That the person using a package pursuant to the general license provided by this paragraph:

(1) Has and complies with the applicable certificate, the revalidation, and the documents referenced in the certificate relative to the use and maintenance of the packaging, and the actions to be taken prior to shipment; and

(2) Complies with the applicable requirements of this part, and the Department of Transportation regulations in 49 CFR part 173, 14 CFR part 103, and 46 CFR part 146.

§ 71.13 Communications.

All communications concerning the regulations in this part should be addressed to the Nuclear Regulatory Commission, Washington, D.C. 20555, Attention: Director of Nuclear Material Safety and Safeguards, or may be delivered in person at the Commission's offices at 1717 H Street NW., Washington, D.C. or at 7920 Norfolk Avenue, Bethesda, Maryland.

*§ 71.14 Interpretations.

Except as specifically authorized by the Commission in writing, no interpretation of the meaning of the regulations in this part by an officer or employee of the Commission other than a written interpretation by the General Counsel will be recognized to be binding on the Commission.

*§ 71.15 Additional requirements.

The Commission may by rule, regulation, or order impose upon any licensee such requirements, in addition to those established in this part, as it deems necessary or appropriate to protect health or to minimize danger to life or property.

***§ 71.16 Amendment of existing licenses.

(a) Licenses issued pursuant to this part and in effect on October 4, 1968, which authorize Fissile Class II packages are hereby amended by increasing the minimum number of units specified for each Fissile Class II package by a factor of 1.25. The new number, shall be rounded up to the first decimal. In addition, the term "radiation units" is changed to "transport index" wherever

used in the license.

(b) The reference to § 71.7(b) in licenses issued pursuant to this part prior to March 26, 1972,** is changed to § 71.9(b).

(c) The reference to § 71.9(b) in licenses issued pursuant to this part prior to June 30, 1973, is changed to 71.12(b).

Subpart B—License Applications

§ 71.21 Contents of application.

An application for a specific license under this part may be submitted as an application for a license or license amendment under this chapter and shall include, for each proposed packaging design and method of transport, the following information in addition to any otherwise required:

(a) A package description as required by § 71.22;

(b) A package evaluation as required by § 71.23;

(c) An identification of the proposed program of quality assurance as required by § 71.24;

(d) In the case of fissile material, an identification of the proposed fissile class.

§ 71.22 Package description.

The application shall include a description of the proposed package in sufficient detail to identify the package accurately and to provide a sufficient basis for evaluation of the packaging. The description should include:

- (a) With respect to the packaging:
 - (1) Gross weight;
 - (2) Model number;
 - (3) Specific materials of construction, weights, dimensions, and fabrication methods of:
 - (i) Receptacles, identifying the one which is considered to be the containment vessel;
 - (ii) Materials specifically used as nonfissile neutron absorbers or moderators;
 - (iii) Internal and external structures supporting or protecting receptacles;
 - (iv) Valves, sampling ports, lifting devices, and tie-down devices;
 - (v) Structural and mechanical means for the transfer and dissipation of heat; and
 - (4) Identification and volumes of

any coolants and of receptacles containing coolant.

(b) With respect to the contents of the package:

- (1) Identification and maximum radioactivity of radioactive constituents;
- (2) Identification and maximum quantities of fissile constituents;
- (3) Chemical and physical form;
- (4) Extent of reflection, the amount and identity of non-fissile neutron absorbers in the fissile constituents, and the atomic ratio of moderator to fissile constituents;
- (5) Maximum weight; and
- (6) Maximum amount of decay heat

§ 71.23 Package evaluation.

The applicant shall:

(a) Demonstrate that the package satisfies the standards specified in Subpart C;

(b) For a Fissile Class II package, ascertain and specify the number of similar packages which may be transported together in accordance with § 71.39; and

(c) For a Fissile Class III shipment, describe any proposed special controls and precautions to be exercised during transport, loading, unloading, and handling, and in the event of accident or delay.

*§ 71.24 Quality assurance.

(a) The applicant shall identify his approved quality assurance program to be applied to the design, fabrication, assembly, testing, maintenance, repair, modification, and use of the proposed packaging.

(b) The applicant shall identify any established codes and standards proposed for use in package design, fabrication, assembly, testing, maintenance, and use. In the absence of such codes and standards, the applicant shall describe the basis and rationale used to formulate the package quality assurance program.

(c) The applicant shall identify any specific provisions to be contained in his quality assurance program which are applicable to the particular package design under consideration.

§ 71.25 Additional information.

The Commission may at any time require further information in order to enable it to determine whether a license, certificate of compliance, or other approval should be granted, denied, modified, suspended, or revoked.

Subpart C—Package Standards

§ 71.31 General standards for all packaging.

(a) Packaging shall be of such materials and construction that there

*Redesignated by FR 10437.

***Amended 37 FR 3915

**Effective date of this amendment.

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will be no significant chemical, galvanic, or other reaction among the packaging components, or between the packaging components and the package contents.

(b) Packaging shall be equipped with a positive closure which will prevent inadvertent opening.

(c) Lifting devices:

(1) If there is a system of lifting devices which is a structural part of the package, the system shall be capable of supporting three times the weight of the loaded package without generating stress in any material of the packaging in excess of its yield strength.

(2) If there is a system of lifting devices which is a structural part only of the lid, the system shall be capable of supporting three times the weight of the lid and any attachments without generating stress in any material of the lid in excess of its yield strength.

(3) If there is a structural part of the package which could be employed to lift the package and which does not comply with subparagraph (1) of this paragraph, the part shall be securely covered or locked during transport in such a manner as to prevent its use for that purpose.

(4) Each lifting device which is a structural part of the package shall be so designed that failure of the device under excessive load would not impair the containment or shielding properties of the package.

(d) Tie-down devices

(1) If there is a system of tie-down devices which is a structural part of the package, the system shall be capable of withstanding, without generating stress in any material of the package in excess of its yield strength, a static force applied to the center of gravity of the package having a vertical component of two times the weight of the package with its contents, a horizontal component along the direction in which the vehicle travels of 10 times the weight of the package with its contents, and a horizontal component in the transverse direction of 5 times the weight of the package with its contents.

(2) If there is a structural part of the package which could be employed to tie the package down and which does not comply with subparagraph (1) of this paragraph, the part shall be securely covered or locked during transport in such a manner as to prevent its use for that purpose.

(3) Each tie-down device which is a structural part of the package shall be so designed that failure of the device under excessive load would not impair the ability of the package to meet other requirements of this subpart.

§ 71.33 Structural standards for type B and large quantity packaging.

Packaging used to ship a type B or a large quantity of radioactive material, as defined in § 71.4 (q) and (r), shall be designed and constructed in accordance with the structural standards of this section.

