ORNL/TM-8061
Dist. Category UC-70

Contract No. W-7405-eng-26

CHEMICAL TECHNOLOGY DIVISION

NUCLEAR WASTE PROGRAMS
Waste Management Analysis for Nuclear Fuel Cycles
(Activity No. AR 05 10 05 K; FTP/A No. ONL-WN12)

GRAPHICAL AND TABULAR SUMMARIES OF DECAY CHARACTERISTICS FOR ONCE-THROUGH PWR, LMFBR, AND FFTF FUEL CYCLE MATERIALS

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Date Published: January 1982

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GLOSSARY

FFTF	Fast Flux Test Facility (located in Richland, Washington)
HLW	High-level waste
LMFBR	Liquid-metal fast-breeder reactor
LWR	Light-water reactor
MTIHM	Metric tons of initial heavy metal
ORIGEN2	A computer code for calculating the radionuclide composition and characteristics (radioactivity, thermal power, etc.) of nuclear materials such as spent fuel and wastes
ORMANG	A computer program that processes ORIGEN2 output to produce publication-quality graphs and tables
PWR	Pressurized-water reactor
SMW	Fuel assembly structural material (cladding) waste

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ABSTRACT

Based on the results of ORIGEN2 and a newly developed code called ORMANG, graphical and summary tabular characteristics of spent fuel, high-level waste, and fuel assembly structural material (cladding) waste are presented for a generic pressurized-water reactor (PWR), a liquid-metal fast breeder reactor (LMFBR), and the Fast Flux Test Facility (FFTF). The characteristics include radioactivity, thermal power, and toxicity (water dilution volume). Given are graphs and summary tables containing characteristic totals and the principal nuclide contributors as well as graphs comparing the three reactors for a single material and the three materials for a single reactor.

1. INTRODUCTION

The purpose of this report is to present information concerning the decay characteristics of nuclear materials from three generic types of nuclear reactors. The decay characteristics considered are radioactivity (Ci), thermal power (W), and ingestion toxicity (m^3 of water required to dilute the material to standards specified in 10 CFR 20). The nuclear reactors considered are a pressurized-water reactor (PWR), a liquid-metal fast breeder reactor (LMFBR), and the Fast-Flux Test Facility (FFTF). All are assumed to be operated on a once-through fuel cycle; i.e., the PWR is fueled with enriched uranium, and the plutonium in the LMFBR and FFTF has not been previously recycled. All of the decay characteristics presented were calculated with the ORIGEN2[1] computer code.

This report represents in a variety of ways an extension of previous work[2] concerning decay characteristics. First, this document considers the characteristics of FFTF materials not available for the

earlier report. Additionally, the toxicity of the nuclear materials, not previously reported, is included here. This report also includes, wherever appropriate, a comparison of the various materials and reactors. However, the greatest extension represented by this work is that the information is presented in graphical as well as tabular form. The graphical presentation of the information was greatly facilitated by the development of a computer program (ORMANG) that accesses the output of the ORIGEN2 computer code, locates the desired information, summarizes it, and produces graphs and listings, as seen in this report.

Section 2 provides a summary description of the ORIGEN2 reactor models that form the basis of the calculations and describes the portions of the spent fuel that are contained in the high-level waste (HLW) and the fuel assembly structural material (cladding) waste (SMW). The final section gives a brief description of the results and contains tables for locating a particular graph.

2. DESCRIPTION OF REACTOR MODELS AND NUCLEAR MATERIALS

The purpose of this section is twofold: (1) to describe the generic reactor models that form the basis of the information provided in this report and (2) to give a physical description of the nuclear materials associated with each reactor.

2.1 Description of Generic Reactor Models

The three generic reactor models used in this report have all been documented in detail in earlier reports.[3,4] As a result, only a summary description of the reactors will be given. The summary quantitative data concerning the three reactors are given in Table 1.

The generic PWR used is based on the Westinghouse design,[5] with a fuel assembly containing a 17 x 17 array of fuel pins. It is fueled with UO_2 in which the uranium has been enriched to 3.2 wt %. One-third of the core is assumed to be replaced during each annual refueling.

Table 1. Summary characteristics of the PWR, LMFBR, and FFTF

Parameter	PWR	LMFBR fuel region(s)[a]					FFTF fuel region(s)		
		CO	AB	RB	CO + AB	CO + AB + RB	Inner core	Outer core	Total
Electric power, MW(e)	1250	1145	34	71	1179	1250	0	0	0
Thermal power, MW(t)	3800	3624	107	225	3731	3956	139	223	362
Average specific power,[b] MW(t)/MTIHM	37.5	123.25	6.89	4.15	83.09	39.86	150.0	150.0	150.0
Average fuel burnup, MWd/MTIHM	33,000	101,289	5660	7250	68,280	45,267	45,000	45,000	45,000
Irradiation duration, full-power days	880	821.8	821.8	1643.6	821.8		300.0	300.0	300.0
Refueling cycle length, full-power days	293.3	273.9	273.9	273.9	273.9	273.9	100.0	100.0	100.0
Charge, kg/refueling cycle									
^{235}U	1081	16.4	10.3	18.1	26.7	44.8	5.1	7.7	12.8
Total uranium	33,778	7990	5166	9059	13,156	22,215	717	1079	1796
Fissile plutonium[c]	0	1236	0	0	1236	1236	183	362	545
Total plutonium	0	1810	0	0	1810	1810	208	411	619
Total (Th + U + Pu)	33,778	9800	5166	9059	14,966	24,025	925	1490	2415
Discharge, kg/refueling cycle									
^{235}U	267	6.7	7.5	12.6	14.2	26.8			10.3
Total uranium	32,173	7069	4970	8662	12,039	20,701			1730
Fissile plutonium[c]	210	1094	159	315	1253	1568			481
Total plutonium	308	1685	166	330	1851	2181			568
Total (Th + U + Pu)	32,481	8790	5137	8993	13,927	22,920			2298

[a] CO = core, AB = axial blanket, RB = radial blanket.

[b] Based on full power and fuel charged.

[c] $^{239}Pu + ^{241}Pu + ^{239}Np$.

The generic LMFBR is based on the Preliminary Large Breeder Reactor study.[6] This is a relatively conservative commercial power reactor design that produces 1250 MW(e) from a thermal power of 3956 MW(t). The core fuel is $(Pu,U)O_2$ containing 18.5 wt % PuO_2. The plutonium is assumed to be typical of that in spent LWR fuel and contains 68 wt % fissile isotopes. Both the axial and radial blankets are composed of depleted UO_2. The core and axial blanket fuels are contained in the same fuel elements, with the axial blanket split equally above and below the core. The entire radial blanket fuel element is composed of UO_2, and the elements have a larger diameter than the core/axial blanket elements to maximize the uranium loading in the reactor. One-third of the core/axial blanket assemblies and one-sixth of the radial blanket assemblies are replaced during each annual refueling. The burnup of the core fuel alone is slightly over 100,000 MWd/metric ton of initial heavy metal (MTIHM), but the average burnup of the total fuel discharged annually is only about 45,000 MWd/MTIHM.

The FFTF is a relatively large test reactor now operating in the Richland, Washington, area. Its function is to provide a high-energy neutron source typical of future commercial LMFBRs for irradiating material and fuel specimens. As a result of this role, the design of the FFTF is somewhat different from that of a commercial power reactor.[7,8] One primary difference is that there are numerous test positions in the core that may be empty or filled with a test specimen of some sort at any given time. An additional feature is that the reactor does not have the fertile axial and radial blankets typical of LMFBRs; it has only the plutonium-enriched core fuel. The full power of the reactor was assumed to be 362 MW(t), which does not include any contribution from the test loops. The plutonium used in the FFTF is relatively high grade (88 wt % fissile), and the $(Pu,U)O_2$ contains 25.6 wt % PuO_2. It is important to note that the plutonium used to fabricate the FFTF fuel was separated from its parent fuel about 10 years ago and thus contains a significant amount of ^{241}Am resulting from the decay of 14.4-year ^{241}Pu. The ^{241}Am will have a significant

effect on the transplutonium nuclide composition of the fuel. The fuel is expected to be irradiated for about 300 d, resulting in a burnup of about 45,000 MWd/MTIHM.

2.2 Description of Spent Fuel Assemblies

A summary physical description of the spent fuel assemblies from each of the three generic reactors is given in Table 2 (see Table 1 for the summary nuclear description). Because this description is substantially self-explanatory, only a few points will be elaborated on here. Photographs of the PWR and LMFBR fuel assemblies are given in Ref. 2.

It is necessary that the fuel elements be spaced apart in the fuel assembly to allow the coolant (water or liquid sodium) to circulate. This is accomplished in the PWR by the use of several grid spacers along the length of the fuel element. The grid spacer is basically a cross-hatched, rectangular piece of Inconel metal that holds each of the rods in a rectangular array and has small spring clips to prevent vibration. On the other hand, the fuel element spacing in the LMFBR is accomplished by wrapping stainless steel wire in a spiral fashion around the fuel element. The elements thus find themselves closely packed in a triangular geometry with the spacing determined by the thickness of the wire wrap.

Another notable difference between the PWR and the fast reactors is that the latter use a fuel channel, a hexagonal stainless steel sheet surrounding the array of fuel elements, to prevent the coolant from moving laterally into another fuel assembly. This feature is necessary in the fast reactors to ensure that each assembly receives adequate coolant, whereas in the PWR this feature is not required.

As noted previously, because the FFTF is a test reactor, it does not have a fertile axial blanket. However, in the interest of neutron economy an axial Inconel reflector has been placed above and below the core fuel in each fuel element to reflect some of the neutrons back into the core region. This metal accounts for a significant fraction of the SMW from the FFTF fuel assembly.

Table 2. Physical characteristics of PWR, LMFBR, and FFTF fuel assemblies

		LMFBR		
	PWR	Core/axial blanket	Radial blanket	FFTF
Assembly component lengths, cm				
Upper-end hardware	13	91	91	30
Gas plenum	16	191	191	107
Upper axial blanket		33		17[a]
Core or radial blanket	366	122	188	91
Lower axial blanket		33		27[a]
Lower-end hardware	11	102	102	94
Overall total	406	572	572	366
Fuel element total	385	379	379	242
Assembly shape	Square	Hexagonal	Hexagonal	Hexagonal
Assembly flats, cm	21.4	13.78	13.78	11.62
Fuel element arrangement	Square	Triangular	Triangular	Triangular
Fuel elements/assembly	264	271	91	217
Fuel element OD, cm	0.95	0.650	1.270	0.584
Fuel pellet OD, cm	0.410	0.573	1.180	0.508
Fuel element pitch, cm	1.26	0.795	1.369	0.726
Cladding thickness, cm	0.058	0.030	0.038	0.038
Channel thickness, cm		0.221	0.221	0.305
Channel height, cm		495	495	~300
Circumscribed volume/assembly, m^3	0.186	0.114	0.114	0.052
Heavy metal/assembly, kg	461.4	117.7	172.7	33.2
MO_2/assembly, kg[b]	523.4	133.4	195.9	37.6
Zircaloy/assembly, kg	108.4			
Stainless steel/assembly, kg	19.0	115.1	97.5	125.7
Inconel/assembly, kg	5.9			8.9
Assembly total weight, kg	657.9	257.7	300.3	172.2

[a] UO_2 insulator pellet and Inconel 600 reflector.

[b] $(Pu,U)O_2$ or UO_2.

Finally, the fact that the PWR has Zircaloy cladding as opposed to the stainless steel cladding of the LMFBR and FFTF has an important impact on the tritium inventory in the spent fuel. The chemical properties of the Zircaloy result in all of the tritium being contained within the fuel element (except for the small fraction of leaking elements). On the other hand, stainless steel does not have these characteristics; as a result, about 90% of the tritium produced in the fuel is expected to diffuse through the stainless steel cladding into the sodium coolant, from which it will be recovered. The tritium inventories in this document reflect this difference; i.e., the LMFBR and FFTF spent fuels contain only 10% of the tritium produced during irradiation.

2.3 Description of High-Level Waste and Structural Material Waste

The HLW and SMW are both produced as a result of chemically reprocessing spent fuel to recover the economic values (plutonium and uranium). The first part of the reprocessing sequence involves chopping the spent-fuel assembly with a heavy-duty shear, cutting the fuel elements into segments a few centimeters in length. The segments are then immersed in concentrated nitric acid to dissolve the oxide fuel matrix while leaving the fuel assembly structural materials essentially intact. At this point the volatile elements are freed, escaping from the dissolver into the off-gas treatment system. After dissolution is complete, the structural materials are removed, becoming the SMW described below. The nitric acid solution containing the dissolved spent fuel is contacted with tributyl phosphate, which removes the uranium and plutonium for separation and purification further downstream in the plant. The fission products and actinides other than uranium and plutonium constitute liquid HLW.

After its generation the liquid HLW will most likely be concentrated by evaporation, then heated to a high temperature to drive off the nitric acid and convert the dissolved fission product and actinide nitrates to oxides (i.e., calcined), and then incorporated into a monolith of glass (i.e., vitrified). The SMW may be compacted to reduce its volume.

Then it will most likely be combined with an inert solid to counteract the pyrophoric nature of the fine Zircaloy particles produced during shearing or incorporated into a concrete matrix. It should be noted that there are many alternative treatment technologies for the HLW and SMW; those mentioned above are only the most likely at present.

As noted above, the HLW contains all of what is in the spent-fuel oxide except the volatile elements and the economic values. More specifically, it is the contents of the spent fuel, decayed until the time of reprocessing, with the following species removed: 99.5% of the uranium and plutonium, 99.9% of the halogen elements (principally iodine), and 100% of the tritium, ^{14}C, and noble gases (krypton, xenon, radon). In addition, because stainless steel is corroded somewhat by the nitric acid, it is assumed that 0.69% of the LMFBR and FFTF fuel assembly structural material is in the HLW.[9]

The SMW principally comprises all of the hardware that constitutes the fuel assembly except the fuel material itself. Thus, for the PWR this is predominantly Zircaloy with some stainless steel and Inconel. For LMFBR and FFTF it is virtually all stainless steel, with some Inconel from the reflector in the case of the FFTF. In addition, it is assumed that 0.05% of the nonvolatile components of the spent-fuel oxide (i.e., the HLW plus the uranium and plutonium) are included in the SMW, a result of the shearing operation, which pinches the end of some of the cladding segments closed so that the fuel matrix is inaccessible to the nitric acid in the dissolver. It is also assumed that 30% of the tritium produced in the PWR fuel is present in the SMW as a part of the Zircaloy cladding.

The time necessary for the spent fuel to be reprocessed, relative to its discharge from the reactor, is assumed to be 160 d for the PWR and FFTF and 90 d for the LMFBR.

2.4 Comparisons and Conversions

One comparison that is often made is that of the toxicity of some material with the toxicity of uranium ore. In the recent past this has

most often been done in studies involving LWRs, which include the PWRs employed here. The basis of the comparison has been to compare one of the fuel cycle materials with the toxicity of the uranium ore mined to produce that material. If the total losses of uranium at the beginning of the fuel cycle are assumed to be 12% (10% during milling, 1% during conversion, and 1% during fabrication) and if the enrichment plant tails are assumed to be 0.25%, then 7.16 MT of uranium must be mined to produce 1.0 MTIHM of fresh fuel. This amount of uranium ore, when in equilibrium with its shorter-lived daughters (i.e., when it is most toxic), requires 1.1×10^8 m^3 of water to dilute it to the standards given in Appendix B, Table II of 10 CFR 20.[10] On other occasions, the comparison of the toxicity of uranium ore to that of a fuel cycle material is made on a volumetric basis. The volumetric toxicity of carnotite ore, virtually the only source of uranium today, is about 10^5 m^3 of water/m^3 of ore. The toxicity of pitchblende, a very-high-grade uranium ore, is about 10^8 m^3 of water/m^3 of ore.

The conversion most often of interest is that from a MTIHM basis to an electrical basis. Most often the electrical unit used is the GWy(e), although it is usually not clear whether the "GW" in this unit is based on reactor capacity or electricity actually produced by the reactor. To circumvent this problem, Table 3 contains the conversion factors on both a capacity and production basis for the PWR and LMFBR. Although these factors are meaningless for the FFTF because it does not produce electricity, they have been included in the table for the case when it is desirable to put the FFTF on an equivalent basis with other reactors. The thermal efficiency of the FFTF has been assumed to be the same as that of the LMFBR. It should be noted that values at two thermal efficiencies are given for both the LMFBR and the FFTF because it may be desirable to use a value of 40%, which is more typical of current designs, rather than the very conservative 31.6% used in the original design.

Table 3. Factors for converting MTIHM to GWy(e)

Parameter		PWR	Thermal efficiency = 31.6%		Thermal efficiency = 40%	
			LMFBR[a]	FFTF	LMFBR[a]	FFTF
MTIHM/GWy(e) of reactor capacity						
Capacity factor:	0.5	16.81	12.76	12.84	10.08	10.14
	0.6	20.17	15.31	15.40	12.09	12.17
	0.7	23.54	17.86	17.97	14.11	14.20
	0.8	26.90	20.41	20.54	16.12	16.23
	0.9	30.26	22.97	23.10	18.15	18.25
	1.0	33.62	25.52	25.67	20.16	20.28
MTIHM/GWy(e) of electricity produced		33.62	25.52	25.67	20.16	20.28

[a]For use with blended fuel or wastes. For core fuel alone, multiply factors by 0.447; for core and axial blanket, multiply factors by 0.663; for radial blanket, multiply factors by 6.24.

3. DESCRIPTION OF GRAPHICAL AND SUMMARY TABULAR FUEL CYCLE MATERIAL CHARACTERISTICS

By applying the computer codes ORIGEN2 and ORMANG to the generic reactors and fuel cycle materials described in the preceding sections, graphical and summary tabular information concerning the radioactivity, thermal power, and toxicity of the materials has been generated. This information is contained in the appendixes to this report. The first three appendixes contain information for each of the three generic reactors, with each graph or table presenting a total and the principal contributing nuclides as a function of decay time. The last two appendixes contain only graphs, which have curves for the totals for all materials for a single reactor or for a single material for all reactors (i.e., the last two appendixes compare materials or reactors).

It should be noted that the time scale on all of the graphs and tables is relative to the time at which the spent fuel is discharged from the reactor. Thus, the curves for HLW and SMW will be offset from the vertical axis by a time increment equal to the lag time between discharge and reprocessing. The time span considered in all graphs and tables is 0.1 to 10^6 years. The vertical axis is always seven logarithmic decades, with the maximum selected so that none of the curves are off scale at the top.

3.1 Description of Graphs and Tables Giving Totals and Principal Contributing Nuclides

Appendixes A-C contain the fuel cycle material characteristics in graphical and tabular form for the PWR, LMFBR, and FFTF, respectively. The information presented in the graphs consists of the total for a particular characteristic as a function of decay time (e.g., total radioactivity of spent PWR fuel) and the decay curves for the nuclides that are the principal contributors to this total. The principal contributors are determined by dividing the amount of each nuclide (in appropriate units) at a given time by the total at that time, summing this fraction over a list of times specified as input to the ORMANG

code and selecting the nuclides with the largest summation. In the present case the times used in this determination were every logarithmic decade (e.g., 0.1 year, 1 year, 10 years, etc.) over the time span 0.1 to 10^6 years inclusive. The graphs are limited such that no more than 14 principal contributors can be plotted on any single graph.

The nuclides in the summary tables are determined using the same test as that described above for the graphs. However, in the tables the first 23 contributors are included.

It should be noted that there are two general ways in which a nuclide can become a principal contributor. In the first way the nuclide is very significant at one or two of the times tested; i.e., the nuclide contributes nearly 100% to the total for a short time. In the second way a nuclide contributes a much smaller fraction to the total but does so over a much longer time span. In many of the graphs an example of the former is ^{144}Ce and an example of the latter is ^{237}Np. As a result, it is occasionally possible that a nuclide will be listed in the tabular summary but not appear on a graph because it is below scale.

Table 4 has been included to facilitate the location of the graphs and tables giving the totals and principal contributors. Given the desired reactor, fuel cycle material, and characteristic, the reader can readily determine from Table 4 the appropriate graph or table. The graphs and summary tables appear together in Appendixes A-C.

3.2 Description of Graphs Comparing Material and Reactor Totals

Appendixes D and E contain graphs comprising the totals for all fuel cycle materials from one reactor on a single graph (e.g., thermal power of spent fuel, HLW, and SMW from the FFTF on one graph) and the totals for a single fuel cycle material from all three reactors on one graph (e.g., total toxicity of HLW from the PWR, LMFBR, and FFTF on one plot), respectively. The principal contributing nuclides and summary tables are not given in these appendixes since the information is available in Appendixes A-C.

Table 4. Numbers for graphs and summary tables giving totals and principal contributing nuclides

Reactor/material in graph or table	Characteristic in graph or table		
	Radioactivity (Ci)	Thermal power (W)	Toxicity (m^3 of water)
PWR			
Spent fuel	A.1	A.4	A.7
HLW	A.2	A.5	A.8
SMW	A.3	A.6	A.9
LMFBR			
Spent core + axial blanket fuel	B.1	B.6	B.11
Spent radial blanket fuel	B.2	B.7	B.12
Spent core fuel	B.3	B.8	B.13
HLW	B.4	B.9	B.14
SMW	B.5	B.10	B.15
FFTF			
Spent fuel	C.1	C.4	C.7
HLW	C.2	C.5	C.8
SMW	C.3	C.6	C.9

Table 5 has been included to facilitate the location of the comparison of graphs in Appendixes D and E.

Table 5. Numbers for graphs giving comparisons of reactors and fuel cycle materials

Contents of one graph	Material characteristic in graph		
	Radioactivity (Ci)	Thermal power (W)	Toxicity (m^3 of water)
Totals for all fuel cycle materials from the following reactor:			
PWR	D.1	D.4	D.7
LMFBR	D.2	D.5	D.8
FFTF	D.3	D.6	D.9
Totals for all reactors from the following fuel cycle material:			
Spent fuel	E.1	E.4	E.7
HLW	E.2	E.5	E.8
SMW	E.3	E.6	E.9

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Appendix A. CHARACTERISTICS OF PWR SPENT FUEL, HIGH-LEVEL WASTE, AND STRUCTURAL MATERIAL WASTE

Appendix A.1. Radioactivity of PWR Spent Fuel, High-Level Waste, and Structural Material Waste

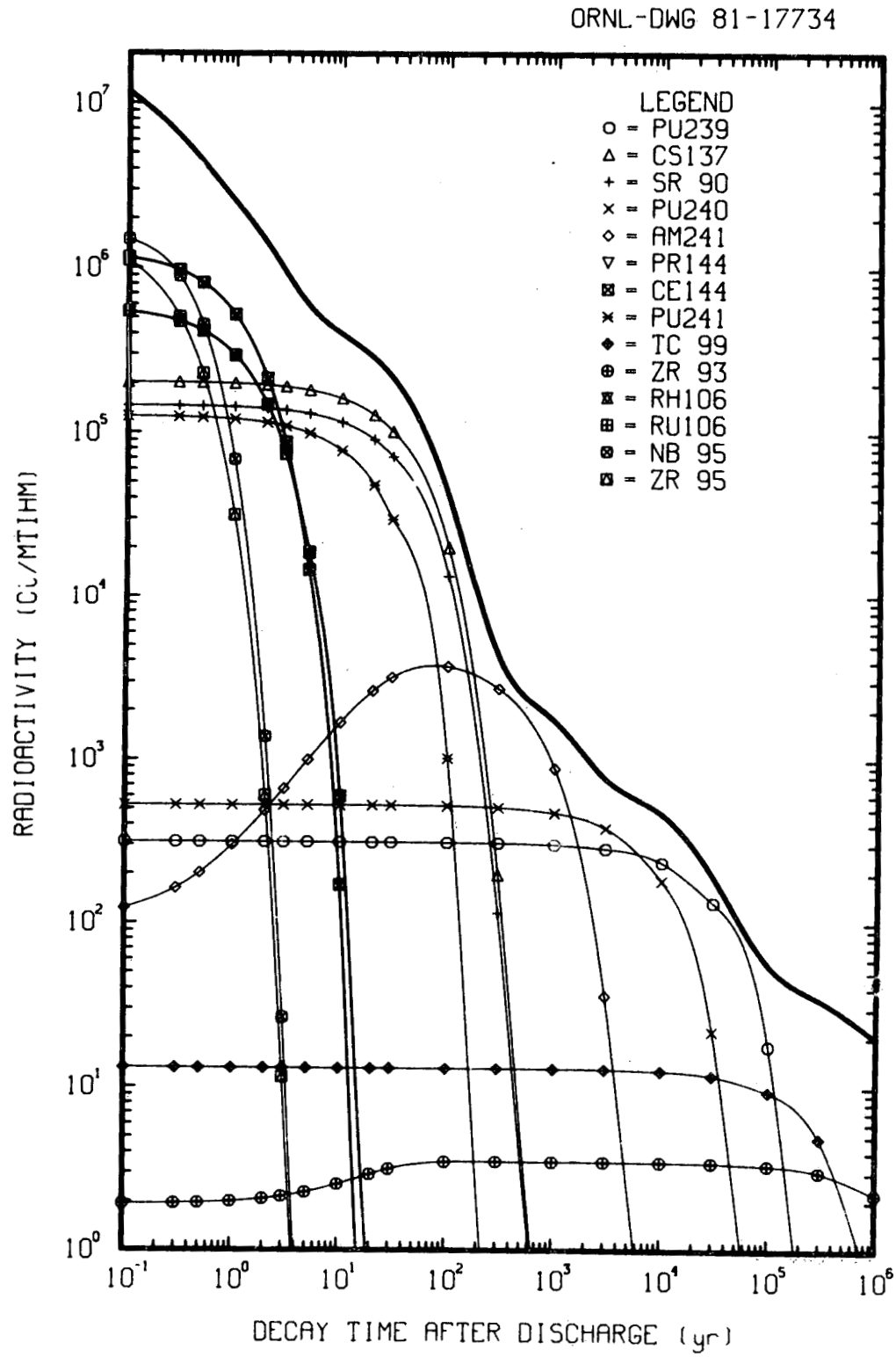

Fig. A.1. Radioactivity of PWR spent fuel as a function of decay time.

Table A.1. Radioactivity of PWR spent fuel as a function of decay time

Radioactivity (Ci/MTIHM)

Time (years)	TOTAL	PU239	CS137	SR 90	PU240	AM241	PR144	CE144	PU241	TC 99	ZR 93	RH106
1.000E-01	1.173E 07	3.131E 02	2.025E 05	1.459E 05	5.259E 02	1.226E 02	1.153E 06	1.153E 06	1.254E 05	1.307E 01	1.924E 00	5.433E 05
3.000E-01	6.334E 06	3.131E 02	2.015E 05	1.452E 05	5.259E 02	1.626E 02	9.645E 05	9.645E 05	1.242E 05	1.307E 01	1.940E 00	4.735E 05
5.000E-01	4.336E 06	3.131E 02	2.006E 05	1.445E 05	5.259E 02	2.022E 02	8.072E 05	8.072E 05	1.230E 05	1.307E 01	1.956E 00	4.126E 05
1.000E 00	2.507E 06	3.131E 02	1.983E 05	1.428E 05	5.261E 02	2.995E 02	5.170E 05	5.170E 05	1.201E 05	1.307E 01	1.996E 00	2.925E 05
2.000E 00	1.386E 06	3.131E 02	1.938E 05	1.395E 05	5.261E 02	4.869E 02	2.122E 05	2.122E 05	1.145E 05	1.307E 01	2.072E 00	1.471E 05
3.000E 00	9.221E 05	3.131E 02	1.894E 05	1.362E 05	5.261E 02	6.653E 02	8.709E 04	8.709E 04	1.091E 05	1.307E 01	2.144E 00	7.396E 04
5.000E 00	5.775E 05	3.131E 02	1.808E 05	1.299E 05	5.264E 02	9.962E 02	1.467E 04	1.467E 04	9.908E 04	1.307E 01	2.277E 00	1.869E 04
1.000E 01	3.935E 05	3.129E 02	1.611E 05	1.153E 05	5.268E 02	1.691E 03	1.708E 02	1.707E 02	7.788E 04	1.307E 01	2.557E 00	6.005E 02
2.000E 01	2.808E 05	3.129E 02	1.279E 05	9.086E 04	5.270E 02	2.648E 03	2.314E-02	2.314E-02	4.813E 04	1.307E 01	2.942E 00	6.369E-01
3.000E 01	2.129E 05	3.129E 02	1.015E 05	7.162E 04	5.272E 02	3.211E 03	3.136E-06	3.136E-06	2.973E 04	1.307E 01	3.174E 00	6.919E-04
1.000E 02	4.096E 04	3.123E 02	2.013E 04	1.354E 04	5.244E 02	3.751E 03	0.0	0.0	1.023E 03	1.307E 01	3.512E 00	8.614E-25
3.000E 02	4.280E 03	3.105E 02	1.982E 02	1.159E 02	5.136E 02	2.748E 03	0.0	0.0	8.770E-02	1.306E 01	3.521E 00	0.0
1.000E 03	1.742E 03	3.047E 02	1.874E-05	6.731E-06	4.767E 02	8.943E 02	0.0	0.0	1.917E-02	1.303E 01	3.520E 00	0.0
3.000E 03	7.697E 02	2.884E 02	1.598E-25	1.425E-26	3.857E 02	3.621E 01	0.0	0.0	1.628E-02	1.295E 01	3.517E 00	0.0
1.000E 04	4.676E 02	2.375E 02	0.0	0.0	1.836E 02	9.682E-03	0.0	0.0	9.291E-03	1.266E 01	3.506E 00	0.0
3.000E 04	1.933E 02	1.347E 02	0.0	0.0	2.204E 01	1.801E-03	0.0	0.0	1.801E-03	1.186E 01	3.474E 00	0.0
1.000E 05	5.524E 01	1.799E 01	0.0	0.0	1.317E-02	5.970E-06	0.0	0.0	5.970E-06	9.442E 00	3.366E 00	0.0
3.000E 05	3.433E 01	5.710E-02	0.0	0.0	5.712E-07	5.173E-13	0.0	0.0	4.908E-13	4.926E 00	3.074E 00	0.0
1.000E 06	2.013E 01	3.589E-08	0.0	0.0	5.680E-07	0.0	0.0	0.0	0.0	5.049E-01	2.239E 00	0.0

Radioactivity (Ci/MTIHM)

Time (years)	RU106	NB 95	ZR 95	PM147	RU103	CS134	Y 91	RH103M	NP237	PA233	CE141	U234
1.000E-01	5.433E 05	1.494E 06	1.110E 06	1.334E 05	8.653E 05	1.512E 05	7.506E 05	7.801E 05	3.120E-01	3.040E-01	7.639E 05	1.123E 00
3.000E-01	4.735E 05	8.872E 05	5.032E 05	1.273E 05	2.384E 05	1.414E 05	3.159E 05	2.149E 05	3.123E-01	3.110E-01	1.609E 05	1.124E 00
5.000E-01	4.126E 05	4.518E 05	2.280E 05	1.208E 05	6.570E 04	1.322E 05	1.330E 05	5.922E 04	3.123E-01	3.120E-01	3.391E 04	1.126E 00
1.000E 00	2.925E 05	6.850E 04	3.153E 04	1.058E 05	2.618E 03	1.117E 05	1.528E 04	2.360E 03	3.123E-01	3.123E-01	6.906E 02	1.129E 00
2.000E 00	1.471E 05	1.384E 03	6.031E 02	8.124E 04	4.204E 00	7.983E 04	2.019E 02	3.790E 00	3.123E-01	3.123E-01	2.867E-01	1.136E 00
3.000E 00	7.396E 04	2.652E 01	1.153E 01	6.239E 04	6.694E-03	5.704E 04	2.665E 00	6.033E-03	3.125E-01	3.125E-01	1.190E-04	1.142E 00
5.000E 00	1.869E 04	9.361E-03	4.217E-03	3.677E 04	1.589E-08	2.912E 04	4.648E-04	1.523E-08	3.131E-01	3.131E-01	2.050E-11	1.156E 00
1.000E 01	6.005E 02	2.392E-11	1.078E-11	9.814E 03	1.709E-22	5.422E 03	1.866E-13	1.541E-22	3.153E-01	3.153E-01	2.525E-28	1.188E 00
2.000E 01	6.369E-01	1.563E-28	7.043E-29	6.989E 02	0.0	1.881E 02	3.006E-32	0.0	3.224E-01	3.224E-01	0.0	1.248E 00
3.000E 01	6.919E-04	1.022E-45	4.601E-46	4.975E 01	0.0	6.521E 00	4.843E-51	0.0	3.320E-01	3.320E-01	0.0	1.305E 00
1.000E 02	8.614E-25	0.0	0.0	4.623E-07	0.0	3.933E-10	0.0	0.0	4.163E-01	4.163E-01	0.0	1.594E 00
3.000E 02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.260E-01	6.260E-01	0.0	1.906E 00
1.000E 03	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.000E 00	1.000E 00	0.0	1.984E 00
3.000E 03	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.173E 00	1.173E 00	0.0	1.975E 00
1.000E 04	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.178E 00	1.178E 00	0.0	1.942E 00
3.000E 04	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.170E 00	1.170E 00	0.0	1.853E 00
1.000E 05	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.144E 00	1.144E 00	0.0	1.576E 00
3.000E 05	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.072E 00	1.072E 00	0.0	1.031E 00
1.000E 06	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.547E-01	8.547E-01	0.0	4.156E-01

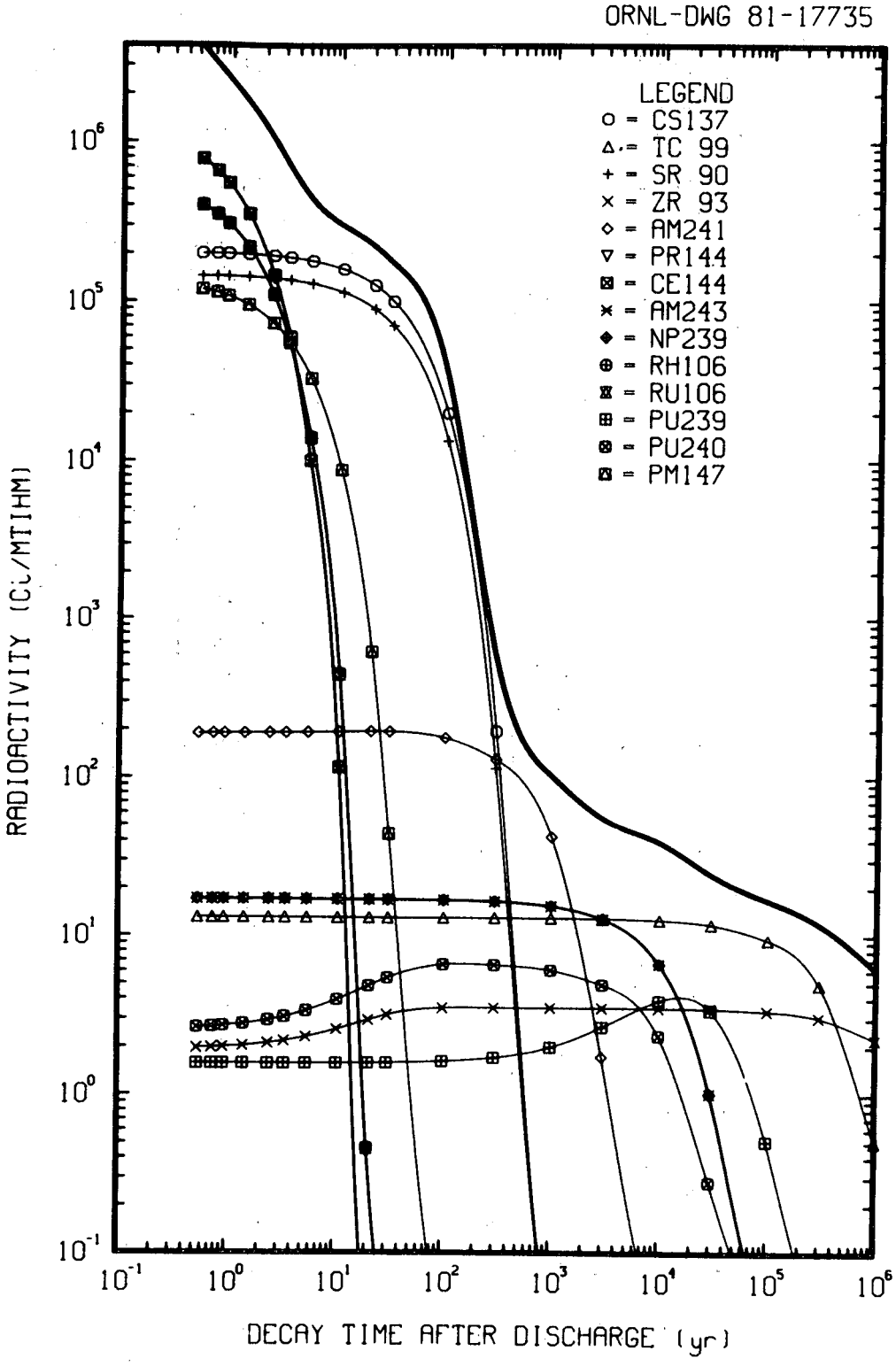

Fig. A.2. Radioactivity of PWR high-level waste as a function of decay time.

Table A.2. Radioactivity of PWR high-level waste as a function of decay time

Radioactivity (Ci/MTIHM)

Time (years)	TOTAL	CS137	TC 99	SR 90	ZR 93	AM241	PR144	CE144	AM243	NP239	RH106	RU106
1.000E-01	3.922E 06	2.004E 05	1.307E 01	1.444E 05	1.958E 00	1.900E 02	7.800E 05	7.799E 05	1.706E 01	1.707E 01	4.019E 05	4.019E 05
3.000E-01	3.027E 06	1.995E 05	1.307E 01	1.437E 05	1.974E 00	1.901E 02	6.527E 05	6.527E 05	1.706E 01	1.706E 01	3.502E 05	3.502E 05
5.000E-01	2.488E 06	1.985E 05	1.307E 01	1.430E 05	1.990E 00	1.902E 02	5.462E 05	5.462E 05	1.706E 01	1.706E 01	3.052E 05	3.052E 05
1.000E 00	1.723E 06	1.962E 05	1.307E 01	1.413E 05	2.028E 00	1.905E 02	3.499E 05	3.499E 05	1.706E 01	1.706E 01	2.164E 05	2.164E 05
2.000E 00	1.005E 06	1.918E 05	1.307E 01	1.380E 05	2.102E 00	1.912E 02	1.436E 05	1.436E 05	1.706E 01	1.706E 01	1.088E 05	1.088E 05
3.000E 00	6.777E 05	1.874E 05	1.307E 01	1.347E 05	2.173E 00	1.917E 02	5.893E 04	5.893E 04	1.706E 01	1.706E 01	5.471E 04	5.471E 04
5.000E 00	4.300E 05	1.789E 05	1.307E 01	1.285E 05	2.303E 00	1.927E 02	9.926E 03	9.925E 03	1.705E 01	1.705E 01	1.383E 04	1.383E 04
1.000E 01	2.975E 05	1.594E 05	1.307E 01	1.141E 05	2.577E 00	1.946E 02	1.156E 02	1.155E 02	1.705E 01	1.705E 01	4.442E 02	4.442E 02
2.000E 01	2.213E 05	1.265E 05	1.307E 01	8.989E 04	2.954E 00	1.964E 02	1.566E-02	1.566E-02	1.703E 01	1.703E 01	4.583E-01	4.560E-01
3.000E 01	1.736E 05	1.004E 05	1.307E 01	7.085E 04	3.180E 00	1.962E 02	2.122E-06	2.122E-06	1.701E 01	1.701E 01	4.752E-04	4.752E-04
1.000E 02	3.382E 04	1.993E 04	1.306E 01	1.339E 04	3.511E 00	1.797E 02	0.0	0.0	1.690E 01	1.690E 01	5.915E-25	5.915E-25
3.000E 02	5.531E 02	1.963E 02	1.306E 01	1.146E 02	3.520E 00	1.305E 02	0.0	0.0	1.659E 01	1.659E 01	0.0	0.0
1.000E 03	1.020E 02	1.856E-05	1.303E 01	6.659E-06	3.519E 00	4.249E 01	0.0	0.0	1.553E 01	1.553E 01	0.0	0.0
3.000E 03	5.490E 01	1.582E-25	1.294E 01	1.410E-26	3.516E 00	1.735E 00	0.0	0.0	1.287E 01	1.287E 01	0.0	0.0
1.000E 04	3.903E 01	0.0	1.265E 01	0.0	3.504E 00	9.220E-03	0.0	0.0	6.671E 00	6.671E 00	0.0	0.0
3.000E 04	2.431E 01	0.0	1.185E 01	0.0	3.473E 00	1.800E-03	0.0	0.0	1.019E 00	1.019E 00	0.0	0.0
1.000E 05	1.675E 01	0.0	9.439E 00	0.0	3.364E 00	5.975E-06	0.0	0.0	1.461E-03	1.461E-03	0.0	0.0
3.000E 05	1.181E 01	0.0	4.923E 00	0.0	3.073E 00	5.187E-13	0.0	0.0	3.692E-08	3.692E-08	0.0	0.0
1.000E 06	6.140E 00	0.0	5.047E-01	0.0	2.238E 00	0.0	0.0	0.0	3.578E-08	3.578E-08	0.0	0.0

Radioactivity (Ci/MTIHM)

Time (years)	PU239	PU240	PM147	NB 95	CS134	NP237	PA233	CS135	ZR 95	U233	TH229	AC225
1.000E-01	1.565E 00	2.645E 00	1.195E 05	3.939E 05	1.305E 05	3.121E-01	3.119E-01	3.449E-01	1.961E 05	2.076E-07	5.080E-08	5.085E-08
3.000E-01	1.565E 00	2.676E 00	1.134E 05	1.875E 05	1.220E 05	3.121E-01	3.121E-01	3.449E-01	8.897E 04	4.805E-07	5.081E-08	5.081E-08
5.000E-01	1.565E 00	2.708E 00	1.075E 05	8.708E 04	1.140E 05	3.121E-01	3.121E-01	3.449E-01	4.028E 04	7.534E-07	5.082E-08	5.081E-08
1.000E 00	1.566E 00	2.785E 00	9.421E 04	1.230E 04	9.639E 04	3.121E-01	3.121E-01	3.449E-01	5.570E 03	1.436E-06	5.087E-08	5.090E-08
2.000E 00	1.567E 00	2.935E 00	7.234E 04	2.446E 02	6.887E 04	3.122E-01	3.122E-01	3.449E-01	1.065E 02	2.946E-06	5.108E-08	5.108E-08
3.000E 00	1.567E 00	3.079E 00	5.554E 04	4.685E 00	4.921E 04	3.122E-01	3.123E-01	3.449E-01	2.037E 00	4.457E-06	5.143E-08	5.143E-08
5.000E 00	1.569E 00	3.351E 00	3.274E 04	1.653E-03	2.512E 04	3.124E-01	3.124E-01	3.449E-01	7.446E-04	7.334E-06	5.255E-08	5.255E-08
1.000E 01	1.573E 00	3.947E 00	8.738E 03	4.226E-12	4.679E 03	3.127E-01	3.127E-01	3.449E-01	1.903E-12	1.417E-05	5.763E-08	5.763E-08
2.000E 01	1.580E 00	4.843E 00	6.222E 02	2.761E-29	1.622E 02	3.133E-01	3.133E-01	3.449E-01	1.244E-29	2.785E-05	7.748E-08	7.748E-08
3.000E 01	1.587E 00	5.452E 00	4.431E 01	1.804E-46	5.627E 00	3.140E-01	3.140E-01	3.449E-01	8.125E-47	4.157E-05	1.102E-07	1.102E-07
1.000E 02	1.625E 00	6.633E 00	4.115E-07	0.0	3.394E-10	3.182E-01	3.182E-01	3.449E-01	0.0	1.383E-04	7.023E-07	7.023E-07
3.000E 02	1.713E 00	6.583E 00	0.0	0.0	0.0	3.282E-01	3.282E-01	3.449E-01	0.0	4.210E-04	5.918E-06	5.918E-06
1.000E 03	1.999E 00	6.112E 00	0.0	0.0	0.0	3.459E-01	3.459E-01	3.448E-01	0.0	1.455E-03	6.564E-05	6.564E-05
3.000E 03	2.680E 00	4.944E 00	0.0	0.0	0.0	3.539E-01	3.539E-01	3.446E-01	0.0	4.505E-03	5.751E-04	5.751E-04
1.000E 04	3.894E 00	2.354E 00	0.0	0.0	0.0	3.535E-01	3.535E-01	3.439E-01	0.0	1.504E-02	5.316E-03	5.316E-03
3.000E 04	3.397E 00	2.823E-01	0.0	0.0	0.0	3.512E-01	3.512E-01	3.418E-01	0.0	4.328E-02	2.930E-02	2.930E-02
1.000E 05	5.116E-01	1.688E-04	0.0	0.0	0.0	3.434E-01	3.434E-01	3.347E-01	0.0	1.234E-01	1.127E-01	1.127E-01
3.000E 05	1.618E-03	2.972E-09	0.0	0.0	0.0	3.218E-01	3.218E-01	3.151E-01	0.0	2.444E-01	2.469E-01	2.469E-01
1.000E 06	3.578E-08	3.060E-09	0.0	0.0	0.0	2.565E-01	2.565E-01	2.552E-01	0.0	2.722E-01	2.728E-01	2.728E-01

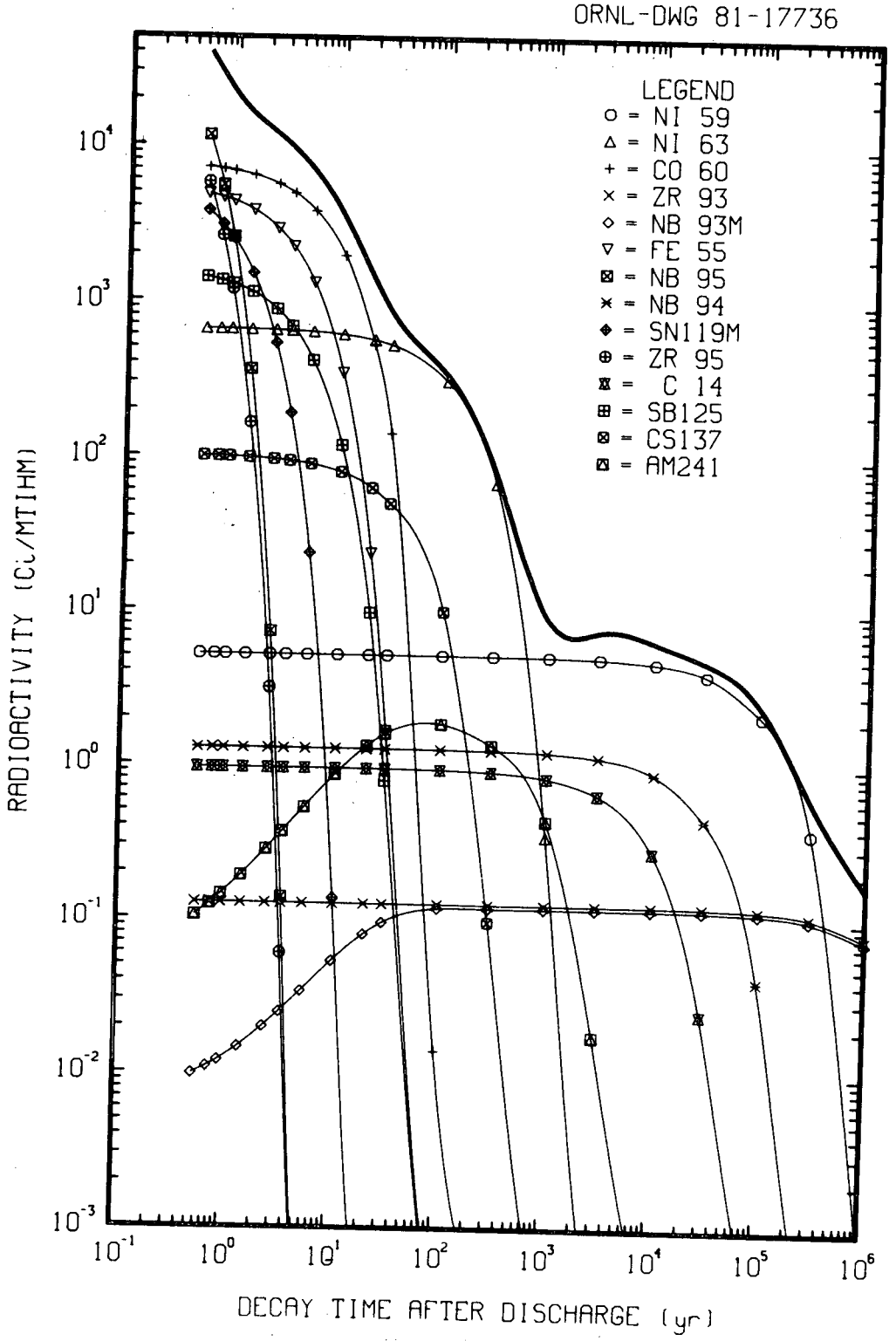

Fig. A.3. Radioactivity of PWR structural material waste as a function of decay time.