Standards different from those specified in this section may be approved by the Commission if the controls proposed to be exercised by the shipper are demonstrated to be adequate to assure the safety of the shipment.

(a) *Load resistance.* Regarded as a simple beam supported at its ends, on any major axis, packaging shall be capable of withstanding a static load, normal to and uniformly distributed along its length, equal to 5 times its fully loaded weight, without generating stress in any material of the packaging in excess of its yield strength.

(b) *External pressure.* Packaging shall be adequate to assure that the containment vessel will suffer no loss of contents if subjected to an external pressure of 25 pounds per square inch gauge.

§ 71.33 Criticality standards for fissile material packages.

(a) A package used for the shipment of fissile material shall be so designed and constructed and its contents so limited that it would be subcritical if it is assumed that water leaks into the containment vessel, and:

(1) Water moderation of the contents occurs to the most reactive credible extent consistent with the chemical and physical form of the contents; and

(2) The containment vessel is fully reflected on all sides by water.

(b) A package used for the shipment of fissile material shall be so designed and constructed and its contents so limited that it would be subcritical if it is assumed that any contents of the package which are liquid during normal transport leak out of the containment vessel, and that the fissile material is then:

(1) In the most reactive credible configuration consistent with the chemical and physical form of the material;

(2) Moderated by water outside of the containment vessel to the most reactive credible extent; and

(3) Fully reflected on all sides by water.

(c) The Commission may approve exceptions to the requirements of this section where the containment vessel incorporates special design features which would preclude leakage of liquids in

spite of any single packaging error and appropriate measures are taken before each shipment to verify the leak tightness of each containment vessel.

§ 71.34 Evaluation of a single package.

(a) The effect of the transport environment on the safety of any single package of radioactive material shall be evaluated as follows:

(1) The ability of a package to withstand conditions likely to occur in normal transport shall be assessed by subjecting a sample package or scale model, by test or other assessment, to the normal conditions of transport as specified in § 71.35; and

(2) The effect on a package of conditions likely to occur in an accident shall be assessed by subjecting a sample package or scale model, by test or other assessment, to the hypothetical accident conditions as specified in § 71.36.

(b) Taking into account controls to be exercised by the shipper, the Commission may permit the shipment to be evaluated together with or without the transporting vehicle, for the purpose of one or more tests.

(c) Normal conditions of transport and hypothetical accident conditions different from those specified in § 71.35 and § 71.36 may be approved by the Commission if the controls proposed to be exercised by the shipper are demonstrated to be adequate to assure the safety of the shipment.

§ 71.35 Standards for normal conditions of transport for a single package.

(a) A package used for the shipment of fissile material or more than a type A quantity of radioactive material, as defined in § 71.4 (q), shall be so designed and constructed and its contents so limited that under the normal conditions of transport specified in appendix A of this part:

(1) There will be no release of radioactive material from the containment vessel;

(2) The effectiveness of the packaging will not be substantially reduced;

(3) There will be no mixture of gases or vapors in the package which could, through any credible increase of pressure or an explosion, significantly reduce the effectiveness of the package;

(4) Radioactive contamination of the liquid or gaseous primary coolant will not exceed 10^{-7} curies of activity of Group I radionuclides per milliliter, 5×10^{-6} curies of activity of Group II ra-

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dionuclides per milliliter, 3×10^{-4} curies of activity of Group III and Group IV radionuclides per milliliter; and

(5) There will be no loss of coolant.

(b) A package used for the shipment of fissile material shall be so designed and constructed and its contents so limited that under the normal conditions of transport specified in Appendix A of this part:

(1) The package will be subcritical;

(2) The geometric form of the package contents would not be substantially altered;

(3) There will be no leakage of water into the containment vessel. This requirement need not be met if, in the evaluation of undamaged packages under § 71.38(a), § 71.39(a)(1), or § 71.40(a), it has been assumed that moderation is present to such an extent as to cause maximum reactivity consistent with the chemical and physical form of the material; and

(4) There will be no substantial reduction in the effectiveness of the packaging, including:

(i) Reduction by more than 5 percent in the total effective volume of the packaging on which nuclear safety is assessed;

(ii) Reduction by more than 5 percent in the effective spacing on which nuclear safety is assessed, between the center of the containment vessel and the outer surface of the packaging; or

(iii) Occurrence of any aperture in the outer surface of the packaging large enough to permit the entry of a 4-inch cube.

(c) A package used for the shipment of more than a type A quantity of radioactive material as defined in § 71.4(q), shall be so designed and constructed and its contents so limited that under the normal conditions of transport specified in appendix A of this part, the containment vessel would not be vented directly to the atmosphere.

§ 71.36 Standards for hypothetical accident conditions for a single package.

(a) A package used for the shipment of more than a type A quantity of radioactive material, as defined in § 71.4(q), shall be so designed and constructed and its contents so limited that if subjected to the hypothetical accident conditions specified in appendix B of this part as the free drop, puncture, thermal, and water immersion conditions in the sequence listed in appendix B, it will meet the following conditions:

(1) The reduction of shielding would not be sufficient to increase the external radiation dose rate to more than 1,000 millirems per hour at 3 feet from the external surface of the package.

(2) No radioactive material would be released from the package except for gases and contaminated coolant containing total radioactivity exceeding neither:

(i) 0.1 percent of the total radioactivity of the package contents; nor

(ii) 0.01 curie of Group I radionuclides, 0.5 curie of Group II radionuclides, 10 curies of Group III radionuclides, 10 curies of Group IV radionuclides, and 1,000 curies of inert gases irrespective of transport group.

A package need not satisfy the requirements of this paragraph if it contains only low specific activity materials, as defined in § 71.4(g), and is transported on a motor vehicle, railroad car, aircraft, inland water craft, or hold or deck of a seagoing vessel assigned for the sole use of the licensee.

(b) A package used for the shipment of fissile material shall be so designed and constructed and its contents so limited that if subjected to the hypothetical accident conditions specified in Appendix B of this part as the Free Drop, Puncture, Thermal, and Water Immersion conditions, in the sequence listed in Appendix B, the package would be subcritical. In determining whether this standard is satisfied, it shall be assumed that:

(1) The fissile material is in the most reactive credible configuration consistent with the damaged condition of the package and the chemical and physical form of the contents;

(2) Water moderation occurs to the most reactive credible extent consistent with the damaged condition of the package and the chemical and physical form of the contents; and

(3) There is reflection by water on all sides and as close as is consistent with the damaged condition of the package.

§ 71.37 Evaluation of an array of packages of fissile material.

(a) The effect of the transport environment on the nuclear safety of an array of packages of fissile material shall be evaluated by subjecting a sample package or a scale model, by test or other assessment, to the hypothetical accident conditions specified in § 71.38, § 71.39, or § 71.40 for the proposed fissile class, and by assuming that each package in the array is damaged to the same extent as the sample package or scale model. In this case of a Fissile

Class III shipment, the Commission may, taking into account controls to be exercised by the shipper, permit the shipment to be evaluated as a whole rather than as individual packages, and either with or without the transporting vehicle, for the purpose of one or more tests.

(b) In determining whether the standards of §§ 71.38(b), 71.39(a)(2), and 71.40(b) are satisfied, it shall be assumed that:

(1) The fissile material is in the most reactive credible configuration consistent with the damaged condition of the package, the chemical and physical form of the contents, and controls exercised over the number of packages to be transported together; and

(2) Water moderation occurs to the most reactive credible extent consistent with the damaged condition of the package and the chemical and physical form of the contents.

§ 71.38 Specific standards for a Fissile Class I package.

A Fissile Class I package shall be so designed and constructed and its contents so limited that:

(a) Any number of such undamaged packages would be subcritical in any arrangement, and with optimum interspersed hydrogenous moderation unless there is a greater amount of interspersed moderation in the packaging, in which case that greater amount may be considered; and

(b) Two hundred fifty such packages would be subcritical in any arrangement, if each package were subjected to the hypothetical accident conditions specified in Appendix B of this part as the Free Drop, Thermal, and Water Immersion conditions, in the sequence listed in Appendix B, with close reflection by water on all sides of the array and with optimum interspersed hydrogenous moderation unless there is a greater amount of interspersed moderation in the packaging in which case that greater amount may be considered. The condition of the package shall be assumed to be as described in § 71.37.

§ 71.39 Specific standards for a Fissile Class II package.

(a) A Fissile Class II package shall be so designed and constructed and its contents so limited, and the number of such packages which may be transported together so limited, that:

(1) Five times that number of such undamaged packages would be subcritical in any arrangement if closely reflected by water; and

(2) Twice that number of such

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packages would be subcritical in any arrangement if each package were subjected to the hypothetical accident conditions specified in Appendix B of this part as the Free Drop, Thermal, and Water Immersion conditions, in the sequence listed in Appendix B, with close reflection by water on all sides of the array and with optimum interspersed hydrogenous moderation unless there is a greater amount of interspersed moderation in the packaging, in which case that greater amount may be considered. The condition of the package shall be assumed to be as described in § 71.37.

(b) The transport index for each Fissile Class II package is calculated by dividing the number 50 by the number of such Fissile Class II packages which may be transported together as determined under the limitations of paragraph (a) of this section. The calculated number shall be rounded up to the first decimal place.

§ 71.40 Specific standards for a Fissile Class III shipment.

A package for Fissile Class III shipment shall be so designed and constructed and its contents so limited, and the number of packages in a Fissile Class III shipment shall be so limited, that:

(a) The undamaged shipment would be subcritical with an identical shipment in contact with it and with the two shipments closely reflected on all sides by water; and

(b) The shipment would be subcritical if each package were subjected to the hypothetical accident conditions specified in Appendix B of this part as the Free Drop, Thermal, and Water Immersion conditions, in the sequence listed in Appendix B, with close reflection by water on all sides of the array and with the packages in the most reactive arrangement and with the most reactive degree of interspersed hydrogenous moderation which would be credible considering the controls to be exercised over the shipment. The condition of the package shall be assumed to be as described in § 71.37. Hypothetical accident conditions different from those specified, in this paragraph may be approved by the Commission if the controls proposed to be exercised by the shipper are demonstrated to be adequate to assure the safety of the shipment.

§ 71.41 Previously constructed packages for irradiated solid nuclear fuel.

(a) Notwithstanding any other provisions of this subpart, a package, the use of which has been authorized by the Atomic Energy Commission for the transport of irradiated solid nuclear fuel on or after September 23, 1961, and

which has been completely constructed prior to January 1, 1967, shall be deemed to comply with the package standards of this subpart for that purpose, except as otherwise provided in paragraph (b).

(b) The holder (licensee) of the specific approval providing the authority specified in paragraph (a) shall, within 6 months after October 18, 1977, file a consolidated application for a superseding approval for the use of such packages, demonstrating that the packages satisfy the package standards of this subpart. If the licensee fails to submit such an application, the provisions of paragraph (a) and the authority granted by the approval to deliver the material to a carrier for transport in such packages shall expire at the end of that 6 month period. The Commission may issue a new approval superseding the existing approval, may confirm the existing approval with or without modification, or may deny the application in whole or in part and terminate the existing approval in whole or in part. If modification of the design of a package being used under the authority of this section in effect prior to October 18, 1977, is proposed by a licensee in his application for a superseding approval in accordance with this paragraph, the licensee shall designate in his application the time period needed to modify the package(s) after approval by the Commission.

§ 71.42 Special requirements for plutonium shipments after June 17, 1978.

(a) Notwithstanding the exemption in § 71.9, plutonium in excess of twenty (20) curies per package shall be shipped as a solid.

(b) Plutonium in excess of twenty (20) curies per package shall be packaged in a separate inner container placed within outer packaging that meets the requirements of Subpart C for packaging of material in normal form. The separate inner container shall not release plutonium when the entire package is subjected to the normal and accident test conditions specified in Appendices A and B. Solid plutonium in the following forms is exempt from the requirements of this paragraph:

- (1) Reactor fuel elements;
- (2) Metal or metal alloy; or
- (3) Other plutonium bearing solids that the Commission determines should be exempt from the requirements of this section.

(c) Authority in licenses issued pursuant to this part for delivery of plutonium to a carrier for transport under conditions which do not meet the limitations of paragraphs (a) and (b) of this section shall expire on June 17, 1978.

Subpart D—Operating Procedures

§ 71.51 Establishment and maintenance of a quality assurance program.

(a) The licensee shall establish, maintain and execute a quality assurance program satisfying each of the applicable criteria specified in Appendix E, "Quality Assurance Criteria for Shipping Packages for Radioactive Material," and satisfying any specific provisions which are applicable to the licensee's activities including procurement of packaging. The description of the quality assurance program shall include a discussion of which requirements of Appendix E are applicable and how they will be satisfied. A description of that program shall be filed, in accordance with this section, by January 1, 1979 with the Director, Office of Nuclear Material Safety and Safeguards, Nuclear Regulatory Commission, Washington, D.C. 20555. If a person has filed such a description, the continued use of his existing quality assurance program is authorized until the acceptability of the program has been finally determined by the Commission.

(b) The provisions of this paragraph deal with packages which have been approved for use in accordance with this part prior to January 1, 1979 and which have been designed in accordance with the provisions of this part in effect at the time of package approval. Notwithstanding the provisions of paragraph (a) of this section, such packages shall be deemed to have been designed in accordance with a quality assurance program which satisfies the provisions of paragraph (a) of this section.