Table A.3. Radioactivity of PWR structural material waste as a function of decay time

Radioactivity (Ci/MTIHM)

Time (years)	TOTAL	NI 59	NI 63	CO 60	ZR 93	NB 93M	FE 55	NB 95	NB 94	SN119M	ZR 95	C 14
1.000E-01	4.009E 04	5.181E 00	6.580E 02	7.232E 03	1.269E-01	9.850E-03	4.857E 03	1.161E 04	1.283E 00	3.802E 03	5.780E 03	9.542E-01
3.000E-01	2.811E 04	5.181E 00	6.571E 02	7.045E 03	1.269E-01	1.097E-02	4.605E 03	5.526E 03	1.283E 00	3.092E 03	2.620E 03	9.541E-01
5.000E-01	2.189E 04	5.181E 00	6.561E 02	6.862E 03	1.269E-01	1.208E-02	4.366E 03	2.567E 03	1.283E 00	2.515E 03	1.187E 03	9.541E-01
1.000E 00	1.366E 04	5.181E 00	6.536E 02	6.425E 03	1.269E-01	1.481E-02	3.821E 03	3.625E 02	1.283E 00	1.500E 03	1.642E 02	9.541E-01
2.000E 00	1.165E 04	5.181E 00	6.487E 02	5.633E 03	1.269E-01	2.006E-02	2.927E 03	7.211E 00	1.283E 00	5.338E 02	3.139E 00	9.540E-01
3.000E 00	9.476E 03	5.181E 00	6.438E 02	4.939E 03	1.269E-01	2.505E-02	2.242E 03	1.381E-01	1.283E 00	1.900E 02	6.003E-02	9.538E-01
5.000E 00	6.740E 03	5.181E 00	6.342E 02	3.796E 03	1.269E-01	3.430E-02	1.315E 03	4.873E-05	1.282E 00	2.405E 01	2.195E-05	9.536E-01
1.000E 01	3.405E 03	5.181E 00	6.107E 02	1.967E 03	1.259E-01	5.370E-02	3.468E 02	1.246E-13	1.282E 00	1.376E-01	5.610E-14	9.530E-01
2.000E 01	1.352E 03	5.180E 00	5.664E 02	5.279E 02	1.269E-01	8.037E-02	2.412E 01	8.138E-31	1.282E 00	4.479E-06	3.656E-31	9.519E-01
3.000E 01	8.258E 02	5.180E 00	5.253E 02	1.417E 02	1.268E-01	9.640E-02	1.677E 00	5.317E-48	1.281E 00	1.458E-10	2.395E-48	9.507E-01
1.000E 02	3.388E 02	5.177E 00	3.100E 02	1.421E-02	1.268E-01	1.198E-01	1.318E-08	0.0	1.278E 00	0.0	0.0	9.427E-01
3.000E 02	7.844E 01	5.168E 00	6.870E 01	5.342E-14	1.268E-01	1.205E-01	0.0	0.0	1.270E 00	0.0	0.0	9.202E-01
1.000E 03	8.709E 00	5.137E 00	3.516E-01	0.0	1.268E-01	1.205E-01	0.0	0.0	1.240E 00	0.0	0.0	8.455E-01
3.000E 03	7.513E 00	5.048E 00	1.005E-07	0.0	1.267E-01	1.203E-01	0.0	0.0	1.158E 00	0.0	0.0	6.637E-01
1.000E 04	6.429E 00	4.751E 00	0.0	0.0	1.263E-01	1.200E-01	0.0	0.0	9.116E-01	0.0	0.0	2.846E-01
3.000E 04	4.821E 00	3.995E 00	0.0	0.0	1.251E-01	1.189E-01	0.0	0.0	4.605E-01	0.0	0.0	2.531E-02
1.000E 05	2.484E 00	2.178E 00	0.0	0.0	1.212E-01	1.152E-01	0.0	0.0	4.218E-02	0.0	0.0	5.313E-06
3.000E 05	6.183E-01	3.851E-01	0.0	0.0	1.107E-01	1.052E-01	0.0	0.0	4.546E-05	0.0	0.0	1.647E-16
1.000E 06	1.682E-01	8.969E-04	0.0	0.0	8.064E-02	7.661E-02	0.0	0.0	1.892E-15	0.0	0.0	0.0

Radioactivity (Ci/MTIHM)

Time (years)	SB125	CS137	AM241	SR 90	PU240	H 3	PU239	TE125M	CO 58	PR144	CE144	H 3
1.000E-01	1.415E 03	1.002E 02	1.049E-01	7.221E 01	2.631E-01	1.591E 02	1.566E-01	3.395E 02	1.015E 03	3.902E 02	3.902E 02	7.634E 01
3.000E-01	1.346E 03	9.977E 01	1.244E-01	7.187E 01	2.631E-01	1.573E 02	1.566E-01	3.260E 02	4.962E 02	3.265E 02	3.265E 02	7.548E 01
5.000E-01	1.280E 03	9.931E 01	1.438E-01	7.153E 01	2.631E-01	1.555E 02	1.566E-01	3.114E 02	2.426E 02	2.733E 02	2.732E 02	7.464E 01
1.000E 00	1.130E 03	9.817E 01	1.914E-01	7.069E 01	2.631E-01	1.512E 02	1.566E-01	2.755E 02	4.057E 01	1.751E 02	1.750E 02	7.258E 01
2.000E 00	8.796E 02	9.593E 01	2.831E-01	6.903E 01	2.632E-01	1.430E 02	1.566E-01	2.146E 02	1.134E 00	7.184E 01	7.184E 01	6.861E 01
3.000E 00	6.849E 02	9.374E 01	3.704E-01	6.741E 01	2.632E-01	1.352E 02	1.566E-01	1.671E 02	3.171E-02	2.948E 01	2.948E 01	6.487E 01
5.000E 00	4.152E 02	8.950E 01	5.323E-01	6.427E 01	2.633E-01	1.208E 02	1.566E-01	1.013E 02	2.478E-05	4.966E 00	4.965E 00	5.798E 01
1.000E 01	1.188E 02	7.974E 01	8.723E-01	5.706E 01	2.634E-01	9.126E 01	1.565E-01	2.899E 01	4.232E-13	5.782E-02	5.782E-02	4.379E 01
2.000E 01	9.728E 00	6.329E 01	1.340E 00	4.497E 01	2.636E-01	5.206E 01	1.565E-01	2.374E 00	1.234E-28	7.836E-06	7.836E-06	2.498E 01
3.000E 01	7.966E-01	5.023E 01	1.616E 00	3.545E 01	2.636E-01	2.970E 01	1.564E-01	1.944E-01	3.598E-44	1.062E-09	1.062E-09	1.425E 01
1.000E 02	1.966E-08	9.967E 00	1.876E 00	6.699E 00	2.623E-01	5.839E-01	1.562E-01	4.797E-09	0.0	0.0	0.0	2.801E-01
3.000E 02	0.0	9.813E-02	1.373E 00	5.742E-02	2.568E-01	7.778E-06	1.553E-01	0.0	0.0	0.0	0.0	3.732E-06
1.000E 03	0.0	9.280E-09	4.470E-01	3.335E-09	2.385E-01	6.712E-23	1.524E-01	0.0	0.0	0.0	0.0	3.221E-23
3.000E 03	0.0	7.912E-29	1.810E-02	7.063E-30	1.929E-01	0.0	1.442E-01	0.0	0.0	0.0	0.0	0.0
1.000E 04	0.0	0.0	4.842E-06	0.0	9.183E-02	0.0	1.187E-01	0.0	0.0	0.0	0.0	0.0
3.000E 04	0.0	0.0	9.004E-07	0.0	1.102E-02	0.0	6.735E-02	0.0	0.0	0.0	0.0	0.0
1.000E 05	0.0	0.0	2.985E-09	0.0	6.586E-06	0.0	8.997E-03	0.0	0.0	0.0	0.0	0.0
3.000E 05	0.0	0.0	2.589E-16	0.0	2.857E-10	0.0	2.849E-05	0.0	0.0	0.0	0.0	0.0
1.000E 06	0.0	0.0	0.0	0.0	2.841E-10	0.0	1.795E-11	0.0	0.0	0.0	0.0	0.0

Appendix A.2. Thermal Power of PWR Spent Fuel, High-Level Waste, and Structural Material Waste

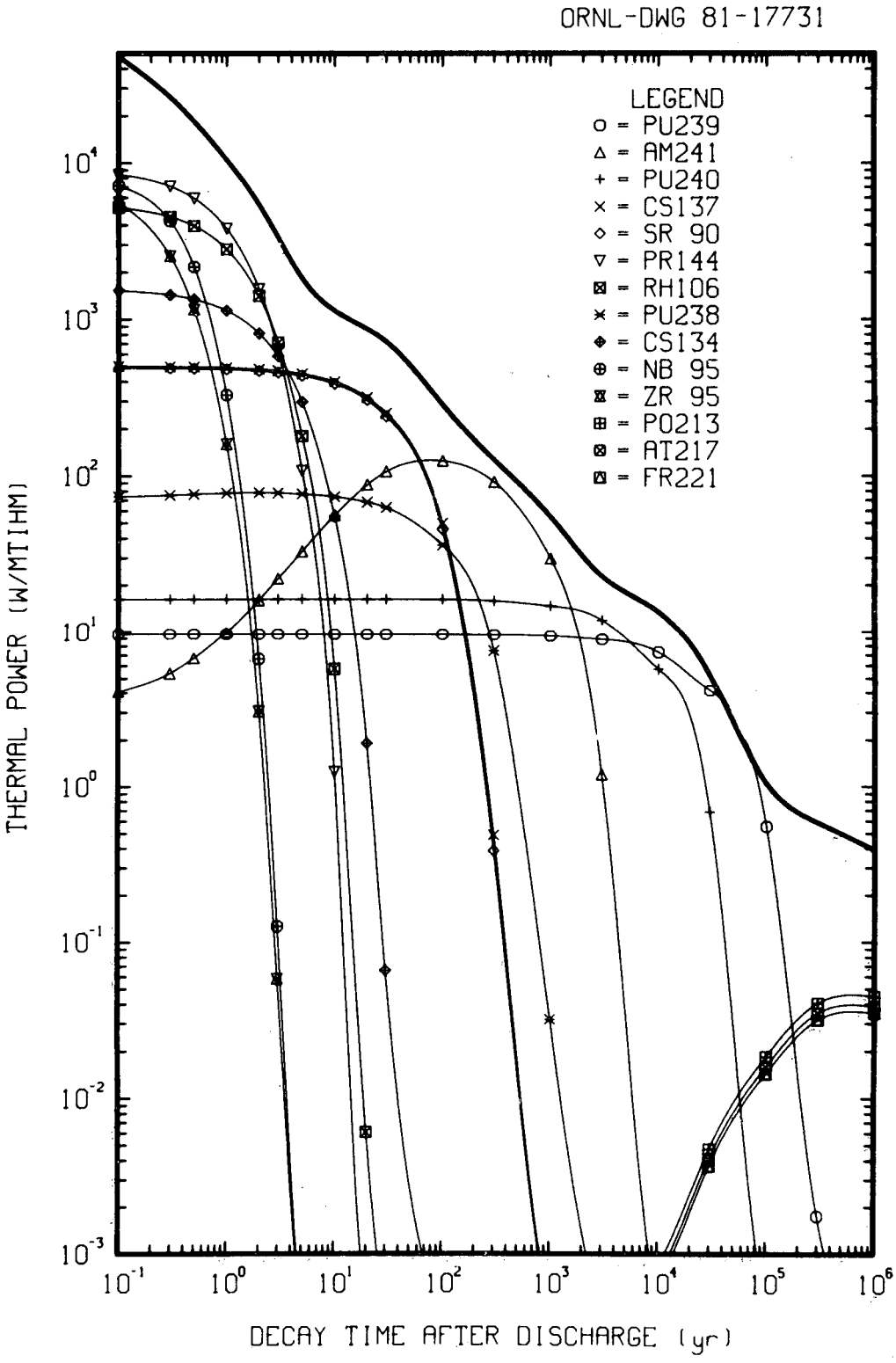

Fig. A.4. Thermal power of PWR spent fuel as a function of decay time.

Table A.4. Thermal power of PWR spent fuel as a function of decay time

Thermal power (W/MTIHM)

Time (years)	TOTAL	PU239	AM241	PU240	CS137	SR 90	PR144	RH106	PU238	CS134	NB 95	ZR 95
1.000E-01	4.778E 04	9.647E 00	4.072E 00	1.638E 01	5.615E 02	4.890E 02	8.471E 03	5.212E 03	7.409E 01	1.539E 03	7.168E 03	5.623E 03
3.000E-01	2.631E 04	9.647E 00	5.400E 00	1.638E 01	4.992E 02	4.867E 02	7.090E 03	4.542E 03	7.548E 01	1.439E 03	4.256E 03	2.548E 03
5.000E-01	1.843E 04	9.647E 00	6.716E 00	1.638E 01	4.969E 02	4.845E 02	5.933E 03	3.957E 03	7.645E 01	1.345E 03	2.167E 03	1.155E 03
1.000E 00	1.346E 04	9.647E 00	9.947E 00	1.638E 01	4.913E 02	4.788E 02	3.801E 03	2.806E 03	7.780E 01	1.137E 03	3.285E 02	1.597E 02
2.000E 00	5.389E 03	9.647E 00	1.617E 01	1.638E 01	4.801E 02	4.675E 02	1.560E 03	1.411E 03	7.927E 01	8.124E 02	6.640E 00	3.055E 00
3.000E 00	3.329E 03	9.647E 00	2.210E 01	1.639E 01	4.691E 02	4.565E 02	6.401E 02	7.095E 02	7.788E 01	5.805E 02	1.273E-01	5.842E-02
5.000E 00	1.826E 03	9.647E 00	3.309E 01	1.639E 01	4.477E 02	4.353E 02	1.078E 02	1.793E 02	7.673E 01	2.964E 02	4.490E-05	2.136E-05
1.000E 01	1.132E 03	9.645E 00	5.619E 01	1.640E 01	3.991E 02	3.865E 02	1.255E 00	5.760E 00	7.376E 01	5.519E 01	1.148E-13	5.459E-14
2.000E 01	8.644E 02	9.643E 00	8.794E 01	1.641E 01	3.167E 02	3.045E 02	1.701E-04	6.107E-03	6.817E 01	1.914E 00	7.503E-31	3.567E-31
3.000E 01	7.190E 02	9.641E 00	1.067E 02	1.642E 01	2.513E 02	2.401E 02	2.306E-08	6.638E-06	6.299E 01	6.638E-02	4.900E-48	2.330E-48
1.000E 02	2.843E 02	9.621E 00	1.246E 02	1.633E 01	4.986E 01	4.536E 01	0.0	8.263E-27	3.628E 01	4.005E-12	0.0	0.0
3.000E 02	1.261E 02	9.569E 00	9.130E 01	1.599E 01	4.910E-01	3.884E-01	0.0	0.0	7.502E 00	0.0	0.0	0.0
1.000E 03	5.474E 01	9.390E 00	2.971E 01	1.485E 01	4.643E-08	2.256E-08	0.0	0.0	3.205E-02	0.0	0.0	0.0
3.000E 03	2.278E 01	8.887E 00	1.203E 00	1.201E 01	3.960E-28	4.777E-29	0.0	0.0	2.852E-07	0.0	0.0	0.0
1.000E 04	1.352E 01	7.318E 00	3.216E-04	5.719E 00	0.0	0.0	0.0	0.0	3.857E-21	0.0	0.0	0.0
3.000E 04	5.205E 00	4.150E 00	5.981E-05	6.859E-01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.000E 05	1.053E 00	5.545E-01	1.983E-07	4.102E-04	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3.000E 05	5.853E-01	1.760E-03	1.718E-14	1.779E-08	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.000E 06	3.907E-01	1.106E-09	0.0	1.769E-08	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Thermal power (W/MTIHM)

Time (years)	PO213	AT217	FR221	NP237	PO214	LA140	AC225	TH229	U234	U233	PO218	RN222
1.000E-01	4.585E-09	3.953E-09	3.573E-09	9.535E-03	7.411E-10	4.631E 03	3.235E-09	1.541E-09	3.235E-02	4.007E-07	5.326E-10	4.871E-10
3.000E-01	2.594E-09	2.236E-09	2.022E-09	9.541E-03	7.955E-10	8.835E 01	1.830E-09	1.549E-09	3.240E-02	4.085E-07	6.172E-10	5.643E-10
5.000E-01	2.518E-09	2.169E-09	1.962E-09	9.541E-03	9.000E-10	1.685E 00	1.776E-09	1.557E-09	3.242E-02	4.165E-07	7.023E-10	6.421E-10
1.000E 00	2.557E-09	2.204E-09	1.992E-09	9.541E-03	1.207E-09	8.475E-05	1.803E-09	1.578E-09	3.253E-02	4.362E-07	9.429E-10	8.620E-10
2.000E 00	2.629E-09	2.265E-09	2.049E-09	9.546E-03	1.977E-09	2.143E-13	1.854E-09	1.624E-09	3.272E-02	4.802E-07	1.544E-09	1.411E-09
3.000E 00	2.709E-09	2.336E-09	2.112E-09	9.552E-03	2.951E-09	5.420E-22	1.912E-09	1.674E-09	3.290E-02	5.242E-07	2.304E-09	2.107E-09
5.000E 00	2.891E-09	2.492E-09	2.254E-09	9.567E-03	5.522E-09	3.467E-39	2.040E-09	1.786E-09	3.329E-02	6.078E-07	4.310E-09	3.942E-09
1.000E 01	3.461E-09	2.982E-09	2.698E-09	9.637E-03	1.561E-08	0.0	2.442E-09	2.138E-09	3.422E-02	8.074E-07	1.219E-08	1.115E-08
2.000E 01	5.084E-09	4.382E-09	3.963E-09	9.953E-03	5.196E-08	0.0	3.586E-09	3.142E-09	3.595E-02	1.212E-06	4.057E-08	3.710E-08
3.000E 01	7.363E-09	6.347E-09	5.740E-09	1.015E-02	1.107E-07	0.0	5.196E-09	4.551E-09	3.758E-02	1.628E-06	8.642E-08	7.903E-08
1.000E 02	4.356E-08	3.755E-08	3.396E-08	1.272E-02	1.216E-06	0.0	3.073E-08	2.691E-08	4.592E-02	4.949E-06	9.491E-07	8.679E-07
3.000E 02	4.005E-07	3.450E-07	3.120E-07	1.913E-02	1.213E-05	0.0	2.824E-07	2.475E-07	5.489E-02	1.833E-05	9.472E-06	8.661E-06
1.000E 03	6.224E-06	5.363E-06	4.852E-06	3.058E-02	1.420E-04	0.0	4.390E-06	3.846E-06	5.714E-02	9.357E-05	1.108E-04	1.014E-04
3.000E 03	7.474E-05	6.440E-05	5.825E-05	3.584E-02	1.053E-03	0.0	5.272E-05	4.618E-05	5.686E-02	3.779E-04	8.217E-04	7.515E-04
1.000E 04	8.193E-04	7.060E-04	6.386E-04	3.599E-02	6.078E-03	0.0	5.779E-04	5.062E-04	5.593E-02	1.400E-03	4.746E-03	4.340E-03
3.000E 04	4.748E-03	4.091E-03	3.701E-03	3.576E-02	2.116E-02	0.0	3.350E-03	2.934E-03	5.335E-02	4.139E-03	1.652E-02	1.510E-02
1.000E 05	1.851E-02	1.596E-02	1.443E-02	3.495E-02	4.822E-02	0.0	1.306E-02	1.144E-02	4.540E-02	1.191E-02	3.764E-02	3.441E-02
3.000E 05	4.070E-02	3.506E-02	3.172E-02	3.277E-02	5.467E-02	0.0	2.871E-02	2.514E-02	2.971E-02	2.364E-02	4.269E-02	3.903E-02
1.000E 06	4.499E-02	3.877E-02	3.506E-02	2.611E-02	2.137E-02	0.0	3.175E-02	2.780E-02	1.197E-02	2.635E-02	1.569E-02	1.526E-02

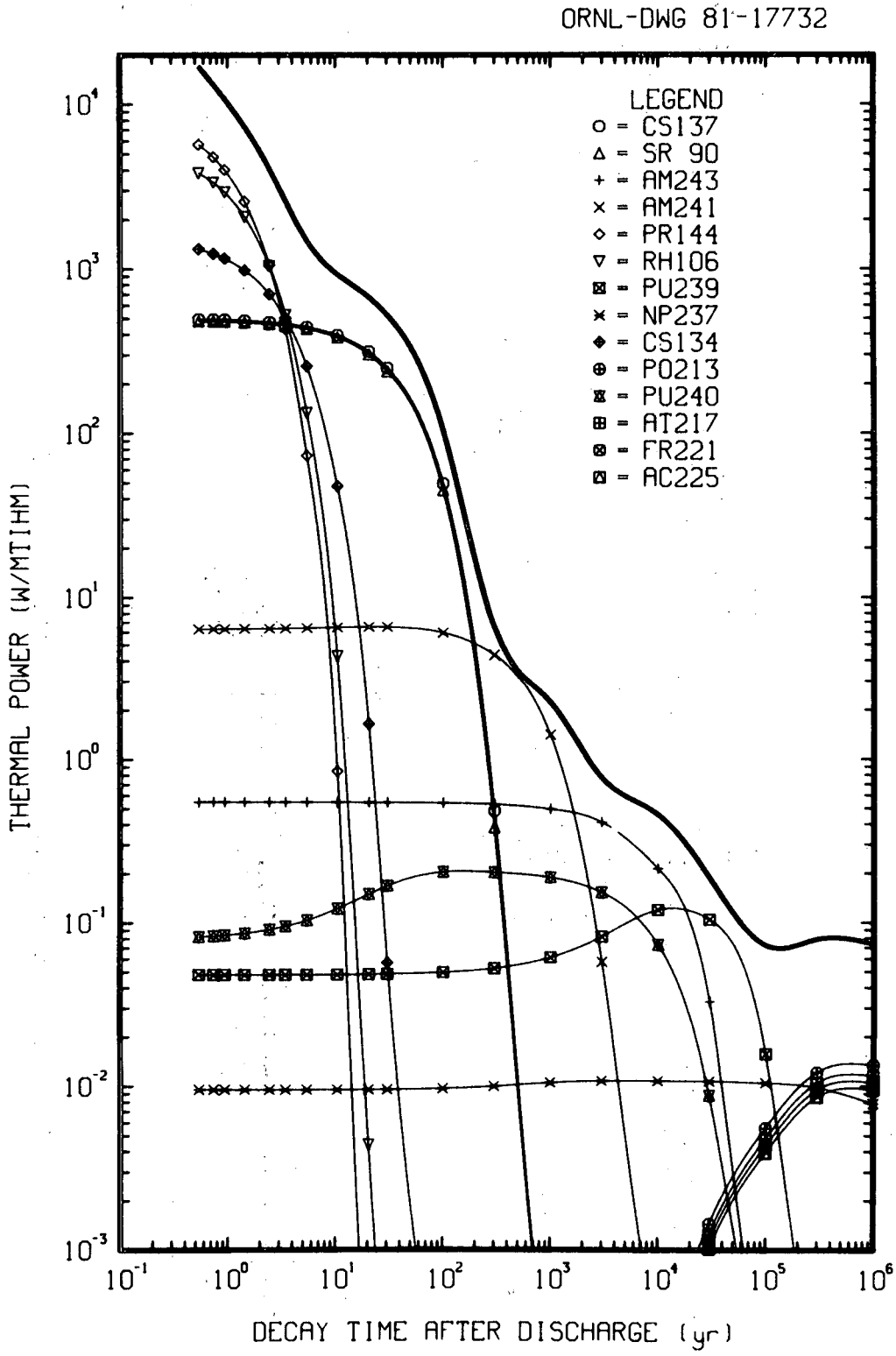

Fig. A.5. Thermal power of PWR high-level waste as a function of decay time.

Table A.5. Thermal power of PWR high-level waste as a function of decay time

Thermal power (W/MTIHM)

Time (years)	TOTAL	CS137	SR 90	AM243	AM241	PR144	RH106	PU239	NP237	CS134	PO213	PU240
1.000E-01	1.710E 04	4.963E 02	4.839E 02	5.485E-01	6.31GE 00	5.733E 03	3.854E 03	4.823E-02	9.538E-03	1.328E 03	2.518E-09	8.236E-02
3.000E-01	1.323E 04	4.941E 02	4.816E 02	5.485E-01	6.314E 00	4.798E 03	3.359E 03	4.823E-02	9.538E-03	1.241E 03	2.516E-09	8.334E-02
5.000E-01	1.080E 04	4.917E 02	4.793E 02	5.485E-01	6.319E 00	4.015E 03	2.928E 03	4.824E-02	9.538E-03	1.161E 03	2.516E-09	8.431E-02
1.000E 00	7.325E 03	4.861E 02	4.736E 02	5.484E-01	6.330E 00	2.572E 03	2.076E 03	4.825E-02	9.539E-03	9.811E 02	2.520E-09	8.671E-02
2.000E 00	4.075E 03	4.750E 02	4.625E 02	5.484E-01	6.350E 00	1.056E 03	1.044E 03	4.828E-02	9.541E-03	7.310E 02	2.529E-09	9.138E-02
3.000E 00	2.600E 03	4.641E 02	4.516E 02	5.483E-01	6.369E 00	4.332E 02	5.247E 02	4.830E-02	9.543E-03	5.009E 02	2.546E-09	9.587E-02
5.000E 00	1.486E 03	4.432E 02	4.306E 02	5.482E-01	6.403E 00	7.296E 01	1.326E 02	4.835E-02	9.547E-03	2.557E 02	2.602E-09	1.043E-01
1.000E 01	9.257E 02	3.948E 02	3.823E 02	5.480E-01	6.466E 00	8.493E-01	4.260E 00	4.848E-02	9.557E-03	4.762E 01	2.853E-09	1.229E-01
2.000E 01	6.707E 02	3.134E 02	3.013E 02	5.475E-01	6.523E 00	1.151E-04	4.395E-03	4.879E-02	9.576E-03	1.651E 00	3.836E-09	1.508E-01
3.000E 01	5.218E 02	2.488E 02	2.375E 02	5.470E-01	6.518E 00	1.560E-08	4.557E-06	4.891E-02	9.595E-03	5.727E-02	5.458E-09	1.698E-01
1.000E 02	1.041E 02	4.935E 01	4.488E 01	5.434E-01	5.959E 00	0.0	5.673E-27	5.007E-02	9.726E-03	3.454E-12	3.477E-08	2.065E-01
3.000E 02	6.495E 00	4.862E-01	3.842E-01	5.333E-01	4.335E 00	0.0	0.0	5.280E-02	1.003E-02	0.0	2.930E-07	2.050E-01
1.000E 03	2.240E 00	4.598E-08	2.232E-08	4.993E-01	1.411E 00	0.0	0.0	6.162E-02	1.057E-02	0.0	3.250E-06	1.903E-01
3.000E 03	7.739E-01	3.920E-28	4.726E-29	4.138E-01	5.765E-02	0.0	0.0	8.258E-02	1.082E-02	0.0	2.847E-05	1.539E-01
1.000E 04	4.594E-01	0.0	0.0	2.144E-01	3.063E-04	0.0	0.0	1.200E-01	1.080E-02	0.0	2.632E-04	7.329E-02
3.000E 04	1.888E-01	0.0	0.0	3.277E-02	5.979E-05	0.0	0.0	1.047E-01	1.073E-02	0.0	1.451E-03	8.792E-03
1.000E 05	7.230E-02	0.0	0.0	4.696E-05	1.985E-07	0.0	0.0	1.577E-02	1.049E-02	0.0	5.578E-03	5.256E-06
3.000E 05	7.918E-02	0.0	0.0	1.187E-09	1.723E-14	0.0	0.0	4.986E-05	9.836E-03	0.0	1.222E-02	9.256E-11
1.000E 06	7.394E-02	0.0	0.0	1.150E-09	0.0	0.0	0.0	1.103E-09	7.840E-03	0.0	1.351E-02	9.529E-11

Thermal power (W/MTIHM)

Time (years)	AT217	FR221	AC225	TH229	U233	NB 95	SB126M	TC 99	CE144	ZR 95	EU154	CM244
1.000E-01	2.170E-09	1.963E-09	1.776E-09	1.554E-09	6.034E-09	1.889E 03	9.895E-03	6.554E-03	5.173E 02	9.933E 02	8.940E 01	5.227E 01
3.000E-01	2.168E-09	1.961E-09	1.775E-09	1.554E-09	1.397E-08	8.992E 02	9.895E-03	6.554E-03	4.329E 02	4.502E 02	8.797E 01	5.187E 01
5.000E-01	2.168E-09	1.961E-09	1.775E-09	1.555E-09	2.190E-08	4.177E 02	9.895E-03	6.554E-03	3.623E 02	2.040E 02	8.656E 01	5.147E 01
1.000E 00	2.172E-09	1.964E-09	1.778E-09	1.556E-09	4.174E-08	5.899E 01	9.895E-03	6.554E-03	2.321E 02	2.821E 01	8.314E 01	5.050E 01
2.000E 00	2.180E-09	1.971E-09	1.784E-09	1.563E-09	8.565E-08	1.173E 00	9.895E-03	6.554E-03	9.525E 01	5.394E-01	7.670E 01	4.860E 01
3.000E 00	2.195E-09	1.985E-09	1.797E-09	1.573E-09	1.296E-07	2.247E-02	9.894E-03	6.554E-03	3.909E 01	1.032E-02	7.076E 01	4.677E 01
5.000E 00	2.242E-09	2.028E-09	1.836E-09	1.608E-09	2.132E-07	7.930E-06	9.894E-03	6.554E-03	6.584E 00	3.772E-06	6.023E 01	4.333E 01
1.000E 01	2.459E-09	2.224E-09	2.013E-09	1.763E-09	4.118E-07	2.027E-14	9.894E-03	6.554E-03	7.664E-02	9.641E-15	4.025E 01	3.578E 01
2.000E 01	3.306E-09	2.990E-09	2.706E-09	2.370E-09	8.096E-07	1.324E-31	9.893E-03	6.553E-03	1.039E-05	6.299E-32	1.798E 01	2.440E 01
3.000E 01	4.704E-09	4.255E-09	3.851E-09	3.373E-09	1.208E-06	8.653E-49	9.893E-03	6.553E-03	1.408E-09	4.116E-49	8.030E 00	1.664E 01
1.000E 02	2.997E-08	2.710E-08	2.453E-08	2.148E-08	4.920E-06	0.0	9.888E-03	6.552E-03	0.0	0.0	2.819E-02	1.142E 00
3.000E 02	2.526E-07	2.284E-07	2.067E-07	1.811E-07	1.224E-05	0.0	9.874E-03	6.547E-03	0.0	0.0	2.816E-09	5.409E-04
1.000E 03	2.801E-06	2.534E-06	2.293E-06	2.008E-06	4.229E-05	0.0	9.826E-03	6.532E-03	0.0	0.0	0.0	1.128E-14
3.000E 03	2.454E-05	2.220E-05	2.009E-05	1.759E-05	1.310E-04	0.0	9.691E-03	6.490E-03	0.0	0.0	0.0	1.004E-14
1.000E 04	2.269E-04	2.052E-04	1.857E-04	1.626E-04	4.371E-04	0.0	9.232E-03	6.344E-03	0.0	0.0	0.0	1.005E-14
3.000E 04	1.250E-03	1.131E-03	1.023E-03	8.964E-04	1.258E-03	0.0	8.037E-03	5.944E-03	0.0	0.0	0.0	1.008E-14
1.000E 05	4.807E-03	4.348E-03	3.935E-03	3.446E-03	3.587E-03	0.0	4.948E-03	4.733E-03	0.0	0.0	0.0	1.019E-14
3.000E 05	1.053E-02	9.528E-03	8.624E-03	7.552E-03	7.104E-03	0.0	1.237E-03	2.469E-03	0.0	0.0	0.0	1.042E-14
1.000E 06	1.164E-02	1.053E-02	9.528E-03	8.345E-03	7.913E-03	0.0	9.668E-06	2.531E-04	0.0	0.0	0.0	1.073E-14

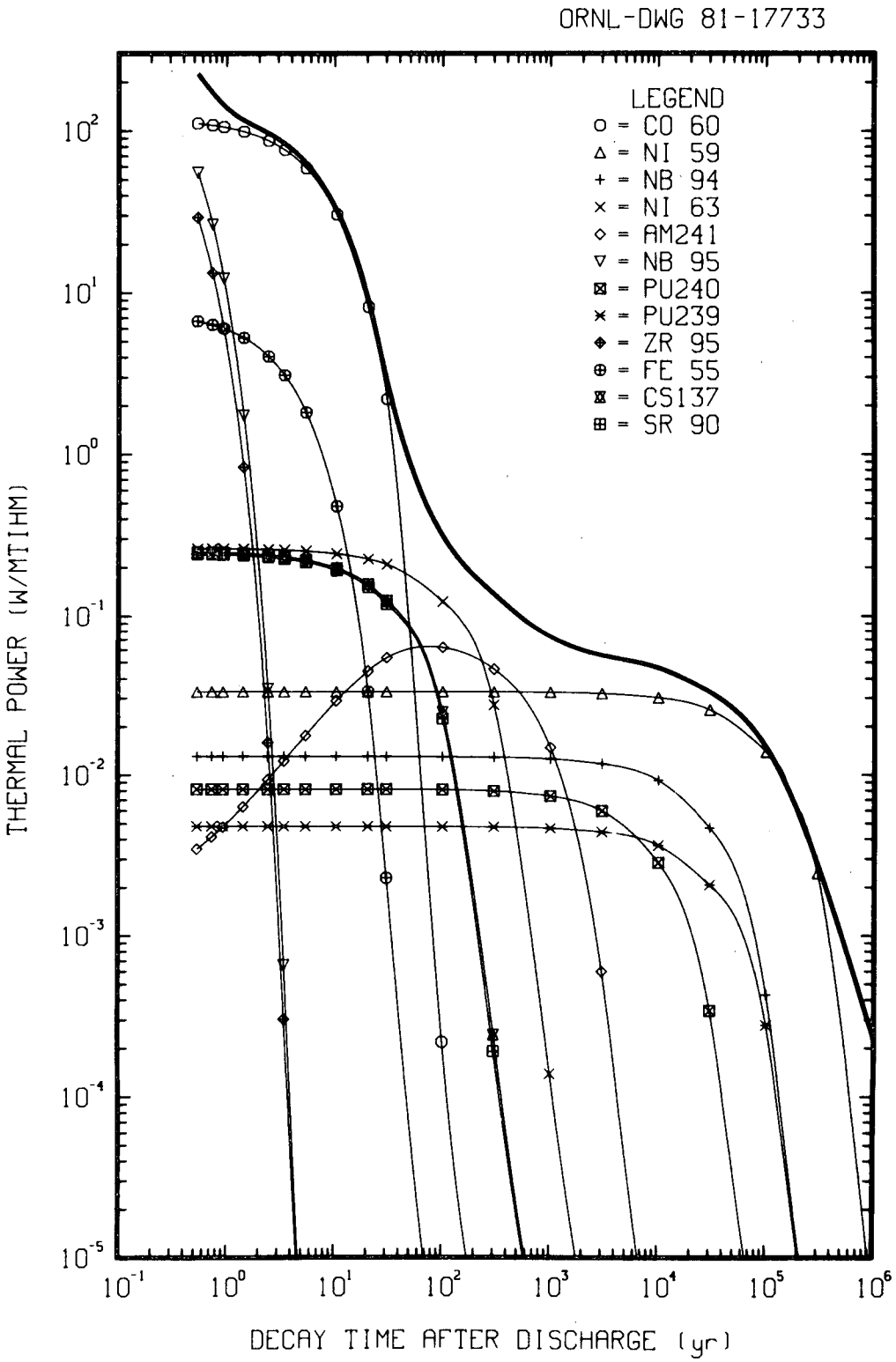

Fig. A.6. Thermal power of PWR structural material waste as a function of decay time.

Table A.6. Thermal power of PWR structural material waste as a function of decay time

Thermal power (W/MTIHM)

Time (years)	TOTAL	CO 60	NI 59	NB 94	NI 63	AM241	NB 95	PU240	PU239	ZR 95	PO213	FE 55
1.000E-01	2.268E 02	1.115E 02	3.299E-02	1.307E-02	2.613E-01	3.483E-03	5.571E 01	8.191E-03	4.925E-03	2.928E 01	1.261E-12	6.679E 00
3.000E-01	1.720E 02	1.086E 02	3.299E-02	1.307E-02	2.609E-01	4.133E-03	2.651E 01	8.191E-03	4.825E-03	1.327E 01	1.265E-12	6.332E 00
5.000E-01	1.437E 02	1.058E 02	3.299E-02	1.307E-02	2.606E-01	4.777E-03	1.231E 01	8.192E-03	4.825E-03	6.014E 00	1.272E-12	6.004E 00
1.000E 00	1.160E 02	9.906E 01	3.299E-02	1.307E-02	2.596E-01	6.358E-03	1.739E 00	8.193E-03	4.825E-03	8.315E-01	1.294E-12	5.254E 00
2.000E 00	9.664E 01	8.685E 01	3.299E-02	1.307E-02	2.576E-01	9.405E-03	3.459E-02	8.194E-03	4.825E-03	1.590E-02	1.331E-12	4.025E 00
3.000E 00	8.331E 01	7.615E 01	3.299E-02	1.307E-02	2.557E-01	1.230E-02	6.624E-04	8.195E-03	4.825E-03	3.041E-04	1.373E-12	3.083E 00
5.000E 00	6.286E 01	5.853E 01	3.298E-02	1.307E-02	2.519E-01	1.768E-02	2.337E-07	8.198E-03	4.825E-03	1.112E-07	1.467E-12	1.809E 00
1.000E 01	3.203E 01	3.032E 01	3.298E-02	1.307E-02	2.426E-01	2.898E-02	5.975E-16	8.203E-03	4.824E-03	2.842E-16	1.759E-12	4.773E-01
2.000E 01	8.901E 00	8.138E 00	3.298E-02	1.306E-02	2.250E-01	4.450E-02	3.904E-33	8.208E-03	4.823E-03	1.857E-33	2.585E-12	3.317E-02
3.000E 01	2.801E 00	2.184E 00	3.298E-02	1.306E-02	2.086E-01	5.368E-02	2.550E-50	8.209E-03	4.821E-03	1.213E-50	3.740E-12	2.306E-03
1.000E 02	3.115E-01	2.191E-04	3.296E-02	1.302E-02	1.231E-01	6.230E-02	0.0	8.167E-03	4.812E-03	0.0	2.196E-11	1.812E-11
3.000E 02	1.364E-01	8.236E-16	3.290E-02	1.294E-02	2.728E-02	4.562E-02	0.0	7.997E-03	4.786E-03	0.0	2.009E-10	0.0
1.000E 03	7.310E-02	0.0	3.270E-02	1.263E-02	1.397E-04	1.485E-02	0.0	7.425E-03	4.696E-03	0.0	3.116E-09	0.0
3.000E 03	5.554E-02	0.0	3.214E-02	1.180E-02	3.990E-11	6.011E-04	0.0	6.006E-03	4.445E-03	0.0	3.739E-08	0.0
1.000E 04	4.640E-02	0.0	3.025E-02	9.289E-03	0.0	1.609E-07	0.0	2.859E-03	3.660E-03	0.0	4.098E-07	0.0
3.000E 04	3.276E-02	0.0	2.544E-02	4.692E-03	0.0	2.991E-08	0.0	3.430E-04	2.076E-03	0.0	2.374E-06	0.0
1.000E 05	1.485E-02	0.0	1.387E-02	4.298E-04	0.0	9.917E-11	0.0	2.051E-07	2.773E-04	0.0	9.259E-06	0.0
3.000E 05	2.775E-03	0.0	2.452E-03	4.633E-07	0.0	8.599E-18	0.0	8.897E-12	8.780E-07	0.0	2.035E-05	0.0
1.000E 06	2.240E-04	0.0	5.710E-06	1.928E-17	0.0	0.0	0.0	8.846E-12	5.531E-13	0.0	2.250E-05	0.0

Thermal power (W/MTIHM)

Time (years)	CS137	AT217	SR 90	FR221	AC225	NB 93M	TH229	SB125	NP237	PU238	U233	PO214
1.000E-01	2.483E-01	1.086E-12	2.421E-01	9.826E-13	8.893E-13	1.745E-06	7.796E-13	4.424E 00	4.771E-06	3.831E-02	2.090E-10	4.559E-13
3.000E-01	2.471E-01	1.090E-12	2.409E-01	9.862E-13	8.926E-13	1.944E-06	7.837E-13	4.208E 00	4.772E-06	3.863E-02	2.130E-10	5.200E-13
5.000E-01	2.460E-01	1.096E-12	2.398E-01	9.915E-13	8.974E-13	2.141E-06	7.880E-13	4.003E 00	4.772E-06	3.885E-02	2.170E-10	5.834E-13
1.000E 00	2.432E-01	1.115E-12	2.369E-01	1.009E-12	9.128E-13	2.624E-06	7.990E-13	3.532E 00	4.773E-06	3.911E-02	2.269E-10	7.598E-13
2.000E 00	2.376E-01	1.148E-12	2.313E-01	1.038E-12	9.394E-13	3.555E-06	8.227E-13	2.750E 00	4.775E-06	3.908E-02	2.489E-10	1.189E-12
3.000E 00	2.322E-01	1.184E-12	2.259E-01	1.070E-12	9.689E-13	4.439E-06	8.485E-13	2.141E 00	4.778E-06	3.883E-02	2.739E-10	1.722E-12
5.000E 00	2.217E-01	1.265E-12	2.154E-01	1.144E-12	1.035E-12	6.078E-06	9.066E-13	1.298E 00	4.787E-06	3.824E-02	3.128E-10	3.098E-12
1.000E 01	1.975E-01	1.516E-12	1.912E-01	1.371E-12	1.241E-12	9.514E-06	1.087E-12	3.714E-01	4.822E-06	3.676E-02	4.126E-10	8.376E-12
2.000E 01	1.568E-01	2.228E-12	1.507E-01	2.015E-12	1.824E-12	1.424E-05	1.597E-12	3.041E-02	4.934E-06	3.397E-02	6.153E-10	2.703E-11
3.000E 01	1.244E-01	3.223E-12	1.188E-01	2.915E-12	2.639E-12	1.708E-05	2.311E-12	2.490E-03	5.081E-06	3.139E-02	8.234E-10	5.690E-11
1.000E 02	2.468E-02	1.893E-11	2.245E-02	1.712E-11	1.549E-11	2.123E-05	1.357E-11	6.146E-11	6.370E-06	1.808E-02	2.486E-09	6.135E-10
3.000E 02	2.431E-04	1.731E-10	1.924E-04	1.566E-10	1.417E-10	2.135E-05	1.241E-10	0.0	9.575E-06	3.739E-03	9.184E-09	6.085E-09
1.000E 03	2.298E-11	2.685E-09	1.118E-11	2.429E-09	2.198E-09	2.134E-05	1.925E-09	0.0	1.529E-05	1.599E-05	4.683E-08	7.106E-08
3.000E 03	1.960E-31	3.222E-08	2.367E-32	2.914E-08	2.638E-08	2.132E-05	2.310E-08	0.0	1.793E-05	1.423E-10	1.891E-07	5.265E-07
1.000E 04	0.0	3.532E-07	0.0	3.194E-07	2.891E-07	2.126E-05	2.532E-07	0.0	1.800E-05	1.925E-24	7.031E-07	3.040E-06
3.000E 04	0.0	2.046E-06	0.0	1.851E-06	1.675E-06	2.106E-05	1.467E-06	0.0	1.788E-05	0.0	2.070E-06	1.058E-05
1.000E 05	0.0	7.980E-06	0.0	7.218E-06	6.533E-06	2.041E-05	5.721E-06	0.0	1.748E-05	0.0	5.957E-06	2.411E-05
3.000E 05	0.0	1.754E-05	0.0	1.586E-05	1.436E-05	1.864E-05	1.257E-05	0.0	1.639E-05	0.0	1.183E-05	2.734E-05
1.000E 06	0.0	1.939E-05	0.0	1.754E-05	1.587E-05	1.357E-05	1.390E-05	0.0	1.306E-05	0.0	1.318E-05	1.069E-05

Appendix A.3. Toxicity of PWR Spent Fuel, High-Level Waste, and Structural Material Waste

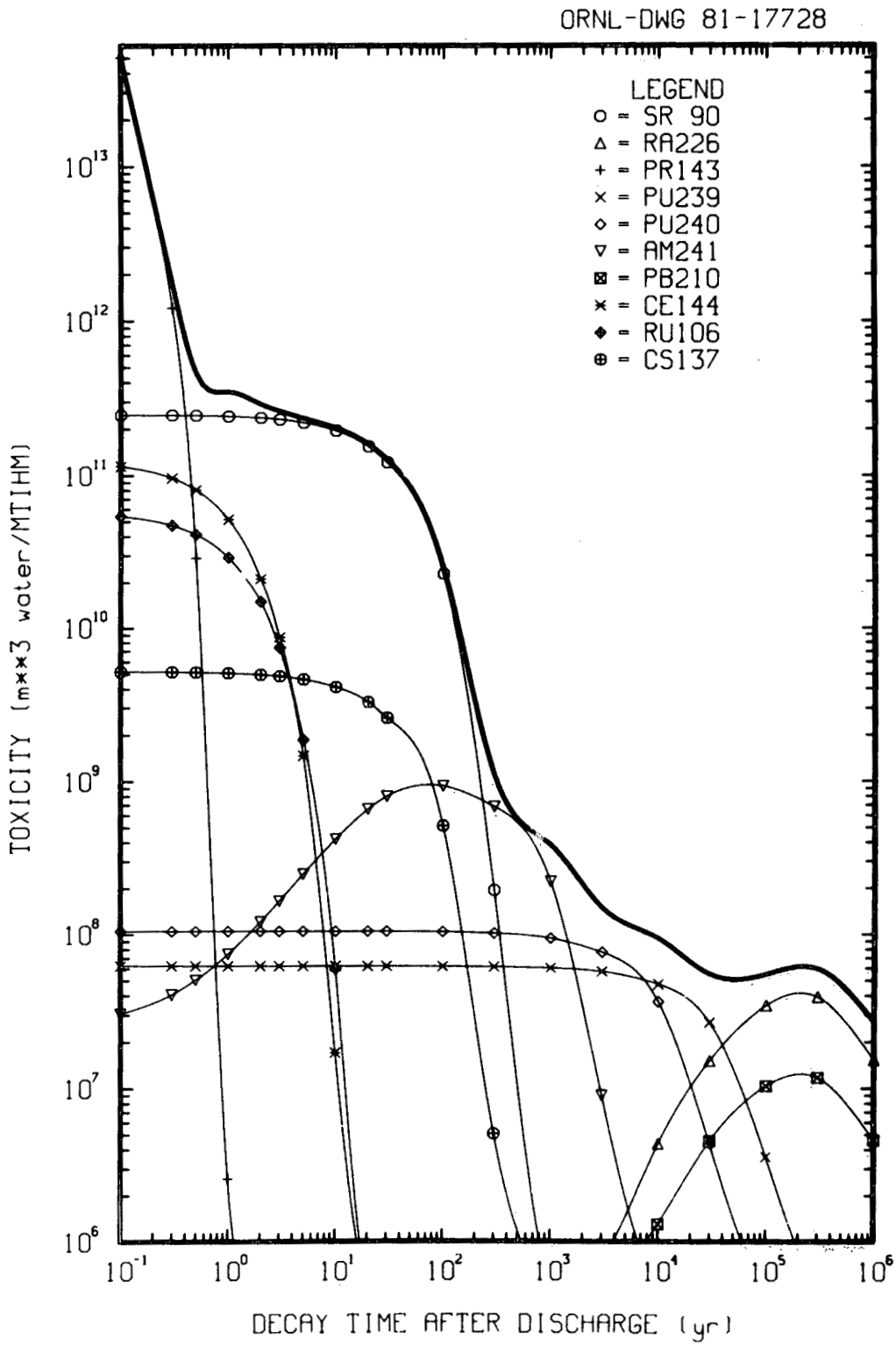

Fig. A.7. Toxicity of PWR spent fuel as a function of decay time.

Table A.7. *Toxicity of PWR spent fuel as a function of decay time*

Toxicity (m^3 water/MTIHM)

Time (years)	TOTAL	SR 90	RA226	PR143	PU239	PU240	AM241	PB210	CE144	TH229	RJ106	RA225
1.000E-01	5.160E 13	2.468E 11	4.952E-01	5.069E 13	6.260E 07	1.052E 08	3.064E 07	5.092E-03	1.153E 11	1.259E-01	5.433E 10	1.402E-01
3.000E-01	1.732E 12	2.457E 11	5.678E-01	1.213E 12	6.250E 07	1.052E 08	4.065E 07	6.072E-03	9.645E 10	1.266E-01	4.735E 10	1.024E-01
5.000E-01	4.605E 11	2.446E 11	6.460E-01	2.902E 10	6.260E 07	1.052E 08	5.053E 07	7.158E-03	8.072E 10	1.273E-01	4.126E 10	1.017E-01
1.000E 00	3.482E 11	2.415E 11	8.672E-01	2.570E 06	6.260E 07	1.052E 08	7.487E 07	1.052E-02	5.170E 10	1.290E-01	2.925E 10	1.032E-01
2.000E 00	2.889E 11	2.360E 11	1.420E 00	2.014E-02	6.260E 07	1.052E 08	1.217E 08	2.055E-02	2.122E 10	1.327E-01	1.471E 10	1.062E-01
3.000E 00	2.605E 11	2.303E 11	2.120E 00	1.580E-10	6.260E 07	1.053E 08	1.663E 08	3.602E-02	8.709E 09	1.368E-01	7.396E 09	1.094E-01
5.000E 00	2.332E 11	2.196E 11	3.966E 00	9.712E-27	6.260E 07	1.053E 08	2.490E 08	8.798E-02	1.467E 09	1.460E-01	1.859E 09	1.168E-01
1.000E 01	2.018E 11	1.950E 11	1.121E 01	0.0	6.260E 07	1.053E 08	4.228E 08	3.929E-01	1.737E 07	1.747E-01	6.005E 07	1.398E-01
2.000E 01	1.588E 11	1.537E 11	3.732E 01	0.0	6.258E 07	1.054E 08	6.618E 08	2.180E 00	2.314E 03	2.568E-01	6.369E 04	2.054E-01
3.000E 01	1.254E 11	1.211E 11	7.951E 01	0.0	6.256E 07	1.054E 08	8.031E 08	6.252E 00	3.136E-01	3.719E-01	6.919E 01	2.975E-01
1.000E 02	2.477E 10	2.290E 10	8.731E 02	0.0	6.245E 07	1.049E 08	9.381E 08	1.440E 02	0.0	2.200E 00	8.614E-20	1.760E 00
3.000E 02	1.107E 09	1.960E 08	8.714E 03	0.0	6.211E 07	1.027E 08	6.872E 08	2.092E 03	0.0	2.022E 01	0.0	1.617E 01
1.000E 03	3.866E 08	1.138E 01	1.020E 05	0.0	6.094E 07	9.537E 07	2.236E 08	3.058E 04	0.0	3.142E 02	0.0	2.514E 02
3.000E 03	1.506E 08	2.411E-20	7.558E 05	0.0	5.769E 07	7.715E 07	9.052E 06	2.267E 05	0.0	3.773E 03	0.0	3.019E 03
1.000E 04	9.431E 07	0.0	4.367E 06	0.0	4.748E 07	3.673E 07	2.421E 03	1.309E 06	0.0	4.137E 04	0.0	3.309E 04
3.000E 04	5.502E 07	0.0	1.520E 07	0.0	2.694E 07	4.406E 06	4.501E 02	4.557E 06	0.0	2.397E 05	0.0	1.918E 05
1.000E 05	5.485E 07	0.0	3.463E 07	0.0	3.597E 06	2.635E 03	1.492E 00	1.038E 07	0.0	9.348E 05	0.0	7.478E 05
3.000E 05	5.955E 07	0.0	3.927E 07	0.0	1.142E 04	1.143E-01	1.293E-07	1.178E 07	0.0	2.055E 06	0.0	1.644E 06
1.000E 06	2.713E 07	0.0	1.535E 07	0.0	7.177E-03	1.136E-01	0.0	4.603E 06	0.0	2.271E 06	0.0	1.817E 06

Toxicity (m^3 water/MTIHM)

Time (years)	CS137	PO210	RN219	CS134	I129	AM243	NP237	TH230	PU238	PU242	SR 89	AC225
1.000E-01	5.203E 09	4.206E-04	9.710E 00	1.680E 10	5.244E 05	4.267E 06	1.040E 05	1.204E 01	4.473E 08	3.515E 05	1.767E 11	1.852E-02
3.000E-01	5.179E 09	5.329E-04	1.213E 01	1.571E 10	5.251E 05	4.267E 06	1.041E 05	1.305E 01	4.555E 08	3.515E 05	5.484E 10	1.048E-02
5.000E-01	5.155E 09	6.555E-04	1.469E 01	1.469E 10	5.266E 05	4.267E 06	1.041E 05	1.407E 01	4.614E 08	3.515E 05	2.379E 10	1.017E-02
1.000E 00	5.095E 09	1.022E-03	2.171E 01	1.241E 10	5.268E 05	4.267E 06	1.041E 05	1.660E 01	4.694E 08	3.515E 05	1.940E 09	1.033E-02
2.000E 00	4.980E 09	2.131E-03	3.550E 01	8.870E 09	5.268E 05	4.267E 06	1.041E 05	2.169E 01	4.724E 08	3.515E 05	1.290E 07	1.062E-02
3.000E 00	4.865E 09	3.901E-03	4.835E 01	6.338E 09	5.268E 05	4.267E 06	1.042E 05	2.683E 01	4.700E 08	3.515E 05	8.575E 04	1.094E-02
5.000E 00	4.646E 09	1.018E-02	7.392E 01	3.235E 09	5.268E 05	4.265E 06	1.044E 05	3.716E 01	4.631E 08	3.515E 05	3.788E 00	1.168E-02
1.000E 01	4.139E 09	5.613E-02	1.375E 02	6.324E 08	5.268E 05	4.262E 06	1.051E 05	6.354E 01	4.451E 08	3.515E 05	4.917E-11	1.398E-02
2.000E 01	3.285E 09	3.114E-01	2.635E 02	2.090E 07	5.258E 05	4.260E 06	1.075E 05	1.184E 02	4.113E 08	3.515E 05	0.0	2.054E-02
3.000E 01	2.607E 09	8.932E-01	3.883E 02	7.246E 05	5.268E 05	4.256E 06	1.107E 05	1.758E 02	3.801E 08	3.515E 05	0.0	2.975E-02
1.000E 02	5.173E 08	2.058E 01	1.245E 03	4.371E-05	5.258E 05	4.228E 06	1.387E 05	6.364E 02	2.189E 08	3.515E 05	0.0	1.760E-01
3.000E 02	5.093E 06	2.988E 02	3.669E 03	0.0	5.268E 05	4.150E 06	2.087E 05	2.245E 03	4.527E 07	3.513E 05	0.0	1.617E 00
1.000E 03	4.817E-01	4.369E 03	1.252E 04	0.0	5.268E 05	3.885E 06	3.335E 05	8.421E 03	1.934E 05	3.508E 05	0.0	2.514E 01
3.000E 03	4.107E-21	3.237E 04	3.650E 04	0.0	5.268E 05	3.220E 06	3.909E 05	2.592E 04	1.720E 00	3.498E 05	0.0	3.019E 02
1.000E 04	0.0	1.870E 05	1.190E 05	0.0	5.266E 05	1.668E 06	3.924E 05	8.412E 04	2.327E-14	3.454E 05	0.0	5.309E 03
3.000E 04	0.0	6.510E 05	3.307E 05	0.0	5.261E 05	2.551E 05	3.901E 05	2.265E 05	0.0	3.333E 05	0.0	1.918E 04
1.000E 05	0.0	1.483E 06	7.584E 05	0.0	5.244E 05	3.534E 02	3.812E 05	5.168E 05	0.0	2.938E 05	0.0	7.478E 04
3.000E 05	0.0	1.682E 06	9.329E 05	0.0	5.199E 05	9.231E-03	3.573E 05	5.873E 05	0.0	2.054E 05	0.0	1.644E 05
1.000E 06	0.0	6.577E 05	9.355E 05	0.0	5.04JE 05	8.948E-03	2.850E 05	2.301E 05	0.0	5.862E 04	0.0	1.817E 05

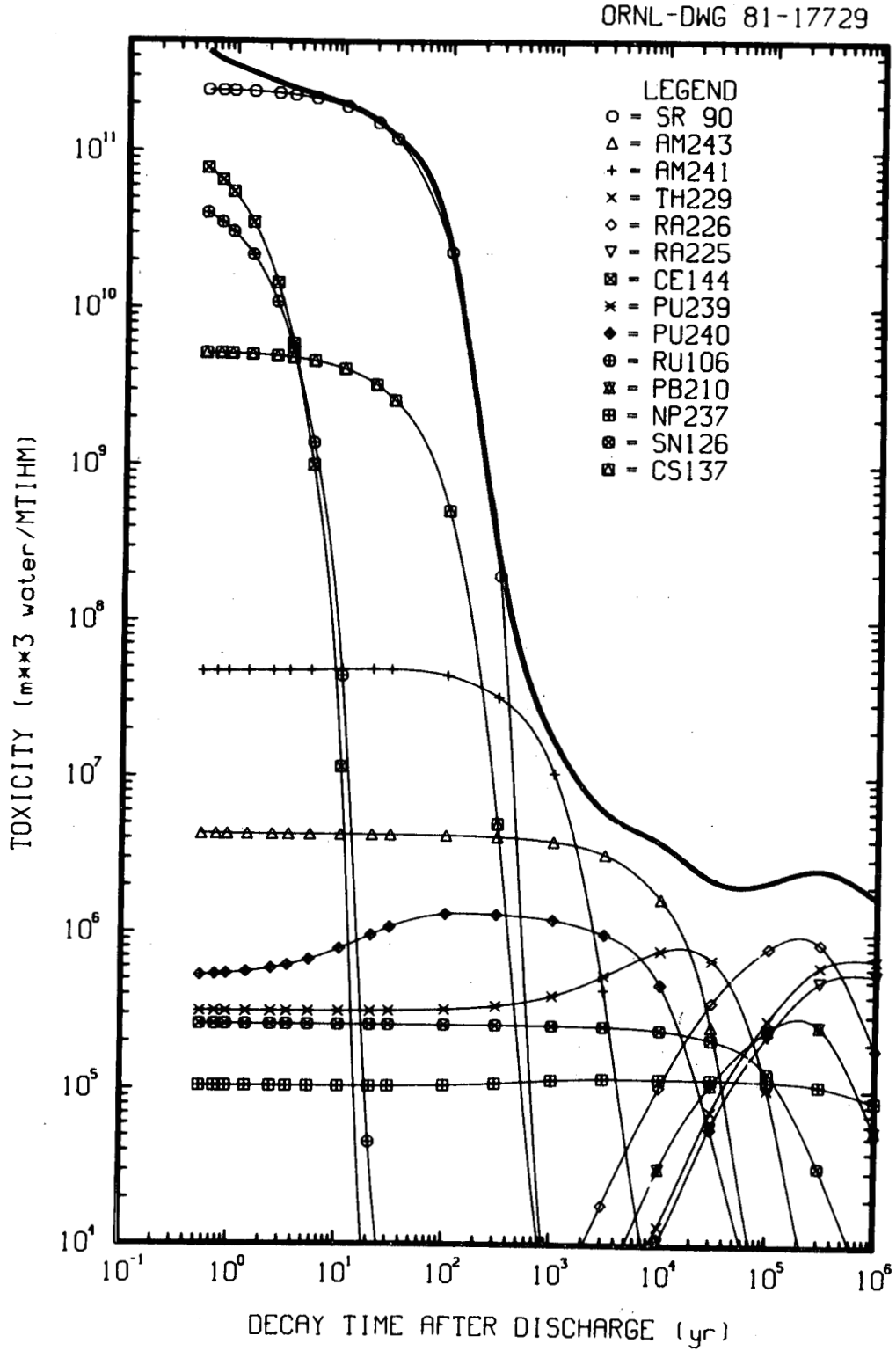

Fig. A.8. Toxicity of PWR high-level waste as a function of decay time.

Table A.8. Toxicity of PWR high-level waste as a function of decay time

Toxicity (m^3 water/MTIHM)

Time (years)	TOTAL	SR 90	AM243	AM241	TH229	RA226	RA225	CE144	PU239	PU240	RU106	PB210
1.000E-01	4.319E 11	2.442E 11	4.266E 06	4.749E 07	1.270E-01	6.606E-01	1.016E-01	7.799E 10	3.130E 05	5.290E 05	4.019E 10	7.291E-03
3.000E-01	3.777E 11	2.430E 11	4.266E 06	4.752E 07	1.270E-01	7.399E-01	1.016E-01	6.527E 10	3.130E 05	5.353E 05	3.592E 10	8.540E-03
5.000E-01	3.521E 11	2.419E 11	4.266E 06	4.755E 07	1.270E-01	8.194E-01	1.016E-01	5.462E 10	3.130E 05	5.415E 05	3.052E 10	9.930E-03
1.000E 00	3.137E 11	2.390E 11	4.265E 06	4.764E 07	1.272E-01	1.018E 00	1.018E-01	3.499E 10	3.131E 05	5.570E 05	2.164E 10	1.401E-02
2.000E 00	2.725E 11	2.333E 11	4.265E 06	4.779E 07	1.277E-01	1.416E 00	1.022E-01	1.436E 10	3.133E 05	5.869E 05	1.088E 10	2.473E-02
3.000E 00	2.506E 11	2.279E 11	4.265E 06	4.793E 07	1.286E-01	1.814E 00	1.029E-01	5.893E 09	3.135E 05	6.158E 05	5.471E 09	3.877E-02
5.000E 00	2.279E 11	2.173E 11	4.264E 06	4.819E 07	1.314E-01	2.612E 00	1.051E-01	9.925E 08	3.138E 05	6.702E 05	1.383E 09	7.645E-02
1.000E 01	1.981E 11	1.930E 11	4.262E 06	4.866E 07	1.441E-01	4.622E 00	1.153E-01	1.155E 07	3.146E 05	7.894E 05	4.442E 07	2.225E-01
2.000E 01	1.556E 11	1.520E 11	4.258E 06	4.909E 07	1.937E-01	8.716E 00	1.550E-01	1.566E 03	3.161E 05	9.687E 05	4.560E 04	7.048E-01
3.000E 01	1.226E 11	1.199E 11	4.254E 06	4.905E 07	2.756E-01	1.294E 01	2.205E-01	2.122E-01	3.174E 05	1.090E 06	4.752E 01	1.391E 00
1.000E 02	2.323E 10	2.264E 10	4.226E 06	4.492E 07	1.756E 00	4.862E 01	1.405E 00	0.0	3.250E 05	1.327E 06	5.915E-20	9.670E 00
3.000E 02	2.410E 08	1.940E 08	4.147E 06	3.263E 07	1.480E 01	2.531E 02	1.184E 01	0.0	3.426E 05	1.317E 06	0.0	6.305E 01
1.000E 03	1.700E 07	1.127E 01	3.883E 06	1.062E 07	1.641E 02	2.476E 03	1.313E 02	0.0	3.999E 05	1.222E 06	0.0	7.426E 02
3.000E 03	6.003E 06	2.385E-20	3.218E 06	4.339E 05	1.438E 03	1.813E 04	1.150E 03	0.0	5.359E 05	9.888E 05	0.0	5.437E 03
1.000E 04	3.795E 06	0.0	1.668E 06	2.305E 03	1.329E 04	1.046E 05	1.063E 04	0.0	7.788E 05	4.707E 05	0.0	3.137E 04
3.000E 04	2.208E 06	0.0	2.549E 05	4.499E 02	7.325E 04	3.627E 05	5.860E 04	0.0	6.793E 05	5.647E 04	0.0	1.088E 05
1.000E 05	2.161E 06	0.0	3.652E 02	1.494E 00	2.816E 05	8.137E 05	2.253E 05	0.0	1.023E 05	3.376E 01	0.0	2.440E 05
3.000E 05	2.577E 06	0.0	9.229E-03	1.297E-07	6.172E 05	8.607E 05	4.937E 05	0.0	3.236E 02	5.945E-04	0.0	2.581E 05
1.000E 06	1.688E 06	0.0	8.944E-03	0.0	6.819E 05	1.845E 05	5.455E 05	0.0	7.156E-03	6.121E-04	0.0	5.534E 04

Toxicity (m^3 water/MTIHM)

Time (years)	NP237	SN126	CS137	CS134	SE 79	PD107	SR 89	TC 99	AC225	PR143	NP239	PO210
1.000E-01	1.040E 05	2.590E 05	5.148E 09	1.449E 10	1.364E 05	3.740E 04	1.965E 10	6.534E 04	1.017E-02	1.426E 10	1.707E 05	6.794E-04
3.000E-01	1.040E 05	2.590E 05	5.124E 09	1.355E 10	1.364E 05	3.740E 04	7.210E 09	6.534E 04	1.016E-02	3.411E 08	1.706E 05	8.130E-04
5.000E-01	1.040E 05	2.590E 05	5.101E 09	1.267E 10	1.364E 05	3.740E 04	2.645E 09	6.534E 04	1.016E-02	8.162E 06	1.706E 05	9.632E-04
1.000E 00	1.040E 05	2.590E 05	5.042E 09	1.071E 10	1.364E 05	3.740E 04	2.157E 08	6.534E 04	1.018E-02	7.228E 02	1.706E 05	1.416E-03
2.000E 00	1.041E 05	2.590E 05	4.927E 09	7.653E 09	1.354E 05	3.740E 04	1.435E 06	6.534E 04	1.022E-02	5.667E-06	1.706E 05	2.574E-03
3.000E 00	1.041E 05	2.590E 05	4.814E 09	5.468E 09	1.364E 05	3.740E 04	9.535E 03	6.534E 04	1.029E-02	4.444E-14	1.706E 05	4.401E-03
5.000E 00	1.041E 05	2.590E 05	4.597E 09	2.792E 09	1.363E 05	3.740E 04	4.213E-01	6.534E 04	1.051E-02	2.732E-30	1.705E 05	9.264E-03
1.000E 01	1.042E 05	2.590E 05	4.095E 09	5.198E 08	1.363E 05	3.740E 04	5.469E-12	6.534E 04	1.153E-02	0.0	1.705E 05	3.179E-02
2.000E 01	1.044E 05	2.590E 05	3.250E 09	1.803E 07	1.363E 05	3.740E 04	0.0	6.534E 04	1.550E-02	0.0	1.703E 05	1.007E-01
3.000E 01	1.047E 05	2.590E 05	2.580E 09	6.252E 05	1.363E 05	3.740E 04	0.0	6.534E 04	2.205E-02	0.0	1.701E 05	1.988E-01
1.000E 02	1.061E 05	2.589E 05	5.119E 08	3.771E-05	1.352E 05	3.740E 04	0.0	6.532E 04	1.405E-01	0.0	1.690E 05	1.381E 00
3.000E 02	1.094E 05	2.585E 05	5.043E 06	0.0	1.359E 05	3.740E 04	0.0	6.528E 04	1.184E 00	0.0	1.659E 05	9.007E 00
1.000E 03	1.153E 05	2.572E 05	4.769E-01	0.0	1.349E 05	3.739E 04	0.0	6.513E 04	1.313E 01	0.0	1.553E 05	1.061E 02
3.000E 03	1.180E 05	2.537E 05	4.066E-21	0.0	1.321E 05	3.739E 04	0.0	6.471E 04	1.150E 02	0.0	1.287E 05	7.767E 02
1.000E 04	1.178E 05	2.417E 05	0.0	0.0	1.226E 05	3.736E 04	0.0	6.325E 04	1.063E 03	0.0	6.671E 04	4.482E 03
3.000E 04	1.171E 05	2.104E 05	0.0	0.0	9.900E 04	3.728E 04	0.0	5.927E 04	5.860E 03	0.0	1.019E 04	1.554E 04
1.000E 05	1.145E 05	1.295E 05	0.0	0.0	4.691E 04	3.700E 04	0.0	4.719E 04	2.253E 04	0.0	1.451E 01	3.486E 04
3.000E 05	1.073E 05	3.238E 04	0.0	0.0	5.552E 03	3.622E 04	0.0	2.462E 04	4.937E 04	0.0	3.692E-04	3.687E 04
1.000E 06	8.551E 04	2.530E 02	0.0	0.0	3.167E 00	3.361E 04	0.0	2.523E 03	5.455E 04	0.0	3.578E-04	7.906E 03

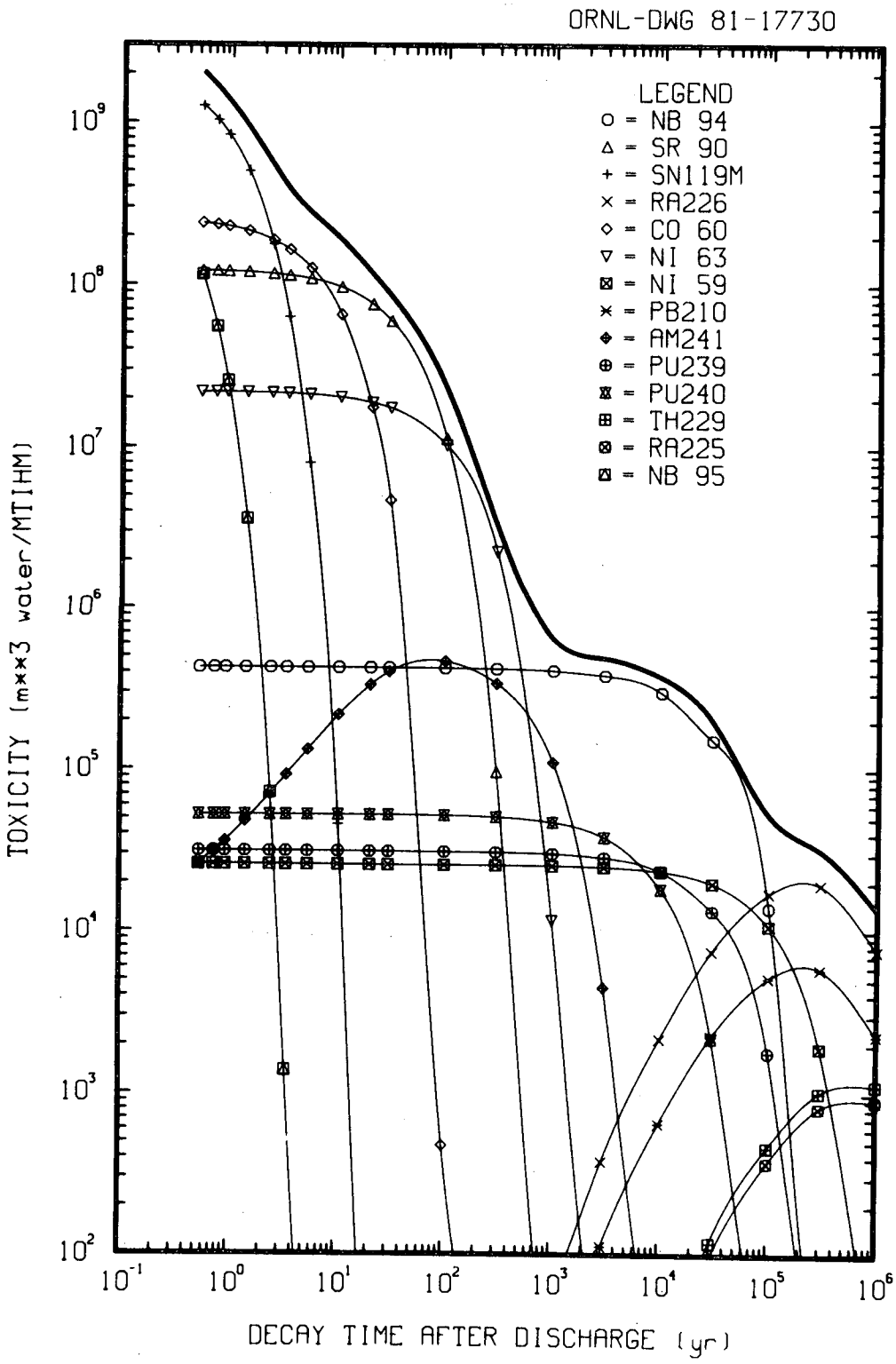

Fig. A.9. Toxicity of PWR structural material waste as a function of decay time.

Table A.9. Toxicity of PWR structural material waste as a function of decay time

Toxicity (m^3 water/MTIHM)

Time (years)	TOTAL	NB 94	SR 90	SN119M	RA226	CD 60	NI 63	NI 59	PB210	AM241	PU239	PU240
1.000E-01	2.056E 09	4.275E 05	1.221E 08	1.267E 09	3.308E-04	2.411E 08	2.193E 07	2.591E 04	3.647E-06	2.621E 04	3.131E 04	5.261E 04
3.000E-01	1.642E 09	4.275E 05	1.216E 08	1.031E 09	3.734E-04	2.348E 08	2.190E 07	2.591E 04	4.275E-06	3.111E 04	3.131E 04	5.261E 04
5.000E-01	1.359E 09	4.275E 05	1.210E 08	8.383E 08	4.190E-04	2.287E 08	2.187E 07	2.591E 04	4.981E-06	3.595E 04	3.131E 04	5.262E 04
1.000E 00	9.280E 08	4.275E 05	1.196E 08	5.001E 08	5.457E-04	2.142E 08	2.179E 07	2.591E 04	7.120E-06	4.785E 04	3.131E 04	5.262E 04
2.000E 00	5.439E 08	4.275E 05	1.167E 08	1.779E 08	8.543E-04	1.878E 08	2.162E 07	2.591E 04	1.326E-05	7.078E 04	3.131E 04	5.263E 04
3.000E 00	3.877E 08	4.275E 05	1.140E 08	6.332E 07	1.237E-03	1.646E 08	2.146E 07	2.591E 04	2.237E-05	9.259E 04	3.131E 04	5.264E 04
5.000E 00	2.779E 08	4.275E 05	1.087E 08	8.018E 06	2.225E-03	1.265E 08	2.114E 07	2.591E 04	5.188E-05	1.331E 05	3.131E 04	5.266E 04
1.000E 01	1.883E 08	4.274E 05	9.651E 07	4.586E 04	6.015E-03	6.556E 07	2.036E 07	2.590E 04	2.173E-04	2.181E 05	3.131E 04	5.269E 04
2.000E 01	1.158E 08	4.273E 05	7.606E 07	1.493E 00	1.982E-02	1.760E 07	1.888E 07	2.590E 04	1.152E-03	3.349E 05	3.130E 04	5.272E 04
3.000E 01	8.491E 07	4.271E 05	5.996E 07	4.860E-05	4.387E-02	4.722E 06	1.751E 07	2.590E 04	3.247E-03	4.040E 05	3.129E 04	5.273E 04
1.000E 02	2.310E 07	4.261E 05	1.133E 07	0.0	4.406E-01	4.736E 02	1.033E 07	2.588E 04	7.283E-02	4.689E 05	3.123E 04	5.246E 04
3.000E 02	3.303E 06	4.232E 05	9.713E 04	0.0	4.370E 00	1.781E-09	2.290E 06	2.584E 04	1.050E 00	3.434E 05	3.106E 04	5.137E 04
1.000E 03	6.518E 05	4.132E 05	5.641E-03	0.0	5.103E 01	0.0	1.172E 04	2.568E 04	1.530E 01	1.117E 05	3.047E 04	4.769E 04
3.000E 03	4.920E 05	3.859E 05	1.195E-23	0.0	3.781E 02	0.0	3.349E-03	2.524E 04	1.134E 02	4.524E 03	2.885E 04	3.858E 04
1.000E 04	3.764E 05	3.039E 05	0.0	0.0	2.183E 03	0.0	0.0	2.376E 04	6.547E 02	1.211E 00	2.375E 04	1.837E 04
3.000E 04	2.012E 05	1.535E 05	0.0	0.0	7.599E 03	0.0	0.0	1.998E 04	2.279E 03	2.251E-01	1.347E 04	2.203E 03
1.000E 05	5.256E 04	1.406E 04	0.0	0.0	1.732E 04	0.0	0.0	1.089E 04	5.193E 03	7.464E-04	1.799E 03	1.317E 00
3.000E 05	3.187E 04	1.515E 01	0.0	0.0	1.964E 04	0.0	0.0	1.926E 03	5.889E 03	6.471E-11	5.698E 00	5.714E-05
1.000E 06	1.362E 04	6.308E-10	0.0	0.0	7.677E 03	0.0	0.0	4.484E 00	2.302E 03	0.0	3.590E-06	5.682E-05

Toxicity (m^3 water/MTIHM)

Time (years)	TH229	RA225	NB 95	ZR 95	RN219	PD210	CE144	SN123	CS137	SB125	RU106	NB 93M
1.000E-01	6.370E-05	5.092E-05	1.161E 08	9.633E 07	7.624E-03	3.399E-07	3.902E 07	3.900E 07	2.575E 05	1.415E 07	2.011E 07	2.462E 01
3.000E-01	6.405E-05	5.116E-05	5.526E 07	4.366E 07	8.875E-03	4.067E-07	3.265E 07	2.635E 07	2.554E 06	1.346E 07	1.752E 07	2.743E 01
5.000E-01	6.439E-05	5.143E-05	2.567E 07	1.979E 07	1.016E-02	4.822E-07	2.732E 07	1.781E 07	2.552E 06	1.280E 07	1.527E 07	3.021E 01
1.000E 00	6.529E-05	5.224E-05	3.625E 06	2.736E 06	1.368E-02	7.132E-07	1.750E 07	6.682E 06	2.522E 06	1.130E 07	1.083E 07	3.703E 01
2.000E 00	6.723E-05	5.378E-05	7.211E 04	5.231E 04	2.057E-02	1.401E-06	7.184E 06	9.412E 05	2.465E 06	8.796E 06	5.444E 06	5.016E 01
3.000E 00	6.934E-05	5.547E-05	1.381E 03	1.001E 03	2.698E-02	2.461E-06	2.948E 06	1.326E 05	2.408E 06	6.849E 06	2.737E 06	6.263E 01
5.000E 00	7.408E-05	5.927E-05	4.873E-01	3.658E-01	3.976E-02	6.060E-06	4.965E 05	2.633E 03	2.333E 06	4.152E 06	6.918E 05	9.576E 01
1.000E 01	8.882E-05	7.105E-05	1.246E-09	9.351E-10	7.154E-02	3.105E-05	5.782E 03	1.458E-01	2.049E 06	1.188E 06	2.222E 04	1.342E 02
2.000E 01	1.305E-04	1.044E-04	8.138E-27	6.109E-27	1.345E-01	1.646E-04	7.836E-01	4.482E-13	1.626E 06	9.728E 04	2.313E 01	2.009E 02
3.000E 01	1.888E-04	1.511E-04	5.317E-44	3.992E-44	1.969E-01	4.640E-04	1.062E-04	1.377E-18	1.291E 06	7.966E 03	2.375E-02	2.410E 02
1.000E 02	1.109E-03	8.870E-04	0.0	0.0	6.251E-01	1.040E-02	0.0	0.0	2.561E 05	1.966E-04	2.956E-23	2.996E 02
3.000E 02	1.014E-02	8.114E-03	0.0	0.0	1.838E 00	1.500E-01	0.0	0.0	2.521E 03	0.0	0.0	3.012E 02
1.000E 03	1.573E-01	1.259E-01	0.0	0.0	6.264E 00	2.186E 00	0.0	0.0	2.384E-04	0.0	0.0	3.011E 02
3.000E 03	1.888E 00	1.510E 00	0.0	0.0	1.830E 01	1.620E 01	0.0	0.0	2.033E-24	0.0	0.0	3.009E 02
1.000E 04	2.069E 01	1.655E 01	0.0	0.0	5.950E 01	9.353E 01	0.0	0.0	0.0	0.0	0.0	2.999E 02
3.000E 04	1.199E 02	9.590E 01	0.0	0.0	1.654E 02	3.255E 02	0.0	0.0	0.0	0.0	0.0	2.972E 02
1.000E 05	4.675E 02	3.740E 02	0.0	0.0	3.793E 02	7.418E 02	0.0	0.0	0.0	0.0	0.0	2.879E 02
3.000E 05	1.028E 03	8.220E 02	0.0	0.0	4.665E 02	8.413E 02	0.0	0.0	0.0	0.0	0.0	2.630E 02
1.000E 06	1.136E 03	9.089E 02	0.0	0.0	4.678E 02	3.289E 02	0.0	0.0	0.0	0.0	0.0	1.915E 02

Appendix B. CHARACTERISTICS OF LMFBR SPENT FUEL, HIGH-LEVEL WASTE, AND STRUCTURAL MATERIAL WASTE

Appendix B.1. Radioactivity of LMFBR Spent Fuel, High-Level Waste, and Structural Material Waste

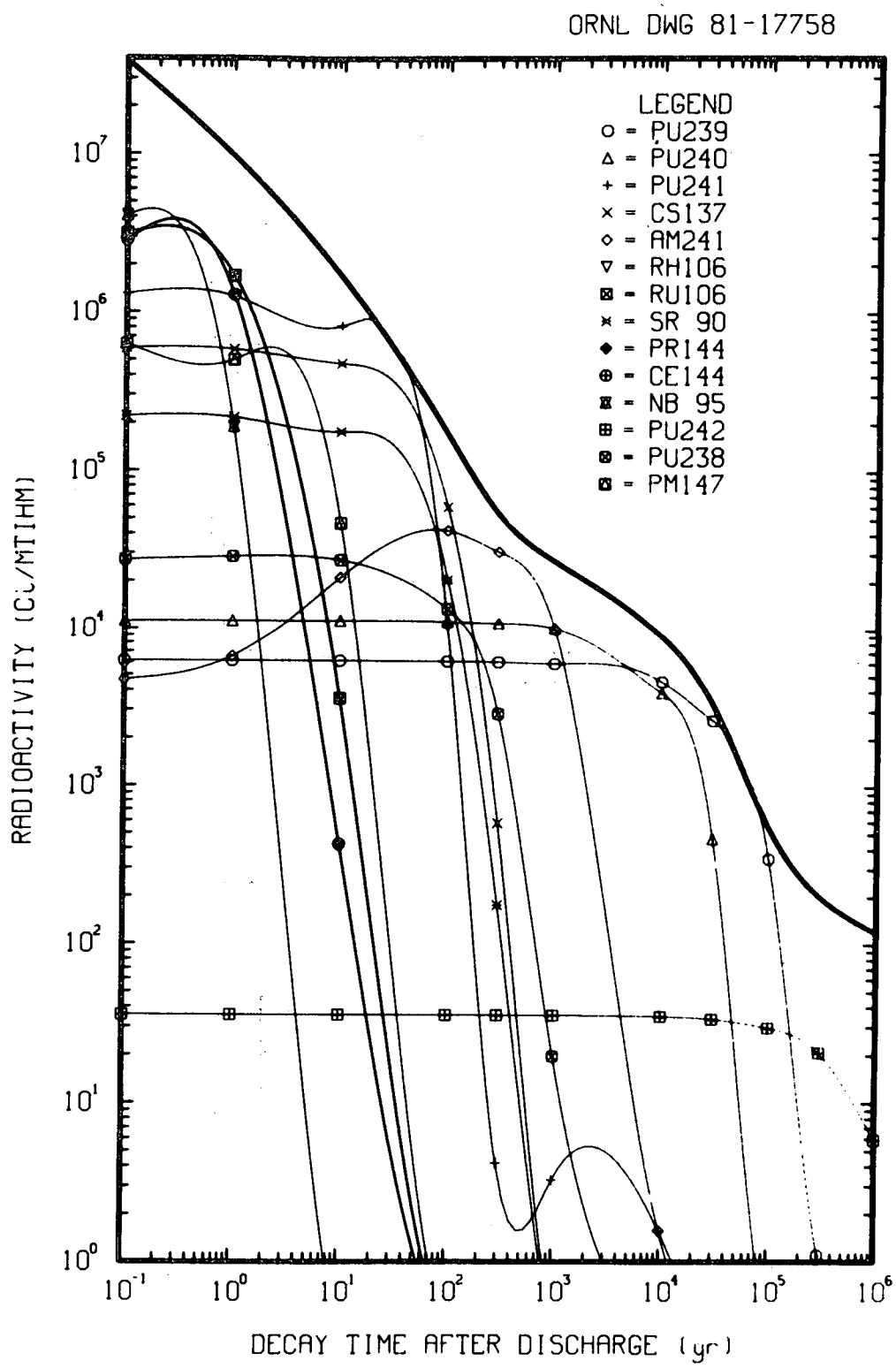

Fig. B.1. Radioactivity of LMFBR spent core fuel as a function of decay time.

Table B.1. Radioactivity of LMFBR spent core fuel as a function of decay time

Time (years)	Radioactivity (Ci/MTIHM)											
	TOTAL	PU239	PU240	PU241	CS137	AM241	RH106	RU106	SR 90	PR144	CE144	NB 95
1.000E-01	3.877E 07	6.101E 03	1.119E 04	1.308E 06	5.948E 05	4.681E 03	3.144E 06	3.144E 06	2.210E 05	2.872E 06	2.872E 06	4.092E 06
1.000E 00	9.583E 06	6.101E 03	1.119E 04	1.252E 06	5.826E 05	6.520E 03	1.694E 06	1.694E 06	2.163E 05	1.289E 06	1.288E 06	1.892E 05
1.000E 01	1.660E 06	6.100E 03	1.120E 04	8.120E 05	4.732E 05	2.098E 04	3.530E 03	3.530E 03	1.746E 05	4.256E 02	4.254E 02	6.609E-11
1.000E 02	1.700E 05	6.086E 03	1.113E 04	1.067E 04	5.915E 04	4.202E 04	0.0	0.0	2.050E 04	0.0	0.0	0.0
3.000E 02	5.345E 04	6.052E 03	1.089E 04	4.160E 00	5.821E 02	3.076E 04	0.0	0.0	1.755E 02	0.0	0.0	0.0
1.000E 03	2.680E 04	5.936E 03	1.012E 04	3.265E 00	5.506E-05	1.001E 04	0.0	0.0	1.019E-05	0.0	0.0	0.0
1.000E 04	8.904E 03	4.622E 03	3.896E 03	1.567E 00	0.0	1.572E 00	0.0	0.0	0.0	0.0	0.0	0.0
3.000E 04	3.286E 03	2.619E 03	4.673E 02	3.067E-01	0.0	3.067E-01	0.0	0.0	0.0	0.0	0.0	0.0
1.000E 05	5.461E 02	3.498E 02	2.793E-01	1.022E-03	0.0	1.022E-03	0.0	0.0	0.0	0.0	0.0	0.0
3.000E 05	2.004E 02	1.107E 00	3.413E-06	8.423E-11	0.0	8.875E-11	0.0	0.0	0.0	0.0	0.0	0.0
1.000E 06	1.192E 02	8.230E-07	3.394E-06	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Time (years)	Radioactivity (Ci/MTIHM)											
	PU242	PU238	PM147	RU103	ZR 95	RH103M	NP237	PA233	U233	TH229	AC225	RA225
1.000E-01	3.542E 01	2.728E 04	6.326E 05	3.475E 06	3.067E 06	3.134E 06	3.168E-01	3.085E-01	2.025E-05	2.225E-06	2.591E-06	2.394E-06
1.000E 00	3.542E 01	2.847E 04	5.008E 05	1.056E 04	8.713E 04	9.523E 03	3.186E-01	3.186E-01	2.165E-05	2.227E-06	2.227E-06	2.227E-06
1.000E 01	3.542E 01	2.697E 04	4.644E 04	0.0	2.977E-11	0.0	3.602E-01	3.602E-01	3.486E-05	2.249E-06	2.249E-06	2.249E-06
1.000E 02	3.543E 01	1.339E 04	2.187E-06	0.0	0.0	0.0	1.504E 00	1.504E 00	3.869E-04	3.690E-06	3.690E-06	3.690E-06
3.000E 02	3.542E 01	2.865E 03	0.0	0.0	0.0	0.0	3.852E 00	3.852E 00	2.783E-03	3.016E-05	3.016E-05	3.016E-05
1.000E 03	3.540E 01	1.957E 01	0.0	0.0	0.0	0.0	8.042E 00	8.042E 00	2.212E-02	7.654E-04	7.654E-04	7.654E-04
1.000E 04	3.483E 01	1.365E-17	0.0	0.0	0.0	0.0	1.004E 01	1.004E 01	4.093E-01	1.401E-01	1.401E-01	1.401E-01
3.000E 04	3.360E 01	0.0	0.0	0.0	0.0	0.0	9.982E 00	9.982E 00	1.213E 00	8.164E-01	8.164E-01	8.164E-01
1.000E 05	2.964E 01	0.0	0.0	0.0	0.0	0.0	9.760E 00	9.760E 00	3.495E 00	3.189E 00	3.189E 00	3.189E 00
3.000E 05	2.072E 01	0.0	0.0	0.0	0.0	0.0	9.147E 00	9.147E 00	6.942E 00	7.012E 00	7.012E 00	7.012E 00
1.000E 06	5.911E 00	0.0	0.0	0.0	0.0	0.0	7.291E 00	7.291E 00	7.737E 00	7.753E 00	7.753E 00	7.753E 00

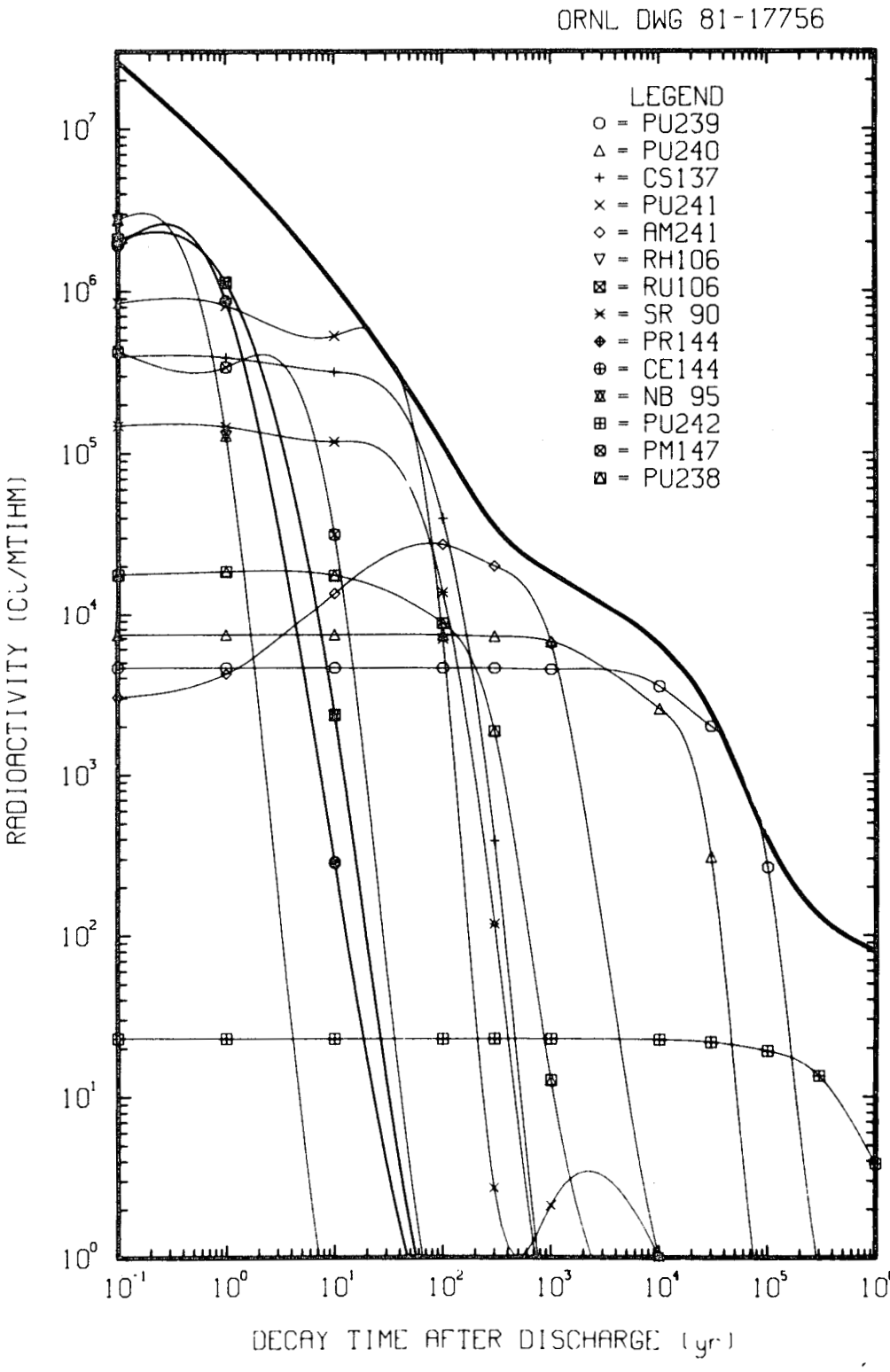

Fig. B.2. Radioactivity of LMFBR spent core + axial blanket fuel as a function of decay time.

Table B.2. Radioactivity of LMFBR spent core + axial blanket fuel as a function of decay time

Radioactivity (Ci/MTIHM)

Time (years)	TOTAL	PU239	PU240	CS137	PU241	AM241	RH106	RU106	SR 90	PR144	CE144	NB 95
1.000E-01	2.620E 07	4.642E 03	7.375E 03	3.981E 05	8.509E 05	3.041E 03	2.101E 06	2.101E 06	1.492E 05	1.936E 06	1.936E 06	2.778E 06
1.000E 00	6.409E 06	4.642E 03	7.375E 03	3.899E 05	8.145E 05	4.237E 03	1.131E 06	1.131E 06	1.461E 05	8.687E 05	8.687E 05	1.285E 05
1.000E 01	1.097E 06	4.641E 03	7.379E 03	3.166E 05	5.281E 05	1.364E 04	2.361E 03	2.361E 03	1.179E 05	2.868E 02	2.868E 02	4.491E-11
1.000E 02	1.131E 05	4.630E 03	7.333E 03	3.958E 04	6.939E 03	2.733E 04	0.0	0.0	1.384E 04	0.0	0.0	0.0
3.000E 02	3.557E 04	4.604E 03	7.180E 03	3.897E 02	2.701E 00	2.000E 04	0.0	0.0	1.185E 02	0.0	0.0	0.0
1.000E 03	1.817E 04	4.516E 03	6.666E 03	3.686E-05	2.120E 00	6.510E 03	0.0	0.0	6.884E-06	0.0	0.0	0.0
1.000E 04	6.332E 03	3.511E 03	2.567E 03	0.0	1.017E 00	1.021E 00	0.0	0.0	0.0	0.0	0.0	0.0
3.000E 04	2.428E 03	1.987E 03	3.080E 02	0.0	1.992E-01	1.992E-01	0.0	0.0	0.0	0.0	0.0	0.0
1.000E 05	3.950E 02	2.653E 02	1.841E-01	0.0	6.638E-04	6.638E-04	0.0	0.0	0.0	0.0	0.0	0.0
3.000E 05	1.324E 02	8.390E-01	2.216E-06	0.0	5.470E-11	5.763E-11	0.0	0.0	0.0	0.0	0.0	0.0
1.000E 06	7.969E 01	5.346E-07	2.204E-06	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Radioactivity (Ci/MTIHM)

Time (years)	PU242	PM147	PU238	RU103	ZR 95	RH103M	NP237	PA233	U233	TH229	AC225	RA225
1.000E-01	2.300E 01	4.293E 05	1.777E 04	2.351E 06	2.084E 06	2.120E 06	2.258E-01	2.199E-01	1.348E-05	1.446E-06	1.682E-06	1.555E-06
1.000E 00	2.300E 01	3.398E 05	1.854E 04	7.134E 03	5.919E 04	6.432E 03	2.269E-01	2.270E-01	1.448E-05	1.447E-06	1.447E-06	1.447E-06
1.000E 01	2.300E 01	3.152E 04	1.756E 04	0.0	2.023E-11	0.0	2.541E-01	2.541E-01	2.385E-05	1.462E-06	1.462E-06	1.462E-06
1.000E 02	2.301E 01	1.484E-06	8.721E 03	0.0	0.0	0.0	9.979E-01	9.979E-01	2.606E-04	2.442E-06	2.442E-06	2.442E-06
3.000E 02	2.301E 01	0.0	1.866E 03	0.0	0.0	0.0	2.525E 00	2.525E 00	1.835E-03	1.998E-05	1.998E-05	1.998E-05
1.000E 03	2.298E 01	0.0	1.272E 01	0.0	0.0	0.0	5.250E 00	5.250E 00	1.448E-02	5.017E-04	5.017E-04	5.017E-04
1.000E 04	2.262E 01	0.0	8.865E-18	0.0	0.0	0.0	5.550E 00	6.550E 00	2.670E-01	9.137E-02	9.137E-02	9.137E-02
3.000E 04	2.182E 01	0.0	0.0	0.0	0.0	0.0	6.511E 00	6.511E 00	7.915E-01	5.326E-01	5.326E-01	5.326E-01
1.000E 05	1.924E 01	0.0	0.0	0.0	0.0	0.0	6.366E 00	6.366E 00	2.280E 00	2.080E 00	2.080E 00	2.080E 00
3.000E 05	1.346E 01	0.0	0.0	0.0	0.0	0.0	5.966E 00	5.966E 00	4.527E 00	4.574E 00	4.574E 00	4.574E 00
1.000E 06	3.839E 00	0.0	0.0	0.0	0.0	0.0	4.756E 00	4.756E 00	5.046E 00	5.057E 00	5.057E 00	5.057E 00

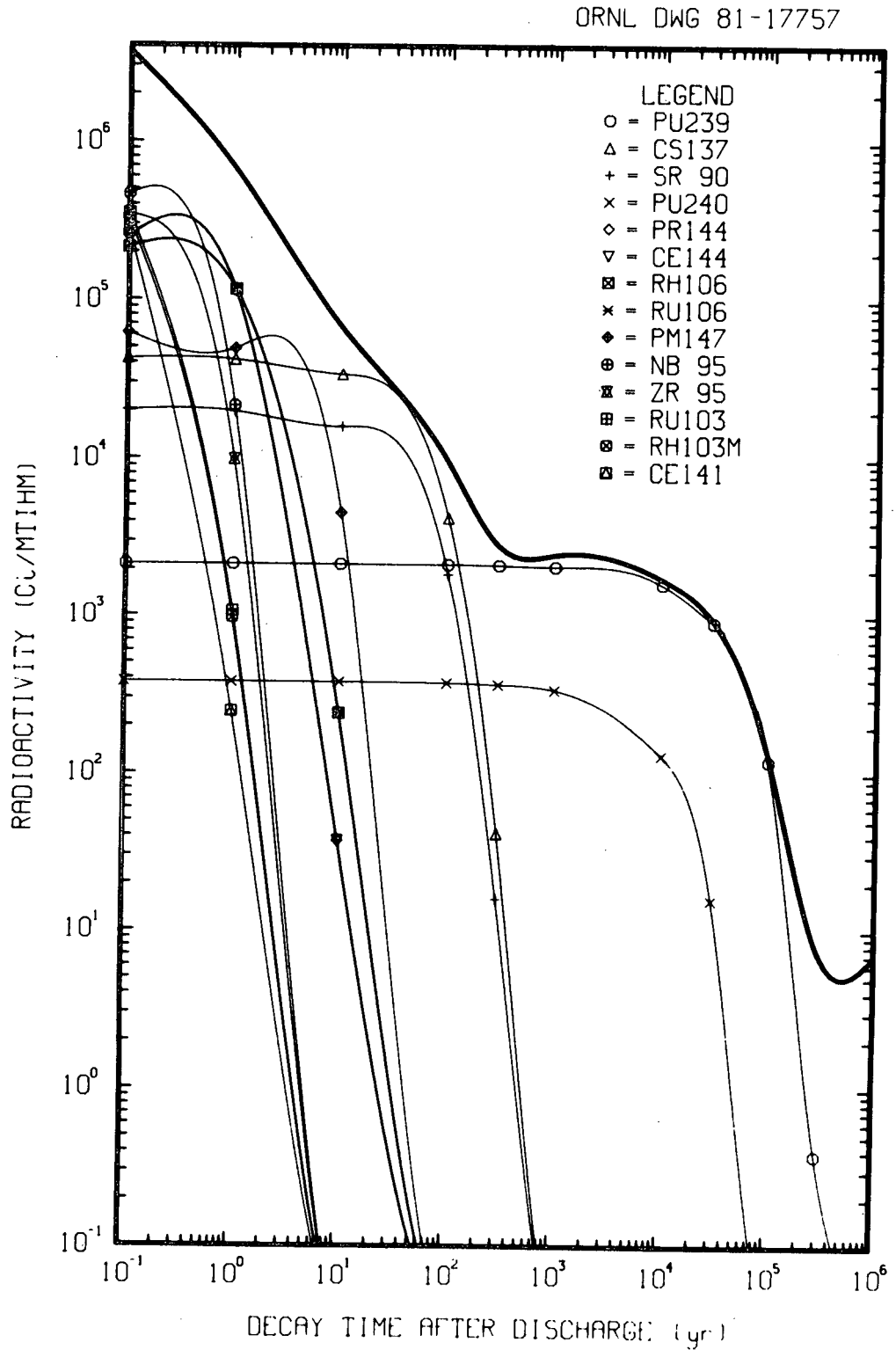

Fig. B.3. Radioactivity of LMFBR spent radial blanket fuel as a function of decay time.