(c) The provisions of this paragraph deal with packages which have been approved for use in accordance with this part prior to January 1, 1979: (1) at least partially fabricated prior to that date, and which have been fabricated in accordance with the provisions of this part in effect at the time of package approval. Notwithstanding the provisions of paragraph (a) of this section, such packages shall be deemed to have been fabricated and assembled in accordance with a quality assurance program which satisfies the provisions of paragraph (a) of this section.

(d) A Commission-approved quality assurance program which satisfies the applicable criteria of Appendix E of Part 60, of this chapter and which is established, maintained, and executed with regard to transport packages shall be deemed to satisfy the requirements of paragraph (a) of this section.

§ 71.52 Assumptions as to unknown properties.

When the isotopic abundance, mass,

¹The pertinent requirements of Appendix E should be applied in a graded approach, i.e., applied to an extent consistent with their importance to safety as described in section 2 of Appendix E.

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concentration, degree of irradiation, degree of moderation, or other pertinent property of fissile material in any package is not known, the licensee shall package the fissile material as if the unknown properties have such credible values as will cause the maximum nuclear reactivity.

§ 71.53 Preliminary determinations.

(a) Prior to the first use of any packaging for the shipment of licensed materials, the licensee shall ascertain that there are no cracks, pinholes, uncontrolled voids or other defects which could significantly reduce the effectiveness of the packaging.

(b) Prior to the first use of any packaging for the shipment of licensed materials, where the maximum normal operating pressure will exceed 5 pounds per square inch gauge, the licensee shall test the containment vessel to assure that it will not leak at an internal pressure 50 percent higher than the maximum normal operating pressure.

(c) Packaging shall be conspicuously and durably marked with its model number. Prior to applying the model number, the licensee shall determine that the packaging has been fabricated in accordance with the design approved by the Commission.

§ 71.54 Routine determinations.

Prior to each use of a package for shipment of licensed material the licensee shall ascertain that the package with its contents satisfies the applicable requirements of Subpart C of this part and of the license, including determinations that:

(a) The packaging has not been significantly damaged;

(b) Any moderators and nonfissile neutron absorbers, if required, are present and are as authorized by the Commission;

(c) The closure of the package and any sealing gaskets are present and are free from defects;

(d) Any valve through which primary coolant can flow is protected against tampering;

(e) The internal gauge pressure of the package will not exceed, during the anticipated period of transport, the maximum normal operating pressure;

(f) Contamination of the primary coolant will not exceed, during the anticipated period of transport, the limits specified in § 71.35(a) (4).

(g) Space provided for contained expansion of liquid coolant or a liquid shielding medium is adequate, and the systems for the liquid coolant and the liquid shielding medium are leaktight.

(h) The pressure relief valve or valves are operable, and are in accordance with written procedures.

(i) The package has been loaded and stored in accordance with written procedures.

The provisions of this section shall not be applicable for packages authorized in the general licenses granted by § 71.6. In such cases the licensee shall ascertain that the contents of the package are as authorized in the general license.

§ 71.55 Opening instructions.

Prior to delivery of a package to a carrier for transport, the licensee shall assure that any special instruction needed to safely open the package are sent to or have been made available to the consignee.

§ 71.61 Reports.

The licensee shall report to the Director of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, within 30 days any instance in which there is substantial reduction in effectiveness of any authorized packaging during use.

§ 71.62 Records.

(a) The licensee shall maintain for a period of 2 years after its generation a record of each shipment of fissile material or of more than a type A quantity of radioactive material as defined in § 71.4(q), in a single package, showing, where applicable:

(1) Identification of the packaging by model number;

(2) Details of any significant defects in the packaging, with the means employed to repair the defects and prevent their recurrence;

(3) Volume and identification of coolant;

(4) Type and quantity of licensed material in each package, and the total quantity in each shipment;

(5) For each item of irradiated fissile material:

(i) Identification by model number;

(ii) Irradiation and decay history to the extent appropriate to demonstrate that its nuclear and thermal characteristics comply with license conditions;

(iii) Any abnormal or unusual condition relevant to radiation safety.

(6) Date of the shipment;

(7) For Fissile Class III, any special controls exercised;

(8) Name and address of the transferee;

(9) Address to which the shipment was made; and

(10) Results of the determinations required by § 71.54.

(b) The licensee shall make available to the Commission for inspection, upon reasonable notice, all records required by this part.

(c) The licensee shall maintain, during the life of the packaging to which they pertain, sufficient quality assurance records to furnish documentary evidence of the quality of packaging components, which have safety significance, and of services affecting such quality, including records of the results of the determinations required by § 71.54, and of monitoring, inspection and auditing of work performance during the design, fabrication, assembly, testing, modification, maintenance, and repair of the packaging.

§ 71.63 Inspection and tests.

(a) The licensee shall permit the Commission at all reasonable times to inspect the licensed material, packaging, and premises and facilities in which the licensed material or packaging are used, produced, tested, stored or shipped.

(b) The licensee shall perform and permit the Commission to perform, such tests as the Commission deems necessary or appropriate for the administration of the regulations in this chapter.

(c) The licensee shall notify the Director of Inspection and Enforcement, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, at least 45 days prior to fabrication of a package to be used for the shipment in that single package of radioactive material having a decay heat load in excess of 8 kW or with an operating pressure in excess of 75 psig.

§ 71.64 Violations.

An injunction or other court order may be obtained prohibiting any violation of any provision of the Atomic Energy Act of 1954, as amended, or Title II of the Energy Reorganization Act of 1974, or any regulation or order issued thereunder. A court order may be obtained for the payment of a civil penalty imposed pursuant to section 234 of the Act for violation of section 53, 57, 62, 63, 81, 82, 101, 103, 104, 107, or 109 of the Act, or section 206 of the Energy Reorganization Act of 1974, or any rule, regulation, or order issued thereunder, or any term, condition, or limitation of any license issued thereunder, or for any

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violation for which a license may be revoked under section 186 of the Act. Any person who willfully violates any provision of the Act or any regulation or order issued thereunder may be guilty of a crime and, upon conviction may be punished by fine or imprisonment or both, as provided by law.

APPENDICES

APPENDIX A—NORMAL CONDITIONS OF TRANSPORT

Each of the following normal conditions of transport is to be applied separately to determine its effect on a package:

1. **Heat**—Direct sunlight in an ambient temperature of 130° F. in still air.
2. **Cold**—An ambient temperature of -40° F. in still air and shade.
3. **Pressure**—Atmospheric pressure of 0.5 times standard atmospheric pressure.
4. **Vibration**—Vibration normally incident to transport.
5. **Water Spray**—A water spray sufficiently heavy to keep the entire exposed surface of the package except the bottom continuously wet during a period 30 minutes.
6. **Free Drop**—Between 1-1/2 and 2-1/2 hours after the conclusion of the water spray test, a free drop through the distance specified below onto a flat essentially unyielding horizontal surface, striking the surface in a position for which maximum damage is expected.