Table B.3. Radioactivity of LMFBR spent radial blanket fuel as a function of decay time

Radioactivity (Ci/MTIHM)

Time (years)	TOTAL	PU239	CS137	SR 90	PU240	PR144	CE144	RH106	RU106	PM147	NB 95	ZR 95
1.000E-01	3.661E 06	2.158E 03	4.246E 04	2.009E 04	3.792E 02	2.517E 05	2.517E 05	2.138E 05	2.138E 05	6.178E 04	4.643E 05	3.460E 05
1.000E 00	6.520E 05	2.158E 03	4.158E 04	1.966E 04	3.791E 02	1.129E 05	1.129E 05	1.151E 05	1.151E 05	4.893E 04	2.134E 04	9.826E 03
1.000E 01	6.548E 04	2.157E 03	3.378E 04	1.587E 04	3.788E 02	3.729E 01	3.729E 01	2.394E 02	2.394E 02	4.538E 03	7.452E-12	3.358E-12
1.000E 02	9.368E 03	2.152E 03	4.222E 03	1.863E 03	3.752E 02	0.0	0.0	0.0	0.0	2.137E-07	0.0	0.0
3.000E 02	2.802E 03	2.139E 03	4.159E 01	1.596E 01	3.673E 02	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.000E 03	2.483E 03	2.097E 03	3.933E-06	9.266E-07	3.410E 02	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.000E 04	1.757E 03	1.618E 03	0.0	0.0	1.313E 02	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3.000E 04	9.322E 02	9.090E 02	0.0	0.0	1.575E 01	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.000E 05	1.282E 02	1.211E 02	0.0	0.0	9.420E-03	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3.000E 05	7.342E 00	3.830E-01	0.0	0.0	2.100E-11	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.000E 06	6.936E 00	6.705E-10	0.0	0.0	1.510E-11	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Radioactivity (Ci/MTIHM)

Time (years)	RU103	RH103M	CE141	Y 91	PU241	ZR 93	SM151	U238	PA234M	TH234	U234	RA226
1.000E-01	3.526E 05	3.178E 05	2.716E 05	2.031E 05	5.103E 03	3.325E-01	8.702E 02	3.211E-01	3.212E-01	3.212E-01	1.112E-03	5.571E-12
1.000E 00	1.060E 03	9.617E 02	2.456E 02	4.133E 03	4.887E 03	3.450E-01	8.639E 02	3.211E-01	3.211E-01	3.211E-01	1.658E-03	1.233E-11
1.000E 01	0.0	0.0	0.0	5.043E-14	3.169E 03	4.433E-01	8.060E 02	3.211E-01	3.211E-01	3.211E-01	6.919E-03	6.462E-10
1.000E 02	0.0	0.0	0.0	0.0	4.162E 01	6.103E-01	4.030E 02	3.211E-01	3.211E-01	3.211E-01	4.326E-02	3.462E-07
3.000E 02	0.0	0.0	0.0	0.0	2.745E-03	6.120E-01	8.639E 01	3.211E-01	3.211E-01	3.211E-01	7.122E-02	6.444E-06
1.000E 03	0.0	0.0	0.0	0.0	2.784E-06	6.118E-01	3.938E-01	3.211E-01	3.211E-01	3.211E-01	7.892E-02	1.052E-04
1.000E 04	0.0	0.0	0.0	0.0	1.336E-06	6.093E-01	0.0	3.211E-01	3.211E-01	3.211E-01	8.506E-02	5.352E-03
3.000E 04	0.0	0.0	0.0	0.0	2.615E-07	6.038E-01	0.0	3.211E-01	3.211E-01	3.211E-01	9.802E-02	2.105E-02
1.000E 05	0.0	0.0	0.0	0.0	8.668E-10	5.850E-01	0.0	3.211E-01	3.211E-01	3.211E-01	1.382E-01	6.786E-02
3.000E 05	0.0	0.0	0.0	0.0	7.133E-17	5.343E-01	0.0	3.211E-01	3.211E-01	3.211E-01	2.173E-01	1.721E-01
1.000E 06	0.0	0.0	0.0	0.0	0.0	3.891E-01	0.0	3.210E-01	3.210E-01	3.210E-01	3.068E-01	3.002E-01

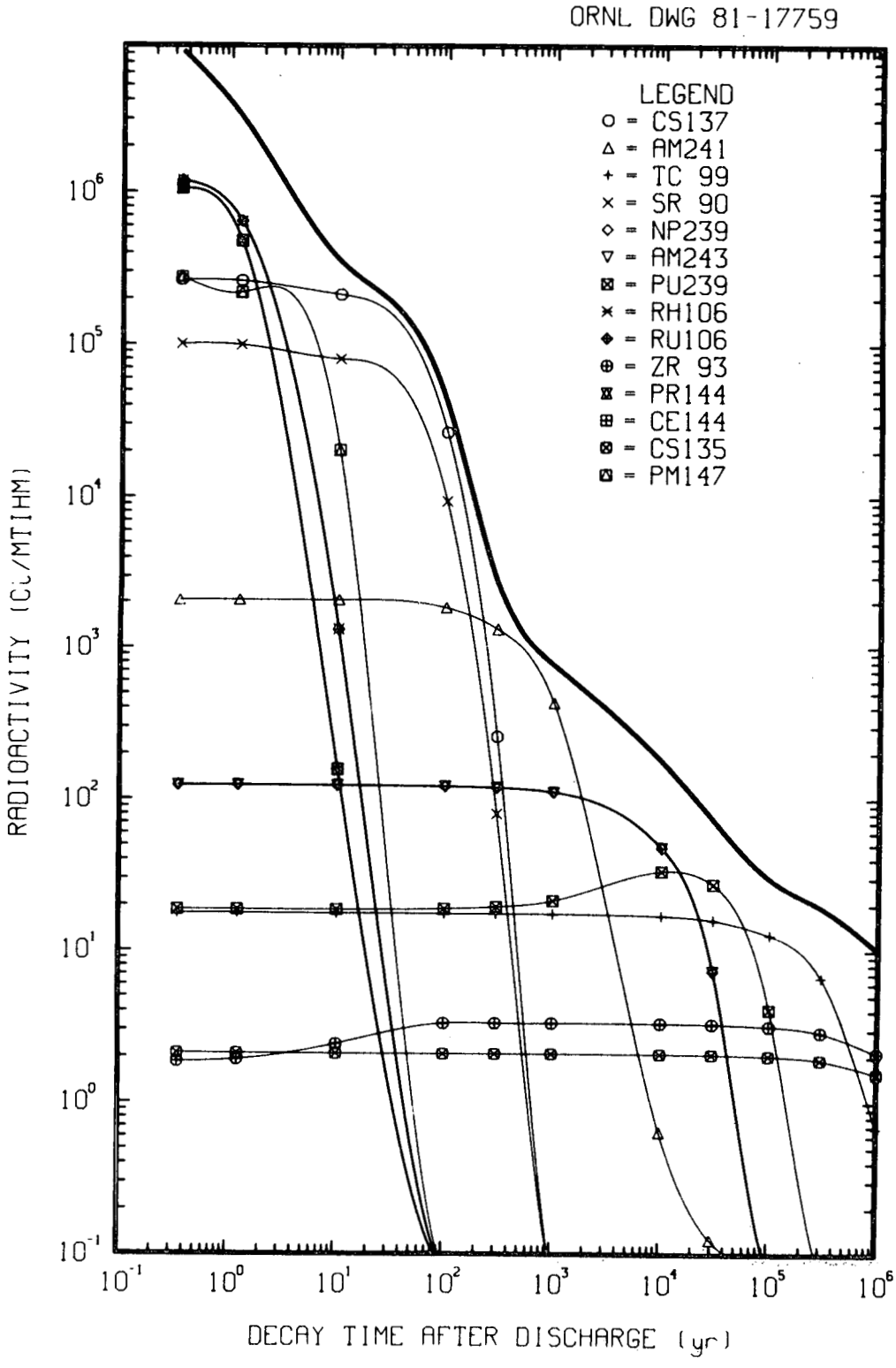

Fig. B.4. Radioactivity of LMFBR high-level waste as a function of decay time.

Table B.4. Radioactivity of LMFBR high-level waste as a function of decay time

Radioactivity (Ci/MTIHM)

Time (years)	TOTAL	CS137	AM241	TC 99	SR 90	NP239	AM243	PU239	RH106	RU106	ZR 93	PR144
3.500E-01	8.328E 06	2.658E 05	2.051E 03	1.770E 01	1.012E 05	1.235E 02	1.235E 02	1.865E 01	1.188E 06	1.188E 06	1.845E 00	1.057E 06
1.250E 00	3.078E 06	2.604E 05	2.052E 03	1.770E 01	9.901E 04	1.235E 02	1.235E 02	1.865E 01	6.398E 05	6.398E 05	1.912E 00	4.744E 05
1.025E 01	3.469E 05	2.115E 05	2.052E 03	1.770E 01	7.991E 04	1.234E 02	1.234E 02	1.870E 01	1.313E 03	1.307E 03	2.440E 00	1.566E 02
1.003E 02	4.110E 04	2.643E 04	1.825E 03	1.770E 01	9.383E 03	1.223E 02	1.223E 02	1.906E 01	0.0	0.0	3.339E 00	0.0
3.003E 02	2.728E 03	2.601E 02	1.325E 03	1.769E 01	8.033E 01	1.201E 02	1.201E 02	1.966E 01	0.0	0.0	3.348E 00	0.0
1.000E 03	7.647E 02	2.460E-05	4.322E 02	1.765E 01	4.666E-06	1.124E 02	1.124E 02	2.158E 01	0.0	0.0	3.348E 00	0.0
1.000E 04	1.778E 02	0.0	6.435E-01	1.714E 01	0.0	4.828E 01	4.828E 01	3.367E 01	0.0	0.0	3.334E 00	0.0
3.000E 04	7.330E 01	0.0	1.259E-01	1.606E 01	0.0	7.379E 00	7.379E 00	2.767E 01	0.0	0.0	3.303E 00	0.0
1.000E 05	2.982E 01	0.0	4.174E-04	1.279E 01	0.0	1.030E-02	1.028E-02	4.114E 00	0.0	0.0	3.200E 00	0.0
3.000E 05	1.929E 01	0.0	3.621E-11	6.670E 00	0.0	3.477E-07	3.477E-07	1.302E-02	0.0	0.0	2.923E 00	0.0
1.000E 06	1.011E 01	0.0	0.0	6.836E-01	0.0	3.370E-07	3.370E-07	3.370E-07	0.0	0.0	2.129E 00	0.0

Radioactivity (Ci/MTIHM)

Time (years)	CE144	CS135	PM147	PU240	NB 95	SM151	ZR 95	NP237	PA233	CS134	U233	TH229
3.500E-01	1.057E 06	2.103E 00	2.767E 05	2.410E 01	9.930E 05	4.784E 03	5.452E 05	1.699E-01	1.695E-01	1.228E 05	1.195E-07	4.583E-09
1.250E 00	4.744E 05	2.103E 00	2.182E 05	2.487E 01	3.402E 04	4.751E 03	1.549E 04	1.705E-01	1.705E-01	9.073E 04	8.684E-07	4.628E-09
1.025E 01	1.566E 02	2.103E 00	2.023E 04	3.124E 01	1.175E-11	4.433E 03	5.291E-12	1.765E-01	1.765E-01	4.404E 03	7.695E-06	8.280E-09
1.003E 02	0.0	2.103E 00	9.528E-07	4.590E 01	0.0	2.216E 03	0.0	2.334E-01	2.334E-01	3.195E-10	8.854E-05	4.006E-07
3.003E 02	0.0	2.103E 00	0.0	4.543E 01	0.0	4.750E 02	0.0	3.345E-01	3.345E-01	0.0	3.390E-04	4.265E-06
1.000E 03	0.0	2.102E 00	0.0	4.218E 01	0.0	2.164E 00	0.0	5.151E-01	5.151E-01	0.0	1.687E-03	6.642E-05
1.000E 04	0.0	2.097E 00	0.0	1.624E 01	0.0	0.0	0.0	6.033E-01	6.033E-01	0.0	2.490E-02	8.611E-03
3.000E 04	0.0	2.084E 00	0.0	1.948E 00	0.0	0.0	0.0	6.016E-01	6.016E-01	0.0	7.329E-02	4.938E-02
1.000E 05	0.0	2.041E 00	0.0	1.165E-03	0.0	0.0	0.0	5.886E-01	5.886E-01	0.0	2.108E-01	1.924E-01
3.000E 05	0.0	1.921E 00	0.0	7.532E-09	0.0	0.0	0.0	5.517E-01	5.517E-01	0.0	4.186E-01	4.229E-01
1.000E 06	0.0	1.556E 00	0.0	7.963E-09	0.0	0.0	0.0	4.398E-01	4.398E-01	0.0	4.656E-01	4.676E-01

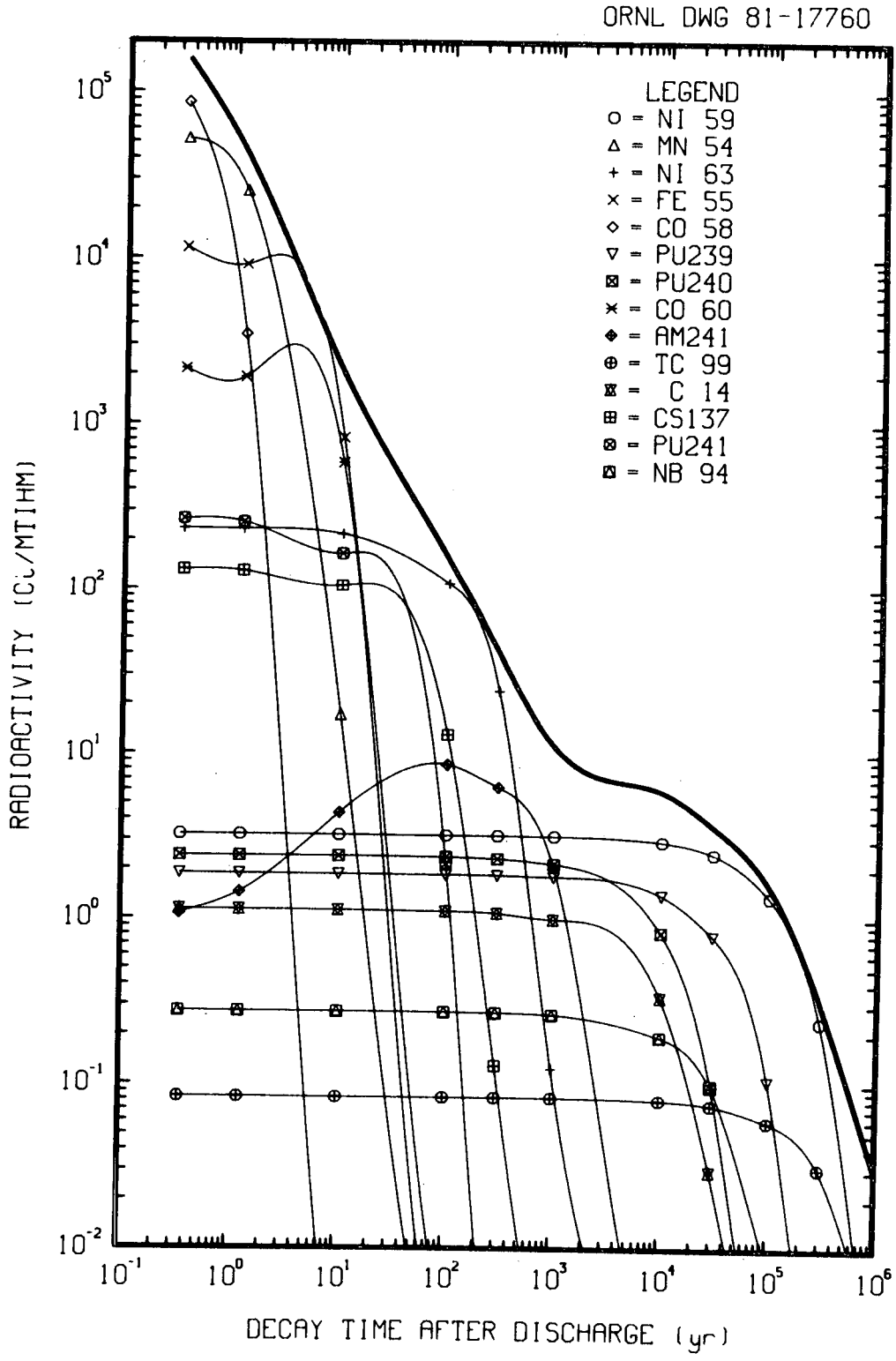

Fig. B.5. Radioactivity of LMFBR structural material waste as a function of decay time.

Table B.5. Radioactivity of LMFBR structural material waste as a function of decay time

Time (years)	Radioactivity (Ci/MTIHM)											
	TOTAL	NI 59	MN 54	NI 63	FE 55	CO 58	PU239	PU240	CO 60	AM241	TC 99	C 14
3.500E-01	1.588E 05	3.238E 00	5.245E 04	2.335E 02	1.158E 04	8.641E 04	1.865E 00	2.403E 00	2.153E 03	1.069E 00	8.329E-02	1.132E 00
1.250E 00	4.183E 04	3.238E 00	2.530E 04	2.319E 02	9.111E 03	3.455E 03	1.865E 00	2.403E 00	1.912E 03	1.444E 00	8.329E-02	1.131E 00
1.025E 01	2.003E 03	3.238E 00	1.724E 01	2.167E 02	8.270E 02	3.604E-11	1.865E 00	2.404E 00	5.854E 02	4.392E 00	8.328E-02	1.130E 00
1.003E 02	1.522E 02	3.236E 00	0.0	1.100E 02	3.142E-08	0.0	1.860E 00	2.388E 00	4.229E-03	8.667E 00	8.326E-02	1.118E 00
3.003E 02	4.099E 01	3.230E 00	0.0	2.438E 01	0.0	0.0	1.850E 00	2.338E 00	1.590E-14	6.344E 00	8.321E-02	1.091E 00
1.000E 03	1.106E 01	3.210E 00	0.0	1.250E-01	0.0	0.0	1.814E 00	2.171E 00	0.0	2.065E 00	8.302E-02	1.003E 00
1.000E 04	5.935E 00	2.970E 00	0.0	0.0	0.0	0.0	1.408E 00	8.361E-01	0.0	3.229E-04	8.062E-02	3.375E-01
3.000E 04	3.640E 00	2.497E 00	0.0	0.0	0.0	0.0	7.961E-01	1.003E-01	0.0	6.297E-05	7.554E-02	3.002E-02
1.000E 05	1.579E 00	1.362E 00	0.0	0.0	0.0	0.0	1.062E-01	5.996E-05	0.0	2.088E-07	6.015E-02	6.300E-06
3.000E 05	3.152E-01	2.407E-01	0.0	0.0	0.0	0.0	3.378E-04	7.008E-10	0.0	1.812E-14	3.138E-02	1.953E-16
1.000E 06	3.026E-02	5.607E-04	0.0	0.0	0.0	0.0	1.692E-10	6.969E-10	0.0	0.0	3.216E-03	0.0

Time (years)	Radioactivity (Ci/MTIHM)											
	CS137	PU241	NB 94	TH229	AC225	RA225	FR221	AT217	BI213	PB209	U233	PO213
3.500E-01	1.330E 02	2.667E 02	2.749E-01	4.585E-10	4.599E-10	4.589E-10	4.599E-10	4.599E-10	4.599E-10	4.599E-10	4.587E-09	4.500E-10
1.250E 00	1.302E 02	2.554E 02	2.749E-01	4.588E-10	4.588E-10	4.588E-10	4.588E-10	4.588E-10	4.588E-10	4.588E-10	4.952E-09	4.489E-10
1.025E 01	1.058E 02	1.656E 02	2.748E-01	4.641E-10	4.641E-10	4.641E-10	4.641E-10	4.641E-10	4.641E-10	4.641E-10	8.465E-09	4.541E-10
1.003E 02	1.322E 01	2.176E 00	2.740E-01	8.058E-10	8.058E-10	8.058E-10	8.058E-10	8.058E-10	8.058E-10	8.058E-10	8.905E-08	7.884E-10
3.003E 02	1.301E-01	8.531E-04	2.721E-01	6.603E-09	6.603E-09	6.603E-09	6.603E-09	6.603E-09	6.603E-09	6.603E-09	6.008E-07	6.461E-09
1.000E 03	1.231E-08	6.704E-04	2.657E-01	1.619E-07	1.619E-07	1.619E-07	1.619E-07	1.619E-07	1.619E-07	1.619E-07	4.653E-06	1.584E-07
1.000E 04	0.0	3.218E-04	1.954E-01	2.921E-05	2.921E-05	2.921E-05	2.921E-05	2.921E-05	2.921E-05	2.921E-05	8.528E-05	2.858E-05
3.000E 04	0.0	6.297E-05	9.869E-02	1.701E-04	1.701E-04	1.701E-04	1.701E-04	1.701E-04	1.701E-04	1.701E-04	2.528E-04	1.664E-04
1.000E 05	0.0	2.088E-07	9.041E-03	6.642E-04	6.642E-04	6.642E-04	6.642E-04	6.642E-04	6.642E-04	6.642E-04	7.279E-04	6.499E-04
3.000E 05	0.0	1.720E-14	9.828E-06	1.460E-03	1.460E-03	1.460E-03	1.460E-03	1.460E-03	1.460E-03	1.460E-03	1.446E-03	1.429E-03
1.000E 06	0.0	0.0	4.091E-16	1.615E-03	1.615E-03	1.615E-03	1.615E-03	1.615E-03	1.615E-03	1.615E-03	1.611E-03	1.580E-03

Appendix B.2. Thermal Power of LMFBR Spent Fuel, High-Level Waste, and Structural Material Waste

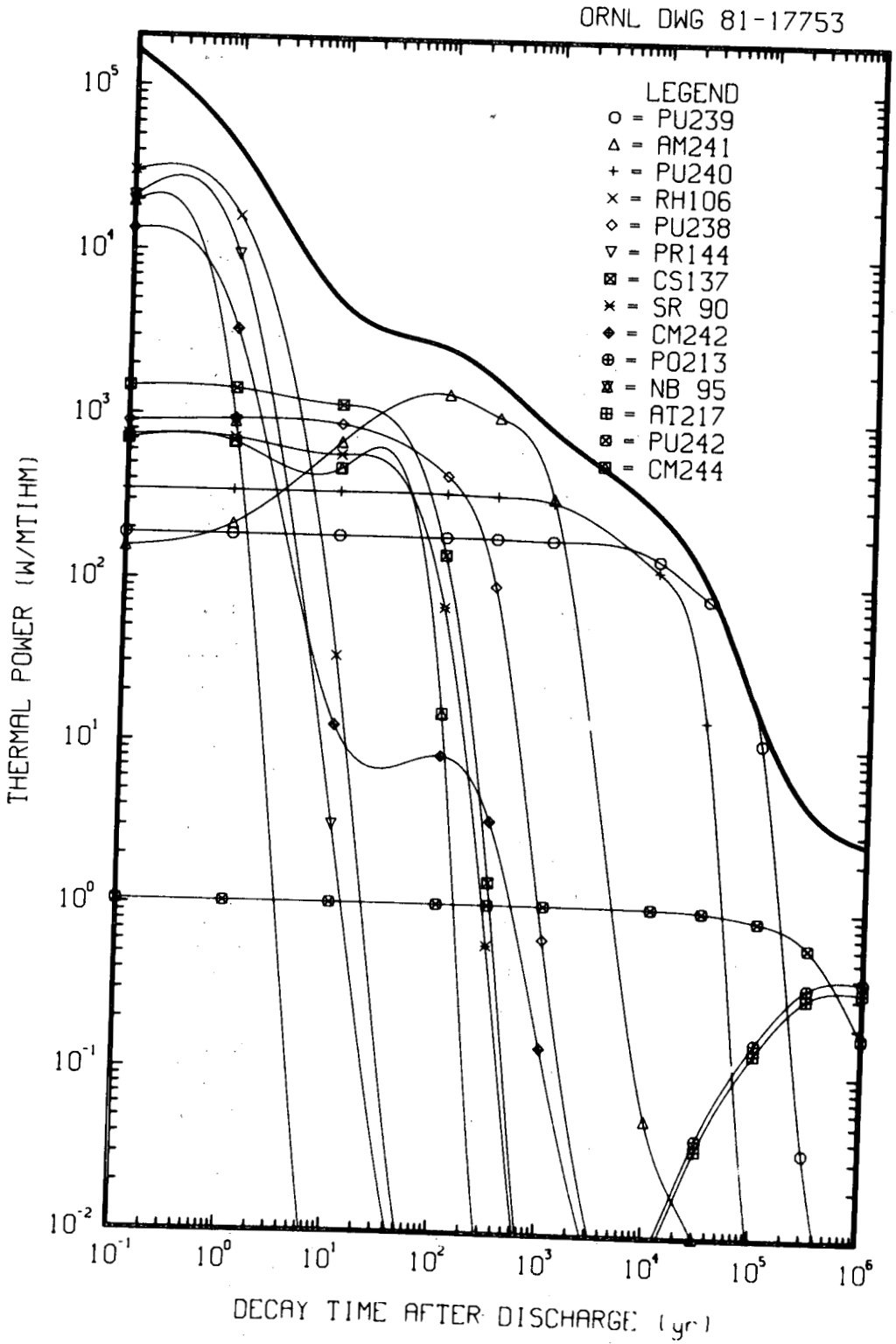

Fig. B.6. Thermal power of LMFBR spent core fuel as a function of decay time.

Table B.6. Thermal power of LMFBR spent core fuel as a function of decay time

Time (years)	Thermal power (W/MTIHM)											
	TOTAL	PU239	AM241	PU240	RH106	PU238	PR144	CS137	SR 90	CM242	PO213	NB 95
1.000E-01	1.638E 05	1.880E 02	1.555E 02	3.485E 02	3.016E 04	9.040E 02	2.111E 04	1.474E 03	7.409E 02	1.335E 04	1.282E-07	1.962E 04
1.000E 00	3.990E 04	1.880E 02	2.166E 02	3.485E 02	1.624E 04	9.435E 02	9.471E 03	1.443E 03	7.251E 02	3.316E 03	1.103E-07	9.971E 02
1.000E 01	4.736E 03	1.880E 02	6.970E 02	3.487E 02	3.386E 01	8.937E 02	3.127E 00	1.172E 03	5.853E 02	1.282E 01	1.113E-07	3.170E-13
1.000E 02	2.627E 03	1.876E 02	1.395E 03	3.465E 02	0.0	4.436E 02	0.0	1.465E 02	6.871E 01	8.502E 00	1.827E-07	0.0
3.000E 02	1.660E 03	1.865E 02	1.022E 03	3.393E 02	0.0	9.495E 01	0.0	1.442E 00	5.882E-01	3.415E 00	1.494E-06	0.0
1.000E 03	8.427E 02	1.830E 02	3.326E 02	3.149E 02	0.0	6.485E-01	0.0	1.364E-07	3.416E-08	1.403E-01	3.790E-05	0.0
1.000E 04	2.700E 02	1.424E 02	5.223E-02	1.213E 02	0.0	4.525E-19	0.0	0.0	0.0	2.114E-19	6.938E-03	0.0
3.000E 04	9.849E 01	8.073E 01	1.019E-02	1.456E 01	0.0	0.0	0.0	0.0	0.0	0.0	4.042E-02	0.0
1.000E 05	1.441E 01	1.078E 01	3.396E-05	8.700E-03	0.0	0.0	0.0	0.0	0.0	0.0	1.579E-01	0.0
3.000E 05	4.180E 00	3.413E-02	2.948E-12	1.063E-07	0.0	0.0	0.0	0.0	0.0	0.0	3.471E-01	0.0
1.000E 06	2.642E 00	2.536E-08	0.0	1.057E-07	0.0	0.0	0.0	0.0	0.0	0.0	3.839E-01	0.0

Time (years)	Thermal power (W/MTIHM)											
	AT217	PU242	CM244	FR221	AC225	NP237	ZR 95	CS134	TH229	U233	LA140	RU103
1.000E-01	1.105E-07	1.046E 00	7.058E 02	9.997E-08	9.048E-08	9.684E-03	1.554E 04	3.194E 03	6.818E-08	5.885E-07	1.357E 04	1.163E 04
1.000E 00	9.503E-08	1.046E 00	6.820E 02	8.595E-08	7.779E-08	9.738E-03	4.413E 02	2.360E 03	6.812E-08	6.292E-07	2.486E-04	3.534E 01
1.000E 01	9.598E-08	1.046E 00	4.832E 02	8.680E-08	7.857E-08	1.101E-02	1.508E-13	1.146E 02	6.880E-08	1.013E-06	0.0	0.0
1.000E 02	1.575E-07	1.046E 00	1.542E 01	1.424E-07	1.289E-07	4.596E-02	0.0	8.312E-12	1.129E-07	1.125E-05	0.0	0.0
3.000E 02	1.287E-06	1.046E 00	7.306E-03	1.164E-06	1.053E-06	1.177E-01	0.0	0.0	9.226E-07	8.088E-05	0.0	0.0
1.000E 03	3.266E-05	1.045E 00	1.200E-11	2.954E-05	2.673E-05	2.458E-01	0.0	0.0	2.342E-05	6.432E-04	0.0	0.0
1.000E 04	5.980E-03	1.028E 00	1.198E-11	5.407E-03	4.894E-03	3.070E-01	0.0	0.0	4.287E-03	1.190E-02	0.0	0.0
3.000E 04	3.485E-02	9.924E-01	1.198E-11	3.151E-02	2.852E-02	3.051E-01	0.0	0.0	2.498E-02	3.528E-02	0.0	0.0
1.000E 05	1.361E-01	8.753E-01	1.198E-11	1.231E-01	1.114E-01	2.983E-01	0.0	0.0	9.757E-02	1.016E-01	0.0	0.0
3.000E 05	2.992E-01	6.117E-01	1.196E-11	2.706E-01	2.449E-01	2.796E-01	0.0	0.0	2.145E-01	2.017E-01	0.0	0.0
1.000E 06	3.309E-01	1.746E-01	1.189E-11	2.992E-01	2.708E-01	2.229E-01	0.0	0.0	2.372E-01	2.249E-01	0.0	0.0

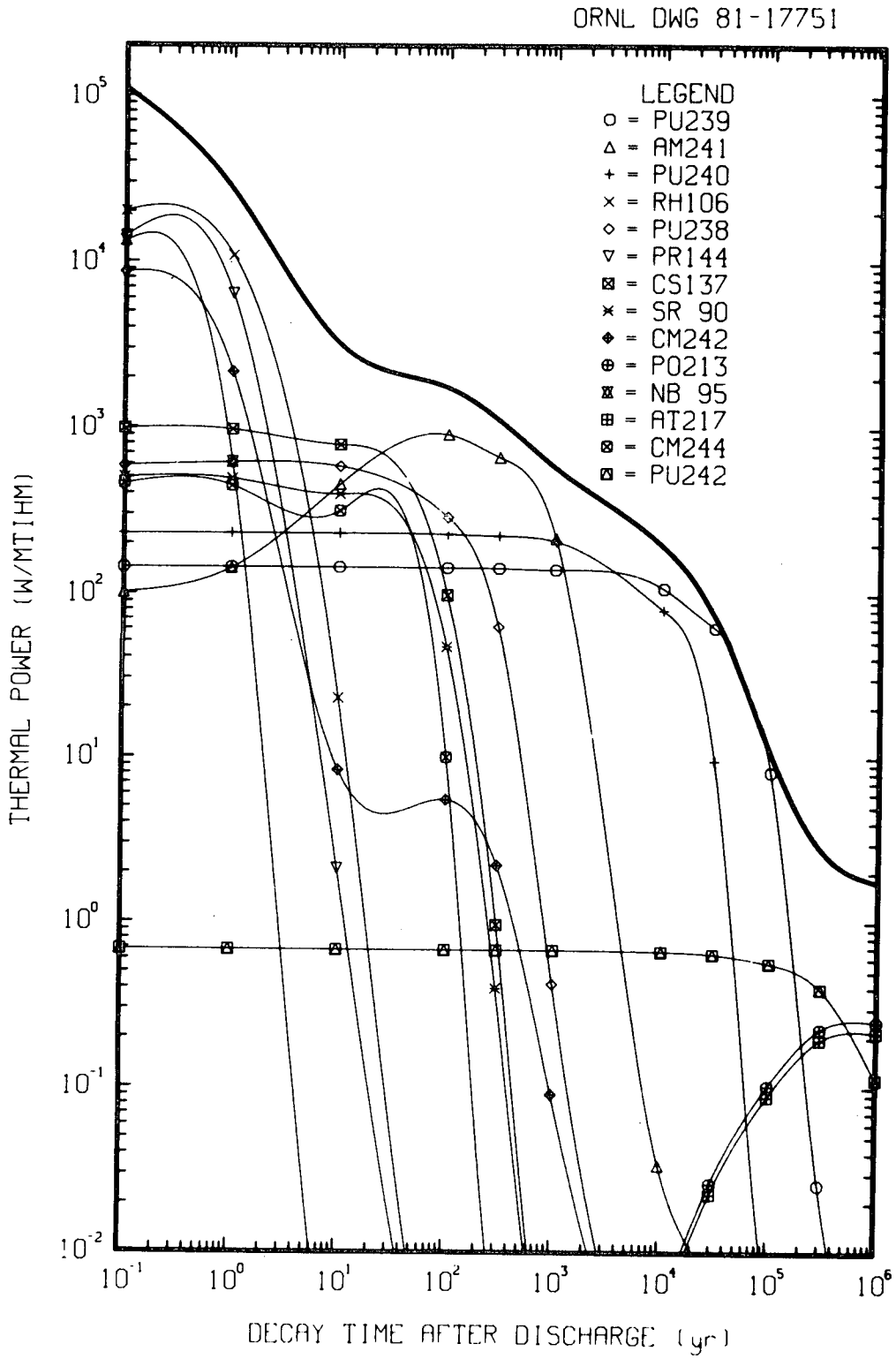

Fig. B.7. Thermal power of LMFBR spent core + axial blanket fuel as a function of decay time.

Table B.7. Thermal power of LMFBR spent core + axial blanket fuel as a function of decay time

Thermal power (W/MTIHM)

Time (years)	TOTAL	PU239	AM241	PU240	RH106	PU238	PR144	CS137	SR 90	CM242	PO213	NB 95
1.000E-01	1.103E 05	1.431E 02	1.011E 02	2.297E 02	2.015E 04	5.889E 02	1.423E 04	9.861E 02	5.002E 02	8.670E 03	8.330E-08	1.333E 04
1.000E 00	2.666E 04	1.431E 02	1.408E 02	2.297E 02	1.385E 04	6.145E 02	6.384E 03	9.658E 02	4.895E 02	2.153E 03	7.162E-08	6.164E 02
1.000E 01	3.146E 03	1.431E 02	4.532E 02	2.298E 02	2.264E 01	5.820E 02	2.108E 00	7.845E 02	3.951E 02	8.324E 00	7.237E-08	2.154E-13
1.000E 02	1.737E 03	1.427E 02	9.078E 02	2.283E 02	0.0	2.889E 02	0.0	9.805E 01	4.639E 01	5.521E 00	1.209E-07	0.0
3.000E 02	1.103E 03	1.419E 02	6.644E 02	2.235E 02	0.0	6.183E 01	0.0	9.653E-01	3.973E-01	2.218E 00	9.894E-07	0.0
1.000E 03	5.709E 02	1.391E 02	2.162E 02	2.076E 02	0.0	4.219E-01	0.0	9.128E-08	2.308E-08	9.112E-02	2.484E-05	0.0
1.000E 04	1.922E 02	1.082E 02	3.391E-02	7.993E 01	0.0	2.939E-19	0.0	0.0	0.0	1.373E-19	4.526E-03	0.0
3.000E 04	7.295E 01	6.125E 01	6.615E-03	9.588E 00	0.0	0.0	0.0	0.0	0.0	0.0	2.637E-02	0.0
1.000E 05	1.056E 01	8.177E 00	2.205E-05	5.733E-03	0.0	0.0	0.0	0.0	0.0	0.0	1.030E-01	0.0
3.000E 05	2.750E 00	2.586E-02	1.914E-12	6.900E-08	0.0	0.0	0.0	0.0	0.0	0.0	2.264E-01	0.0
1.000E 06	1.759E 00	1.647E-08	0.0	6.862E-08	0.0	0.0	0.0	0.0	0.0	0.0	2.504E-01	0.0

Thermal power (W/MTIHM)

Time (years)	AT217	CM244	PU242	FR221	AC225	ZR 95	NP237	CS134	TH229	U233	LA140	RU103
1.000E-01	7.180E-08	4.583E 02	6.793E-01	6.494E-08	5.877E-08	1.056E 04	6.901E-03	2.092E 03	4.423E-08	3.918E-07	9.231E 03	7.867E 03
1.000E 00	6.174E-08	4.428E 02	6.793E-01	5.583E-08	5.053E-08	2.999E 02	6.937E-03	1.545E 03	4.426E-08	4.208E-07	1.691E-04	2.387E 01
1.000E 01	6.237E-08	3.137E 02	6.793E-01	5.641E-08	5.106E-08	1.024E-13	7.765E-03	7.501E 01	4.472E-08	6.933E-07	0.0	0.0
1.000E 02	1.042E-07	1.001E 01	6.794E-01	9.426E-08	8.525E-08	0.0	3.049E-02	5.442E-12	7.470E-08	7.576E-06	0.0	0.0
3.000E 02	8.525E-07	4.743E-03	6.794E-01	7.712E-07	6.980E-07	0.0	7.717E-02	0.0	6.113E-07	5.335E-05	0.0	0.0
1.000E 03	2.141E-05	7.794E-12	6.787E-01	1.936E-05	1.753E-05	0.0	1.605E-01	0.0	1.535E-05	4.208E-04	0.0	0.0
1.000E 04	3.901E-03	7.783E-12	6.678E-01	3.528E-03	3.193E-03	0.0	2.002E-01	0.0	2.796E-03	7.761E-03	0.0	0.0
3.000E 04	2.273E-02	7.781E-12	6.444E-01	2.055E-02	1.861E-02	0.0	1.990E-01	0.0	1.629E-02	2.301E-02	0.0	0.0
1.000E 05	8.874E-02	7.777E-12	5.684E-01	8.028E-02	7.267E-02	0.0	1.946E-01	0.0	6.364E-02	6.627E-02	0.0	0.0
3.000E 05	1.952E-01	7.766E-12	3.973E-01	1.765E-01	1.598E-01	0.0	1.823E-01	0.0	1.399E-01	1.316E-01	0.0	0.0
1.000E 06	2.158E-01	7.723E-12	1.134E-01	1.952E-01	1.766E-01	0.0	1.453E-01	0.0	1.547E-01	1.467E-01	0.0	0.0

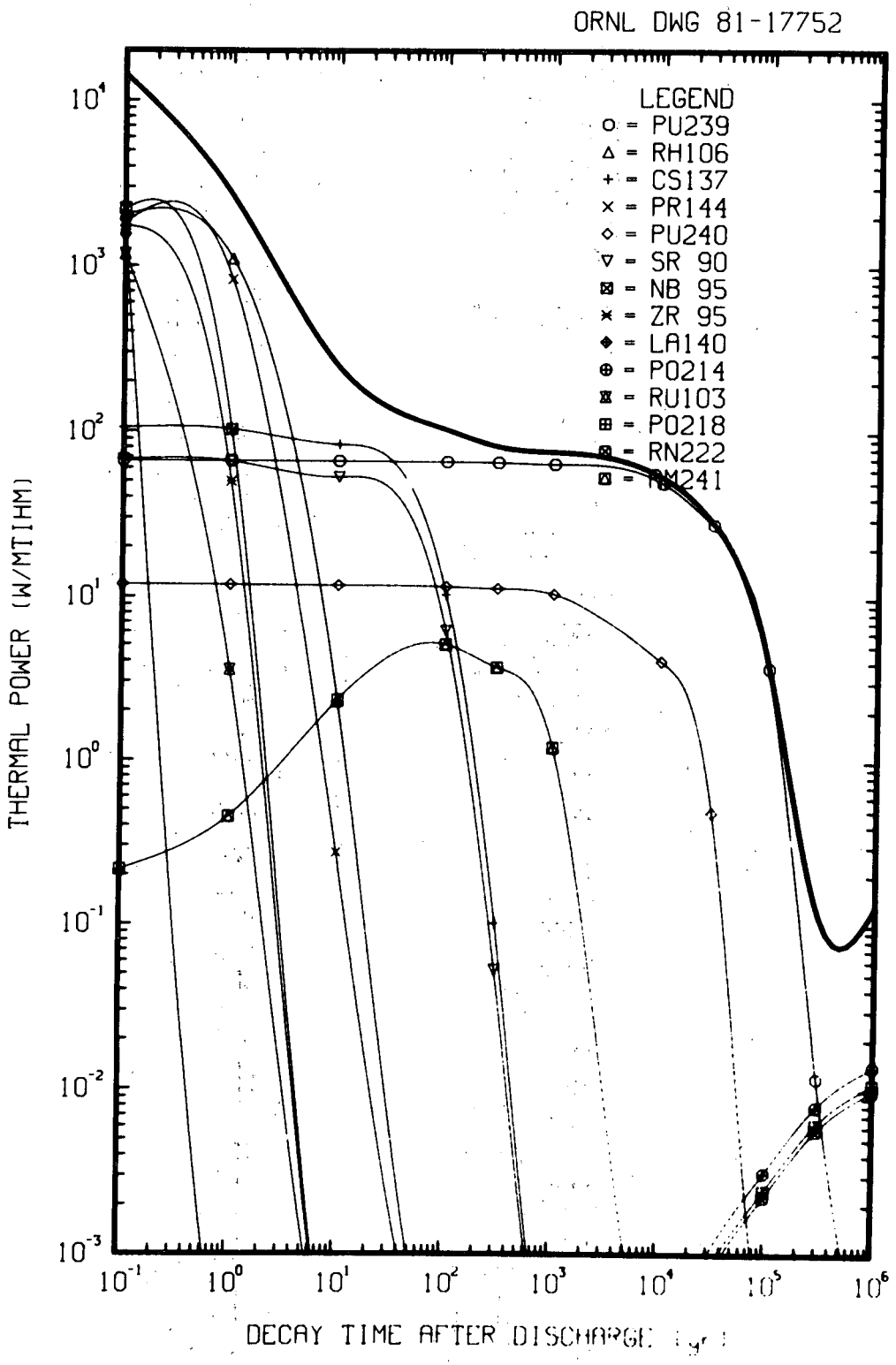

Fig. B.8. Thermal power of LMFBR spent radial blanket fuel as a function of decay time.

Table B.8. Thermal power of LMFBR spent radial blanket fuel as a function of decay time

Thermal power (W/MTIHM)

Time (years)	TOTAL	PU239	RH106	CS137	PR144	PU240	SR 90	NB 95	ZR 95	LA140	PO214	RU103
1.000E-01	1.430E 04	6.647E 01	2.050E 03	1.052E 02	1.850E 03	1.181E 01	6.734E 01	2.227E 03	1.753E 03	1.549E 03	3.277E-10	1.179E 03
1.000E 00	2.639E 03	6.647E 01	1.104E 03	1.030E 02	8.297E 02	1.181E 01	6.590E 01	1.024E 02	4.977E 01	2.835E-05	5.782E-13	3.545E 00
1.000E 01	2.427E 02	6.647E 01	2.296E 00	8.364E 01	2.741E-01	1.179E 01	5.320E 01	3.576E-14	1.791E-14	0.0	2.999E-11	0.0
1.000E 02	1.031E 02	6.630E 01	0.0	1.046E 01	0.0	1.168E 01	6.245E 00	0.0	0.0	0.0	1.607E-08	0.0
3.000E 02	8.199E 01	6.595E 01	0.0	1.030E-01	0.0	1.144E 01	5.348E-02	0.0	0.0	0.0	2.992E-07	0.0
1.000E 03	7.649E 01	6.462E 01	0.0	9.745E-09	0.0	1.062E 01	3.106E-09	0.0	0.0	0.0	4.883E-06	0.0
1.000E 04	5.398E 01	4.986E 01	0.0	0.0	0.0	4.089E 00	0.0	0.0	0.0	0.0	2.484E-04	0.0
3.000E 04	2.856E 01	2.802E 01	0.0	0.0	0.0	4.905E-01	0.0	0.0	0.0	0.0	9.774E-04	0.0
1.000E 05	3.798E 00	3.731E 00	0.0	0.0	0.0	2.933E-04	0.0	0.0	0.0	0.0	3.150E-03	0.0
3.000E 05	1.123E-01	1.181E-02	0.0	0.0	0.0	6.537E-13	0.0	0.0	0.0	0.0	7.990E-03	0.0
1.000E 06	1.310E-01	2.067E-11	0.0	0.0	0.0	4.702E-13	0.0	0.0	0.0	0.0	1.394E-02	0.0

Thermal power (W/MTIHM)

Time (years)	PO218	RN222	AM241	PO210	U234	RA226	TH230	U238	PU238	Y 91	CS134	CE144
1.000E-01	1.991E-13	1.820E-13	2.148E-01	9.386E-12	3.201E-05	1.608E-13	3.428E-10	8.141E-03	7.099E 00	7.295E 02	9.490E 01	1.669E 02
1.000E 00	4.470E-13	4.087E-13	4.537E-01	1.526E-11	4.774E-05	3.561E-13	6.601E-10	8.141E-03	7.064E 00	1.485E 01	7.012E 01	7.492E 01
1.000E 01	2.341E-11	2.141E-11	2.334E 00	1.443E-11	1.992E-04	1.866E-11	1.056E-08	8.141E-03	6.583E 00	1.811E-16	3.403E 00	2.473E-02
1.000E 02	1.255E-08	1.147E-08	5.113E 00	5.349E-09	1.246E-03	9.994E-09	6.346E-07	8.141E-03	3.234E 00	0.0	2.469E-13	0.0
3.000E 02	2.336E-07	2.136E-07	3.744E 00	1.588E-07	2.051E-03	1.861E-07	3.726E-06	8.141E-03	6.664E-01	0.0	0.0	0.0
1.000E 03	3.812E-06	3.486E-06	1.219E 00	3.371E-06	2.273E-03	3.037E-06	1.746E-05	8.141E-03	2.688E-03	0.0	0.0	0.0
1.000E 04	1.939E-04	1.773E-04	7.017E-07	1.715E-04	2.449E-03	1.545E-04	1.967E-04	8.141E-03	7.492E-23	0.0	0.0	0.0
3.000E 04	7.631E-04	6.977E-04	8.685E-09	6.745E-04	2.824E-03	6.079E-04	5.923E-04	8.141E-03	0.0	0.0	0.0	0.0
1.000E 05	2.460E-03	2.249E-03	2.880E-11	2.175E-03	3.980E-03	1.960E-03	1.914E-03	8.141E-03	0.0	0.0	0.0	0.0
3.000E 05	6.236E-03	5.703E-03	2.497E-18	5.515E-03	6.259E-03	4.970E-03	4.864E-03	8.141E-03	0.0	0.0	0.0	0.0
1.000E 06	1.088E-02	9.947E-03	0.0	9.623E-03	8.836E-03	8.668E-03	8.494E-03	8.141E-03	0.0	0.0	0.0	0.0

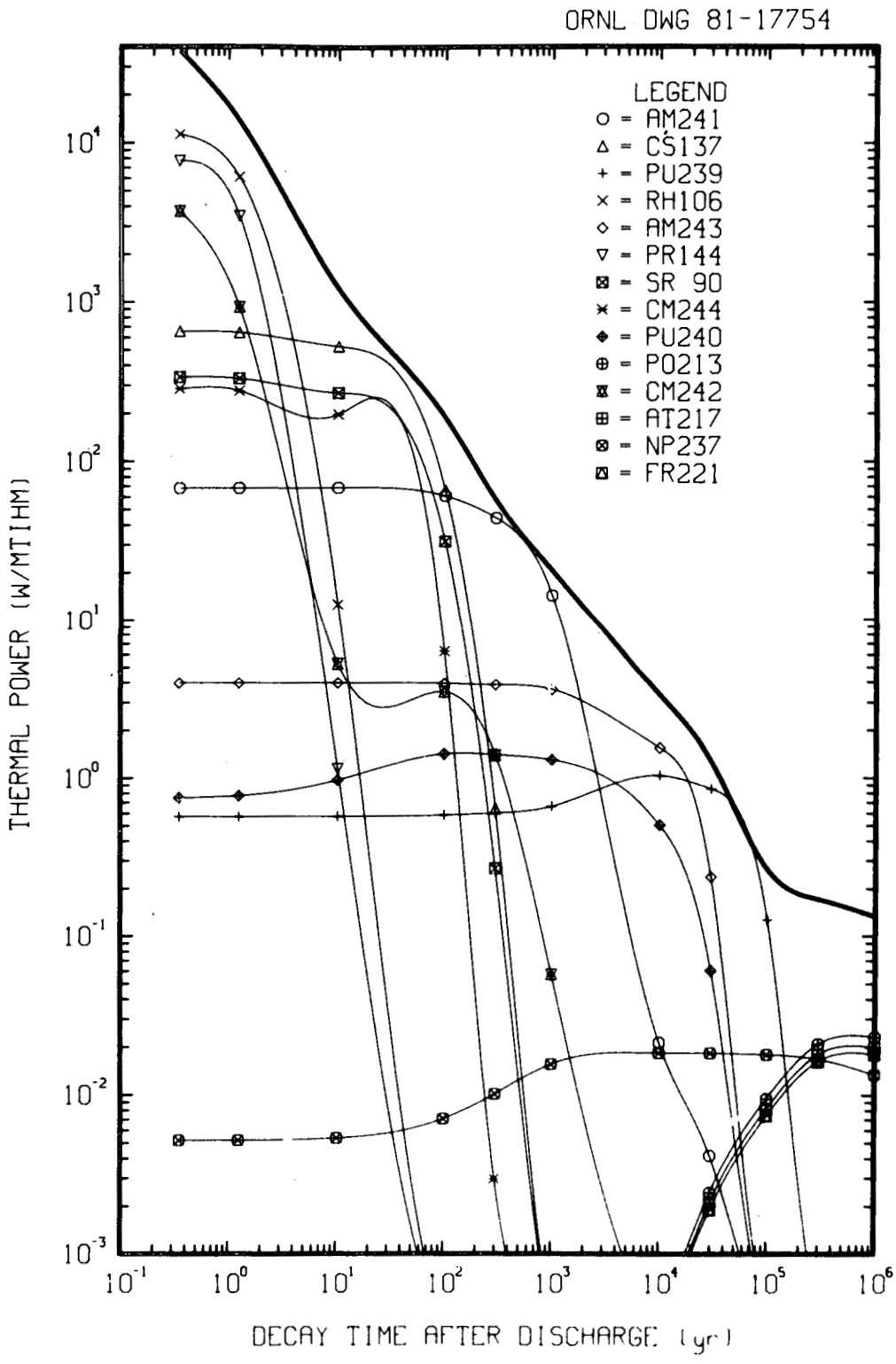

Fig. B.9. Thermal power of LMFBR high-level waste as a function of decay time.

Table B.9. Thermal power of LMFBR high-level waste as a function of decay time

Thermal power (W/MTIHM)

Time (years)	TOTAL	AM241	CS137	PU239	RH106	AM243	PR144	SR 90	CM244	PU240	PO213	CM242
3.500E-01	3.779E 04	6.813E 01	6.585E 02	5.747E-01	1.139E 04	3.970E 00	7.772E 03	3.391E 02	2.870E 02	7.504E-01	1.806E-08	3.743E 03
1.250E 00	1.379E 04	6.816E 01	6.449E 02	5.748E-01	6.136E 03	3.970E 00	3.487E 03	3.318E 02	2.773E 02	7.743E-01	2.291E-10	9.307E 02
1.025E 01	1.203E 03	6.817E 01	5.238E 02	5.764E-01	1.259E 01	3.966E 00	1.151E 00	2.679E 02	1.965E 02	9.728E-01	4.099E-10	5.257E 00
1.003E 02	1.866E 02	6.063E 01	6.547E 01	5.873E-01	0.0	3.933E 00	0.0	3.144E 01	6.271E 00	1.429E 00	1.983E-08	3.487E 00
3.003E 02	5.671E 01	4.402E 01	6.443E-01	6.058E-01	0.0	3.860E 00	0.0	2.692E-01	2.971E-03	1.415E 00	2.112E-07	1.401E 00
1.000E 03	2.053E 01	1.436E 01	6.092E-08	6.651E-01	0.0	3.614E 00	0.0	1.564E-08	3.148E-14	1.313E 00	3.289E-06	5.756E-02
1.000E 04	3.337E 00	2.137E-02	0.0	1.038E 00	0.0	1.552E 00	0.0	0.0	2.468E-14	5.058E-01	4.263E-04	8.672E-20
3.000E 04	1.274E 00	4.182E-03	0.0	8.527E-01	0.0	2.372E-01	0.0	0.0	2.484E-14	6.067E-02	2.445E-03	0.0
1.000E 05	2.641E-01	1.386E-05	0.0	1.268E-01	0.0	3.305E-04	0.0	0.0	2.533E-14	3.627E-05	9.526E-03	0.0
3.000E 05	1.708E-01	1.203E-12	0.0	4.012E-04	0.0	1.118E-08	0.0	0.0	2.640E-14	2.345E-10	2.094E-02	0.0
1.000E 06	1.326E-01	0.0	0.0	1.039E-08	0.0	1.083E-08	0.0	0.0	2.791E-14	2.480E-10	2.315E-02	0.0

Thermal power (W/MTIHM)

Time (years)	AT217	NP237	FR221	AC225	NB 95	CS134	TH229	U233	PU238	ZR 95	SB126M	NP239
3.500E-01	1.557E-08	5.193E-03	1.408E-08	1.274E-08	4.763E 03	1.250E 03	1.402E-10	3.473E-09	4.772E 00	2.761E 03	2.618E-02	2.985E-01
1.250E 00	1.975E-10	5.211E-03	1.786E-10	1.617E-10	1.632E 02	9.234E 02	1.416E-10	2.524E-08	1.760E 01	7.844E 01	2.618E-02	2.985E-01
1.025E 01	3.533E-10	5.394E-03	3.196E-10	2.892E-10	5.635E-14	4.482E 01	2.533E-10	2.237E-07	2.069E 01	2.680E-14	2.617E-02	2.983E-01
1.003E 02	1.709E-08	7.132E-03	1.546E-08	1.399E-08	0.0	3.251E-12	1.225E-08	2.574E-06	1.210E 01	0.0	2.616E-02	2.957E-01
3.003E 02	1.820E-07	1.022E-02	1.646E-07	1.490E-07	0.0	0.0	1.305E-07	9.856E-06	3.954E 00	0.0	2.612E-02	2.902E-01
1.000E 03	2.835E-06	1.574E-02	2.564E-06	2.320E-06	0.0	0.0	2.032E-06	4.904E-05	1.270E-01	0.0	2.600E-02	2.718E-01
1.000E 04	3.675E-04	1.844E-02	3.323E-04	3.008E-04	0.0	0.0	2.634E-04	7.237E-04	1.856E-19	0.0	2.442E-02	1.167E-01
3.000E 04	2.107E-03	1.839E-02	1.906E-03	1.725E-03	0.0	0.0	1.511E-03	2.130E-03	0.0	0.0	2.126E-02	1.784E-02
1.000E 05	8.210E-03	1.799E-02	7.426E-03	6.721E-03	0.0	0.0	5.886E-03	6.129E-03	0.0	0.0	1.309E-02	2.489E-05
3.000E 05	1.805E-02	1.686E-02	1.632E-02	1.477E-02	0.0	0.0	1.294E-02	1.217E-02	0.0	0.0	3.273E-03	8.406E-10
1.000E 06	1.995E-02	1.344E-02	1.805E-02	1.633E-02	0.0	0.0	1.430E-02	1.356E-02	0.0	0.0	2.558E-05	8.147E-10

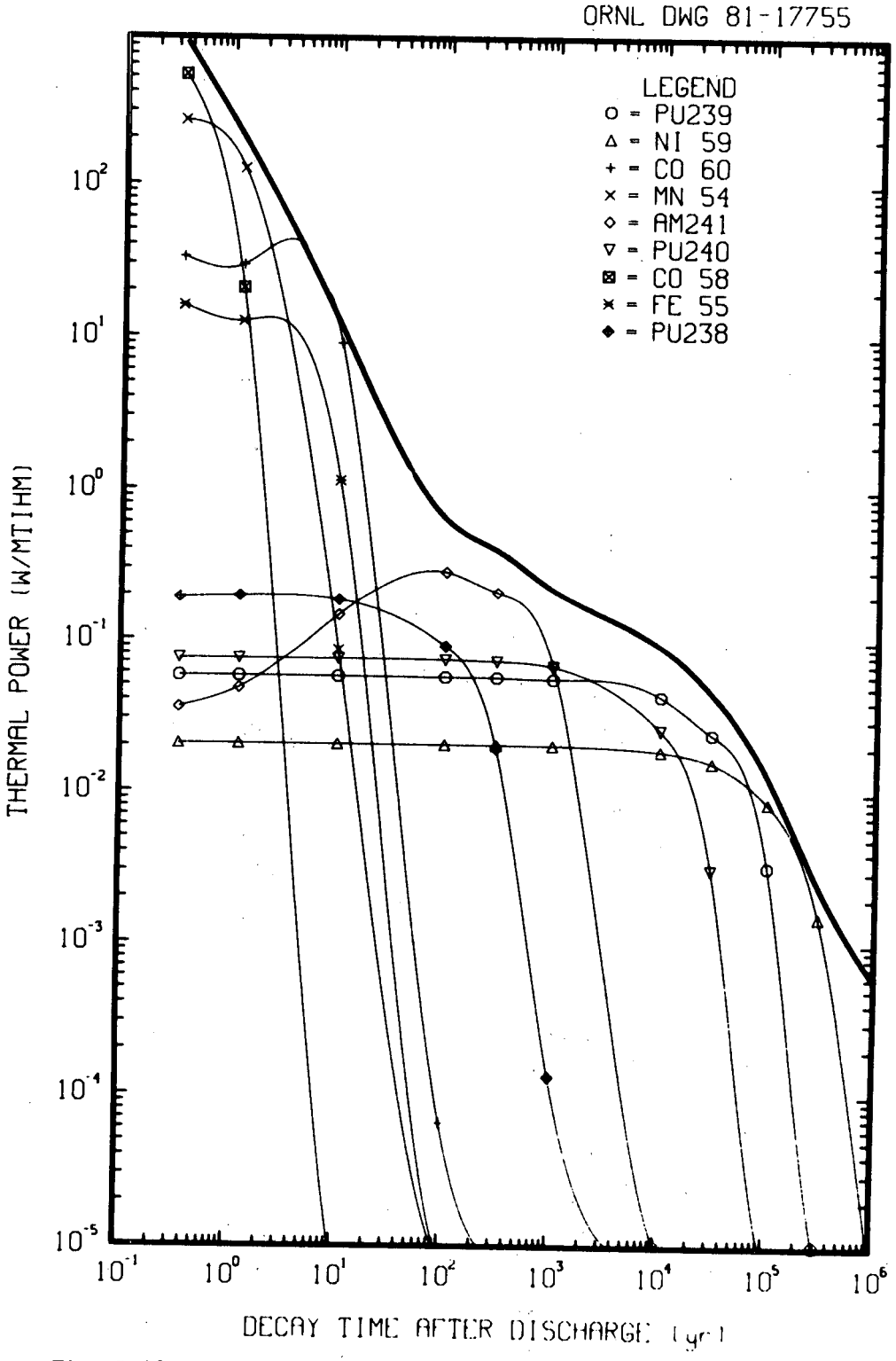

Fig. B.10. Thermal power of LMFBR structural material waste as a function of decay time.

Table B.10. Thermal power of LMFBR structural material waste as a function of decay time

Time (years)	Thermal power (W/MTIHM)											
	TOTAL	PU239	NI 59	CO 60	MN 54	AM241	PU240	CO 58	FE 55	PU238	PO213	AT217
3.500E-01	8.490E 02	5.749E-02	2.062E-02	3.319E 01	2.612E 02	3.550E-02	7.481E-02	5.174E 02	1.593E 01	1.912E-01	2.277E-11	1.963E-11
1.250E 00	1.960E 02	5.749E-02	2.062E-02	2.949E 01	1.260E 02	4.796E-02	7.481E-02	2.068E 01	1.253E 01	1.962E-01	2.272E-11	1.958E-11
1.025E 01	1.139E 01	5.747E-02	2.061E-02	9.026E 00	8.583E-02	1.459E-01	7.484E-02	2.157E-13	1.137E 00	1.849E-01	2.298E-11	1.981E-11
1.003E 02	6.352E-01	5.733E-02	2.060E-02	6.521E-05	0.0	2.879E-01	7.436E-02	0.0	4.321E-11	9.180E-02	3.990E-11	3.439E-11
3.003E 02	3.972E-01	5.701E-02	2.056E-02	2.452E-16	0.0	2.107E-01	7.281E-02	0.0	0.0	1.964E-02	3.269E-10	2.818E-10
1.000E 03	2.182E-01	5.591E-02	2.044E-02	0.0	0.0	6.860E-02	6.760E-02	0.0	0.0	1.332E-04	8.018E-09	6.911E-09
1.000E 04	9.176E-02	4.341E-02	1.891E-02	0.0	0.0	1.073E-05	2.603E-02	0.0	0.0	9.285E-23	1.446E-06	1.246E-06
3.000E 04	4.527E-02	2.453E-02	1.590E-02	0.0	0.0	2.092E-06	3.123E-03	0.0	0.0	0.0	8.421E-06	7.258E-06
1.000E 05	1.282E-02	3.273E-03	8.668E-03	0.0	0.0	6.936E-09	1.867E-06	0.0	0.0	0.0	3.289E-05	2.835E-05
3.000E 05	2.438E-03	1.041E-05	1.532E-03	0.0	0.0	6.020E-16	2.182E-11	0.0	0.0	0.0	7.230E-05	6.232E-05
1.000E 06	5.857E-04	5.214E-12	3.570E-06	0.0	0.0	0.0	2.170E-11	0.0	0.0	0.0	7.995E-05	6.891E-05

Time (years)	Thermal power (W/MTIHM)											
	FR221	AC225	TH229	NP237	U233	PU242	NI 63	CS137	NB 94	SR 90	U236	PO214
3.500E-01	1.775E-11	1.607E-11	1.403E-11	2.598E-06	1.333E-10	2.149E-04	9.273E-02	3.294E-01	2.801E-03	1.697E-01	1.522E-07	2.138E-12
1.250E 00	1.771E-11	1.603E-11	1.404E-11	2.609E-06	1.442E-10	2.149E-04	9.210E-02	3.226E-01	2.801E-03	1.660E-01	1.540E-07	2.418E-14
1.025E 01	1.791E-11	1.621E-11	1.420E-11	2.879E-06	2.461E-10	2.149E-04	8.606E-02	2.620E-01	2.800E-03	1.340E-01	1.713E-07	9.948E-13
1.003E 02	3.110E-11	2.815E-11	2.465E-11	1.010E-05	2.588E-09	2.149E-04	4.368E-02	3.275E-02	2.791E-03	1.573E-02	3.444E-07	4.623E-10
3.003E 02	2.549E-10	2.307E-10	2.020E-10	2.491E-05	1.747E-08	2.149E-04	9.681E-03	3.224E-04	2.772E-03	1.347E-04	7.234E-07	8.521E-09
1.000E 03	6.250E-09	5.657E-09	4.954E-09	5.132E-05	1.353E-07	2.147E-04	4.966E-05	3.048E-11	2.707E-03	7.825E-12	1.989E-06	1.391E-07
1.000E 04	1.127E-06	1.020E-06	8.935E-07	6.392E-05	2.479E-06	2.112E-04	0.0	0.0	1.991E-03	0.0	1.208E-05	6.817E-06
3.000E 04	6.564E-06	5.941E-06	5.203E-06	6.354E-05	7.348E-06	2.038E-04	0.0	0.0	1.036E-03	0.0	1.764E-05	2.382E-05
1.000E 05	2.564E-05	2.320E-05	2.032E-05	6.212E-05	2.116E-05	1.798E-04	0.0	0.0	9.212E-05	0.0	1.836E-05	5.374E-05
3.000E 05	5.636E-05	5.101E-05	4.468E-05	5.823E-05	4.202E-05	1.256E-04	0.0	0.0	1.001E-07	0.0	1.825E-05	5.789E-05
1.000E 06	6.232E-05	5.641E-05	4.940E-05	4.641E-05	4.684E-05	3.585E-05	0.0	0.0	4.168E-18	0.0	1.788E-05	1.511E-05

Appendix B.3. Toxicity of LMFBR Spent Fuel, High-Level Waste, and Structural Material Waste

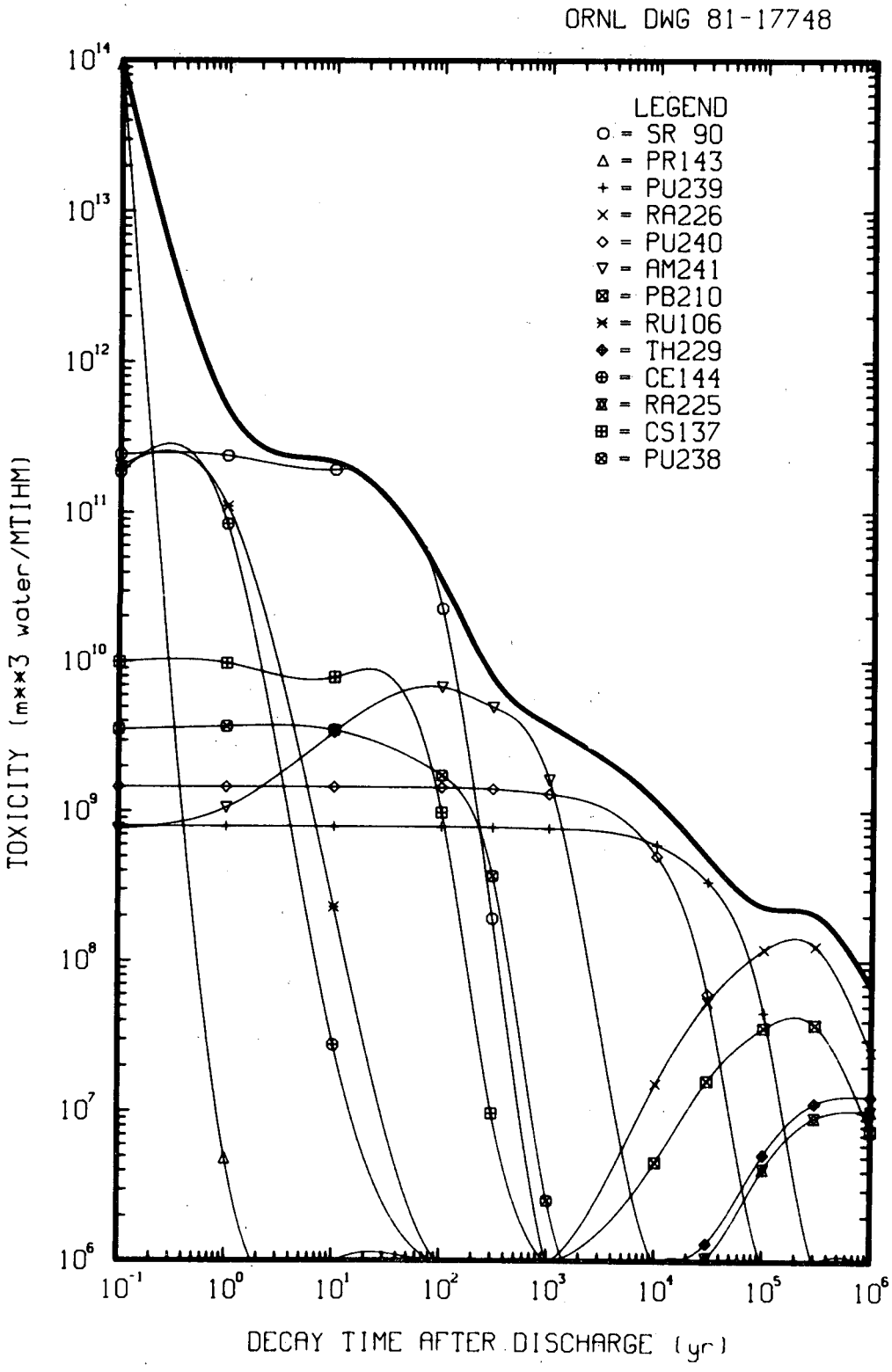

Fig. B.11. Toxicity of LMFBR spent core fuel as a function of decay time.

Table B.11. Toxicity of LMFBR spent core fuel as a function of decay time

Toxicity (m^3 water/MTIHM)

Time (years)	TOTAL	SR 90	PR143	PU239	RA226	PU240	AM241	PB210	RU106	TH229	CE144	RA225
1.000E-01	9.630E 13	2.428E 11	9.469E 13	7.924E 08	1.759E-02	1.453E 09	7.600E 08	3.799E 00	2.042E 11	3.612E 00	1.865E 11	3.108E 00
1.000E 00	4.846E 11	2.376E 11	4.801E 06	7.924E 08	4.423E-02	1.453E 09	1.058E 09	3.766E 00	1.130E 11	3.615E 00	8.367E 10	2.892E 00
1.000E 01	2.146E 11	1.918E 11	0.0	7.922E 08	2.112E 00	1.454E 09	3.406E 09	2.904E 00	2.292E 08	3.651E 00	2.762E 07	2.921E 00
1.000E 02	3.450E 10	2.252E 10	0.0	7.902E 08	1.033E 03	1.445E 09	6.821E 09	1.499E 02	0.0	5.990E 00	0.0	4.792E 00
3.000E 02	7.852E 09	1.927E 08	0.0	7.859E 08	1.913E 04	1.415E 09	4.993E 09	4.412E 03	0.0	4.896E 01	0.0	3.917E 01
1.000E 03	3.771E 09	1.120E 01	0.0	7.709E 08	3.128E 05	1.314E 09	1.625E 09	9.384E 04	0.0	1.243E 03	0.0	9.936E 02
1.000E 04	1.159E 09	0.0	0.0	6.003E 08	1.533E 07	5.059E 08	2.553E 05	4.597E 06	0.0	2.275E 05	0.0	1.820E 05
3.000E 04	4.898E 08	0.0	0.0	3.402E 08	5.350E 07	6.069E 07	4.978E 04	1.604E 07	0.0	1.325E 06	0.0	1.060E 06
1.000E 05	2.305E 08	0.0	0.0	4.543E 07	1.200E 08	3.629E 04	1.660E 02	3.600E 07	0.0	5.177E 06	0.0	4.142E 06
3.000E 05	2.049E 08	0.0	0.0	1.438E 05	1.262E 08	4.432E-01	1.441E-05	3.785E 07	0.0	1.138E 07	0.0	9.104E 06
1.000E 06	6.678E 07	0.0	0.0	1.068E-01	2.494E 07	4.407E-01	0.0	7.479E 06	0.0	1.259E 07	0.0	1.007E 07

Toxicity (m^3 water/MTIHM)

Time (years)	CS137	RN219	PU238	PO210	CS134	NP237	PU242	AM243	I129	PU241	AC225	TH230
1.000E-01	9.928E 09	2.193E 00	3.543E 09	3.616E-01	2.264E 10	6.858E 04	4.600E 06	4.884E 07	1.397E 06	4.246E 09	3.363E-01	7.432E-01
1.000E 00	9.724E 09	2.768E-01	3.697E 09	5.029E-01	1.674E 10	6.896E 04	4.600E 06	4.883E 07	1.403E 06	4.066E 09	2.892E-01	1.339E 00
1.000E 01	7.895E 09	2.294E 00	3.502E 09	4.151E-01	8.122E 08	7.798E 04	4.601E 06	4.879E 07	1.403E 06	2.637E 09	2.921E-01	1.772E 01
1.000E 02	9.869E 08	5.970E 01	1.738E 09	2.141E 01	5.892E-05	3.255E 05	4.601E 06	4.838E 07	1.403E 06	3.465E 07	4.792E-01	9.996E 02
3.000E 02	9.716E 06	2.877E 02	3.721E 08	6.302E 02	0.0	8.339E 05	4.601E 06	4.748E 07	1.403E 06	1.351E 04	3.917E 00	5.862E 03
1.000E 03	9.189E-01	2.035E 03	2.542E 06	1.340E 04	0.0	1.741E 06	4.596E 06	4.446E 07	1.403E 06	1.060E 04	9.936E 01	2.753E 04
1.000E 04	0.0	1.233E 05	1.774E-12	6.567E 05	0.0	2.173E 06	4.523E 06	1.909E 07	1.403E 06	5.087E 03	1.820E 04	2.960E 05
3.000E 04	0.0	7.862E 05	0.0	2.292E 06	0.0	2.161E 06	4.364E 06	2.918E 06	1.402E 06	9.953E 02	1.060E 05	7.971E 05
1.000E 05	0.0	3.239E 06	0.0	5.143E 06	0.0	2.112E 06	3.850E 06	4.049E 03	1.397E 06	3.319E 00	4.142E 05	1.792E 06
3.000E 05	0.0	4.587E 06	0.0	5.408E 06	0.0	1.980E 06	2.690E 06	1.375E-01	1.385E 06	2.735E-07	9.104E 05	1.887E 06
1.000E 06	0.0	4.612E 06	0.0	1.068E 06	0.0	1.578E 06	7.676E 05	1.333E-01	1.343E 06	0.0	1.007E 06	3.740E 05

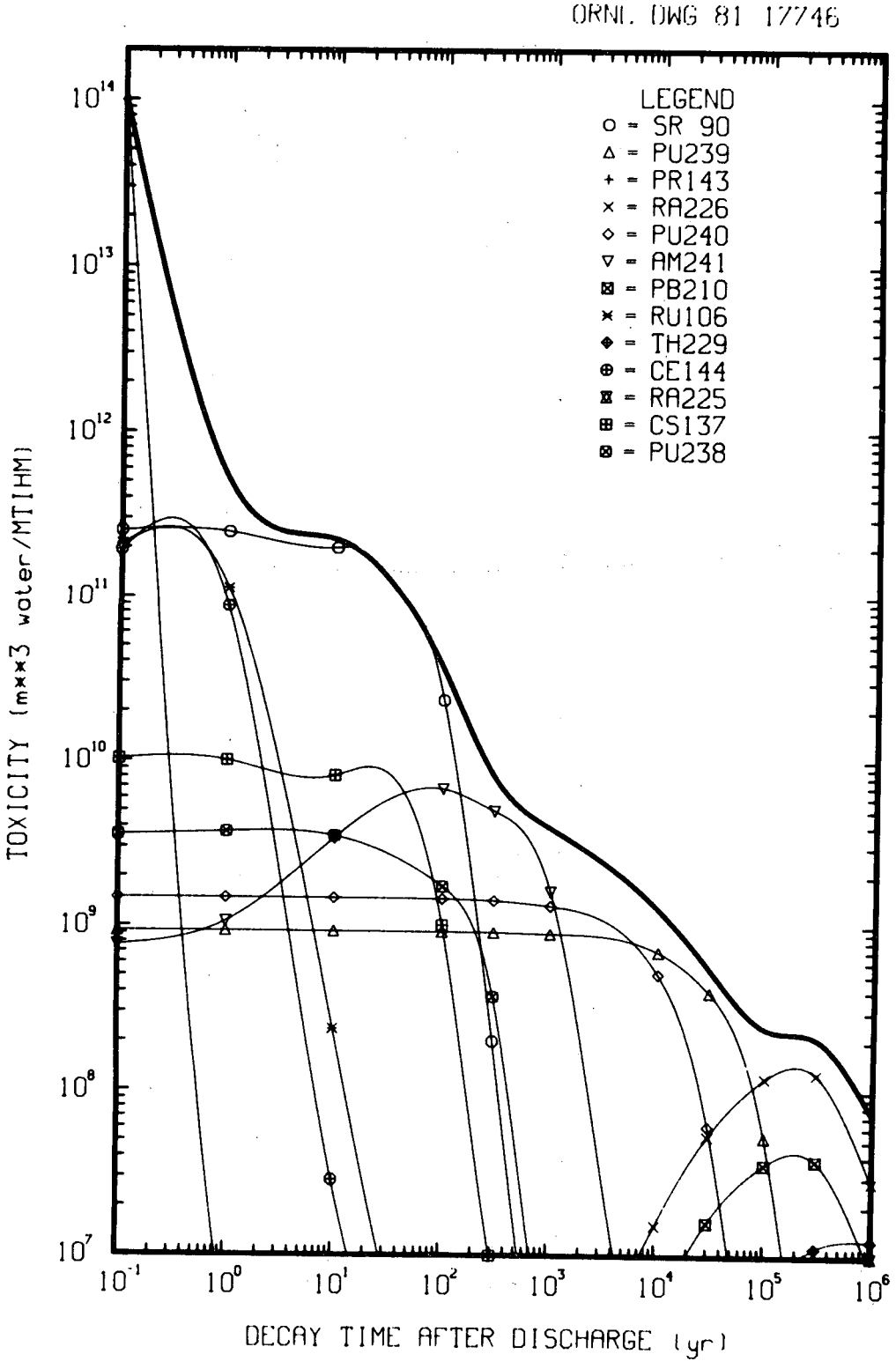

Fig. B.12. Toxicity of LMFBR spent core + axial blanket fuel as a function of decay time.

Table B.12. Toxicity of LMFBR spent core + axial blanket fuel as a function of decay time

Toxicity (m^3 water/MTIHM)

Time (years)	TOTAL	SR 90	PU239	PR143	RA226	PU240	AM241	PB210	RU106	TH229	CE144	RA225
1.000E-01	1.009E 14	2.524E 11	9.282E 08	9.919E 13	1.762E-02	1.475E 09	7.603E 08	3.799E 00	2.101E 11	3.614E 00	1.936E 11	3.109E 00
1.000E 00	5.016E 11	2.470E 11	9.282E 08	5.030E 06	4.431E-02	1.475E 09	1.059E 09	3.767E 00	1.131E 11	3.617E 00	8.687E 10	2.893E 00
1.000E 01	2.227E 11	1.994E 11	9.282E 08	0.0	2.118E 00	1.476E 09	3.411E 09	2.904E 00	2.361E 08	3.654E 00	2.868E 07	2.923E 00
1.000E 02	3.560E 10	2.341E 10	9.256E 08	0.0	1.036E 03	1.466E 09	6.831E 09	1.503E 02	0.0	6.104E 00	0.0	4.883E 00
3.000E 02	8.025E 09	2.005E 08	9.205E 08	0.0	1.918E 04	1.436E 09	5.001E 09	4.424E 03	0.0	4.995E 01	0.0	3.997E 01
1.000E 03	3.924E 09	1.165E 01	9.035E 08	0.0	3.137E 05	1.333E 09	1.628E 09	9.410E 04	0.0	1.255E 03	0.0	1.003E 03
1.000E 04	1.268E 09	0.0	7.023E 08	0.0	1.538E 07	5.134E 08	2.553E 05	4.611E 06	0.0	2.286E 05	0.0	1.828E 05
3.000E 04	5.486E 08	0.0	3.975E 08	0.0	5.369E 07	6.159E 07	4.978E 04	1.610E 07	0.0	1.331E 06	0.0	1.065E 06
1.000E 05	2.399E 08	0.0	5.307E 07	0.0	1.207E 08	3.682E 04	1.660E 02	3.620E 07	0.0	5.200E 06	0.0	4.161E 06
3.000E 05	2.086E 08	0.0	1.678E 05	0.0	1.282E 08	4.432E-01	1.441E-05	3.843E 07	0.0	1.143E 07	0.0	9.146E 06
1.000E 06	7.268E 07	0.0	1.069E-01	0.0	2.849E 07	4.407E-01	0.0	8.543E 06	0.0	1.264E 07	0.0	1.012E 07

Toxicity (m^3 water/MTIHM)

Time (years)	RN219	CS137	PU238	PO210	CS134	NP237	PU242	AM243	I129	PU241	AC225	TH230
1.000E-01	2.258E 00	1.023E 10	3.554E 09	3.617E-01	2.283E 10	7.527E 04	4.601E 06	4.884E 07	1.445E 06	4.253E 09	3.365E-01	7.445E-01
1.000E 00	4.061E-01	1.001E 10	3.708E 09	5.030E-01	1.687E 10	7.566E 04	4.601E 06	4.883E 07	1.451E 06	4.072E 09	2.893E-01	1.341E 00
1.000E 01	3.941E 00	8.136E 09	3.512E 09	4.151E-01	8.190E 08	8.469E 04	4.601E 06	4.879E 07	1.451E 06	2.640E 09	2.923E-01	1.776E 01
1.000E 02	1.179E 02	1.017E 09	1.743E 09	2.147E 01	5.941E-05	3.325E 05	4.601E 06	4.838E 07	1.451E 06	3.470E 07	4.883E-01	1.302E 03
3.000E 02	5.184E 02	1.001E 07	3.731E 08	6.320E 02	0.0	8.417E 05	4.601E 06	4.748E 07	1.451E 06	1.351E 04	3.997E 00	5.879E 03
1.000E 03	3.052E 03	9.469E-01	2.546E 06	1.344E 04	0.0	1.750E 06	4.597E 06	4.446E 07	1.451E 06	1.060E 04	1.003E 02	2.761E 04
1.000E 04	1.505E 05	0.0	1.774E-12	6.587E 05	0.0	2.184E 06	4.523E 06	1.909E 07	1.451E 06	5.087E 03	1.828E 04	2.968E 05
3.000E 04	9.350E 05	0.0	0.0	2.300E 06	0.0	2.170E 06	4.364E 06	2.918E 06	1.449E 06	9.953E 02	1.065E 05	8.000E 05
1.000E 05	3.815E 06	0.0	0.0	5.171E 06	0.0	2.122E 06	3.850E 06	4.055E 03	1.445E 06	3.319E 00	4.161E 05	1.802E 06
3.000E 05	5.395E 06	0.0	0.0	5.489E 06	0.0	1.989E 06	2.690E 06	1.375E-01	1.432E 06	2.735E-07	9.146E 05	1.916E 06
1.000E 06	5.424E 06	0.0	0.0	1.221E 06	0.0	1.585E 06	7.677E 05	1.333E-01	1.389E 06	0.0	1.012E 06	4.274E 05

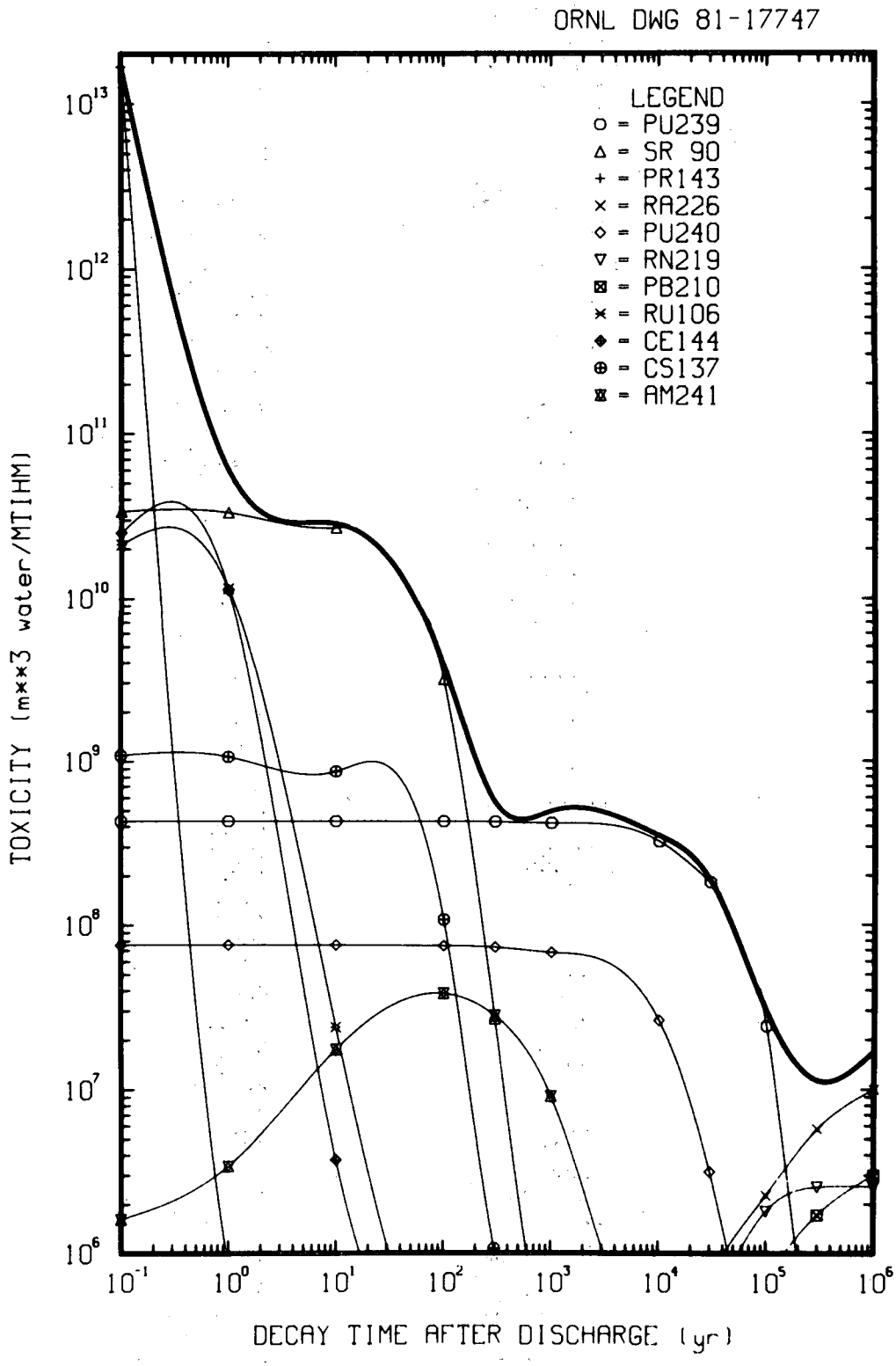

Fig. B.13. Toxicity of LMFBR spent radial blanket fuel as a function of decay time.

Table B.13. Toxicity of LMFBR spent radial blanket fuel as a function of decay time

Toxicity (m^3 water/MTIHM)

Time (years)	TOTAL	PU239	SR 90	PR143	RA226	PU240	RN219	PB210	RU106	CE144	CS137	AM241
1.000E-01	1.705E 13	4.318E 08	3.398E 10	1.681E 13	1.857E-04	7.585E 07	8.424E-01	5.176E-03	2.138E 10	2.517E 10	1.091E 09	1.616E 06
1.000E 00	6.027E 10	4.315E 08	3.326E 10	8.523E 05	4.111E-04	7.585E 07	1.131E 00	5.212E-03	1.151E 10	1.129E 10	1.068E 09	3.415E 06
1.000E 01	2.843E 10	4.314E 08	2.685E 10	0.0	2.154E-02	7.573E 07	6.195E 00	4.499E-03	2.394E 07	3.729E 06	8.679E 08	1.757E 07
1.000E 02	3.827E 09	4.303E 08	3.152E 09	0.0	1.154E 01	7.504E 07	1.610E 02	1.669E 00	0.0	0.0	1.084E 08	3.848E 07
3.000E 02	5.627E 08	4.278E 08	2.699E 07	0.0	2.149E 02	7.348E 07	6.305E 02	4.954E 01	0.0	0.0	1.069E 06	2.818E 07
1.000E 03	4.972E 08	4.193E 08	1.567E 00	0.0	3.507E 03	6.821E 07	2.841E 03	1.051E 03	0.0	0.0	1.010E-01	9.171E 06
1.000E 04	3.506E 08	3.235E 08	0.0	0.0	1.784E 05	2.626E 07	8.262E 04	5.350E 04	0.0	0.0	0.0	5.280E 00
3.000E 04	1.870E 08	1.819E 08	0.0	0.0	7.017E 05	3.151E 06	4.633E 05	2.105E 05	0.0	0.0	0.0	6.537E-02
1.000E 05	2.980E 07	2.421E 07	0.0	0.0	2.263E 06	1.883E 03	1.812E 06	6.786E 05	0.0	0.0	0.0	2.167E-04
3.000E 05	1.130E 07	7.660E 04	0.0	0.0	5.737E 06	4.200E-06	2.544E 06	1.720E 06	0.0	0.0	0.0	1.879E-11
1.000E 06	1.703E 07	1.342E-04	0.0	0.0	1.001E 07	3.020E-06	2.557E 06	3.001E 06	0.0	0.0	0.0	0.0

Toxicity (m^3 water/MTIHM)

Time (years)	PO210	I129	TH229	CS134	RA225	SR 89	TH230	RA223	PU238	PA231	PM147	NB 95
1.000E-01	4.183E-04	1.705E 05	1.600E-02	1.036E 09	1.391E-02	4.718E 10	6.056E-03	3.611E-02	4.283E 07	3.175E-01	3.088E 08	4.643E 09
1.000E 00	6.797E-04	1.715E 05	1.630E-02	7.654E 08	1.304E-02	5.177E 08	1.167E-02	4.850E-02	4.262E 07	3.813E-01	2.446E 08	2.134E 08
1.000E 01	6.433E-04	1.715E 05	2.273E-02	3.715E 07	1.818E-02	1.312E-11	1.866E-01	3.972E 07	1.019E 00	2.269E 07	7.452E-08
1.000E 02	2.384E-01	1.715E 05	4.267E-01	2.695E-06	3.413E-01	0.0	1.121E 01	6.896E 00	1.951E 07	7.608E 00	1.068E-03	0.0
3.000E 02	7.075E 00	1.715E 05	3.655E 00	0.0	2.923E 00	0.0	6.583E 01	2.703E 01	4.023E 06	2.364E 01	0.0	0.0
1.000E 03	1.503E 02	1.715E 05	4.309E 01	0.0	3.448E 01	0.0	3.085E 02	1.218E 02	1.622E 04	9.467E 01	0.0	0.0
1.000E 04	7.643E 03	1.714E 05	4.006E 03	0.0	3.204E 03	0.0	3.476E 03	3.542E 03	4.523E-16	2.754E 03	0.0	0.0
3.000E 04	3.007E 04	1.713E 05	2.234E 04	0.0	1.787E 04	0.0	1.047E 04	1.985E 04	0.0	1.544E 04	0.0	0.0
1.000E 05	9.692E 04	1.707E 05	8.616E 04	0.0	6.890E 04	0.0	3.383E 04	7.764E 04	0.0	6.039E 04	0.0	0.0
3.000E 05	2.458E 05	1.692E 05	1.889E 05	0.0	1.511E 05	0.0	8.592E 04	1.090E 05	0.0	8.477E 04	0.0	0.0
1.000E 06	4.287E 05	1.641E 05	2.088E 05	0.0	1.670E 05	0.0	1.501E 05	1.096E 05	0.0	8.523E 04	0.0	0.0

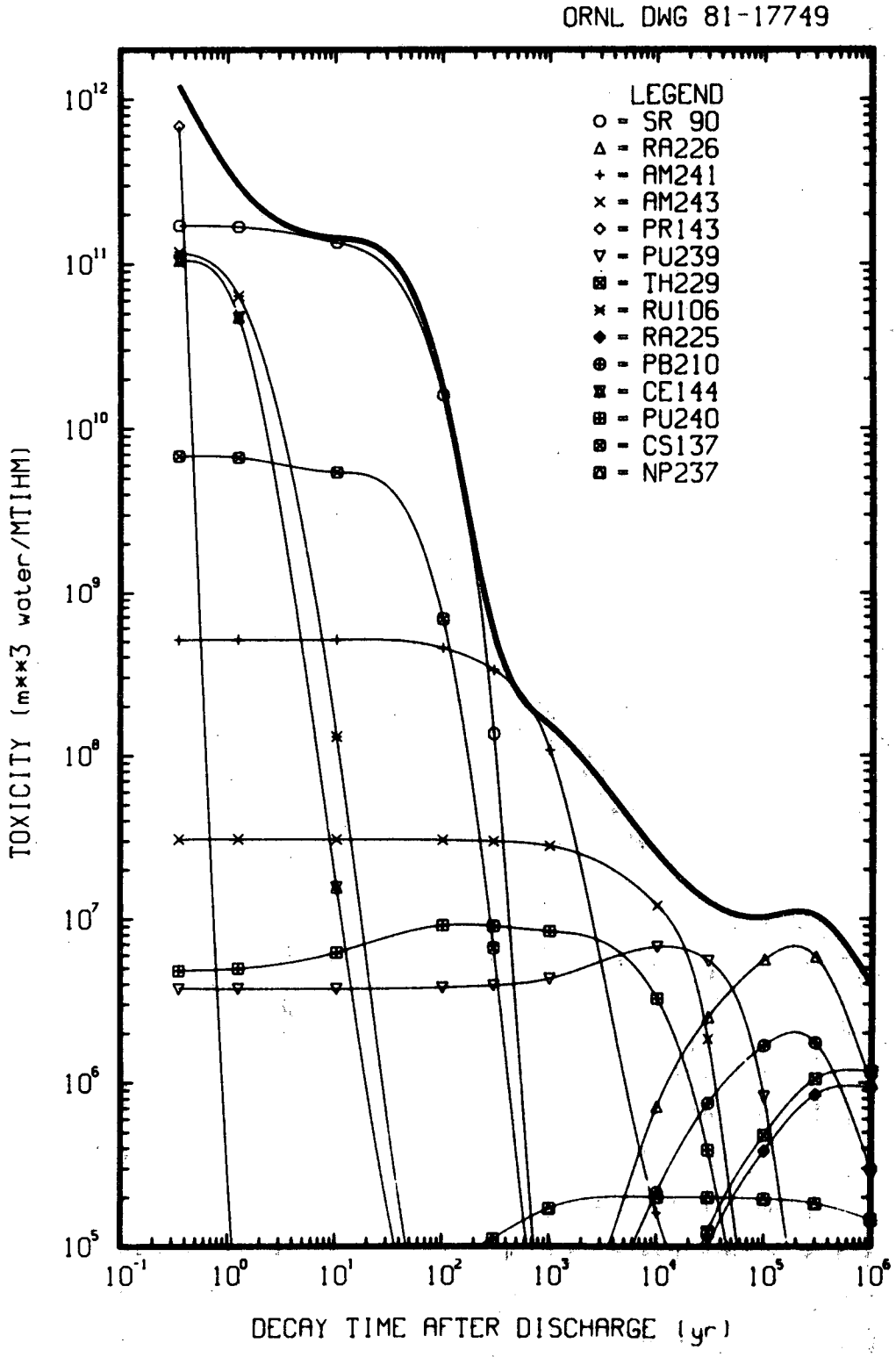

Fig. B.14. Toxicity of LMFBR high-level waste as a function of decay time.

Table B.14. Toxicity of LMFBR high-level waste as a function of decay time

Toxicity (m^3 water/MTIHM)

Time (years)	TOTAL	SR 90	RA226	AM241	AM243	PR143	PU239	TH229	RU106	RA225	PB210	CE144
3.500E-01	1.219E 12	1.711E 11	1.333E-02	5.127E 08	3.088E 07	6.938E 11	3.729E 06	1.146E-02	1.188E 11	3.409E-01	2.425E 00	1.057E 11
1.250E 00	3.028E 11	1.675E 11	1.343E-02	5.129E 08	3.087E 07	3.517E 04	3.730E 06	1.157E-02	6.398E 10	9.255E-03	2.358E 00	4.744E 10
1.025E 01	1.432E 11	1.352E 11	5.161E-02	5.130E 08	3.085E 07	0.0	3.741E 06	2.070E-02	1.307E 08	1.656E-02	1.784E 00	1.566E 07
1.003E 02	1.719E 10	1.587E 10	3.462E 01	4.563E 08	3.059E 07	0.0	3.812E 06	1.001E 00	0.0	8.012E-01	5.033E 00	0.0
3.003E 02	5.588E 08	1.359E 08	7.144E 02	3.313E 08	3.002E 07	0.0	3.931E 06	1.066E 01	0.0	8.529E 00	1.633E 02	0.0
1.000E 03	1.531E 08	7.893E 00	1.323E 04	1.081E 08	2.811E 07	0.0	4.317E 06	1.661E 02	0.0	1.328E 02	3.967E 03	0.0
1.000E 04	2.522E 07	0.0	7.142E 05	1.609E 05	1.207E 07	0.0	6.735E 06	2.153E 04	0.0	1.722E 04	2.142E 05	0.0
3.000E 04	1.276E 07	0.0	2.505E 06	3.147E 04	1.845E 06	0.0	5.534E 06	1.234E 05	0.0	9.875E 04	7.512E 05	0.0
1.000E 05	1.028E 07	0.0	5.617E 06	1.043E 02	2.570E 03	0.0	8.228E 05	4.810E 05	0.0	3.848E 05	1.684E 06	0.0
3.000E 05	1.049E 07	0.0	5.846E 06	9.053E-06	8.694E-02	0.0	2.604E 03	1.057E 06	0.0	8.458E 05	1.753E 06	0.0
1.000E 06	3.906E 06	0.0	9.897E 05	0.0	8.426E-02	0.0	6.741E-02	1.169E 06	0.0	9.352E 05	2.968E 05	0.0

Toxicity (m^3 water/MTIHM)

Time (years)	PU240	CS137	NP237	SN126	CS134	SR 89	PD107	PD210	AC225	NP239	RN219	SE 79
3.500E-01	4.820E 06	6.830E 09	5.663E 04	6.853E 05	1.364E 10	5.110E 10	1.037E 05	2.701E-01	7.295E-02	1.235E 06	3.354E-01	1.670E 05
1.250E 00	4.974E 06	6.689E 09	5.683E 04	6.853E 05	1.008E 10	5.612E 08	1.037E 05	3.233E-01	9.256E-04	1.235E 06	7.196E-01	1.670E 05
1.025E 01	6.248E 06	5.433E 09	5.883E 04	6.852E 05	4.893E 08	1.422E-11	1.037E 05	2.550E-01	1.656E-03	1.234E 06	2.480E 00	1.669E 05
1.003E 02	9.181E 06	6.791E 08	7.779E 04	6.848E 05	3.550E-05	0.0	1.037E 05	7.190E-01	8.012E-02	1.223E 06	8.057E 00	1.668E 05
3.003E 02	9.086E 06	6.682E 06	1.115E 05	6.839E 05	0.0	0.0	1.037E 05	2.333E 01	8.529E-01	1.201E 06	1.046E 01	1.664E 05
1.000E 03	8.436E 06	6.319E-01	1.717E 05	6.805E 05	0.0	0.0	1.037E 05	5.667E 02	1.328E 01	1.124E 06	2.284E 01	1.652E 05
1.000E 04	3.249E 06	0.0	2.011E 05	6.394E 05	0.0	0.0	1.036E 05	3.060E 04	1.722E 03	4.828E 05	9.269E 02	1.501E 05
3.000E 04	3.897E 05	0.0	2.005E 05	5.566E 05	0.0	0.0	1.034E 05	1.073E 05	9.875E 03	7.379E 04	7.992E 03	1.212E 05
1.000E 05	2.330E 02	0.0	1.962E 05	3.427E 05	0.0	0.0	1.026E 05	2.406E 05	3.848E 04	1.030E 02	4.289E 04	5.744E 04
3.000E 05	1.506E-03	0.0	1.839E 05	8.567E 04	0.0	0.0	1.004E 05	2.504E 05	8.458E 04	3.477E-03	6.448E 04	6.798E 03
1.000E 06	1.593E-03	0.0	1.466E 05	6.690E 02	0.0	0.0	9.320E 04	4.240E 04	9.352E 04	3.370E-03	6.491E 04	3.878E 00

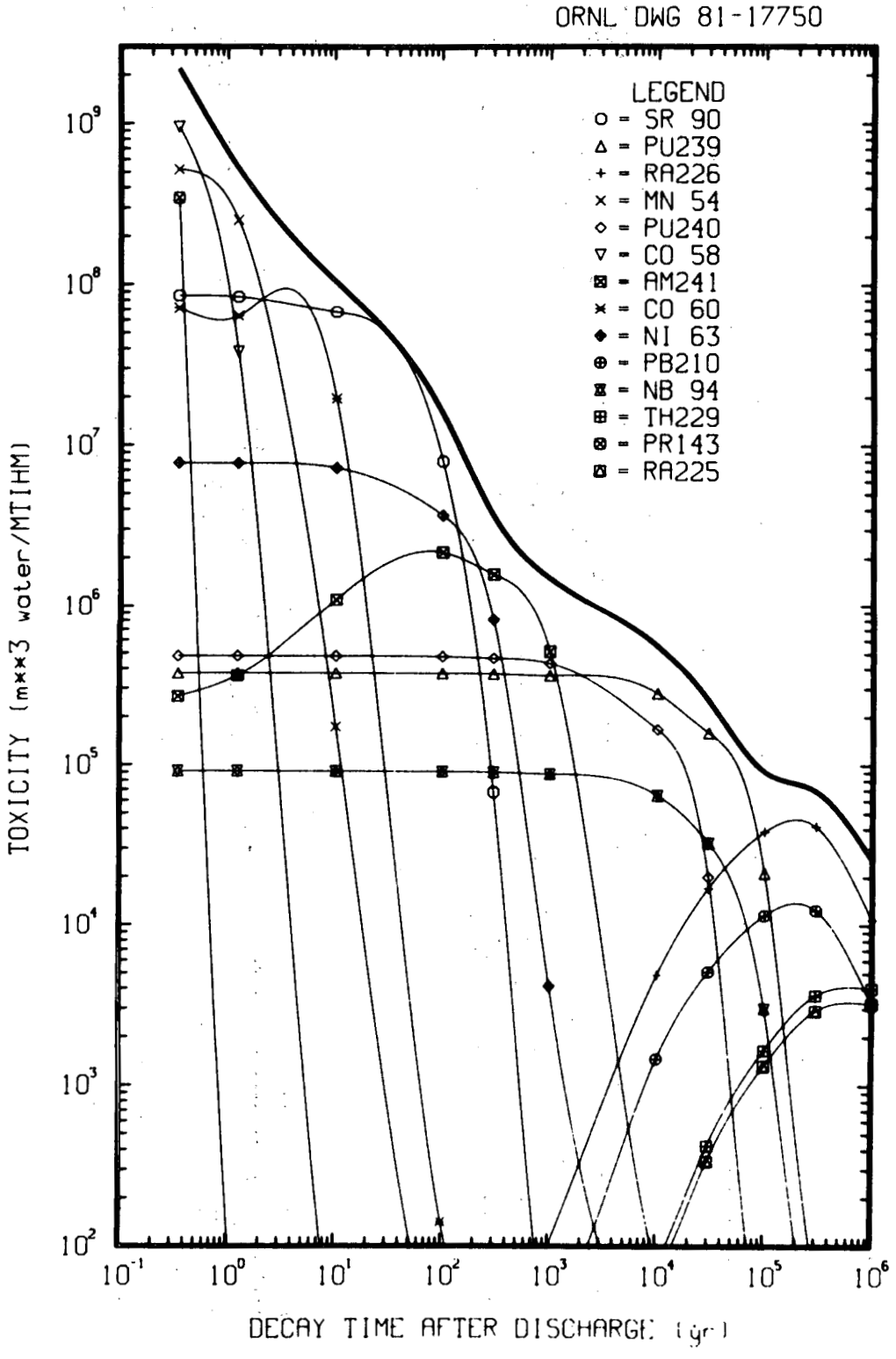

Fig. B.15. Toxicity of LMFBR structural material waste as a function of decay time.