FREE FALL DISTANCE

Package weight (pounds)	Distance (feet)
Less than 10,000.....	4
10,000 to 20,000.....	3
20,000 to 30,000.....	2
More than 30,000.....	1

7. **Carrier Drop**—A free drop onto each corner of the package in succession, or in the case of a cylindrical package onto each quarter of each rim, from a height of 1 foot onto a flat essentially unyielding horizontal surface. This test applies only to packages which are constructed primarily of wood or fiberboard, and do not exceed 110 pounds gross weight, and to all Finite Class II packagings.

8. **Puncture**—Impact of the hemispherical end of a vertical steel cylinder 1-1/8 inches in diameter and weighing 13 pounds, dropped from a height of 40 inches onto the exposed surface of the package which is expected to be most vulnerable to puncture. The long axis of the cylinder shall be perpendicular to the package surface.

9. **Compression**—For packages not exceeding 10,000 pounds in weight, a compressive load equal to either 5 times the weight of the package or 2 pounds per square inch multiplied by the maximum horizontal cross section of the package, whichever is greater. The load shall be applied during a period of 24 hours, uniformly against the top and bottom of the package in the position in which the package would normally be transported.

APPENDIX B—HYPOTHETICAL ACCIDENT CONDITIONS

The following hypothetical accident conditions are to be applied sequentially, in the order indicated, to determine their cumulative effect on a package or array of packages:

1. **Free Drop**—A free drop through a distance of 30 feet onto a flat essentially unyielding horizontal surface, striking the surface in a position for which maximum damage is expected.

2. **Puncture**—A free drop through a distance of 40 inches, striking, in a position for which maximum damage is expected, the top end of a vertical cylindrical mild steel bar mounted on an essentially unyielding horizontal surface. The bar shall be 6 inches in diameter, with the top horizontal and its edge rounded to a radius of not more than one-quarter inch, and of such a length as to cause maximum damage in the package, but not less than 8 inches long. The long axis of the bar shall be perpendicular to the unyielding horizontal surface.

3. **Thermal**—Exposure to a thermal test in which the heat input to the package is not less than that which would result from exposure of the whole package to a radiation environment of 1,475° F. for 30 minutes with an emissivity coefficient of 0.9, assuming the surfaces of the package have an absorption coefficient of 0.8. The package shall not be cooled artificially until 3 hours after the test period unless it can be shown that the temperature on the inside of the package has begun to fall in less than 3 hours.

4. **Water Immersion** (for Class I material packages only)—Immersion in water to the extent that all portions of the package to be tested are under at least 3 feet of water for a period of not less than 4 hours.

NOTE—The reporting and record keeping requirements contained in this part have been approved by the General Accounting Office under B-190226 (20026).

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APPENDIX B—TRANSPORT GROUPING OF RADIONUCLIDES

Element*	Radionuclide***	Group
Actinium (89).....	Ac 227.....	I
Americium (95).....	Am 241.....	I
Antimony (51).....	Sb 122.....	IV
	Sb 124.....	III
	Sb 125.....	III
Argon (18).....	Ar-37.....	V
	Ar-41.....	V
	Ar-41 (uncum. pressed)**	V
Arsenic (33).....	As 73.....	IV
	As 74.....	IV
	As 76.....	IV
	As 77.....	IV
Astatine (85).....	At 211.....	III
Barium (56).....	Ba 131.....	IV
	Ba 140.....	II
	Ba 140.....	III
Berkelium (97).....	Bk 249.....	V
Beryllium (4).....	Be 7.....	IV
Bismuth (83).....	Bi 206.....	IV
	Bi 207.....	III
	Bi 210.....	II
	Bi 212.....	III
Bromine (35).....	Br 82.....	IV
Cadmium (48).....	Cd 109.....	IV
	Cd 115 m.....	III
	Cd 115.....	IV
Calcium (20).....	Ca 45.....	IV
	Ca 47.....	IV
Californium (98).....	Cf 249.....	I
	Cf 250.....	I
	Cf 252.....	I
Carbon (6).....	C 14.....	IV
Cerium (58).....	Ce 141.....	IV
	Ce 143.....	IV
	Ce 144.....	III
Cesium (55).....	Cs 131.....	IV
	Cs 134 m.....	III
	Cs 134.....	III
	Cs 135.....	IV
	Cs 136.....	IV
	Cs 137.....	III
Chlorine (17).....	Cl 36.....	III
	Cl 38.....	IV
Chromium (24).....	Cr 51.....	IV
Coals (27).....	Co 56.....	III
	Co 57.....	IV
	Co 58 m.....	IV
	Co 58.....	IV
	Co 60.....	III
Copper (29).....	Cu 64.....	IV
Curium (96).....	Cm 242.....	I
	Cm 243.....	I
	Cm 244.....	I
	Cm 245.....	I
	Cm 246.....	I
Dysprosium (66).....	Dy 154.....	III
	Dy 165.....	IV
	Dy 166.....	IV
Erbium (68).....	Er 169.....	IV
	Er 171.....	IV
Eurprium (63).....	Eu 150.....	III
	Eu 152 m.....	IV
	Eu 152.....	III
	Eu 154.....	II
	Eu 155.....	IV
Fluorine (9).....	F 18.....	IV
Gadolinium (64).....	Gd 153.....	IV
	Gd 159.....	IV
Gallium (31).....	Ga 67.....	III
	Ga 72.....	IV
Germanium (32).....	Ge 68.....	IV
Gold (79).....	Au 193.....	III
	Au 194.....	III
	Au 195.....	III

See footnotes at end of table.