Table B.15. Toxicity of LMFBR structural material waste as a function of decay time

Toxicity (m^3 water/MTIHM)

Time (years)	TOTAL	SR 90	PU239	RA226	MN 54	PU240	CO 58	AM241	CO 60	NI 63	PB210	NB 94
3.500E-01	2.201E 09	8.559E 07	3.731E 05	7.452E-06	5.245E 08	4.805E 05	9.602E 08	2.672E 05	7.176E 07	7.783E 06	1.216E-03	9.163E 04
1.250E 00	5.306E 08	8.378E 07	3.731E 05	1.734E-05	2.530E 08	4.805E 05	3.839E 07	3.609E 05	6.375E 07	7.730E 06	1.183E-03	9.163E 04
1.025E 01	1.033E 08	6.762E 07	3.730E 05	7.144E-04	1.724E 05	4.807E 05	4.004E-07	1.098E 06	1.951E 07	7.223E 06	9.139E-04	9.160E 04
1.003E 02	1.576E 07	7.938E 06	3.721E 05	3.320E-01	0.0	4.776E 05	0.0	2.167E 06	1.410E 02	3.666E 06	4.823E-02	9.132E 04
3.003E 02	3.625E 06	6.799E 04	3.700E 05	6.120E 00	0.0	4.677E 05	0.0	1.586E 06	5.300E-10	8.125E 05	1.411E 00	9.070E 04
1.000E 03	1.499E 06	3.948E-03	3.628E 05	9.992E 01	0.0	4.342E 05	0.0	5.162E 05	0.0	4.168E 03	2.996E 01	8.855E 04
1.000E 04	5.553E 05	0.0	2.817E 05	4.896E 03	0.0	1.672E 05	0.0	8.072E 01	0.0	0.0	1.468E 03	6.512E 04
3.000E 04	2.534E 05	0.0	1.592E 05	1.711E 04	0.0	2.006E 04	0.0	1.574E 01	0.0	0.0	5.130E 03	3.290E 04
1.000E 05	9.097E 04	0.0	2.124E 04	3.860E 04	0.0	1.199E 01	0.0	5.220E-02	0.0	0.0	1.157E 04	3.014E 03
3.000E 05	6.892E 04	0.0	6.756E 01	4.158E 04	0.0	1.402E-04	0.0	4.531E-09	0.0	0.0	1.247E 04	3.276E 00
1.000E 06	2.567E 04	0.0	3.384E-05	1.085E 04	0.0	1.394E-04	0.0	0.0	0.0	0.0	3.253E 03	1.364E-10

Toxicity (m^3 water/MTIHM)

Time (years)	TH229	PR143	RA225	NI 59	RN219	RU106	CE144	MO 93	CS137	PU238	FE 55	PO210
3.500E-01	1.146E-03	3.471E 08	9.179E-04	1.619E 04	2.769E-04	5.943E 07	5.289E 07	6.871E 04	3.416E 06	1.154E 06	1.448E 07	1.351E-04
1.250E 00	1.147E-03	1.759E 01	9.176E-04	1.619E 04	3.736E-04	3.201E 07	2.373E 07	6.869E 04	3.346E 06	1.184E 06	1.139E 07	1.622E-04
1.025E 01	1.160E-03	0.0	9.283E-04	1.619E 04	2.471E-03	6.662E 04	7.836E 03	6.857E 04	2.718E 06	1.116E 06	1.034E 06	1.306E-04
1.003E 02	2.014E-03	0.0	1.612E-03	1.618E 04	6.705E-02	0.0	0.0	6.736E 04	3.397E 05	5.540E 05	3.928E-05	6.890E-03
3.003E 02	1.651E-02	0.0	1.321E-02	1.615E 04	2.800E-01	0.0	0.0	6.474E 04	3.343E 03	1.185E 05	0.0	2.016E-01
1.000E 03	4.049E-01	0.0	3.239E-01	1.605E 04	1.487E 00	0.0	0.0	5.636E 04	3.162E-04	8.040E 02	0.0	4.280E 00
1.000E 04	7.302E 01	0.0	5.842E 01	1.485E 04	6.280E 01	0.0	0.0	9.474E 03	0.0	5.603E-16	0.0	2.097E 02
3.000E 04	4.252E 02	0.0	3.402E 02	1.249E 04	3.810E 02	0.0	0.0	1.801E 02	0.0	0.0	0.0	7.329E 02
1.000E 05	1.661E 03	0.0	1.328E 03	6.808E 03	1.540E 03	0.0	0.0	1.706E-04	0.0	0.0	0.0	1.653E 03
3.000E 05	3.651E 03	0.0	2.921E 03	1.203E 03	2.175E 03	0.0	0.0	1.053E-21	0.0	0.0	0.0	1.781E 03
1.000E 06	4.037E 03	0.0	3.229E 03	2.803E 00	2.186E 03	0.0	0.0	0.0	0.0	0.0	0.0	4.648E 02

Appendix C. CHARACTERISTICS OF FFTF SPENT FUEL, HIGH-LEVEL WASTE, AND STRUCTURAL MATERIAL WASTE

Appendix C.1. Radioactivity of FFTF Spent Fuel, High-Level Waste, and Structural Material Waste

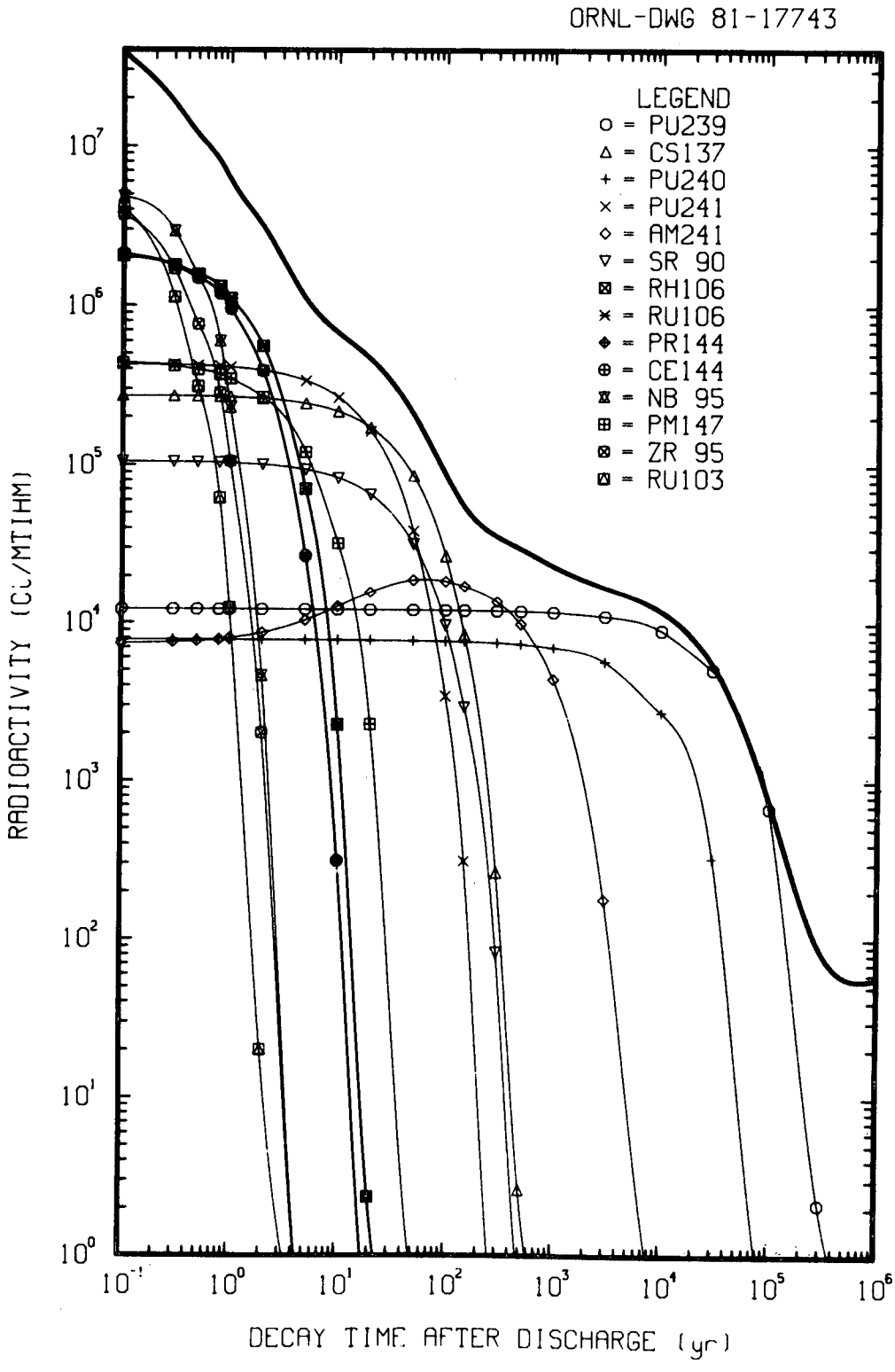

Fig. C.1. Radioactivity of FFTF spent fuel as a function of decay time.

Table C.1. Radioactivity of FFTF spent fuel as a function of decay time

Radioactivity (Ci/MTIHM)

Time (years)	TOTAL	PU239	CS137	PU240	PU241	AM241	SR 90	RH106	RU106	PR144	CE144	NB 95
1.000E-01	3.849E 07	1.210E 04	2.721E 05	7.876E 03	4.277E 05	7.446E 03	1.051E 05	2.055E 06	2.055E 06	2.113E 06	2.113E 06	4.840E 06
3.000E-01	1.867E 07	1.210E 04	2.709E 05	7.876E 03	4.235E 05	7.581E 03	1.046E 05	1.791E 06	1.791E 06	1.768E 06	1.768E 06	2.929E 06
5.000E-01	1.175E 07	1.210E 04	2.696E 05	7.876E 03	4.196E 05	7.714E 03	1.042E 05	1.561E 06	1.561E 06	1.479E 06	1.479E 06	1.502E 06
8.000E-01	7.937E 06	1.210E 04	2.681E 05	7.873E 03	4.145E 05	7.876E 03	1.036E 05	1.314E 06	1.314E 06	1.184E 06	1.184E 06	5.979E 05
1.000E 00	6.069E 06	1.210E 04	2.665E 05	7.873E 03	4.096E 05	8.039E 03	1.029E 05	1.107E 06	1.107E 06	9.479E 05	9.479E 05	2.288E 05
2.000E 00	3.114E 06	1.210E 04	2.604E 05	7.873E 03	3.904E 05	8.669E 03	1.005E 05	5.563E 05	5.563E 05	3.892E 05	3.888E 05	4.626E 03
5.000E 00	1.090E 06	1.210E 04	2.430E 05	7.870E 03	3.376E 05	1.037E 04	9.358E 04	7.069E 04	7.069E 04	2.689E 04	2.689E 04	3.129E-02
1.000E 01	6.714E 05	1.210E 04	2.165E 05	7.867E 03	2.655E 05	1.268E 04	8.307E 04	2.271E 03	2.271E 03	3.132E 02	3.132E 02	7.997E-11
2.000E 01	4.595E 05	1.209E 04	1.718E 05	7.858E 03	1.641E 05	1.583E 04	6.548E 04	2.350E 00	2.350E 00	4.244E-02	4.244E-02	5.226E-28
5.000E 01	2.079E 05	1.208E 04	8.593E 04	7.834E 03	3.870E 04	1.914E 04	3.206E 04	2.581E-09	2.581E-09	1.056E-13	1.056E-13	0.0
1.000E 02	8.708E 04	1.206E 04	2.706E 04	7.792E 03	3.488E 03	1.878E 04	9.753E 03	3.018E-24	3.018E-24	4.828E-33	4.828E-33	0.0
1.500E 02	5.476E 04	1.205E 04	8.524E 03	7.750E 03	3.142E 02	1.743E 04	2.967E 03	3.530E-39	3.530E-39	2.207E-52	2.207E-52	0.0
3.000E 02	3.575E 04	1.199E 04	2.663E 02	7.629E 03	2.352E-01	1.371E 04	8.352E 01	0.0	0.0	0.0	0.0	0.0
5.000E 02	2.996E 04	1.192E 04	2.623E 00	7.470E 03	5.343E-03	9.952E 03	7.147E-01	0.0	0.0	0.0	0.0	0.0
1.000E 03	2.340E 04	1.176E 04	2.520E-05	7.084E 03	5.117E-03	4.464E 03	4.848E-06	0.0	0.0	0.0	0.0	0.0
3.000E 03	1.707E 04	1.110E 04	2.149E-25	5.729E 03	4.346E-03	1.806E 02	1.026E-26	0.0	0.0	0.0	0.0	0.0
1.000E 04	1.186E 04	9.072E 03	0.0	2.728E 03	2.455E-03	4.861E-03	0.0	0.0	0.0	0.0	0.0	0.0
3.000E 04	5.488E 03	5.099E 03	0.0	3.271E 02	4.804E-04	4.804E-04	0.0	0.0	0.0	0.0	0.0	0.0
1.000E 05	7.563E 02	6.789E 02	0.0	1.956E-01	1.604E-06	1.604E-06	0.0	0.0	0.0	0.0	0.0	0.0
3.000E 05	8.500E 01	2.140E 00	0.0	3.006E-08	1.322E-13	1.393E-13	0.0	0.0	0.0	0.0	0.0	0.0
1.000E 06	5.690E 01	3.819E-09	0.0	2.977E-08	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Radioactivity (Ci/MTIHM)

Time (years)	PM147	ZR 95	RU103	RH103M	CE141	NP237	PA233	PU238	U233	TH229	AC225	RA225
1.000E-01	4.367E 05	3.711E 06	4.093E 06	3.690E 06	2.992E 06	1.510E-01	1.419E-01	7.202E 03	2.595E-05	2.013E-06	2.246E-06	2.119E-06
3.000E-01	4.169E 05	1.682E 06	1.128E 06	1.017E 06	6.301E 05	1.516E-01	1.499E-01	7.663E 03	2.608E-05	2.014E-06	2.023E-06	2.017E-06
5.000E-01	3.955E 05	7.623E 05	3.108E 05	2.801E 05	1.328E 05	1.520E-01	1.516E-01	7.997E 03	2.621E-05	2.014E-06	2.014E-06	2.014E-06
8.000E-01	3.702E 05	2.835E 05	6.202E 04	5.593E 04	1.895E 04	1.527E-01	1.524E-01	8.289E 03	2.638E-05	2.015E-06	2.014E-06	2.015E-06
1.000E 00	3.467E 05	1.054E 05	1.238E 04	1.116E 04	2.705E 03	1.533E-01	1.531E-01	8.479E 03	2.654E-05	2.015E-06	2.015E-06	2.015E-06
2.000E 00	2.661E 05	2.016E 03	2.000E 01	1.803E 01	1.123E 00	1.561E-01	1.561E-01	8.762E 03	2.729E-05	2.018E-06	2.018E-06	2.018E-06
5.000E 00	1.204E 05	1.409E-02	8.018E-08	7.226E-08	8.027E-11	1.653E-01	1.653E-01	8.656E 03	2.947E-05	2.025E-06	2.025E-06	2.025E-06
1.000E 01	3.214E 04	3.602E-11	8.111E-22	7.313E-22	9.885E-28	1.841E-01	1.841E-01	8.337E 03	3.328E-05	2.039E-06	2.039E-06	2.039E-06
2.000E 01	2.289E 03	2.354E-28	0.0	0.0	0.0	2.307E-01	2.307E-01	7.738E 03	4.229E-05	2.073E-06	2.073E-06	2.073E-06
5.000E 01	8.265E-01	0.0	0.0	0.0	0.0	4.054E-01	4.054E-01	6.184E 03	8.364E-05	2.240E-06	2.240E-06	2.240E-06
1.000E 02	1.514E-06	0.0	0.0	0.0	0.0	7.160E-01	7.160E-01	4.268E 03	2.063E-04	2.886E-06	2.886E-06	2.886E-06
1.500E 02	2.772E-12	0.0	0.0	0.0	0.0	1.009E 00	1.009E 00	2.957E 03	3.952E-04	4.265E-06	4.265E-06	4.265E-06
3.000E 02	1.702E-29	0.0	0.0	0.0	0.0	1.763E 00	1.763E 00	1.009E 03	1.314E-03	1.567E-05	1.567E-05	1.567E-05
5.000E 02	0.0	0.0	0.0	0.0	0.0	2.523E 00	2.523E 00	2.602E 02	3.202E-03	5.666E-05	5.666E-05	5.666E-05
1.000E 03	0.0	0.0	0.0	0.0	0.0	3.629E 00	3.629E 00	1.392E 01	1.008E-02	3.524E-04	3.524E-04	3.524E-04
3.000E 03	0.0	0.0	0.0	0.0	0.0	4.494E 00	4.494E 00	1.206E-03	4.711E-02	5.226E-03	5.226E-03	5.226E-03
1.000E 04	0.0	0.0	0.0	0.0	0.0	4.518E 00	4.518E 00	1.654E-17	1.821E-01	6.187E-02	6.187E-02	6.187E-02
3.000E 04	0.0	0.0	0.0	0.0	0.0	4.491E 00	4.491E 00	0.0	5.440E-01	3.654E-01	3.654E-01	3.654E-01
1.000E 05	0.0	0.0	0.0	0.0	0.0	4.388E 00	4.388E 00	0.0	1.570E 00	1.433E 00	1.433E 00	1.433E 00
3.000E 05	0.0	0.0	0.0	0.0	0.0	4.114E 00	4.114E 00	0.0	3.120E 00	3.154E 00	3.154E 00	3.154E 00
1.000E 06	0.0	0.0	0.0	0.0	0.0	3.280E 00	3.280E 00	0.0	3.479E 00	3.488E 00	3.488E 00	3.488E 00

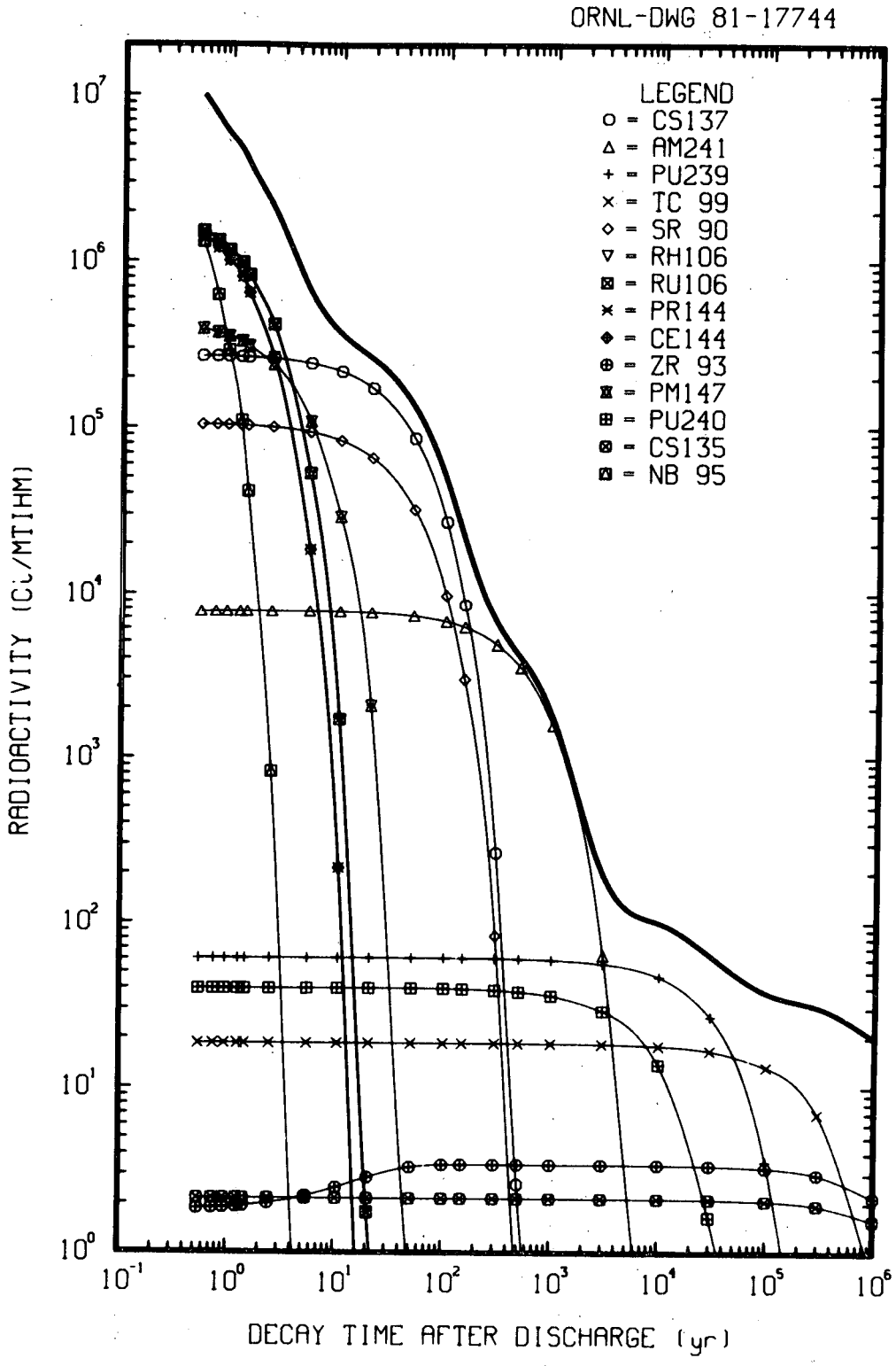

Fig. C.2. Radioactivity of FFTF high-level waste as a function of decay time.

Table C.2. *Radioactivity of FFTF high-level waste as a function of decay time*

Radioactivity (Ci/MTIHM)

Time (years)	TOTAL	CS137	AM241	PU239	TC 99	SR 90	RH106	RU106	PR144	CE144	ZR 93	PM147
5.380E-01	1.008E 07	2.701E 05	7.691E 03	6.065E 01	1.851E 01	1.043E 05	1.524E 06	1.524E 06	1.434E 06	1.434E 06	1.851E 00	3.926E 05
7.380E-01	7.372E 06	2.688E 05	7.689E 03	6.065E 01	1.851E 01	1.038E 05	1.328E 06	1.328E 06	1.200E 06	1.200E 06	1.867E 00	3.724E 05
9.380E-01	5.842E 06	2.676E 05	7.688E 03	6.065E 01	1.851E 01	1.033E 05	1.158E 06	1.158E 06	1.004E 06	1.004E 06	1.883E 00	3.532E 05
1.238E 00	4.652E 06	2.660E 05	7.685E 03	6.065E 01	1.851E 01	1.027E 05	9.749E 05	9.749E 05	8.037E 05	8.037E 05	1.902E 00	3.306E 05
1.438E 00	3.843E 06	2.645E 05	7.683E 03	6.065E 01	1.851E 01	1.021E 05	8.209E 05	8.209E 05	6.433E 05	6.433E 05	1.922E 00	3.095E 05
2.438E 00	2.053E 06	2.585E 05	7.674E 03	6.065E 01	1.851E 01	9.971E 04	4.127E 05	4.127E 05	2.640E 05	2.640E 05	1.997E 00	2.376E 05
5.438E 00	6.364E 05	2.411E 05	7.646E 03	6.065E 01	1.851E 01	9.284E 04	5.245E 04	5.245E 04	1.825E 04	1.825E 04	2.199E 00	1.076E 05
1.044E 01	3.593E 05	2.148E 05	7.596E 03	6.065E 01	1.851E 01	8.243E 04	1.685E 03	1.685E 03	2.125E 02	2.125E 02	2.476E 00	2.870E 04
2.044E 01	2.557E 05	1.705E 05	7.492E 03	6.066E 01	1.851E 01	6.497E 04	1.756E 00	1.756E 00	2.880E-02	2.880E-02	2.856E 00	2.044E 03
5.044E 01	1.306E 05	8.526E 04	7.160E 03	6.064E 01	1.851E 01	3.181E 04	1.929E-09	1.929E-09	7.168E-14	7.168E-14	3.304E 00	7.381E-01
1.004E 02	4.761E 04	2.685E 04	6.614E 03	6.059E 01	1.850E 01	9.677E 03	2.256E-24	2.256E-24	3.277E-33	3.277E-33	3.418E 00	1.352E-06
1.504E 02	2.076E 04	8.459E 03	6.105E 03	6.052E 01	1.850E 01	2.944E 03	2.638E-39	2.638E-39	1.498E-52	1.498E-52	3.427E 00	2.475E-12
3.004E 02	6.514E 03	2.643E 02	4.799E 03	6.029E 01	1.849E 01	8.285E 01	0.0	0.0	0.0	0.0	3.429E 00	1.520E-29
5.004E 02	4.014E 03	2.602E 00	3.483E 03	5.998E 01	1.848E 01	7.103E-01	0.0	0.0	0.0	0.0	3.428E 00	0.0
1.000E 03	1.732E 03	2.499E-05	1.562E 03	5.922E 01	1.845E 01	4.818E-06	0.0	0.0	0.0	0.0	3.426E 00	0.0
3.000E 03	1.924E 02	2.131E-25	6.321E 01	5.624E 01	1.833E 01	1.020E-26	0.0	0.0	0.0	0.0	3.424E 00	0.0
1.000E 04	9.915E 01	0.0	3.304E-03	4.669E 01	1.792E 01	0.0	0.0	0.0	0.0	0.0	3.413E 00	0.0
3.000E 04	6.260E 01	0.0	4.817E-04	2.676E 01	1.679E 01	0.0	0.0	0.0	0.0	0.0	3.382E 00	0.0
1.000E 05	3.717E 01	0.0	1.597E-06	3.588E 00	1.337E 01	0.0	0.0	0.0	0.0	0.0	3.276E 00	0.0
3.000E 05	3.055E 01	0.0	1.386E-13	1.133E-02	6.974E 00	0.0	0.0	0.0	0.0	0.0	2.993E 00	0.0
1.000E 06	1.982E 01	0.0	0.0	9.197E-11	7.148E-01	0.0	0.0	0.0	0.0	0.0	2.180E 00	0.0

Radioactivity (Ci/MTIHM)

Time (years)	PU240	CS135	NB 95	NP237	PA233	U233	TH229	AC225	RA225	FR221	AT217	BI213
5.380E-01	3.948E 01	2.137E 00	1.314E 06	1.525E-01	1.521E-01	1.976E-07	2.019E-06	2.020E-06	2.019E-06	2.020E-06	2.020E-06	2.020E-06
7.380E-01	3.948E 01	2.137E 00	6.270E 05	1.530E-01	1.528E-01	3.310E-07	2.019E-06	2.019E-06	2.019E-06	2.019E-06	2.019E-06	2.019E-06
9.380E-01	3.948E 01	2.137E 00	2.916E 05	1.535E-01	1.533E-01	4.648E-07	2.019E-06	2.019E-06	2.019E-06	2.019E-06	2.019E-06	2.019E-06
1.238E 00	3.948E 01	2.137E 00	1.101E 05	1.542E-01	1.539E-01	6.327E-07	2.019E-06	2.019E-06	2.019E-06	2.019E-06	2.019E-06	2.019E-06
1.438E 00	3.948E 01	2.137E 00	4.122E 04	1.548E-01	1.545E-01	8.013E-07	2.019E-06	2.019E-06	2.019E-06	2.019E-06	2.019E-06	2.019E-06
2.438E 00	3.949E 01	2.137E 00	8.203E 02	1.573E-01	1.573E-01	1.556E-06	2.019E-06	2.019E-06	2.019E-06	2.019E-06	2.019E-06	2.019E-06
5.438E 00	3.951E 01	2.137E 00	5.543E-03	1.647E-01	1.647E-01	3.741E-06	2.019E-06	2.019E-06	2.019E-06	2.019E-06	2.019E-06	2.019E-06
1.044E 01	3.954E 01	2.137E 00	1.417E-11	1.771E-01	1.771E-01	7.474E-06	2.021E-06	2.021E-06	2.021E-06	2.021E-06	2.021E-06	2.021E-06
2.044E 01	3.956E 01	2.137E 00	9.258E-29	2.015E-01	2.015E-01	1.575E-05	2.030E-06	2.030E-06	2.030E-06	2.030E-06	2.030E-06	2.030E-06
5.044E 01	3.954E 01	2.136E 00	0.0	2.727E-01	2.727E-01	4.686E-05	2.111E-06	2.111E-06	2.111E-06	2.111E-06	2.111E-06	2.111E-06
1.004E 02	3.937E 01	2.136E 00	0.0	3.842E-01	3.842E-01	1.188E-04	2.482E-06	2.482E-06	2.482E-06	2.482E-06	2.482E-06	2.482E-06
1.504E 02	3.917E 01	2.136E 00	0.0	4.871E-01	4.871E-01	2.141E-04	3.246E-06	3.246E-06	3.246E-06	3.246E-06	3.246E-06	3.246E-06
3.004E 02	3.855E 01	2.136E 00	0.0	7.507E-01	7.507E-01	6.233E-04	8.897E-06	8.897E-06	8.897E-06	8.897E-06	8.897E-06	8.897E-06
5.004E 02	3.774E 01	2.136E 00	0.0	1.017E 00	1.017E 00	1.401E-03	2.734E-05	2.734E-05	2.734E-05	2.734E-05	2.734E-05	2.734E-05
1.000E 03	3.579E 01	2.136E 00	0.0	1.404E 00	1.404E 00	4.098E-03	1.502E-04	1.502E-04	1.502E-04	1.502E-04	1.502E-04	1.502E-04
3.000E 03	2.895E 01	2.135E 00	0.0	1.706E 00	1.706E 00	1.821E-02	2.052E-03	2.052E-03	2.052E-03	2.052E-03	2.052E-03	2.052E-03
1.000E 04	1.378E 01	2.130E 00	0.0	1.715E 00	1.715E 00	6.942E-02	2.368E-02	2.368E-02	2.368E-02	2.368E-02	2.368E-02	2.368E-02
3.000E 04	1.653E 00	2.117E 00	0.0	1.704E 00	1.704E 00	2.068E-01	1.390E-01	1.390E-01	1.390E-01	1.390E-01	1.390E-01	1.390E-01
1.000E 05	9.886E-04	2.073E 00	0.0	1.666E 00	1.666E 00	5.962E-01	5.440E-01	5.440E-01	5.440E-01	5.440E-01	5.440E-01	5.440E-01
3.000E 05	1.507E-10	1.952E 00	0.0	1.561E 00	1.561E 00	1.185E 00	1.197E 00	1.197E 00	1.197E 00	1.197E 00	1.197E 00	1.197E 00
1.000E 06	1.493E-10	1.581E 00	0.0	1.244E 00	1.244E 00	1.321E 00	1.323E 00	1.323E 00	1.323E 00	1.323E 00	1.323E 00	1.323E 00

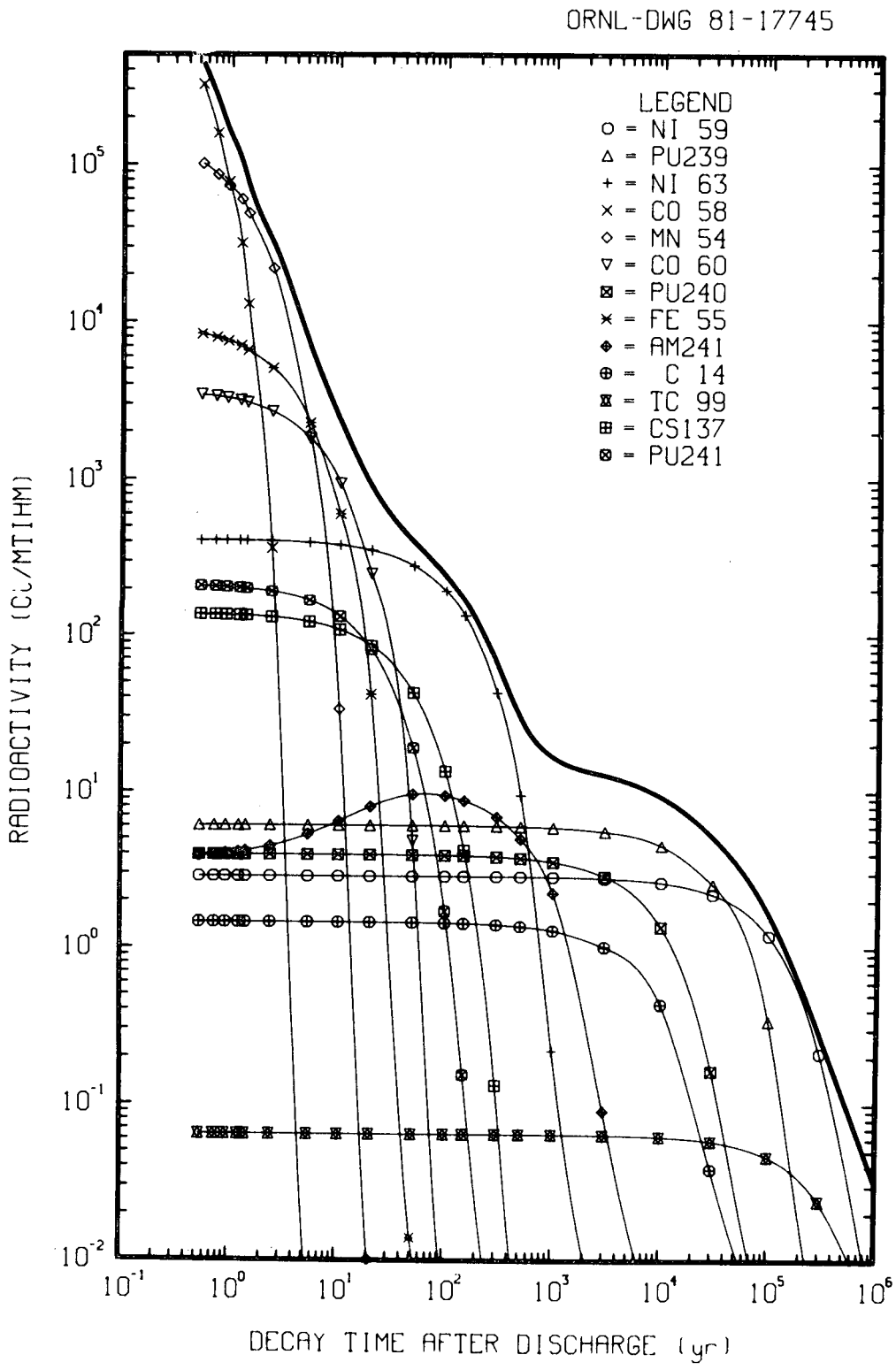

Fig. C.3. Radioactivity of FFTF structural material waste as a function of decay time.

Table C.3. Radioactivity of FFTF structural material waste as a function of decay time

Radioactivity (Ci/MTIHM)

Time (years)	TOTAL	NI 59	PU239	NI 63	CO 58	MN 54	CO 60	PU240	FE 55	AM241	C 14	TC 99
5.380E-01	4.445E 05	2.865E 00	6.068E 00	4.096E 02	3.246E 05	1.016E 05	3.449E 03	3.949E 00	8.396E 03	3.881E 00	1.457E 00	6.438E-02
7.380E-01	2.610E 05	2.865E 00	6.068E 00	4.090E 02	1.587E 05	8.640E 04	3.360E 03	3.949E 00	7.963E 03	3.947E 00	1.457E 00	6.438E-02
9.380E-01	1.656E 05	2.865E 00	6.068E 00	4.083E 02	7.761E 04	7.348E 04	3.273E 03	3.949E 00	7.546E 03	4.012E 00	1.457E 00	6.438E-02
1.238E 00	1.050E 05	2.865E 00	6.067E 00	4.076E 02	3.174E 04	6.001E 04	3.167E 03	3.949E 00	7.060E 03	4.092E 00	1.457E 00	6.438E-02
1.438E 00	7.426E 04	2.865E 00	6.067E 00	4.068E 02	1.298E 04	4.901E 04	3.064E 03	3.949E 00	6.605E 03	4.172E 00	1.457E 00	6.438E-02
2.438E 00	3.160E 04	2.865E 00	6.067E 00	4.038E 02	3.628E 02	2.180E 04	2.687E 03	3.949E 00	5.059E 03	4.480E 00	1.457E 00	6.438E-02
5.438E 00	6.943E 03	2.865E 00	6.067E 00	3.947E 02	7.927E-03	1.918E 03	1.811E 03	3.947E 00	2.274E 03	5.315E 00	1.457E 00	6.438E-02
1.044E 01	2.313E 03	2.864E 00	6.066E 00	3.801E 02	1.354E-10	3.340E 01	9.380E 02	3.945E 00	5.996E 02	6.449E 00	1.456E 00	6.438E-02
2.044E 01	8.943E 02	2.864E 00	6.064E 00	3.526E 02	3.947E-26	1.012E-02	2.517E 02	3.941E 00	4.169E 01	7.992E 00	1.454E 00	6.438E-02
5.044E 01	3.971E 02	2.863E 00	6.059E 00	2.812E 02	0.0	2.818E-13	4.867E 00	3.929E 00	1.402E-02	9.608E 00	1.449E 00	6.437E-02
1.004E 02	2.413E 02	2.862E 00	6.050E 00	1.930E 02	0.0	7.207E-31	6.952E-03	3.908E 00	2.278E-08	9.413E 00	1.440E 00	6.436E-02
1.504E 02	1.645E 02	2.861E 00	6.042E 00	1.324E 02	0.0	1.843E-48	9.801E-06	3.887E 00	3.703E-14	8.737E 00	1.431E 00	6.435E-02
3.004E 02	6.538E 01	2.857E 00	6.015E 00	4.276E 01	0.0	0.0	2.646E-14	3.826E 00	1.590E-31	6.873E 00	1.405E 00	6.432E-02
5.004E 02	2.916E 01	2.852E 00	5.981E 00	9.476E 00	0.0	0.0	9.948E-26	3.746E 00	0.0	4.987E 00	1.372E 00	6.428E-02
1.000E 03	1.651E 01	2.840E 00	5.895E 00	2.191E-01	0.0	0.0	0.0	3.552E 00	0.0	2.237E 00	1.291E 00	6.418E-02
3.000E 03	1.274E 01	2.791E 00	5.566E 00	6.258E-08	0.0	0.0	0.0	2.873E 00	0.0	9.051E-02	1.014E 00	6.376E-02
1.000E 04	9.265E 00	2.627E 00	4.550E 00	0.0	0.0	0.0	0.0	1.368E 00	0.0	2.438E-06	4.347E-01	6.232E-02
3.000E 04	5.145E 00	2.209E 00	2.558E 00	0.0	0.0	0.0	0.0	1.641E-01	0.0	2.410E-07	3.866E-02	5.840E-02
1.000E 05	1.638E 00	1.204E 00	3.405E-01	0.0	0.0	0.0	0.0	9.811E-05	0.0	7.997E-10	8.115E-06	4.653E-02
3.000E 05	2.797E-01	2.129E-01	1.089E-03	0.0	0.0	0.0	0.0	1.508E-11	0.0	6.942E-17	2.516E-16	2.426E-02
1.000E 06	3.153E-02	4.923E-04	1.943E-12	0.0	0.0	0.0	0.0	1.493E-11	0.0	0.0	0.0	2.486E-03

Radioactivity (Ci/MTIHM)

Time (years)	CS137	PU241	TH229	AC225	RA225	FR221	AT217	BI213	PB209	U233	PO213	NP237
5.380E-01	1.351E 02	2.100E 02	1.010E-09	1.011E-09	1.010E-09	1.011E-09	1.011E-09	1.011E-09	1.011E-09	1.316E-08	9.887E-10	7.631E-05
7.380E-01	1.345E 02	2.080E 02	1.010E-09	1.010E-09	1.010E-09	1.010E-09	1.010E-09	1.010E-09	1.010E-09	1.322E-08	9.885E-10	7.656E-05
9.380E-01	1.339E 02	2.060E 02	1.011E-09	1.011E-09	1.011E-09	1.011E-09	1.011E-09	1.011E-09	1.011E-09	1.329E-08	9.887E-10	7.682E-05
1.238E 00	1.331E 02	2.035E 02	1.011E-09	1.011E-09	1.011E-09	1.011E-09	1.011E-09	1.011E-09	1.011E-09	1.338E-08	9.890E-10	7.715E-05
1.438E 00	1.323E 02	2.011E 02	1.011E-09	1.011E-09	1.011E-09	1.011E-09	1.011E-09	1.011E-09	1.011E-09	1.346E-08	9.893E-10	7.748E-05
2.438E 00	1.293E 02	1.916E 02	1.012E-09	1.012E-09	1.012E-09	1.012E-09	1.012E-09	1.012E-09	1.012E-09	1.384E-08	9.906E-10	7.888E-05
5.438E 00	1.206E 02	1.659E 02	1.016E-09	1.016E-09	1.016E-09	1.016E-09	1.016E-09	1.016E-09	1.016E-09	1.494E-08	9.943E-10	8.365E-05
1.044E 01	1.075E 02	1.304E 02	1.023E-09	1.023E-09	1.023E-09	1.023E-09	1.023E-09	1.023E-09	1.023E-09	1.687E-08	1.001E-09	9.322E-05
2.044E 01	8.531E 01	8.057E 01	1.040E-09	1.040E-09	1.040E-09	1.040E-09	1.040E-09	1.040E-09	1.040E-09	2.143E-08	1.018E-09	1.168E-04
5.044E 01	4.265E 01	1.901E 01	1.125E-09	1.125E-09	1.125E-09	1.125E-09	1.125E-09	1.125E-09	1.125E-09	4.234E-08	1.101E-09	2.047E-04
1.004E 02	1.343E 01	1.713E 00	1.452E-09	1.452E-09	1.452E-09	1.452E-09	1.452E-09	1.452E-09	1.452E-09	1.041E-07	1.420E-09	3.604E-04
1.504E 02	4.231E 00	1.543E-01	2.147E-09	2.147E-09	2.147E-09	2.147E-09	2.147E-09	2.147E-09	2.147E-09	1.992E-07	2.101E-09	5.075E-04
3.004E 02	1.322E-01	1.156E-04	7.883E-09	7.883E-09	7.883E-09	7.883E-09	7.883E-09	7.883E-09	7.883E-09	6.605E-07	7.713E-09	8.850E-04
5.004E 02	1.301E-03	2.680E-06	2.848E-08	2.848E-08	2.848E-08	2.848E-08	2.848E-08	2.848E-08	2.848E-08	1.609E-06	2.787E-08	1.266E-03
1.000E 03	1.251E-08	2.566E-06	1.770E-07	1.770E-07	1.770E-07	1.770E-07	1.770E-07	1.770E-07	1.770E-07	5.057E-06	1.731E-07	1.821E-03
3.000E 03	1.066E-28	2.179E-06	2.621E-06	2.621E-06	2.621E-06	2.621E-06	2.621E-06	2.621E-06	2.621E-06	2.362E-05	2.565E-06	2.253E-03
1.000E 04	0.0	1.231E-06	3.103E-05	3.103E-05	3.103E-05	3.103E-05	3.103E-05	3.103E-05	3.103E-05	9.132E-05	3.036E-05	2.266E-03
3.000E 04	0.0	2.410E-07	1.833E-04	1.833E-04	1.833E-04	1.833E-04	1.833E-04	1.833E-04	1.833E-04	2.728E-04	1.793E-04	2.252E-03
1.000E 05	0.0	7.997E-10	7.187E-04	7.187E-04	7.187E-04	7.187E-04	7.187E-04	7.187E-04	7.187E-04	7.877E-04	7.031E-04	2.201E-03
3.000E 05	0.0	6.589E-17	1.581E-03	1.581E-03	1.581E-03	1.581E-03	1.581E-03	1.581E-03	1.581E-03	1.565E-03	1.547E-03	2.063E-03
1.000E 06	0.0	0.0	1.749E-03	1.749E-03	1.749E-03	1.749E-03	1.749E-03	1.749E-03	1.749E-03	1.745E-03	1.711E-03	1.645E-03

Appendix C.2. Thermal Power of FFTF Spent Fuel, High-Level Waste, and Structural Material Waste

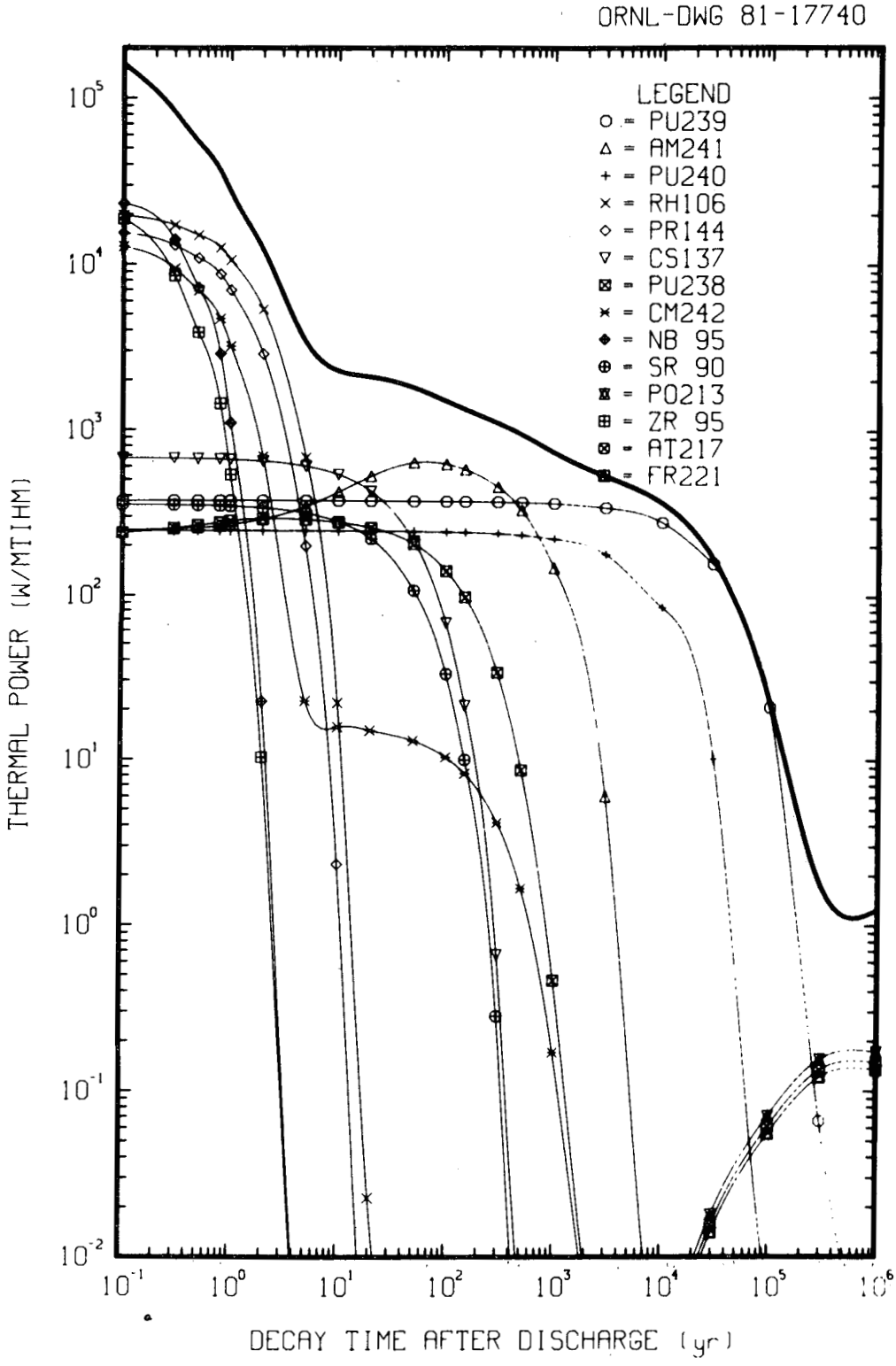

Fig. C.4. Thermal power of FFTF spent fuel as a function of decay time.