APPENDIX C—TRANSPORT GROUPING OF RADIONUCLIDES—Continued

Element*	Radionuclide***	Group
	Au 196.....	IV
	Au 198.....	IV
	Au 199.....	IV
Hafrum (72).....	Hf 181.....	IV
Holmium (67).....	Ho 166.....	IV
Hydrogen (1).....	H 3 (see tritium).....	IV
Indium (49).....	In 113 m.....	III
	In 114 m.....	III
	In 115 m.....	IV
	In 115.....	IV
Iodine (53).....	I 124.....	III
	I 125.....	III
	I 126.....	III
	I 129.....	III
	I 131.....	III
	I 132.....	IV
	I 133.....	III
	I 134.....	IV
	I 135.....	IV
Iridium (77).....	Ir 190.....	I
	Ir 192.....	III
	Ir 194.....	IV
Iron (26).....	Fe 55.....	IV
	Fe 59.....	IV
Krypton (36).....	Kr 85 m.....	III
	Kr 85 m (uncum. pressed) **	V
	Kr 85.....	III
	Kr 85 (uncum. pressed) **	V
	Kr 87.....	II
	Kr 87 (uncum. pressed) **	V
Lanthanum (57).....	La 140.....	IV
Lead (82).....	Pb 203.....	IV
	Pb 210.....	II
	Pb 212.....	II
Lutetium (71).....	Lu 172.....	III
	Lu 177.....	IV
Magnesium (12).....	Mg 28.....	III
Manganese (25).....	Mn 52.....	IV
	Mn 54.....	IV
	Mn 56.....	IV
Mercury (80).....	Hg 197 m.....	IV
	Hg 197.....	IV
	Hg 203.....	IV
Mixed fission prod- ucts MFP.....		II
Molybdenum (42).....	Mo 99.....	IV
Neodymium (60).....	Nd 147.....	IV
	Nd 149.....	IV
Neptunium (93).....	Np 237.....	I
	Np 239.....	I
Nickel (28).....	Ni 56.....	III
	Ni 59.....	IV
	Ni 63.....	IV
	Ni 65.....	IV
Niobium (41).....	Nb 93 m.....	IV
	Nb 95.....	IV
	Nb 97.....	IV
Osmium (76).....	Os 185.....	IV
	Os 191 m.....	IV
	Os 191.....	IV
	Os 193.....	IV
Palladium (46).....	Pd 103.....	IV
	Pd 109.....	IV
Phosphorus (15).....	P 32.....	IV
Platinum (78).....	Pt 191.....	IV
	Pt 193.....	IV
	Pt 193 m.....	IV
	Pt 197.....	IV
	Pt 197.....	IV
Plutonium (94).....	Pu 238 (F).....	I
	Pu 239 (F).....	I

See footnotes at end of table.

APPENDIX C—TRANSPORT GROUPING OF RADIONUCLIDES—Continued

Element*	Radionuclide***	Group
	Pu 240.....	IV
	Pu 241 (F).....	I
	Pu 242.....	I
	Pu 210.....	I
Polonium (84).....	Po 210.....	I
Potassium (19).....	K 42.....	IV
	K 43.....	III
Praseodymium (59).....	Pr 142.....	IV
	Pr 143.....	IV
Promethium (61).....	Pm 147.....	IV
	Pm 149.....	IV
Protactinium (91).....	Pa 230.....	I
	Pa 231.....	I
	Pa 233.....	II
Radium (88).....	Ra 223.....	II
	Ra 224.....	II
	Ra 226.....	I
	Ra 228.....	I
Radium (86).....	Rn 220.....	IV
	Rn 222.....	II
Rhenium (75).....	Re 187.....	IV
	Re 186.....	IV
	Re 187.....	IV
	Re 188.....	IV
	Re Natural.....	IV
Rhodium (45).....	Rh 103 m.....	IV
	Rh 105.....	IV
Rubidium (37).....	Rb 86.....	IV
	Rb 87.....	IV
	Rb Natural.....	IV
Ruthenium (44).....	Ru 97.....	IV
	Ru 101.....	IV
	Ru 101.....	IV
	Ru 101.....	III
	Ru 101.....	IV
Samarium (62).....	Sm 147.....	III
	Sm 147.....	III
	Sm 151.....	IV
	Sm 153.....	IV
Scandium (21).....	Sc 46.....	III
	Sc 47.....	IV
	Sc 48.....	IV
	Sc 48.....	IV
Selenium (34).....	Se 75.....	IV
Silicon (14).....	Si 31.....	IV
Silver (47).....	Ag 108.....	III
	Ag 110 m.....	IV
	Ag 111.....	IV
Sodium (11).....	Na 22.....	III
	Na 24.....	IV
Strontium (38).....	Sr 85 m.....	IV
	Sr 85.....	IV
	Sr 89.....	III
	Sr 90.....	II
	Sr 91.....	II
	Sr 92.....	IV
Sulphur (16).....	S 35.....	IV
Tantalum (73).....	Ta 182.....	III
Technetium (43).....	Tc 96 m.....	IV
	Tc 96.....	IV
	Tc 97 m.....	IV
	Tc 97.....	IV
	Tc 99 m.....	IV
	Tc 99.....	IV
Tellurium (52).....	Te 125 m.....	IV
	Te 127 m.....	IV
	Te 127.....	III
	Te 129 m.....	IV
	Te 129.....	IV
	Te 131 m.....	III
	Te 132.....	IV
Terbium (65).....	Tb 160.....	III
Thallium (81).....	Tl 200.....	IV
	Tl 201.....	IV
	Tl 203.....	IV
	Tl 204.....	III
Thorium (90).....	Th 227.....	II
	Th 228.....	I
	Th 230.....	I
	Th 231.....	I

See footnotes at end of table.

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APPENDIX B—KANSAS CITY RECORDING OF RADIOISOTOPES—Continued

Element	Radioisotopes***	Group
Thallium (81)	Th 204.....	II
	Th 234.....	II
	Th 238.....	III
	Th 232.....	III
	Th 230.....	III
Thulium (69)	Tm 168.....	III
	Tm 170.....	III
	Tm 171.....	IV
	Tm 183.....	IV
	Tm 187.....	IV
Tin (50)	Sn 113.....	III
	Sn 117 m.....	III
	Sn 119.....	III
	Sn 123.....	IV
	Sn 125.....	IV
Tungsten (74)	W 181.....	IV
	W 183.....	IV
	W 187.....	IV
	W 191.....	IV
	W 193.....	IV
Uranium (92)	U 230.....	I
	U 232.....	I
	U 233 (F).....	II
	U 234.....	II
	U 235 (F).....	II
Vanadium (23)	V 48.....	IV
	V 49.....	IV
	V 50.....	IV
	V 51.....	IV
	V 52.....	IV
Xenon (54)	Xe 125.....	III
	Xe 131 m.....	III
	Xe 131 m (uncom- pressed)**	V
	Xe 133.....	III
	Xe 133 (uncom- pressed)**	VI
Ytterbium (70)	Yb 173.....	IV
	Yb 175.....	IV
	Yb 177.....	IV
	Yb 179.....	IV
	Yb 181.....	IV
Zinc (30)	Zn 65.....	IV
	Zn 69 m.....	IV
	Zn 69.....	IV
	Zn 70.....	IV
	Zn 71.....	IV
Zirconium (40)	Zr 93.....	IV
	Zr 95.....	III
	Zr 97.....	IV
	Zr 98.....	IV
	Zr 99.....	IV

*Atomic number shown in parentheses.
**Uncompressed means at a pressure not exceed-
ing one atmosphere.
***Atomic weight shown after the radioisotope
symbol.
m—Metastable state.
(F) Fissile material.