Table C.4. Thermal power of FFTF spent fuel as a function of decay time

Thermal power (W/MTIHM)

Time (years)	TOTAL	PU239	AM241	PU240	RH106	PR144	CS137	PU238	CM242	NB 95	SR 90	PO213
1.000E-01	1.611E 05	3.729E 02	2.474E 02	2.452E 02	1.971E 04	1.553E 04	6.742E 02	2.386E 02	1.283E 04	2.322E 04	3.525E 02	1.112E-07
3.000E-01	8.250E 04	3.729E 02	2.518E 02	2.452E 02	1.717E 04	1.300E 04	6.711E 02	2.539E 02	9.412E 03	1.405E 04	3.508E 02	1.002E-07
5.000E-01	5.410E 04	3.729E 02	2.562E 02	2.452E 02	1.497E 04	1.088E 04	6.680E 02	2.650E 02	6.937E 03	7.202E 03	3.491E 02	9.973E-08
8.000E-01	3.638E 04	3.729E 02	2.617E 02	2.452E 02	1.261E 04	8.705E 03	6.641E 02	2.747E 02	4.693E 03	2.867E 03	3.470E 02	9.973E-08
1.000E 00	2.699E 04	3.729E 02	2.671E 02	2.452E 02	1.061E 04	6.967E 03	6.602E 02	2.810E 02	3.190E 03	1.097E 03	3.450E 02	9.976E-08
2.000E 00	1.210E 04	3.729E 02	2.879E 02	2.452E 02	5.337E 03	2.859E 03	6.450E 02	2.903E 02	6.885E 02	2.220E 01	3.369E 02	9.991E-08
5.000E 00	3.355E 03	3.729E 02	3.446E 02	2.451E 02	6.780E 02	1.976E 02	6.020E 02	2.869E 02	2.232E 01	1.501E-04	3.137E 02	1.003E-07
1.000E 01	2.264E 03	3.729E 02	4.214E 02	2.450E 02	2.178E 01	2.301E 00	5.363E 02	2.764E 02	1.553E 01	3.837E-13	2.784E 02	1.010E-07
2.000E 01	2.087E 03	3.726E 02	5.259E 02	2.447E 02	2.254E-02	3.120E-04	4.257E 02	2.564E 02	1.483E 01	2.507E-30	2.195E 02	1.026E-07
5.000E 01	1.796E 03	3.723E 02	6.358E 02	2.439E 02	2.476E-11	7.765E-16	2.128E 02	2.049E 02	1.293E 01	0.0	1.075E 02	1.109E-07
1.000E 02	1.492E 03	3.717E 02	6.238E 02	2.426E 02	2.895E-26	3.548E-35	6.704E 01	1.414E 02	1.030E 01	0.0	3.269E 01	1.429E-07
1.500E 02	1.330E 03	3.714E 02	5.792E 02	2.414E 02	3.385E-41	1.623E-54	2.111E 01	9.801E 01	8.199E 00	0.0	9.944E 00	2.112E-07
3.000E 02	1.102E 03	3.696E 02	4.557E 02	2.376E 02	0.0	0.0	6.598E-01	3.346E 01	4.135E 00	0.0	2.799E-01	7.756E-07
5.000E 02	9.416E 02	3.675E 02	3.307E 02	2.326E 02	0.0	0.0	6.497E-03	8.623E 00	1.662E 00	0.0	2.397E-03	2.805E-06
1.000E 03	7.325E 02	3.623E 02	1.483E 02	2.206E 02	0.0	0.0	6.243E-08	4.614E-01	1.700E-01	0.0	1.625E-08	1.745E-05
3.000E 03	5.271E 02	3.419E 02	6.000E 00	1.784E 02	0.0	0.0	5.324E-28	3.997E-05	1.866E-05	0.0	3.441E-29	2.587E-04
1.000E 04	3.651E 02	2.796E 02	1.615E-04	8.494E 01	0.0	0.0	0.0	5.482E-19	2.561E-19	0.0	0.0	3.063E-03
3.000E 04	1.682E 02	1.572E 02	1.596E-05	1.019E 01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.810E-02
1.000E 05	2.223E 01	2.093E 01	5.328E-08	6.090E-03	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.096E-02
3.000E 05	1.720E 00	6.596E-02	4.626E-15	9.361E-10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.561E-01
1.000E 06	1.249E 00	1.177E-10	0.0	9.268E-10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.726E-01

Thermal power (W/MTIHM)

Time (years)	ZR 95	AT217	FR221	LA140	AC225	TH229	NP237	RU103	U233	CO 58	Y 91	U236
1.000E-01	1.880E 04	9.584E-08	8.669E-08	1.670E 04	7.846E-08	6.160E-08	4.614E-03	1.369E 04	7.542E-07	9.286E 03	7.175E 03	4.388E-04
3.000E-01	8.521E 03	8.635E-08	7.810E-08	3.187E 02	7.069E-08	6.160E-08	4.632E-03	3.771E 03	7.581E-07	4.542E 03	3.021E 03	4.401E-04
5.000E-01	3.861E 03	8.596E-08	7.774E-08	6.078E 00	7.036E-08	6.163E-08	4.648E-03	1.039E 03	7.617E-07	2.220E 03	1.271E 03	4.413E-04
8.000E-01	1.436E 03	8.596E-08	7.774E-08	4.310E-02	7.036E-08	6.163E-08	4.666E-03	2.075E 02	7.669E-07	9.078E 02	4.307E 02	4.428E-04
1.000E 00	5.340E 02	8.599E-08	7.777E-08	3.054E-04	7.039E-08	6.166E-08	4.687E-03	4.145E 01	7.717E-07	3.714E 02	1.461E 02	4.446E-04
2.000E 00	1.021E 01	8.611E-08	7.786E-08	7.723E-13	7.048E-08	6.172E-08	4.768E-03	6.690E-02	7.934E-07	1.038E 01	1.929E 00	4.509E-04
5.000E 00	7.138E-05	8.641E-08	7.816E-08	0.0	7.075E-08	6.196E-08	5.051E-03	2.682E-10	8.566E-07	2.267E-04	4.440E-06	4.699E-04
1.000E 01	1.825E-13	8.702E-08	7.870E-08	0.0	7.123E-08	6.238E-08	5.626E-03	2.714E-24	9.675E-07	3.873E-12	1.783E-15	5.012E-04
2.000E 01	1.192E-30	8.843E-08	8.000E-08	0.0	7.241E-08	6.340E-08	7.051E-03	0.0	1.229E-06	1.129E-27	2.872E-34	5.644E-04
5.000E 01	0.0	9.557E-08	8.644E-08	0.0	7.822E-08	6.852E-08	1.239E-02	0.0	2.431E-06	0.0	0.0	7.530E-04
1.000E 02	0.0	1.232E-07	1.114E-07	0.0	1.008E-07	8.828E-08	2.188E-02	0.0	5.997E-06	0.0	0.0	1.067E-03
1.500E 02	0.0	1.820E-07	1.646E-07	0.0	1.490E-07	1.305E-07	3.084E-02	0.0	1.149E-05	0.0	0.0	1.378E-03
3.000E 02	0.0	6.684E-07	6.045E-07	0.0	5.473E-07	4.792E-07	5.388E-02	0.0	3.819E-05	0.0	0.0	2.303E-03
5.000E 02	0.0	2.418E-06	2.187E-06	0.0	1.979E-06	1.733E-06	7.711E-02	0.0	9.310E-05	0.0	0.0	3.515E-03
1.000E 03	0.0	1.504E-05	1.360E-05	0.0	1.231E-05	1.078E-05	1.110E-01	0.0	2.929E-04	0.0	0.0	6.431E-03
3.000E 03	0.0	2.230E-04	2.017E-04	0.0	1.825E-04	1.598E-04	1.373E-01	0.0	1.369E-03	0.0	0.0	1.667E-02
1.000E 04	0.0	2.640E-03	2.388E-03	0.0	2.161E-03	1.893E-03	1.381E-01	0.0	5.292E-03	0.0	0.0	3.937E-02
3.000E 04	0.0	1.560E-02	1.411E-02	0.0	1.277E-02	1.118E-02	1.372E-01	0.0	1.582E-02	0.0	0.0	5.750E-02
1.000E 05	0.0	6.114E-02	5.530E-02	0.0	5.006E-02	4.382E-02	1.342E-01	0.0	4.566E-02	0.0	0.0	5.985E-02
3.000E 05	0.0	1.345E-01	1.217E-01	0.0	1.101E-01	9.644E-02	1.257E-01	0.0	9.072E-02	0.0	0.0	5.949E-02
1.000E 06	0.0	1.488E-01	1.346E-01	0.0	1.218E-01	1.067E-01	1.002E-01	0.0	1.011E-01	0.0	0.0	5.828E-02

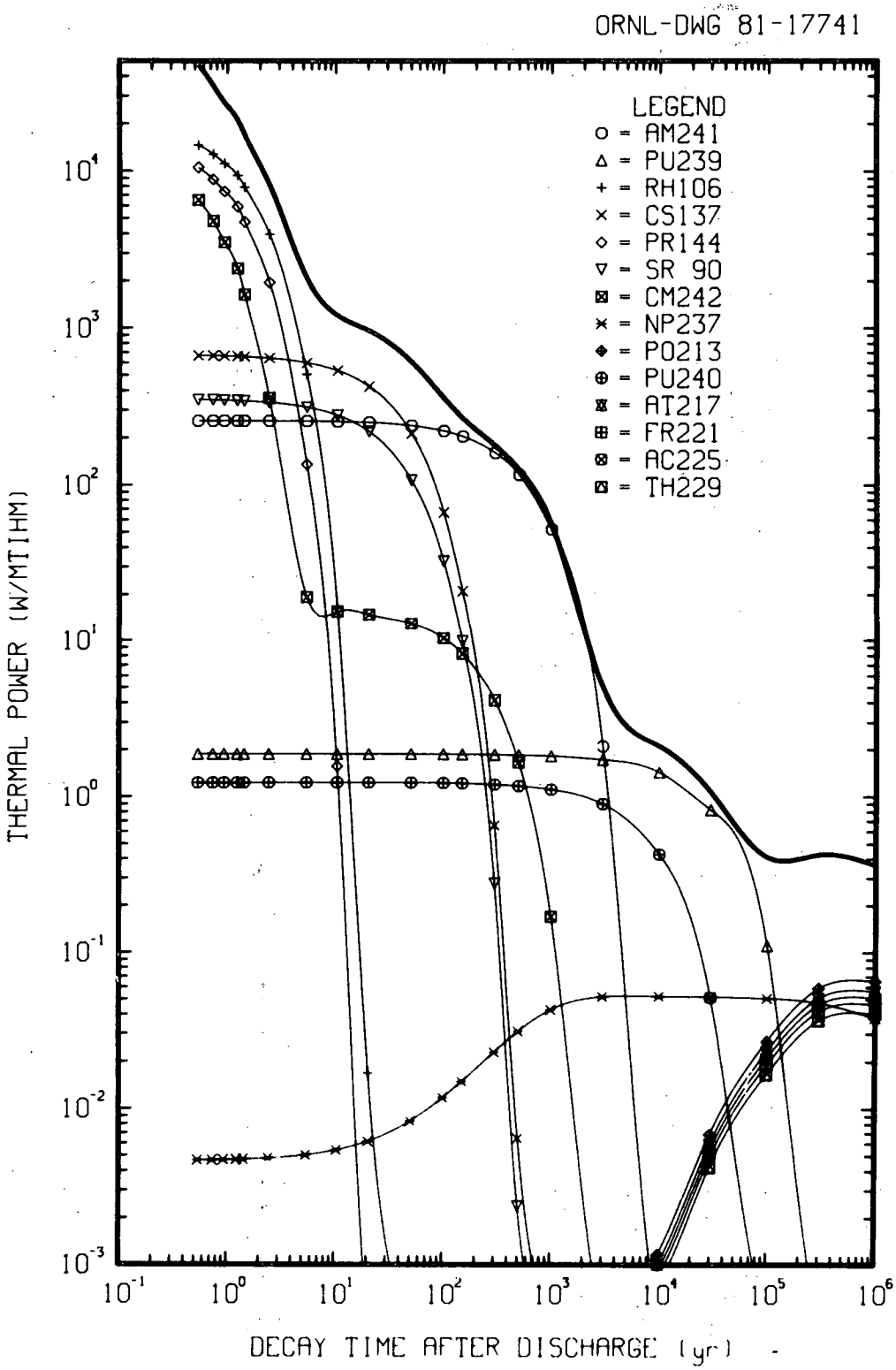

Fig. C.5. Thermal power of FFTF high-level waste as a function of decay time.

Table C.5. Thermal power of FFTF high-level waste as a function of decay time

Thermal power (W/MTIHM)

Time (years)	TOTAL	AM241	PU239	RH106	CS137	PR144	SR 90	CM242	NP237	PO213	PU240	AT217
5.380E-01	4.723E 04	2.555E 02	1.869E 00	1.462E 04	6.690E 02	1.054E 04	3.497E 02	6.528E 03	4.662E-03	1.000E-07	1.229E 00	8.620E-08
7.380E-01	3.474E 04	2.554E 02	1.869E 00	1.274E 04	6.659E 02	8.820E 03	3.480E 02	4.791E 03	4.677E-03	9.997E-08	1.229E 00	8.616E-08
9.380E-01	2.714E 04	2.554E 02	1.869E 00	1.110E 04	6.629E 02	7.381E 03	3.464E 02	3.518E 03	4.693E-03	9.997E-08	1.229E 00	8.616E-08
1.238E 00	2.104E 04	2.553E 02	1.869E 00	9.350E 03	6.590E 02	5.908E 03	3.443E 02	2.392E 03	4.712E-03	9.996E-08	1.229E 00	8.616E-08
1.438E 00	1.688E 04	2.552E 02	1.869E 00	7.873E 03	6.553E 02	4.728E 03	3.423E 02	1.628E 03	4.731E-03	9.996E-08	1.229E 00	8.616E-08
2.438E 00	8.144E 03	2.549E 02	1.869E 00	3.958E 03	6.403E 02	1.941E 03	3.343E 02	3.578E 02	4.807E-03	9.996E-08	1.230E 00	8.615E-08
5.438E 00	2.054E 03	2.540E 02	1.869E 00	5.030E 02	5.974E 02	1.341E 02	3.112E 02	1.918E 01	5.034E-03	9.997E-08	1.230E 00	8.616E-08
1.044E 01	1.189E 03	2.523E 02	1.869E 00	1.616E 01	5.322E 02	1.562E 00	2.762E 02	1.554E 01	5.411E-03	1.001E-07	1.231E 00	8.623E-08
2.044E 01	9.533E 02	2.489E 02	1.869E 00	1.685E-02	4.224E 02	2.117E-04	2.178E 02	1.484E 01	6.158E-03	1.005E-07	1.232E 00	8.662E-08
5.044E 01	6.039E 02	2.378E 02	1.869E 00	1.850E-11	2.112E 02	5.269E-16	1.066E 02	1.294E 01	8.334E-03	1.045E-07	1.231E 00	9.007E-08
1.004E 02	3.563E 02	2.197E 02	1.867E 00	2.164E-26	6.652E 01	2.409E-35	3.243E 01	1.030E 01	1.174E-02	1.229E-07	1.226E 00	1.059E-07
1.504E 02	2.640E 02	2.028E 02	1.865E 00	2.530E-41	2.096E 01	1.101E-54	9.866E 00	8.202E 00	1.489E-02	1.607E-07	1.220E 00	1.385E-07
3.004E 02	1.772E 02	1.594E 02	1.858E 00	0.0	6.547E-01	0.0	2.777E-01	4.139E 00	2.294E-02	4.405E-07	1.200E 00	3.797E-07
5.004E 02	1.244E 02	1.157E 02	1.848E 00	0.0	6.444E-03	0.0	2.380E-03	1.663E 00	3.107E-02	1.354E-06	1.175E 00	1.167E-06
1.000E 03	5.571E 01	5.189E 01	1.825E 00	0.0	6.192E-08	0.0	1.615E-08	1.701E-01	4.292E-02	7.438E-06	1.115E 00	6.410E-06
3.000E 03	5.046E 00	2.100E 00	1.733E 00	0.0	5.279E-28	0.0	3.420E-29	1.867E-05	5.214E-02	1.016E-04	9.016E-01	8.759E-05
1.000E 04	2.101E 00	1.098E-04	1.439E 00	0.0	0.0	0.0	0.0	2.562E-19	5.241E-02	1.172E-03	4.292E-01	1.010E-03
3.000E 04	1.071E 00	1.600E-05	8.246E-01	0.0	0.0	0.0	0.0	0.0	5.208E-02	6.882E-03	5.149E-02	5.931E-03
1.000E 05	4.101E-01	5.306E-08	1.106E-01	0.0	0.0	0.0	0.0	0.0	5.091E-02	2.694E-02	3.078E-05	2.322E-02
3.000E 05	4.266E-01	4.603E-15	3.491E-04	0.0	0.0	0.0	0.0	0.0	4.771E-02	5.924E-02	4.694E-12	5.106E-02
1.000E 06	3.642E-01	0.0	2.834E-12	0.0	0.0	0.0	0.0	0.0	3.803E-02	6.551E-02	4.648E-12	5.647E-02

Thermal power (W/MTIHM)

Time (years)	FR221	AC225	TH229	U233	NB 95	PU238	ZR 95	U234	AM243	PO214	CE144	SB126M
5.380E-01	7.796E-08	7.056E-08	6.177E-08	5.744E-09	6.303E 03	6.327E 00	3.330E 03	6.180E-05	2.324E-01	3.670E-09	9.511E 02	2.533E-02
7.380E-01	7.793E-08	7.053E-08	6.177E-08	9.621E-09	3.007E 03	1.429E 01	1.509E 03	6.698E-05	2.324E-01	3.826E-09	7.959E 02	2.533E-02
9.380E-01	7.793E-08	7.053E-08	6.177E-08	1.351E-08	1.399E 03	2.012E 01	6.841E 02	7.553E-05	2.324E-01	3.968E-09	6.661E 02	2.533E-02
1.238E 00	7.792E-08	7.053E-08	6.177E-08	1.839E-08	5.282E 02	2.526E 01	2.544E 02	8.961E-05	2.324E-01	4.145E-09	5.331E 02	2.533E-02
1.438E 00	7.792E-08	7.053E-08	6.177E-08	2.329E-08	1.977E 02	2.873E 01	9.459E 01	1.063E-04	2.323E-01	4.323E-09	4.267E 02	2.533E-02
2.438E 00	7.792E-08	7.052E-08	6.176E-08	4.522E-08	3.935E 00	3.441E 01	1.809E 00	1.859E-04	2.323E-01	5.033E-09	1.751E 02	2.533E-02
5.438E 00	7.793E-08	7.053E-08	6.177E-08	1.087E-07	2.659E-05	3.547E 01	1.265E-05	4.475E-04	2.323E-01	7.171E-09	1.210E 01	2.533E-02
1.044E 01	7.799E-08	7.059E-08	6.182E-08	2.173E-07	6.796E-14	3.466E 01	3.233E-14	8.799E-04	2.321E-01	1.079E-08	1.409E-01	2.533E-02
2.044E 01	7.834E-08	7.090E-08	6.210E-08	4.577E-07	4.441E-31	3.307E 01	2.112E-31	1.715E-03	2.319E-01	1.849E-08	1.910E-05	2.533E-02
5.044E 01	8.146E-08	7.373E-08	6.457E-08	1.362E-06	0.0	2.873E 01	0.0	3.997E-03	2.313E-01	4.977E-08	4.755E-17	2.532E-02
1.004E 02	9.578E-08	8.669E-08	7.592E-08	3.453E-06	0.0	2.275E 01	0.0	7.156E-03	2.302E-01	1.561E-07	2.174E-36	2.531E-02
1.504E 02	1.253E-07	1.134E-07	9.931E-08	6.225E-06	0.0	1.803E 01	0.0	9.658E-03	2.291E-01	3.705E-07	9.937E-56	2.531E-02
3.004E 02	3.434E-07	3.108E-07	2.722E-07	1.812E-05	0.0	9.004E 00	0.0	1.446E-02	2.259E-01	1.986E-06	0.0	2.528E-02
5.004E 02	1.055E-06	9.550E-07	8.364E-07	4.074E-05	0.0	3.589E 00	0.0	1.735E-02	2.217E-01	7.064E-06	0.0	2.524E-02
1.000E 03	5.798E-06	5.247E-06	4.596E-06	1.191E-04	0.0	3.646E-01	0.0	1.906E-02	2.115E-01	3.591E-05	0.0	2.516E-02
3.000E 03	7.921E-05	7.170E-05	6.279E-05	5.295E-04	0.0	3.996E-05	0.0	1.915E-02	1.753E-01	3.250E-04	0.0	2.481E-02
1.000E 04	9.139E-04	8.272E-04	7.244E-04	2.018E-03	0.0	5.485E-19	0.0	1.878E-02	9.084E-02	2.006E-03	0.0	2.364E-02
3.000E 04	5.365E-03	4.855E-03	4.252E-03	6.010E-03	0.0	0.0	0.0	1.774E-02	1.388E-02	7.050E-03	0.0	2.058E-02
1.000E 05	2.100E-02	1.900E-02	1.664E-02	1.733E-02	0.0	0.0	0.0	1.456E-02	1.930E-05	1.581E-02	0.0	1.267E-02
3.000E 05	4.618E-02	4.180E-02	3.661E-02	3.443E-02	0.0	0.0	0.0	8.272E-03	2.526E-12	1.643E-02	0.0	3.167E-03
1.000E 06	5.107E-02	4.622E-02	4.048E-02	3.839E-02	0.0	0.0	0.0	1.167E-03	2.319E-12	2.714E-03	0.0	2.475E-05

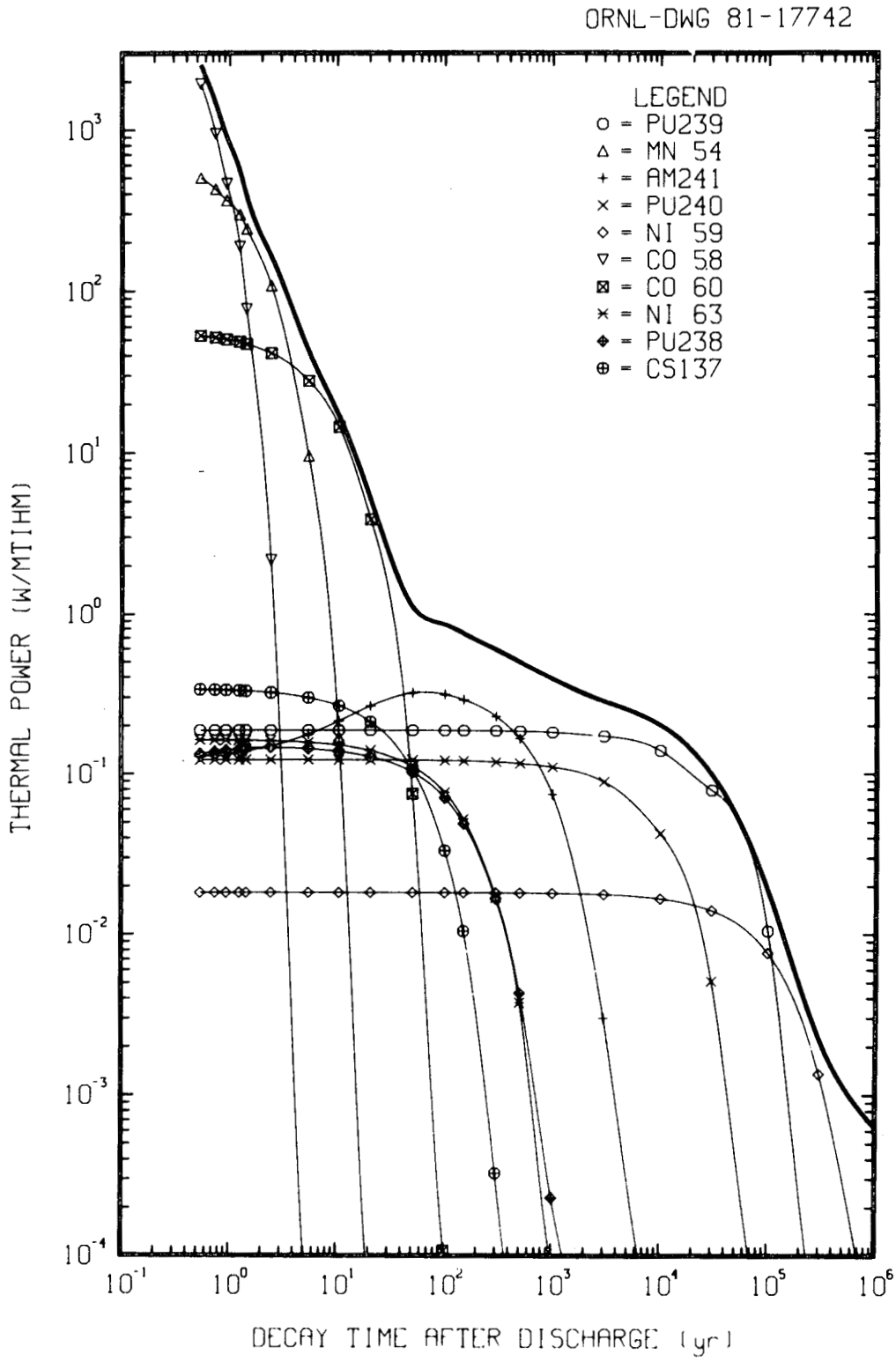

Fig. C.6. Thermal power of FFTF structural material waste as a function of decay time.

Table C.6. Thermal power of FFTF structural material waste as a function of decay time

Thermal power (W/MTIHM)

Time (years)	TOTAL	PU239	MN 54	AM241	PU240	NI 59	CO 58	CO 60	PO213	NI 63	PU238	AT217
5.380E-01	2.540E 03	1.870E-01	5.059E 02	1.289E-01	1.230E-01	1.824E-02	1.943E 03	5.318E 01	5.003E-11	1.627E-01	1.338E-01	4.312E-11
7.380E-01	1.462E 03	1.870E-01	4.302E 02	1.311E-01	1.230E-01	1.824E-02	9.503E 02	5.180E 01	5.002E-11	1.624E-01	1.376E-01	4.311E-11
9.380E-01	9.058E 02	1.870E-01	3.659E 02	1.333E-01	1.230E-01	1.824E-02	4.647E 02	5.046E 01	5.003E-11	1.622E-01	1.403E-01	4.312E-11
1.238E 00	5.585E 02	1.870E-01	2.988E 02	1.359E-01	1.230E-01	1.824E-02	1.900E 02	4.882E 01	5.005E-11	1.619E-01	1.426E-01	4.313E-11
1.438E 00	3.871E 02	1.870E-01	2.440E 02	1.386E-01	1.230E-01	1.824E-02	7.769E 01	4.724E 01	5.006E-11	1.616E-01	1.441E-01	4.315E-11
2.438E 00	1.638E 02	1.870E-01	1.085E 02	1.488E-01	1.230E-01	1.824E-02	2.172E 00	4.142E 01	5.013E-11	1.604E-01	1.459E-01	4.320E-11
5.438E 00	4.229E 01	1.870E-01	9.551E 00	1.765E-01	1.229E-01	1.824E-02	4.746E-05	2.792E 01	5.031E-11	1.568E-01	1.434E-01	4.337E-11
1.044E 01	1.674E 01	1.869E-01	1.663E-01	2.142E-01	1.228E-01	1.824E-02	8.104E-13	1.446E 01	5.066E-11	1.510E-01	1.381E-01	4.367E-11
2.044E 01	5.141E 00	1.869E-01	5.040E-05	2.655E-01	1.227E-01	1.823E-02	2.363E-28	3.881E 00	5.151E-11	1.400E-01	1.282E-01	4.439E-11
5.044E 01	1.107E 00	1.867E-01	1.403E-15	3.192E-01	1.223E-01	1.823E-02	0.0	7.504E-02	5.570E-11	1.117E-01	1.024E-01	4.801E-11
1.004E 02	8.450E-01	1.865E-01	3.588E-33	3.127E-01	1.217E-01	1.822E-02	0.0	1.072E-04	7.187E-11	7.663E-02	7.071E-02	6.195E-11
1.504E 02	7.403E-01	1.862E-01	9.178E-51	2.902E-01	1.210E-01	1.821E-02	0.0	1.511E-07	1.363E-10	5.258E-02	4.899E-02	9.163E-11
2.004E 02	5.906E-01	1.854E-01	0.0	2.283E-01	1.191E-01	1.819E-02	0.0	4.080E-16	3.903E-10	1.698E-02	1.673E-02	3.364E-10
5.004E 02	4.969E-01	1.843E-01	0.0	1.657E-01	1.166E-01	1.816E-02	0.0	1.534E-27	1.410E-09	3.763E-03	4.313E-03	1.215E-09
1.000E 03	3.882E-01	1.817E-01	0.0	7.430E-02	1.106E-01	1.808E-02	0.0	0.0	8.761E-09	8.701E-05	2.309E-04	7.551E-09
3.000E 03	2.847E-01	1.715E-01	0.0	3.007E-03	8.947E-02	1.777E-02	0.0	0.0	1.298E-07	2.486E-11	2.000E-08	1.119E-07
1.000E 04	2.018E-01	1.402E-01	0.0	8.098E-08	4.259E-02	1.672E-02	0.0	0.0	1.537E-06	0.0	2.744E-22	1.324E-06
3.000E 04	9.932E-02	7.882E-02	0.0	8.905E-09	5.110E-03	1.406E-02	0.0	0.0	9.076E-06	0.0	0.0	7.822E-06
1.000E 05	1.892E-02	1.049E-02	0.0	2.657E-11	3.055E-06	7.668E-03	0.0	0.0	3.558E-05	0.0	0.0	3.067E-05
3.000E 05	2.230E-03	3.357E-05	0.0	2.306E-18	4.695E-13	1.356E-03	0.0	0.0	7.829E-05	0.0	0.0	6.748E-05
1.000E 06	6.308E-04	5.989E-14	0.0	0.0	4.649E-13	3.134E-06	0.0	0.0	8.658E-05	0.0	0.0	7.462E-05

Thermal power (W/MTIHM)

Time (years)	FR221	CS137	AC225	TH229	NP237	U233	FE 55	SR 90	U236	NB 94	PO214	PU242
5.380E-01	3.900E-11	3.347E-01	3.530E-11	3.090E-11	2.332E-06	3.825E-10	1.155E 01	1.750E-01	2.215E-07	2.471E-03	2.044E-12	5.805E-05
7.380E-01	3.899E-11	3.331E-01	3.529E-11	3.091E-11	2.340E-06	3.844E-10	1.095E 01	1.741E-01	2.221E-07	2.471E-03	1.934E-12	5.805E-05
9.380E-01	3.900E-11	3.316E-01	3.530E-11	3.092E-11	2.348E-06	3.864E-10	1.038E 01	1.733E-01	2.227E-07	2.471E-03	1.991E-12	5.805E-05
1.238E 00	3.901E-11	3.296E-01	3.531E-11	3.093E-11	2.358E-06	3.888E-10	9.709E 00	1.722E-01	2.235E-07	2.471E-03	2.084E-12	5.805E-05
1.438E 00	3.902E-11	3.278E-01	3.532E-11	3.094E-11	2.368E-06	3.913E-10	9.083E 00	1.712E-01	2.243E-07	2.471E-03	2.182E-12	5.805E-05
2.438E 00	3.907E-11	3.203E-01	3.537E-11	3.097E-11	2.411E-06	4.022E-10	6.957E 00	1.671E-01	2.275E-07	2.471E-03	2.596E-12	5.805E-05
5.438E 00	3.922E-11	2.989E-01	3.550E-11	3.109E-11	2.557E-06	4.343E-10	3.127E 00	1.556E-01	2.370E-07	2.470E-03	4.104E-12	5.806E-05
1.044E 01	3.949E-11	2.663E-01	3.574E-11	3.130E-11	2.849E-06	4.903E-10	8.245E-01	1.382E-01	2.528E-07	2.470E-03	7.629E-12	5.807E-05
2.044E 01	4.015E-11	2.113E-01	3.634E-11	3.183E-11	3.571E-06	6.231E-10	5.733E-02	1.089E-01	2.844E-07	2.469E-03	1.943E-11	5.809E-05
5.044E 01	4.342E-11	1.056E-01	3.930E-11	3.441E-11	6.257E-06	1.231E-09	1.927E-05	5.333E-02	3.791E-07	2.467E-03	1.102E-10	5.815E-05
1.004E 02	5.603E-11	3.328E-02	5.071E-11	4.441E-11	1.102E-05	3.027E-09	3.133E-11	1.623E-02	5.362E-07	2.462E-03	5.424E-10	5.823E-05
1.504E 02	8.288E-11	1.048E-02	7.501E-11	6.569E-11	1.551E-05	5.790E-09	5.092E-17	4.935E-03	6.925E-07	2.458E-03	1.457E-09	5.830E-05
3.004E 02	3.043E-10	3.275E-04	2.754E-10	2.412E-10	2.705E-05	1.920E-08	2.187E-34	1.389E-04	1.156E-06	2.446E-03	7.958E-09	5.842E-05
5.004E 02	1.099E-09	3.224E-06	9.950E-10	8.714E-10	3.869E-05	4.677E-08	0.0	1.190E-06	1.764E-06	2.429E-03	2.659E-08	5.848E-05
1.000E 03	6.830E-09	3.098E-11	6.181E-09	5.414E-09	5.566E-05	1.470E-07	0.0	8.075E-12	3.226E-06	2.388E-03	1.221E-07	5.847E-05
3.000E 03	1.012E-07	2.641E-31	9.157E-08	8.020E-08	6.887E-05	6.868E-07	0.0	1.710E-32	8.360E-06	2.230E-03	9.964E-07	5.827E-05
1.000E 04	1.198E-06	0.0	1.084E-06	9.496E-07	6.927E-05	2.654E-06	0.0	0.0	1.974E-05	1.756E-03	5.934E-06	5.754E-05
3.000E 04	7.075E-06	0.0	6.403E-06	5.608E-06	6.882E-05	7.931E-06	0.0	0.0	2.883E-05	8.870E-04	2.073E-05	5.552E-05
1.000E 05	2.774E-05	0.0	2.510E-05	2.199E-05	6.728E-05	2.290E-05	0.0	0.0	3.001E-05	8.126E-05	4.675E-05	4.898E-05
3.000E 05	6.103E-05	0.0	5.524E-05	4.837E-05	6.306E-05	4.550E-05	0.0	0.0	2.984E-05	9.010E-08	5.027E-05	3.423E-05
1.000E 06	6.749E-05	0.0	6.109E-05	5.350E-05	5.026E-05	5.073E-05	0.0	0.0	2.922E-05	3.750E-18	1.287E-05	9.767E-06

Appendix C.3. Toxicity of FFTF Spent Fuel, High-Level Waste, and Structural Material Waste

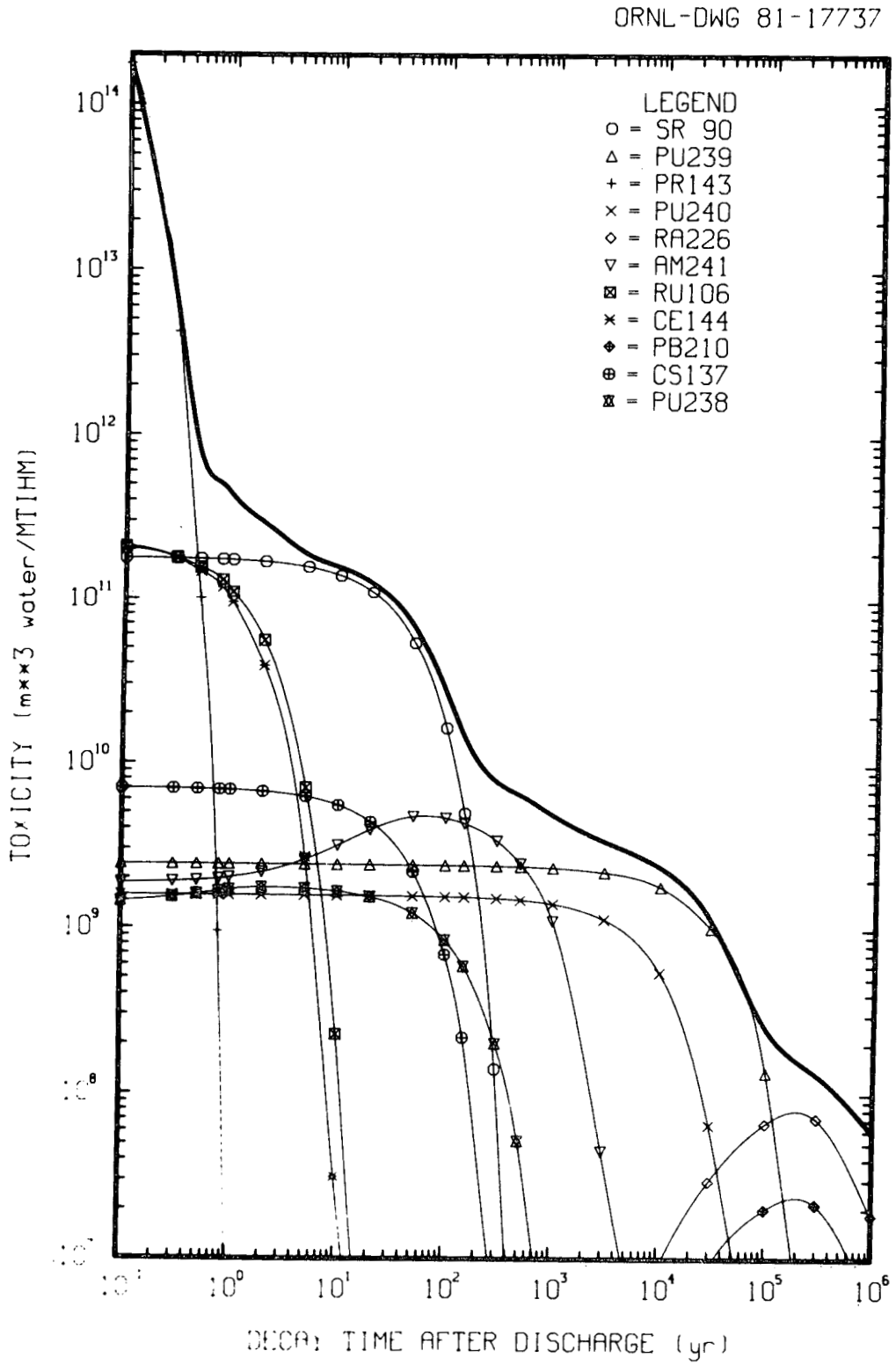

Fig. C.7. Toxicity of FFTF spent fuel as a function of decay time.

Table C.7. Toxicity of FFTF spent fuel as a function of decay time

Toxicity (m^3 water/MTIHM)

Time (years)	TOTAL	SR 90	PU239	PR143	PU240	RA226	AM241	RN219	RU106	CE144	PB210	TH229
1.000E-01	1.787E 14	1.779E 11	2.420E 09	1.765E 14	1.575E 09	2.419E 00	1.862E 09	1.448E 01	2.055E 11	2.113E 11	1.661E 00	5.033E 00
3.000E-01	5.105E 12	1.770E 11	2.420E 09	4.223E 12	1.575E 09	2.518E 00	1.895E 09	1.387E 01	1.791E 11	1.768E 11	1.698E 00	5.033E 00
5.000E-01	7.361E 11	1.762E 11	2.420E 09	1.010E 11	1.575E 09	2.620E 00	1.928E 09	1.433E 01	1.561E 11	1.479E 11	1.696E 00	5.036E 00
8.000E-01	4.955E 11	1.751E 11	2.420E 09	9.503E 08	1.575E 09	2.749E 00	1.970E 09	1.503E 01	1.314E 11	1.184E 11	1.690E 00	5.036E 00
1.000E 00	4.205E 11	1.741E 11	2.420E 09	8.946E 06	1.575E 09	2.882E 00	2.010E 09	1.575E 01	1.107E 11	9.479E 10	1.683E 00	5.039E 00
2.000E 00	2.874E 11	1.700E 11	2.420E 09	7.015E-02	1.575E 09	3.452E 00	2.167E 09	1.909E 01	5.563E 10	3.888E 10	1.661E 00	5.045E 00
5.000E 00	1.864E 11	1.583E 11	2.419E 09	0.0	1.574E 09	5.524E 00	2.592E 09	2.864E 01	7.069E 09	2.689E 09	1.632E 00	5.063E 00
1.000E 01	1.572E 11	1.405E 11	2.419E 09	0.0	1.573E 09	1.040E 01	3.172E 09	4.657E 01	2.271E 08	3.132E 07	1.736E 00	5.096E 00
2.000E 01	1.258E 11	1.108E 11	2.418E 09	0.0	1.572E 09	2.686E 01	3.958E 09	8.873E 01	2.350E 05	4.244E 03	2.732E 00	5.181E 00
5.000E 01	6.681E 10	5.423E 10	2.416E 09	0.0	1.567E 09	1.549E 02	4.786E 09	2.494E 02	2.581E-04	1.056E-08	1.731E 01	5.599E 00
1.000E 02	2.685E 10	1.650E 10	2.413E 09	0.0	1.558E 09	7.687E 02	4.696E 09	5.750E 02	3.018E-19	4.828E-28	1.196E 02	7.217E 00
1.500E 02	1.424E 10	5.017E 09	2.409E 09	0.0	1.550E 09	2.071E 03	4.358E 09	9.349E 02	3.530E-34	2.207E-47	3.846E 02	1.066E 01
3.000E 02	7.753E 09	1.413E 08	2.399E 09	0.0	1.526E 09	1.136E 04	3.428E 09	2.148E 03	0.0	0.0	2.646E 03	3.916E 01
5.000E 02	6.443E 09	1.209E 06	2.385E 09	0.0	1.494E 09	3.801E 04	2.488E 09	4.051E 03	0.0	0.0	9.837E 03	1.417E 02
1.000E 03	4.894E 09	8.199E 00	2.351E 09	0.0	1.417E 09	1.747E 05	1.116E 09	1.067E 04	0.0	0.0	5.238E 04	8.810E 02
3.000E 03	3.419E 09	1.736E-20	2.220E 09	0.0	1.146E 09	1.426E 06	4.515E 07	5.497E 04	0.0	0.0	4.277E 05	1.306E 04
1.000E 04	2.378E 09	0.0	1.814E 09	0.0	5.455E 08	8.497E 06	1.216E 03	4.151E 05	0.0	0.0	2.548E 06	1.547E 05
3.000E 04	1.135E 09	0.0	1.020E 09	0.0	6.545E 07	2.969E 07	1.201E 02	2.479E 06	0.0	0.0	8.903E 06	9.138E 05
1.000E 05	2.485E 08	0.0	1.358E 08	0.0	3.913E 04	6.696E 07	4.012E-01	9.940E 06	0.0	0.0	2.007E 07	3.581E 06
3.000E 05	1.318E 08	0.0	4.280E 05	0.0	6.012E-03	7.199E 07	3.482E-08	1.401E 07	0.0	0.0	2.159E 07	7.882E 06
1.000E 06	5.943E 07	0.0	7.638E-04	0.0	5.955E-03	1.844E 07	0.0	1.408E 07	0.0	0.0	5.527E 06	8.717E 06

Toxicity (m^3 water/MTIHM)

Time (years)	RA225	CS137	PU238	NP237	PO210	I129	SR 89	PU241	AC225	RA223	CM242	PA231
1.000E-01	4.238E 00	6.991E 09	1.440E 09	5.033E 04	1.242E-01	1.016E 06	4.608E 11	2.138E 09	4.491E-01	6.205E-01	1.741E 10	3.379E 00
3.000E-01	4.033E 00	6.961E 09	1.533E 09	5.051E 04	1.589E-01	1.024E 06	1.691E 11	2.118E 09	4.048E-01	5.946E-01	1.277E 10	3.422E 00
5.000E-01	4.027E 00	6.928E 09	1.599E 09	5.069E 04	1.835E-01	1.026E 06	6.202E 10	2.098E 09	4.030E-01	6.141E-01	9.373E 09	3.467E 00
8.000E-01	4.030E 00	6.889E 09	1.658E 09	5.090E 04	2.037E-01	1.027E 06	1.771E 10	2.072E 09	4.030E-01	6.443E-01	6.367E 09	3.521E 00
1.000E 00	4.030E 00	6.849E 09	1.696E 09	5.111E 04	2.161E-01	1.027E 06	5.057E 09	2.048E 09	4.030E-01	6.750E-01	4.328E 09	3.578E 00
2.000E 00	4.036E 00	6.693E 09	1.752E 09	5.202E 04	2.323E-01	1.027E 06	3.364E 07	1.951E 09	4.036E-01	8.181E-01	9.343E 08	3.795E 00
5.000E 00	4.051E 00	6.244E 09	1.731E 09	5.509E 04	2.319E-01	1.027E 06	9.879E 00	1.689E 09	4.051E-01	1.227E 00	3.027E 07	4.449E 00
1.000E 01	4.078E 00	5.563E 09	1.668E 09	6.135E 04	2.482E-01	1.027E 06	1.282E-10	1.328E 09	4.078E-01	1.996E 00	2.107E 07	5.542E 00
2.000E 01	4.145E 00	4.416E 09	1.547E 09	7.690E 04	3.904E-01	1.027E 06	0.0	8.205E 08	4.145E-01	3.804E 00	2.012E 07	7.753E 00
5.000E 01	4.479E 00	2.208E 09	1.237E 09	1.351E 05	2.473E 00	1.027E 06	0.0	1.936E 08	4.479E-01	1.069E 01	1.755E 07	1.454E 01
1.000E 02	5.771E 00	6.952E 08	8.536E 08	2.387E 05	1.708E 01	1.027E 06	0.0	1.744E 07	5.771E-01	2.464E 01	1.397E 07	2.641E 01
1.500E 02	8.530E 00	2.190E 08	5.913E 08	3.364E 05	5.494E 01	1.027E 06	0.0	1.571E 06	8.530E-01	4.006E 01	1.112E 07	3.895E 01
3.000E 02	3.132E 01	6.843E 06	2.019E 08	5.876E 05	3.780E 02	1.027E 06	0.0	1.176E 03	3.132E 00	9.205E 01	5.614E 06	8.069E 01
5.000E 02	1.133E 02	6.741E 04	5.205E 07	8.410E 05	1.405E 03	1.027E 06	0.0	2.672E 01	1.133E 01	1.736E 02	2.255E 06	1.458E 02
1.000E 03	7.048E 02	6.476E-01	2.785E 06	1.210E 06	7.482E 03	1.027E 06	0.0	2.558E 01	7.048E 01	4.572E 02	2.307E 05	3.554E 02
3.000E 03	1.045E 04	5.521E-21	2.411E 02	1.498E 06	6.111E 04	1.027E 06	0.0	2.173E 01	1.045E 03	2.356E 03	2.532E 01	1.832E 03
1.000E 04	1.238E 05	0.0	3.307E-12	1.506E 06	3.642E 05	1.026E 06	0.0	1.228E 01	1.238E 04	1.779E 04	3.476E-13	1.383E 04
3.000E 04	7.310E 05	0.0	0.0	1.497E 06	1.272E 06	1.026E 06	0.0	2.403E 00	7.310E 04	1.062E 05	0.0	8.262E 04
1.000E 05	2.866E 06	0.0	0.0	1.463E 06	2.868E 06	1.022E 06	0.0	8.021E-03	2.866E 05	4.259E 05	0.0	3.313E 05
3.000E 05	6.307E 06	0.0	0.0	1.371E 06	3.084E 06	1.013E 06	0.0	6.608E-10	6.307E 05	6.006E 05	0.0	4.672E 05
1.000E 06	6.973E 06	0.0	0.0	1.093E 06	7.897E 05	9.825E 05	0.0	0.0	6.973E 05	6.036E 05	0.0	4.696E 05

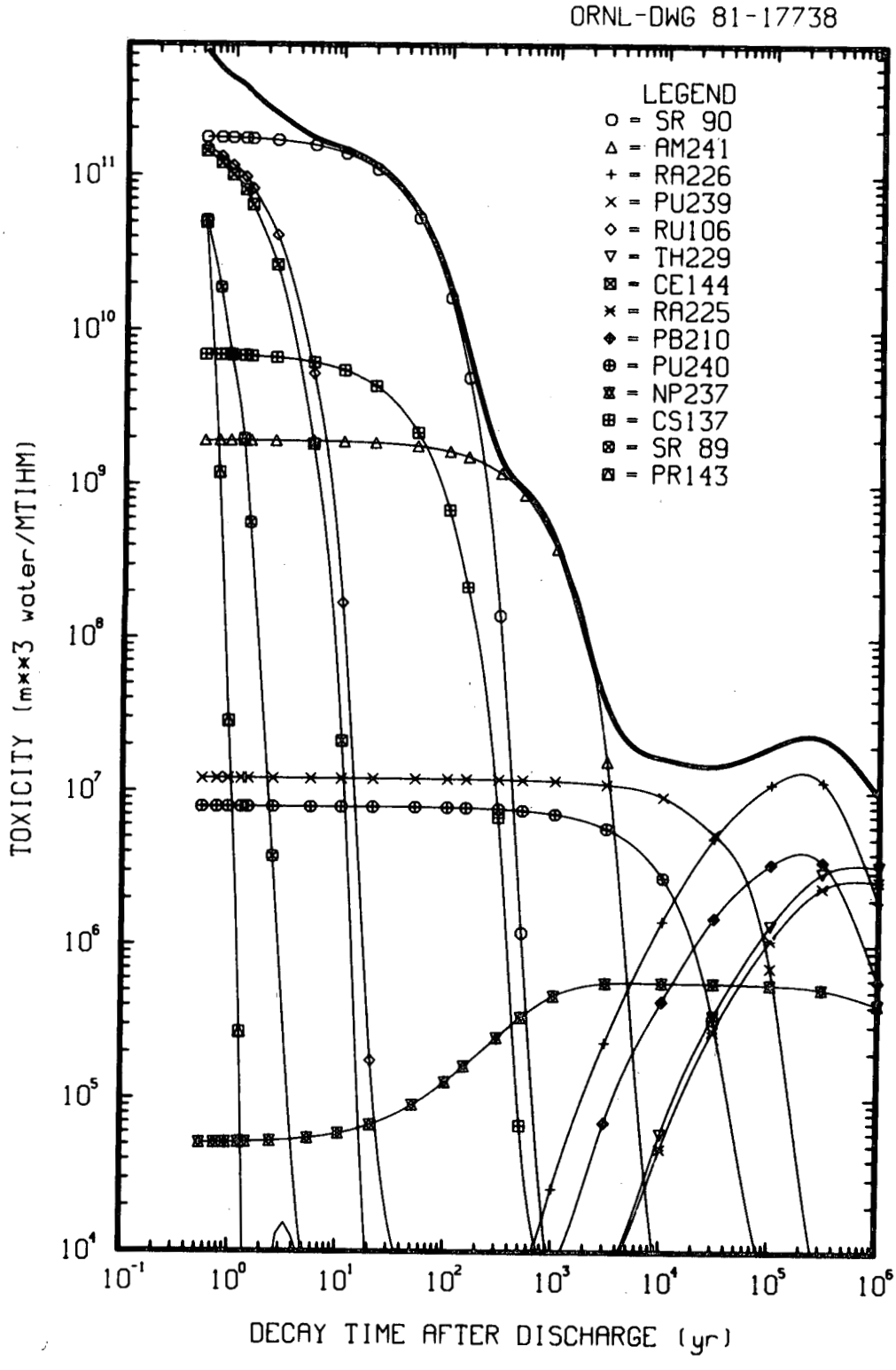

Fig. C.8. Toxicity of FFTF high-level waste as a function of decay time.