APPENDIX D—TESTS FOR SPECIAL FORM LICENSED MATERIAL

1. **Free Drop**—A free drop through a distance of 30 feet onto a flat essentially unyielding horizontal surface, striking the surface in such a position as to suffer maximum damage.
2. **Penetration**—Impact of the flat circular end of a 1 inch diameter steel rod weighing 3 pounds, dropped through a distance of 40 inches. The capsule or material shall be placed on a sheet of lead, of hard-
ness number 3.5 to 4.5 on the Vickers scale, and not more than 1 inch thick, supported by a smooth essentially unyielding surface.
3. **Heating**—Heating in air to a temperature of 1,475° F and remaining at that temperature for a period of 10 minutes.
4. **Immersion**—Immersion for 24 hours in water at room temperature. The water shall be at pH 6–pH 8, with a maximum conductivity of 10 microhm/cm per centimeter.

APPENDIX E—QUALITY ASSURANCE OUTLINE FOR SPECIAL FORM LICENSED MATERIAL

Introduction.—In accordance with § 71.24, every applicant for an approval for use of a shipping package is required to describe his quality assurance program, and every licensee is required by § 71.81 to establish and maintain a quality assurance program for the design, fabrication, assembly, testing, use, and maintenance of such packaging, as defined in § 71.61(1).

This appendix establishes quality assurance requirements which apply to all activities affecting the components of the packaging which are significant to safety. These activities include designing, purchasing, fabricating, handling, shipping, storing, cleaning, assembling, inspecting, testing, operating, maintaining, repairing, and modifying.

As used in this appendix, "quality assurance" comprises all those planned and systematic actions necessary to provide adequate confidence that a system or component will perform satisfactorily in service. Quality assurance includes quality control, which comprises those quality assurance actions related to control of the physical characteristics and quality of the material or component to predetermined requirements.

1. ORGANIZATION

The licensee shall be responsible for the establishment and execution of the quality assurance program. The licensee may delegate to others, such as contractors, agents, or consultants, the work of establishing and executing the quality assurance program, or any part thereof, but shall retain responsibility therefor. The authority and duties of persons and organizations performing activities affecting the safety-related functions of structures, systems, and components shall be clearly established and delineated in writing. These activities include both the performing functions of attaining quality objectives and the quality assurance functions. The quality assurance functions are those of (a) assuring that an appropriate quality assurance program is established and effectively executed and (b) verifying, such as by checking, auditing, and inspection, that activities affecting the safety-related functions have been correctly performed. The persons and organizations performing quality assurance functions shall have sufficient authority and organizational freedom to identify quality problems; to initiate, recommend or provide solutions; and to verify implementation of solutions. Such persons and organizations performing quality assurance functions shall report to a management level such that the required authority and organizational freedom, including sufficient independence from cost and schedule when opposed to safety considerations, are provided. Because of the many variables involved, such as the number of personnel, the type of activity being performed, and the location or locations where activities are performed, the organizational structure for executing the quality assurance program may take various forms, provided that the persons and organizations assigned the quality assurance functions have the required authority and organizational freedom. Irrespective of the organizational structure, the individual(s) assigned the responsibility for assuring effective execution of any portion of the quality assurance program at any

*While the term "licensee" is used in this appendix, the quality assurance requirements are applicable to whatever design, fabrication, assembly and testing of the package is accomplished with respect to a package prior to the time a package approval is issued.

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location where activities subject to this Appendix are held; personnel shall have direct access to such level of management as may be necessary to perform this function.

C. QUALITY ASSURANCE PROGRAM

The licensee shall establish at the earliest practicable time, consistent with the schedule for accomplishing the activities, a quality assurance program which complies with the requirements of this appendix. The quality assurance program shall be documented by written procedures or instructions, and shall be carried out in accordance with those procedures throughout the period during which packaging is used. The licensee shall verify the material and components to be used by the quality assurance program and, if major organizations participating in the program, together with the designated function of those organizations. The quality assurance program shall provide control over activities affecting the quality of the identified materials and components to be used, consistent with their importance to safety and as necessary to assure conformance to the approved design of each individual package used for the shipment of radioactive material. Activities affecting quality shall be accomplished under suitably controlled conditions. Controlled conditions include the use of appropriate equipment; suitable environmental conditions for accomplishing the activity, such as adequate climatic; and assurance that all prerequisites for the given activity have been satisfied. The program shall take into account the need for control, processes, test equipment, tools and aids to attain the required quality, and the need for verification of quality by inspection and test.

The licensee shall base the requirements and procedures of his quality assurance program on the following considerations concerning the complexity and proposed use of the package and its components:

- (1) The importance of malfunction or failure of the item to safety;
- (2) The design and fabrication complexity or uniqueness of the item;
- (3) The need for special controls and surveillance over processes and equipment;
- (4) The degree to which functional complexities can be demonstrated by inspection or test; and
- (5) The quality history and degree of standardization of the item.

The program shall provide for indoctrination and training of personnel performing activities affecting quality as necessary to ensure that suitable proficiency is achieved and maintained. The licensee shall review the status and adequacy of the quality assurance program at established intervals. Management of other organizations participating in the quality assurance program shall regularly review the status and adequacy of that part of the quality assurance program which they are executing.

a. source control

Measures shall be established to assure that applicable regulatory requirements and the package design, as specified in the license, for those materials and components to which this appendix applies, are correctly translated into specifications, drawings, procedures and instructions. These measures shall include provisions to assure that appropriate quality standards are specified and included in design documents and that deviations from such standards are controlled. Measures shall be established for the selection and review for suitability of application of materials, parts, equipment, and processes that are essential to the safety-related functions of the materials, parts, and components of the packaging.

Measures shall be established for the identification and control of design interfaces and

coordination among participating design organizations. These measures shall include the establishment of written procedures among participating design organizations for the review, approval, release, distribution, and revision of documents involving design interfaces. The design control measures shall provide for verifying or checking the adequacy of design, such as by the performance of design reviews, by the use of alternate or simplified calculation methods, or by the performance of a suitable testing program. The verifying or checking process shall be performed by individuals or groups other than those who performed the original design, but who may be from the same organization. Where a test program is used to verify the adequacy of a specific design feature in lieu of other verifying or checking processes, it shall include suitable qualification testing of a prototype or sample unit under the most adverse design conditions. Design control measures shall be applied to items such as the following: critically physical radiation shielding stress, thermal, structural, and accident analysis; compatibility of materials; accountability for inventory inspection, maintenance and repair; features to facilitate decontamination; and delineation of acceptance criteria for inspections and tests.

Design changes, including field changes, shall be subject to design control measures commensurate with those applied to the original design. Changes in the conditions specified in the package approval require licensee approval.

1. PROCUREMENT DOCUMENT CONTROL

Measures shall be established to assure that applicable requirements of this part which are necessary to ensure adequate quality are suitably included or referenced in the documents for procurement of material, equipment, and services, whether purchased by the licensee or by his contractors or subcontractors. To the extent necessary, the licensee shall require contractors or subcontractors to provide a quality assurance program consistent with the pertinent provisions of this part.

a. DISTRIBUTION, PROCEDURES AND DRAWINGS

Activities affecting quality shall be prescribed by documented instructions, procedures, or drawings of a type appropriate to the circumstances and shall be accomplished in accordance with these instructions, procedures, or drawings. These shall include appropriate quantitative or qualitative acceptance criteria for determining that important activities have been satisfactorily accomplished.

b. DOCUMENT CONTROL

Measures shall be established to control the issuance of documents, such as instructions, procedures, and drawings, including design drawings, which prescribe all activities affecting quality. These measures shall assure that documents, including changes, are reviewed for adequacy and approved for release by authorized personnel and are distributed and used at the location where the prescribed activity is performed. Changes to documents shall be reviewed and approved by the same organizations that performed the original review and approval unless the relevant designates another organization.

c. CONTROL OF PURCHASED MATERIAL, EQUIPMENT, AND SERVICES

Measures shall be established to assure that purchased material, equipment, and services, whether purchased directly or through contractors and subcontractors, conform to the procurement documents. These measures shall include provisions, as appropriate, for source evaluation and selection, objective evidence of quality furnished by the contractor or subcontractor, inspection at the contractor or subcontractor source, and examination of products upon delivery. Docu-

mentary evidence that material and equipment conform to the procurement specifications shall be available prior to installation or use of such material and equipment. This documentary evidence shall be retained by or be available to the licensee and shall be sufficient to identify the specific requirements met by the purchased material and equipment. The effectiveness of the control of quality by contractors and subcontractors shall be assessed by the licensee or licensee at intervals consistent with the importance, complexity and quantity of the product or service.

d. IDENTIFICATION AND CONTROL OF MATERIAL, PARTS AND COMPONENTS

Measures shall be established for the identification and control of material, parts, and components. These measures shall assure that identification of the item is maintained by label number, part number, or other appropriate means, either on the item or on records accessible to the item, as required throughout fabrication, installation, and use of the item. These identification and control measures shall be designed to prevent the use of incorrect or defective materials, parts and components.

e. CONTROL OF SPECIAL PROCESS

Measures shall be established to assure that special processes, including welding, heat treating, and nondestructive testing, are controlled and accomplished by qualified personnel using qualified procedures in accordance with applicable laws, standards, specifications, criteria, and other special requirements.

f. INSPECTION

A program for inspection of activities affecting quality shall be established and executed by or for the organization performing the activity to verify conformance with the documented instructions, procedures, and drawings for accomplishing the activity. Such inspection shall be performed by individuals other than those who performed the activity being inspected. Examination, measurements, or tests of material or products processed shall be performed for each work operation where necessary to assure quality. If inspection of processed material or products is impossible or disadvantageous, indirect control by monitoring processing methods, equipment, and personnel shall be provided. Both inspection and process monitoring shall be provided when quality control is inadequate without both. If mandatory inspection hold points, which require witnessing or inspecting by the licensee designated representative and beyond which work shall not proceed without the consent of its designated representative, are required, the specific hold points shall be indicated in appropriate documents.

g. TEST CONTROL

A test program shall be established to assure that all testing required to demonstrate that the packaging components will perform satisfactorily is identified and performed in accordance with written test procedures which incorporate the requirements of this part and the requirements and acceptance limits contained in the package approval. The procedures shall include provisions for assuring that all prerequisites for the given test have been met, that adequate test instrumentation is available and used, and that the test is performed under suitable environmental conditions. Test results shall be documented and evaluated to assure that test requirements have been satisfied.

h. CONTROL OF MANUFACTURING AND TEST EQUIPMENT

Measures shall be established to assure

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that tools, gages, instruments, and other measuring and testing devices used in activities affecting quality are properly controlled, calibrated, and adjusted at specified times to maintain accuracy within necessary limits.

10. HANDLING, STORAGE AND CARRIER

Measures shall be established to control the handling, storage, shipping, unloading and preservation of materials and equipment to be used in packaging in accordance with instructions to prevent damage or deterioration. When necessary for particular products, special protective environments, such as inert gas atmosphere, specific moisture content levels and temperature levels shall be specified and provided.

11. INSPECTION, TEST AND OPERATING STATUS

Measures shall be established to indicate, by the use of markings such as stamps, tags, label routing cards, or other suitable means, the status of inspections and tests performed upon individual items of the packaging. These measures shall provide for the identification of items which have satisfactorily passed required inspections and tests, where necessary to preclude inadvertent re-passing of such inspections and tests.

Measures shall also be established for indicating the operating status of components of the packaging, such as tagging valves and switches, to prevent inadvertent operation.

12. NONCONFORMING MATERIALS, PARTS OR COMPONENTS

Measures shall be established to control materials, parts, or components which do not conform to requirements in order to prevent their inadvertent use or installation. These measures shall include, as appropriate, procedures for identification, documentation, segregation, disposition, and notification to affected organizations. Non-conforming items shall be reviewed and accepted, rejected, repaired or reworked in accordance with documented procedures.

13. CORRECTIVE ACTION

Measures shall be established to ensure that conditions adverse to quality, such as deficiencies, deviations, defective material and equipment, and nonconformances, are promptly identified and corrected. In the case of a significant condition adverse to quality, the measures shall ensure that the cause of the condition is determined and corrective action taken to preclude repetition. The identification of the significant condition adverse to quality, the cause of the condition, and the corrective action taken shall be documented and reported to appropriate levels of management.

14. QUALITY ASSURANCE RECORDS

Sufficient written records shall be maintained to furnish evidence of activities affecting quality. The records shall include the following: design records, records of use and the results of review, inspection, tests, audits, monitoring of work performance and materials analysis. The records shall also include closely-related data such as qualifications of personnel, procedures, and equipment. Inspection and test records shall, as a minimum, identify the inspector or data recorder, the type of observation, the results, the acceptability, and the action taken in connection with any deficiencies noted. Records shall be identifiable and retrievable. Consistent with applicable regulatory requirements, the measures shall establish requirements concerning record retention, such as duration, location, and assigned responsibility.

15. AUDITS

A comprehensive system of planned and periodic audits shall be carried out to verify compliance with all aspects of the quality

assurance program and to determine the effectiveness of the program. The audits shall be performed in accordance with the written procedures or check lists by appropriately trained personnel not having direct responsibility in the area being audited. Audit results shall be documented and reviewed by management having responsibility in the area audited. Follow-up action, including re-audit of deficient areas, shall be taken when indicated.