Table C.8. Toxicity of FFTF high-level waste as a function of decay time

Toxicity (m^3 water/MTIHM)

Time (years)	TOTAL	SR 90	AM241	RA226	PU239	RU106	TH229	CE144	RA225	PB210	PU240	NP237
5.380E-01	6.447E 11	1.765E 11	1.923E 09	2.646E 00	1.213E 07	1.524E 11	5.048E 00	1.434E 11	4.039E 00	1.699E 00	7.895E 06	5.085E 04
7.380E-01	4.910E 11	1.756E 11	1.922E 09	2.748E 00	1.213E 07	1.328E 11	5.048E 00	1.200E 11	4.038E 00	1.693E 00	7.895E 06	5.101E 04
9.380E-01	4.272E 11	1.748E 11	1.922E 09	2.849E 00	1.213E 07	1.158E 11	5.048E 00	1.004E 11	4.038E 00	1.688E 00	7.896E 06	5.118E 04
1.238E 00	3.753E 11	1.738E 11	1.921E 09	2.977E 00	1.213E 07	9.749E 10	5.048E 00	8.037E 10	4.038E 00	1.682E 00	7.896E 06	5.139E 04
1.438E 00	3.378E 11	1.728E 11	1.921E 09	3.104E 00	1.213E 07	8.209E 10	5.047E 00	6.433E 10	4.038E 00	1.676E 00	7.897E 06	5.159E 04
2.438E 00	2.498E 11	1.687E 11	1.918E 09	3.615E 00	1.213E 07	4.127E 10	5.047E 00	2.640E 10	4.038E 00	1.655E 00	7.898E 06	5.242E 04
5.438E 00	1.743E 11	1.570E 11	1.911E 09	5.150E 00	1.213E 07	5.245E 09	5.048E 00	1.825E 09	4.038E 00	1.625E 00	7.902E 06	5.490E 04
1.044E 01	1.479E 11	1.395E 11	1.899E 09	7.750E 00	1.213E 07	1.685E 08	5.052E 00	2.125E 07	4.042E 00	1.670E 00	7.907E 06	5.902E 04
2.044E 01	1.166E 11	1.099E 11	1.873E 09	1.328E 01	1.213E 07	1.756E 05	5.074E 00	2.880E 03	4.060E 00	2.074E 00	7.913E 06	6.716E 04
5.044E 01	5.814E 10	5.381E 10	1.790E 09	3.575E 01	1.213E 07	1.929E-04	5.276E 00	7.168E-09	4.221E 00	5.413E 00	7.908E 06	9.090E 04
1.004E 02	1.898E 10	1.637E 10	1.653E 09	1.121E 02	1.212E 07	2.256E-19	6.204E 00	3.277E-28	4.964E 00	1.968E 01	7.874E 06	1.281E 05
1.504E 02	6.941E 09	4.979E 09	1.526E 09	2.661E 02	1.210E 07	2.638E-34	8.115E 00	1.498E-47	6.492E 00	5.164E 01	7.834E 06	1.624E 05
3.004E 02	1.467E 09	1.402E 08	1.200E 09	1.427E 03	1.206E 07	0.0	2.224E 01	0.0	1.779E 01	3.309E 02	7.710E 06	2.502E 05
5.004E 02	9.333E 08	1.202E 06	8.706E 08	5.073E 03	1.200E 07	0.0	6.835E 01	0.0	5.468E 01	1.303E 03	7.548E 06	3.389E 05
1.000E 03	4.168E 08	8.149E 00	3.905E 08	2.579E 04	1.184E 07	0.0	3.756E 02	0.0	3.004E 02	7.733E 03	7.159E 06	4.681E 05
3.000E 03	3.633E 07	1.726E-20	1.580E 07	2.334E 05	1.125E 07	0.0	5.131E 03	0.0	4.105E 03	7.000E 04	5.791E 06	5.687E 05
1.000E 04	1.660E 07	0.0	8.260E 02	1.441E 06	9.338E 06	0.0	5.920E 04	0.0	4.736E 04	4.320E 05	2.757E 06	5.716E 05
3.000E 04	1.491E 07	0.0	1.204E 02	5.064E 06	5.351E 06	0.0	3.475E 05	0.0	2.780E 05	1.518E 06	3.307E 05	5.680E 05
1.000E 05	2.001E 07	0.0	3.993E-01	1.135E 07	7.176E 05	0.0	1.360E 06	0.0	1.088E 06	3.405E 06	1.977E 02	5.552E 05
3.000E 05	2.260E 07	0.0	3.465E-08	1.180E 07	2.266E 03	0.0	2.991E 06	0.0	2.393E 06	3.539E 06	3.015E-05	5.204E 05
1.000E 06	9.544E 06	0.0	0.0	1.949E 06	1.839E-05	0.0	3.308E 06	0.0	2.646E 06	5.845E 05	2.985E-05	4.148E 05

Toxicity (m^3 water/MTIHM)

Time (years)	CS137	SR 89	PR143	SN126	AM243	PO210	AC225	CM242	NB 95	PD107	ZR 95	Y 91
5.380E-01	6.939E 09	5.139E 10	4.978E 10	6.632E 05	1.807E 06	1.880E-01	4.040E-01	8.859E 09	1.314E 10	1.002E 05	1.096E 10	1.003E 10
7.380E-01	6.907E 09	1.885E 10	1.191E 09	6.632E 05	1.807E 06	2.036E-01	4.038E-01	6.502E 09	6.270E 09	1.002E 05	4.967E 09	4.221E 09
9.380E-01	6.875E 09	6.917E 09	2.850E 07	6.632E 05	1.807E 06	2.142E-01	4.038E-01	4.773E 09	2.916E 09	1.002E 05	2.251E 09	1.777E 09
1.238E 00	6.836E 09	1.975E 09	2.680E 05	6.632E 05	1.807E 06	2.227E-01	4.038E-01	3.246E 09	1.101E 09	1.002E 05	8.370E 08	6.022E 08
1.438E 00	6.796E 09	5.639E 08	2.522E 03	6.632E 05	1.807E 06	2.277E-01	4.038E-01	2.209E 09	4.122E 08	1.002E 05	3.113E 08	2.042E 08
2.438E 00	6.641E 09	3.748E 06	1.978E-05	6.632E 05	1.807E 06	2.335E-01	4.038E-01	4.855E 08	8.203E 06	1.002E 05	5.952E 06	2.696E 06
5.438E 00	6.196E 09	1.101E 00	0.0	6.632E 05	1.806E 06	2.311E-01	4.038E-01	2.602E 07	5.543E 01	1.002E 05	4.161E 01	6.206E 00
1.044E 01	5.520E 09	1.429E-11	0.0	6.631E 05	1.805E 06	2.388E-01	4.042E-01	2.108E 07	1.417E-07	1.002E 05	1.064E-07	2.491E-09
2.044E 01	4.382E 09	0.0	0.0	6.631E 05	1.804E 06	2.964E-01	4.060E-01	2.013E 07	9.258E-25	1.002E 05	6.950E-25	4.014E-28
5.044E 01	2.191E 09	0.0	0.0	6.630E 05	1.799E 06	7.733E-01	4.221E-01	1.756E 07	0.0	1.002E 05	0.0	0.0
1.004E 02	6.900E 08	0.0	0.0	6.627E 05	1.790E 06	2.811E 00	4.964E-01	1.398E 07	0.0	1.002E 05	0.0	0.0
1.504E 02	2.173E 08	0.0	0.0	6.625E 05	1.782E 06	7.378E 00	6.492E-01	1.113E 07	0.0	1.002E 05	0.0	0.0
3.004E 02	6.791E 06	0.0	0.0	6.618E 05	1.757E 06	4.727E 01	1.779E 00	5.616E 06	0.0	1.002E 05	0.0	0.0
5.004E 02	6.684E 04	0.0	0.0	6.609E 05	1.724E 06	1.861E 02	5.468E 00	2.256E 06	0.0	1.002E 05	0.0	0.0
1.000E 03	6.422E-01	0.0	0.0	6.586E 05	1.645E 06	1.105E 03	3.004E 01	2.308E 05	0.0	1.001E 05	0.0	0.0
3.000E 03	5.476E-21	0.0	0.0	6.495E 05	1.363E 06	1.000E 04	4.105E 02	2.534E 01	0.0	1.001E 05	0.0	0.0
1.000E 04	0.0	0.0	0.0	6.188E 05	7.065E 05	6.172E 04	4.736E 03	3.477E-13	0.0	1.000E 05	0.0	0.0
3.000E 04	0.0	0.0	0.0	5.387E 05	1.080E 05	2.169E 05	2.780E 04	0.0	0.0	9.984E 04	0.0	0.0
1.000E 05	0.0	0.0	0.0	3.316E 05	1.501E 02	4.864E 05	1.088E 05	0.0	0.0	9.909E 04	0.0	0.0
3.000E 05	0.0	0.0	0.0	8.291E 04	1.965E-05	5.056E 05	2.393E 05	0.0	0.0	9.700E 04	0.0	0.0
1.000E 06	0.0	0.0	0.0	6.475E 02	1.803E-05	8.351E 04	2.646E 05	0.0	0.0	9.002E 04	0.0	0.0

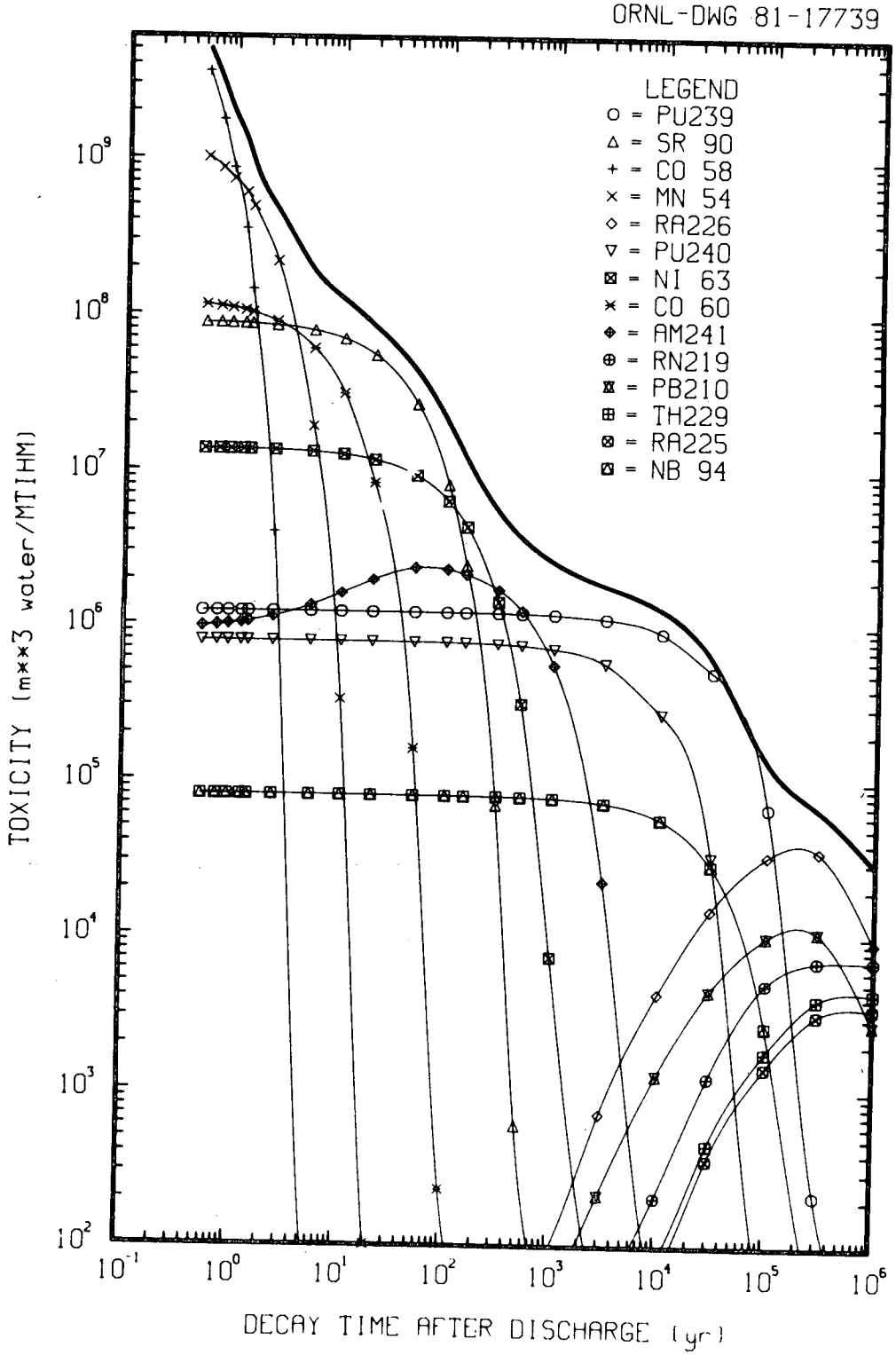

Fig. C.9. Toxicity of FFTF structural material waste as a function of decay time.

Table C.9. Toxicity of FFTF structural material waste as a function of decay time

Toxicity (m^3 water/MTIHM)

Time (years)	TOTAL	PU239	SR 90	CO 58	MN 54	RA226	PU240	NI 63	CO 60	AM241	RN219	PB210
5.380E-01	5.096E 09	1.214E 06	8.827E 07	3.607E 09	1.016E 09	1.324E-03	7.899E 05	1.365E 07	1.150E 08	9.703E 05	7.248E-03	8.501E-04
7.380E-01	3.017E 09	1.214E 06	8.786E 07	1.764E 09	8.640E 08	1.376E-03	7.899E 05	1.363E 07	1.120E 08	9.867E 05	7.522E-03	8.474E-04
9.380E-01	1.950E 09	1.214E 06	8.744E 07	8.624E 08	7.348E 08	1.429E-03	7.898E 05	1.361E 07	1.091E 08	1.003E 06	7.809E-03	8.448E-04
1.238E 00	1.275E 09	1.213E 06	8.692E 07	3.526E 08	6.001E 08	1.497E-03	7.898E 05	1.359E 07	1.056E 08	1.023E 06	8.172E-03	8.416E-04
1.438E 00	9.328E 08	1.213E 06	8.641E 07	1.442E 08	4.901E 08	1.567E-03	7.898E 05	1.356E 07	1.021E 08	1.043E 06	8.539E-03	8.387E-04
2.438E 00	4.609E 08	1.213E 06	8.438E 07	4.031E 06	2.180E 08	1.865E-03	7.897E 05	1.346E 07	8.955E 07	1.120E 06	1.024E-02	8.287E-04
5.438E 00	1.869E 08	1.213E 06	7.856E 07	8.807E 01	1.918E 07	2.948E-03	7.895E 05	1.316E 07	6.035E 07	1.329E 06	1.510E-02	8.186E-04
1.044E 01	1.232E 08	1.213E 06	6.974E 07	1.504E-06	3.340E 05	5.479E-03	7.891E 05	1.267E 07	3.127E 07	1.612E 06	2.420E-02	8.804E-04
2.044E 01	8.282E 07	1.213E 06	5.497E 07	4.386E-22	1.012E 02	1.395E-02	7.882E 05	1.175E 07	8.391E 06	1.998E 06	4.552E-02	1.407E-03
5.044E 01	4.289E 07	1.212E 06	2.692E 07	0.0	2.818E-09	7.916E-02	7.857E 05	9.374E 06	1.622E 05	2.402E 06	1.264E-01	8.880E-03
1.004E 02	1.995E 07	1.210E 06	8.188E 06	0.0	7.207E-27	3.895E-01	7.816E 05	6.432E 06	2.317E 02	2.353E 06	2.898E-01	6.073E-02
1.504E 02	1.167E 07	1.208E 06	2.491E 06	0.0	1.843E-44	1.046E 00	7.775E 05	4.413E 06	3.267E-01	2.184E 06	4.706E-01	1.945E-01
3.004E 02	5.457E 06	1.203E 06	7.011E 04	0.0	0.0	5.715E 00	7.652E 05	1.425E 06	8.820E-10	1.718E 06	1.079E 00	1.332E 00
5.004E 02	3.690E 06	1.196E 06	6.007E 02	0.0	0.0	1.910E 01	7.491E 05	3.159E 05	3.316E-21	1.247E 06	2.034E 00	4.944E 00
1.000E 03	2.600E 06	1.179E 06	4.075E-03	0.0	0.0	8.768E 01	7.104E 05	7.303E 03	0.0	5.592E 05	5.353E 00	2.629E 01
3.000E 03	1.832E 06	1.113E 06	8.630E-24	0.0	0.0	7.156E 02	5.747E 05	2.086E-03	0.0	2.263E 04	2.758E 01	2.146E 02
1.000E 04	1.271E 06	9.099E 05	0.0	0.0	0.0	4.262E 03	2.736E 05	0.0	0.0	6.094E-01	2.082E 02	1.278E 03
3.000E 04	6.091E 05	5.115E 05	0.0	0.0	0.0	1.489E 04	3.282E 04	0.0	0.0	6.025E-02	1.243E 03	4.465E 03
1.000E 05	1.330E 05	6.811E 04	0.0	0.0	0.0	3.358E 04	1.962E 01	0.0	0.0	1.999E-04	4.985E 03	1.007E 04
3.000E 05	6.678E 04	2.178E 02	0.0	0.0	0.0	3.611E 04	3.015E-06	0.0	0.0	1.736E-11	7.027E 03	1.083E 04
1.000E 06	2.933E 04	3.887E-07	0.0	0.0	0.0	9.245E 03	2.986E-06	0.0	0.0	0.0	7.064E 03	2.772E 03

Toxicity (m^3 water/MTIHM)

Time (years)	TH229	RA225	NB 94	NI 59	RU106	CE144	CS137	PU238	MO 93	NP237	PO210	FE 55
5.380E-01	2.525E-03	2.021E-03	8.082E 04	1.432E 04	7.625E 07	7.173E 07	3.471E 06	8.074E 05	5.431E 04	2.544E 01	9.404E-05	1.049E 07
7.380E-01	2.526E-03	2.021E-03	8.082E 04	1.432E 04	6.645E 07	6.003E 07	3.455E 06	8.302E 05	5.430E 04	2.552E 01	1.319E-04	9.950E 06
9.380E-01	2.527E-03	2.021E-03	8.082E 04	1.432E 04	5.791E 07	5.023E 07	3.439E 06	8.465E 05	5.430E 04	2.561E 01	1.072E-04	9.433E 06
1.238E 00	2.527E-03	2.022E-03	8.082E 04	1.432E 04	4.877E 07	4.021E 07	3.420E 06	8.605E 05	5.430E 04	2.572E 01	1.114E-04	8.825E 06
1.438E 00	2.528E-03	2.022E-03	8.082E 04	1.432E 04	4.106E 07	3.218E 07	3.400E 06	8.694E 05	5.430E 04	2.583E 01	1.140E-04	8.256E 06
2.438E 00	2.531E-03	2.025E-03	8.082E 04	1.432E 04	2.065E 07	1.321E 07	3.322E 06	8.804E 05	5.428E 04	2.629E 01	1.169E-04	6.324E 06
5.438E 00	2.541E-03	2.032E-03	8.081E 04	1.432E 04	2.624E 06	9.128E 05	3.100E 06	8.654E 05	5.425E 04	2.788E 01	1.162E-04	2.842E 06
1.044E 01	2.558E-03	2.046E-03	8.080E 04	1.432E 04	8.428E 04	1.063E 04	2.762E 06	8.336E 05	5.420E 04	3.107E 01	1.258E-04	7.494E 05
2.044E 01	2.601E-03	2.081E-03	8.077E 04	1.432E 04	8.778E 01	1.441E 00	2.192E 06	7.735E 05	5.409E 04	3.894E 01	2.010E-04	5.211E 04
5.044E 01	2.812E-03	2.250E-03	8.069E 04	1.432E 04	9.642E-08	3.586E-12	1.096E 06	6.182E 05	5.377E 04	6.824E 01	1.269E-03	1.752E 01
1.004E 02	3.629E-03	2.903E-03	8.055E 04	1.431E 04	1.127E-22	1.639E-31	3.452E 05	4.267E 05	5.324E 04	1.201E 02	8.675E-03	2.848E-05
1.504E 02	5.368E-03	4.295E-03	8.041E 04	1.430E 04	1.318E-37	7.495E-51	1.087E 05	2.956E 05	5.272E 04	1.692E 02	2.779E-02	4.628E-11
3.004E 02	1.971E-02	1.577E-02	8.000E 04	1.429E 04	0.0	0.0	3.397E 03	1.009E 05	5.117E 04	2.950E 02	1.903E-01	1.988E-28
5.004E 02	7.121E-02	5.697E-02	7.946E 04	1.426E 04	0.0	0.0	3.344E 01	2.603E 04	4.918E 04	4.219E 02	7.063E-01	0.0
1.000E 03	4.424E-01	3.539E-01	7.811E 04	1.420E 04	0.0	0.0	3.213E-04	1.393E 03	4.455E 04	6.070E 02	3.756E 00	0.0
3.000E 03	6.553E 00	5.243E 00	7.296E 04	1.396E 04	0.0	0.0	2.740E-24	1.207E-01	2.997E 04	7.511E 02	3.066E 01	0.0
1.000E 04	7.759E 01	6.207E 01	5.744E 04	1.313E 04	0.0	0.0	0.0	1.656E-15	7.488E 03	7.555E 02	1.826E 02	0.0
3.000E 04	4.583E 02	3.666E 02	2.902E 04	1.104E 04	0.0	0.0	0.0	0.0	1.423E 02	7.506E 02	6.379E 02	0.0
1.000E 05	1.797E 03	1.437E 03	2.658E 03	6.022E 03	0.0	0.0	0.0	0.0	1.349E-04	7.338E 02	1.438E 03	0.0
3.000E 05	3.953E 03	3.162E 03	2.947E 00	1.065E 03	0.0	0.0	0.0	0.0	8.321E-22	6.877E 02	1.547E 03	0.0
1.000E 06	4.372E 03	3.497E 03	1.227E-10	2.461E 00	0.0	0.0	0.0	0.0	0.0	5.482E 02	3.961E 02	0.0

Appendix D. COMPARISON OF CHARACTERISTICS OF FUEL CYCLE MATERIALS FROM A SINGLE REACTOR

Appendix D.1. Comparison of the Radioactivity of Fuel Cycle Materials from a Single Reactor

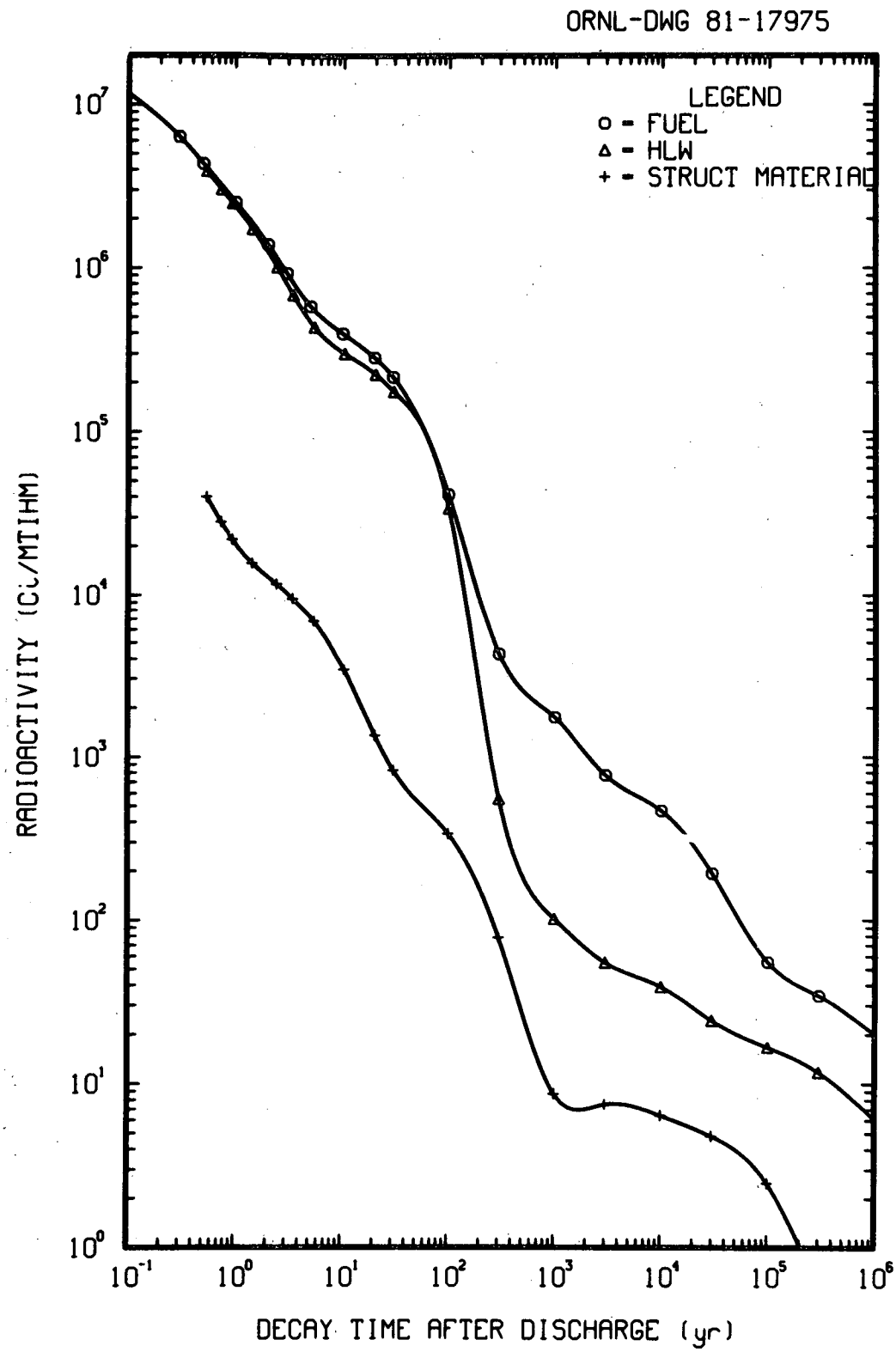

Fig. D.1. Radioactivity of PWR spent fuel, high-level waste, and structural material waste as a function of decay time.

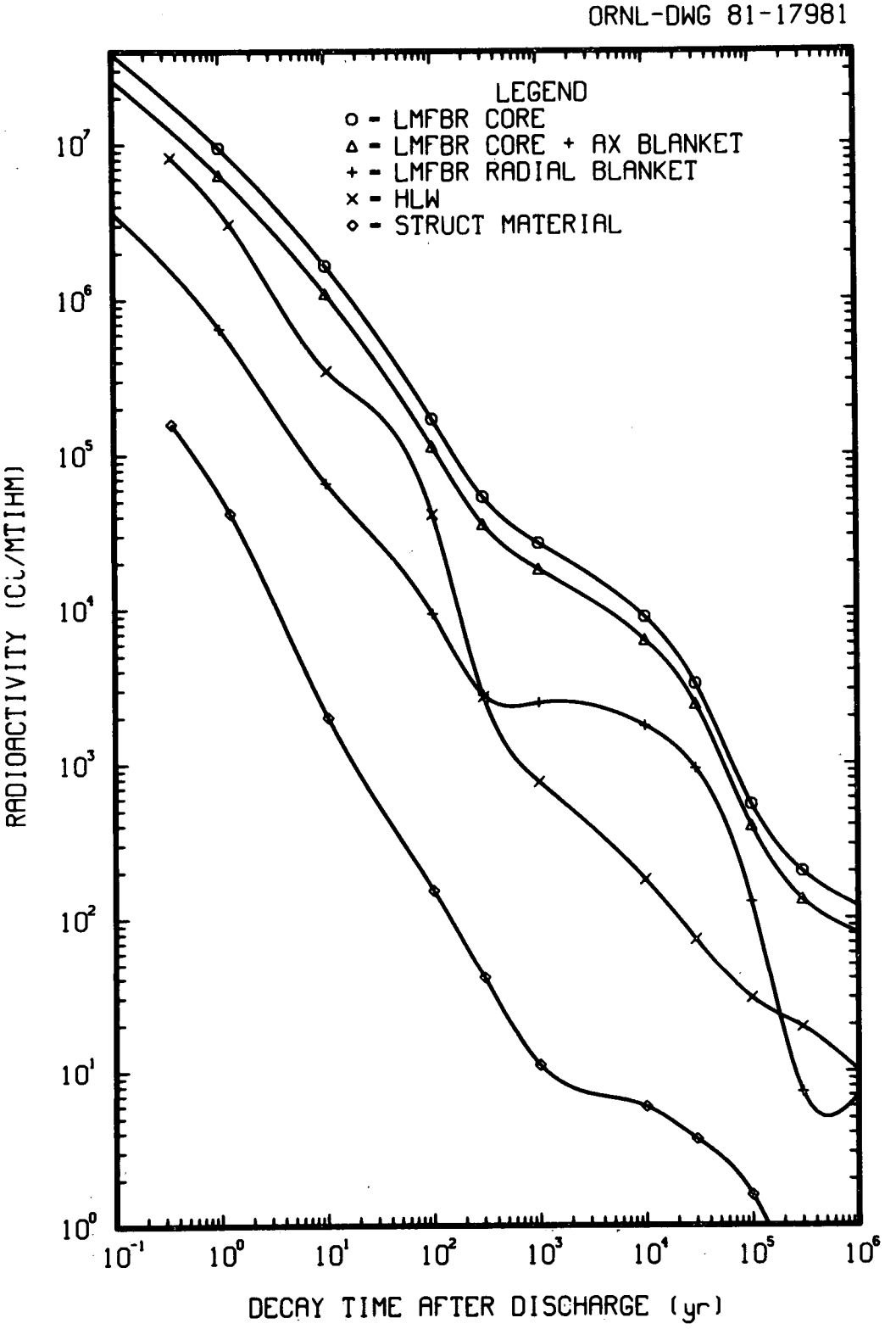

Fig. D.2. Radioactivity of LMFBR spent fuel, high-level waste, and structural material waste as a function of decay time.

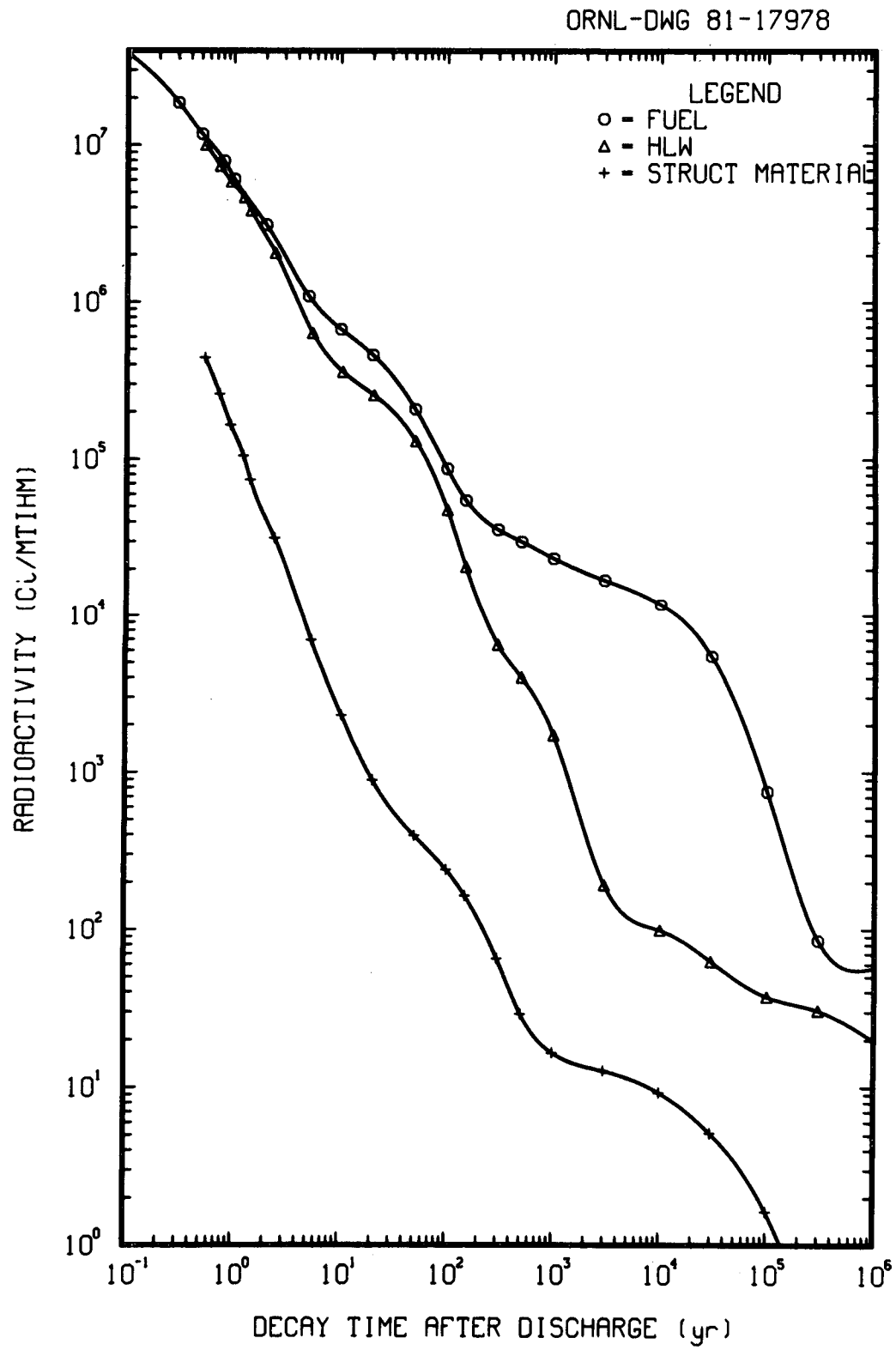

Fig. D.3. Radioactivity of FFTF spent fuel, high-level waste, and structural material waste as a function of decay time.

Appendix D.2. Comparison of the Thermal Power of Fuel Cycle Materials from a Single Reactor

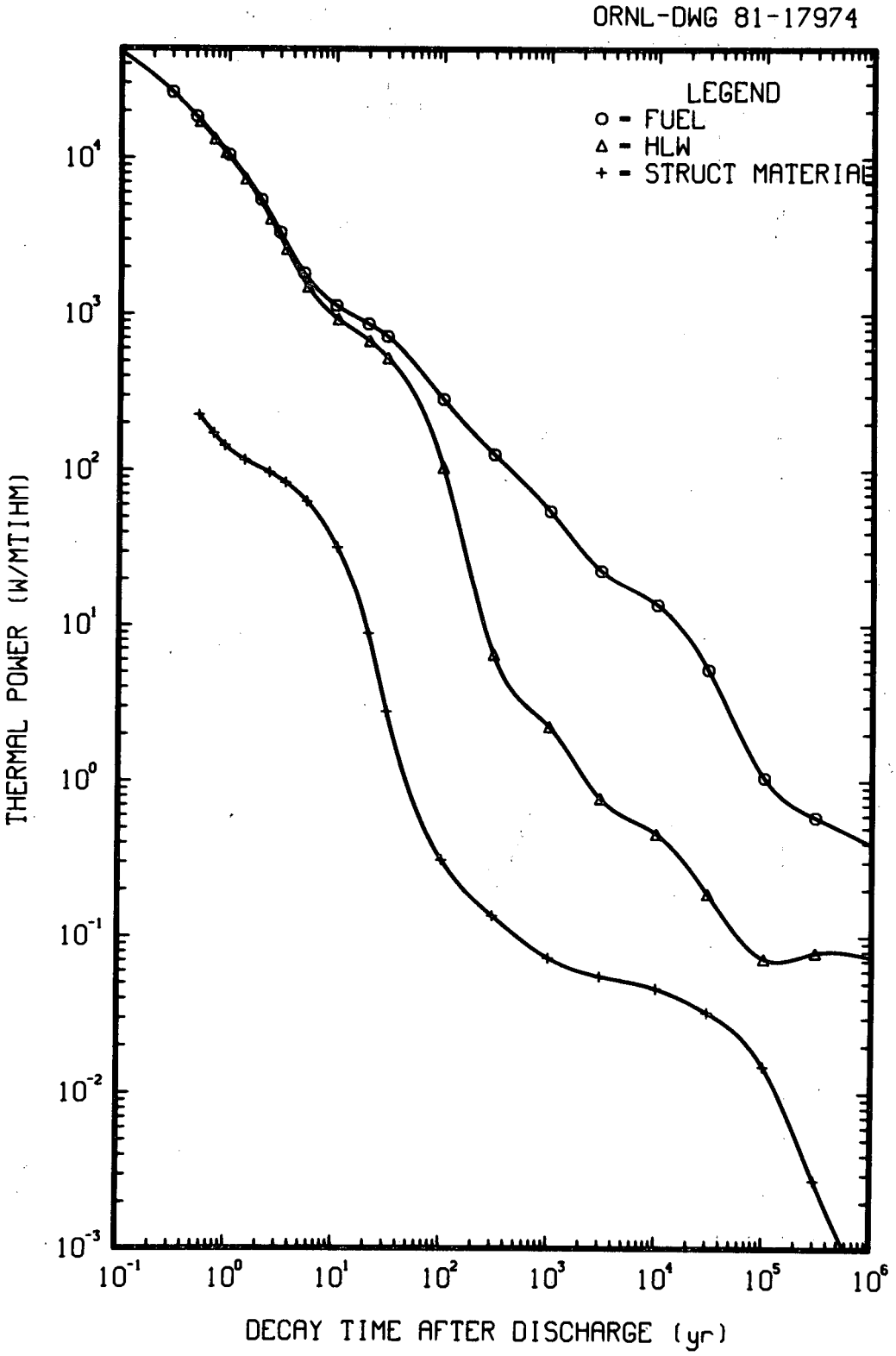

Fig. D.4. Thermal power of PWR spent fuel, high-level waste, and structural material waste as a function of decay time.

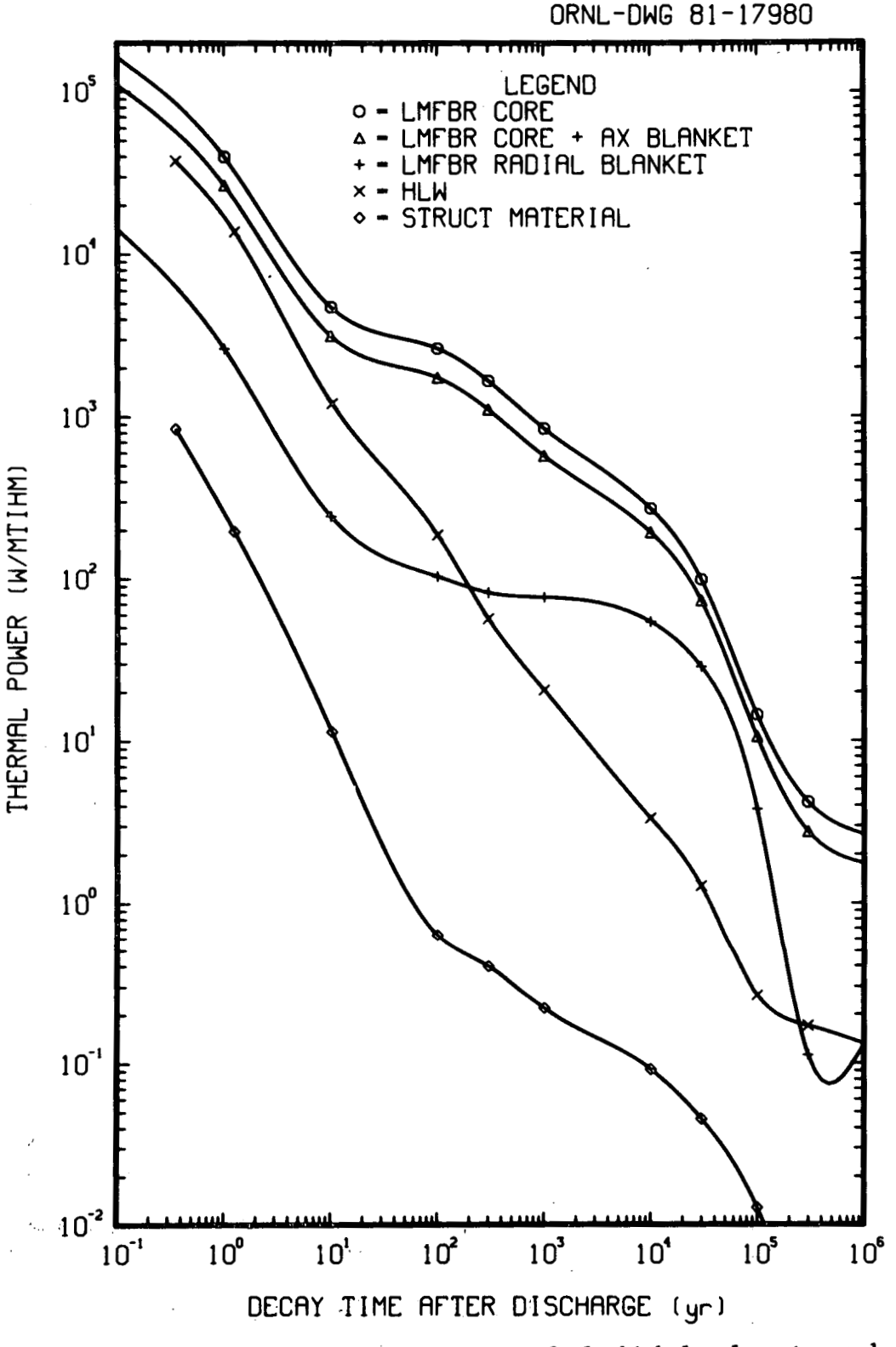

Fig. D.5. Thermal power of LMFBR spent fuel, high-level waste, and structural material waste as a function of decay time.

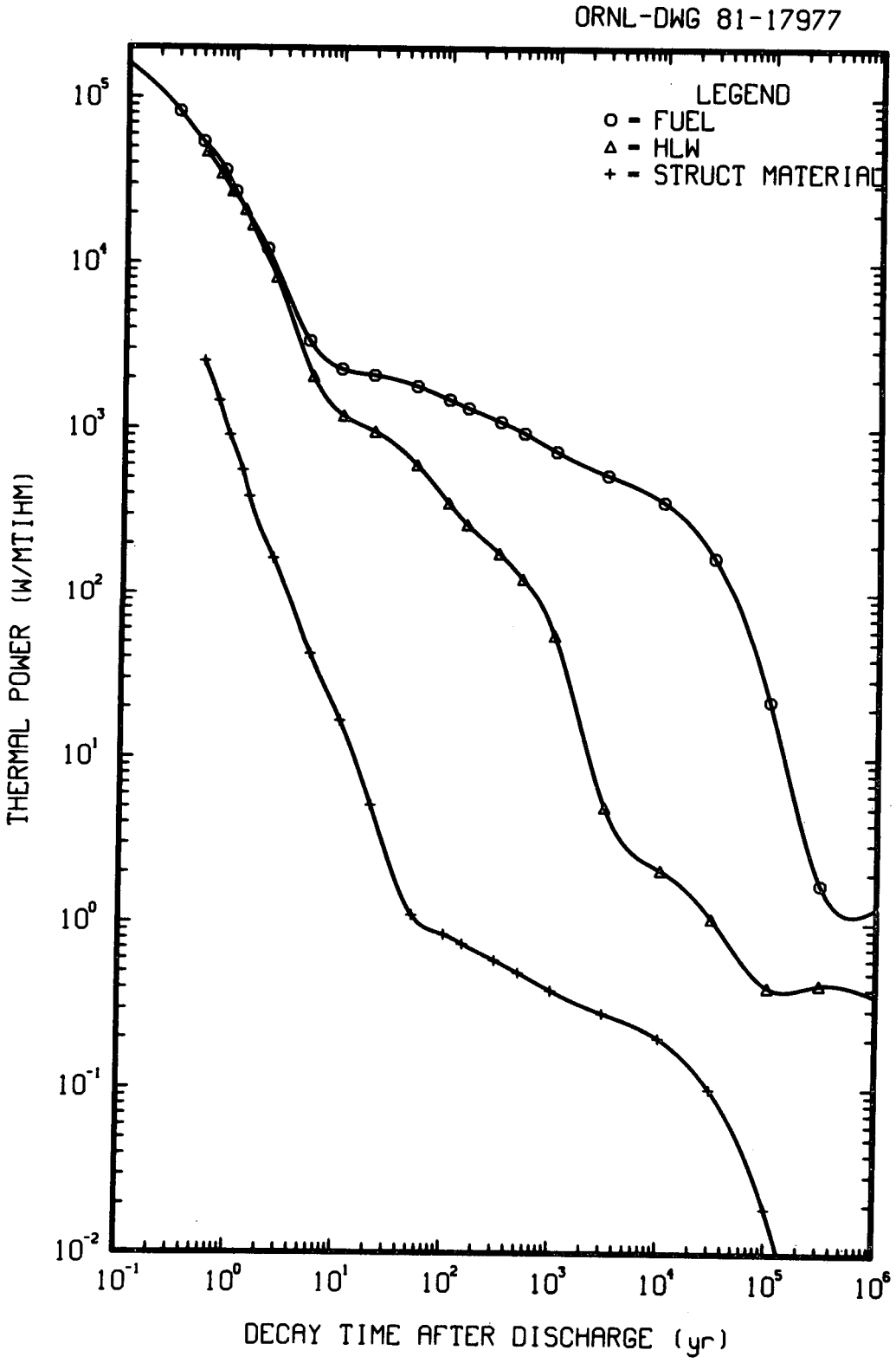

Fig. D.6. Thermal power of FFTF spent fuel, high-level waste, and structural material waste as a function of decay time.

Appendix D.3. Comparison of the Toxicity of Fuel Cycle Materials from a Single Reactor

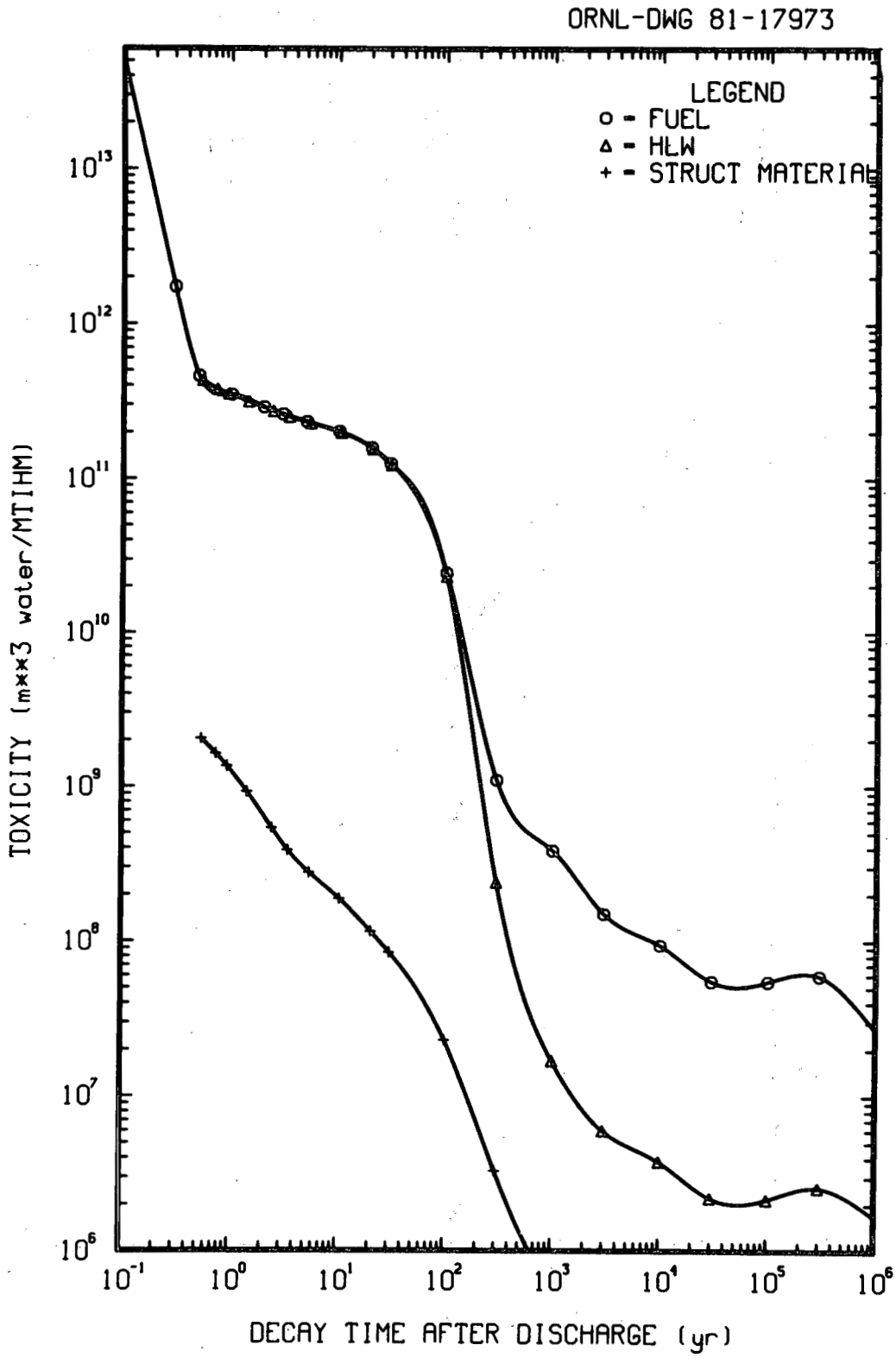

Fig. D.7. Toxicity of PWR spent fuel, high-level waste, and structural material waste as a function of decay time.

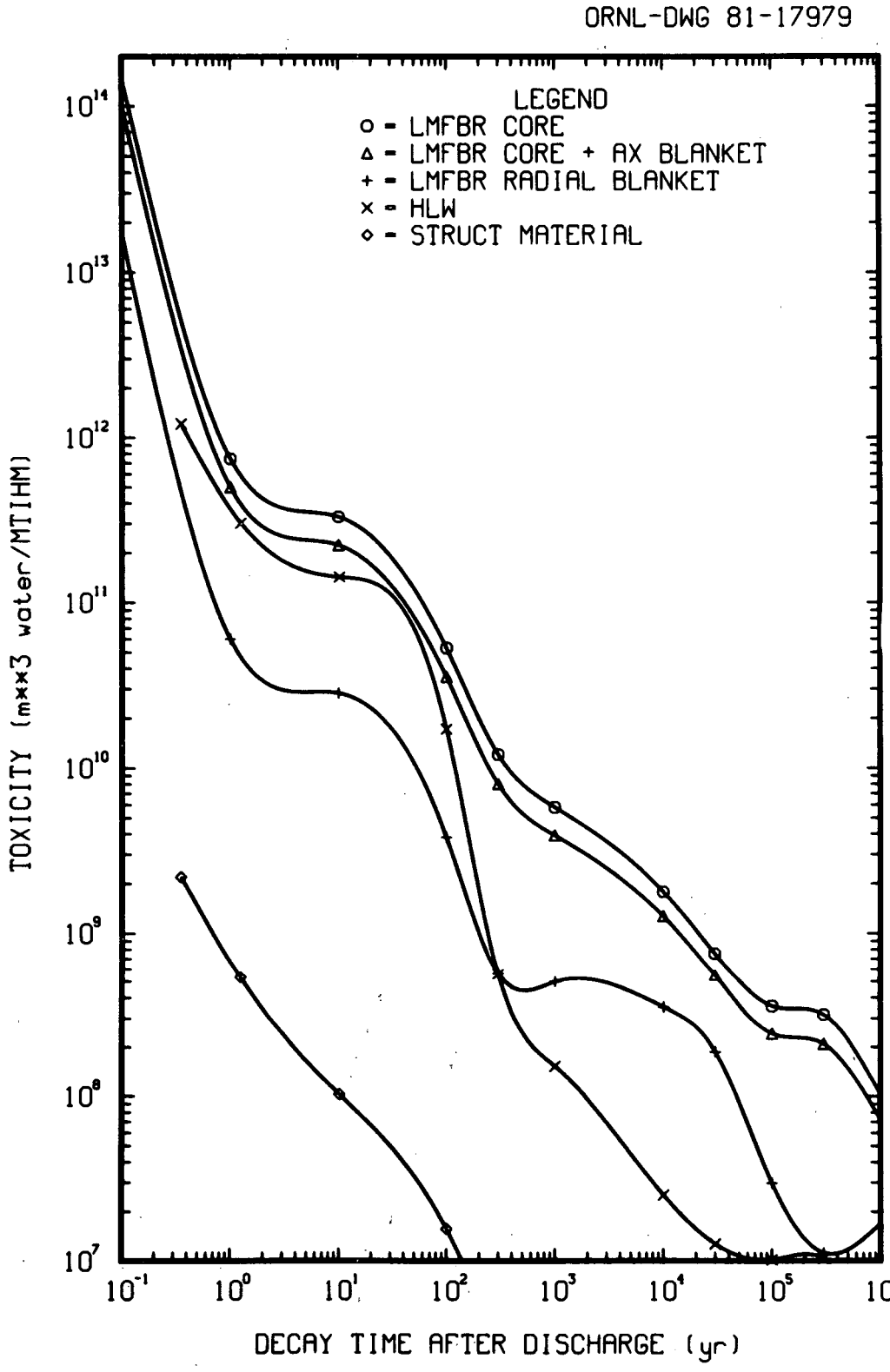

Fig. D.8. Toxicity of LMFBR spent fuel, high-level waste, and structural material waste as a function of decay time.

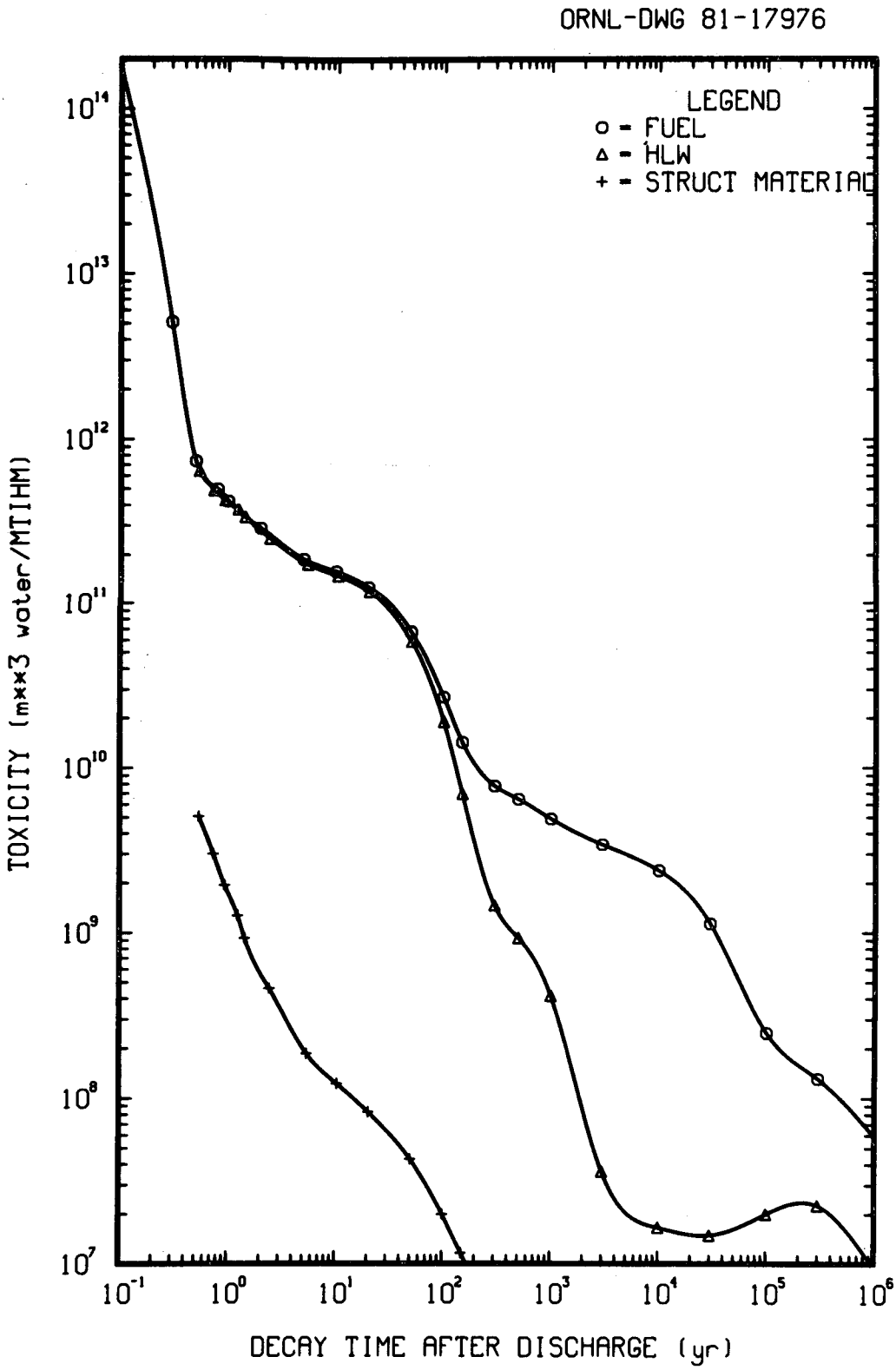

Fig. D.9. Toxicity of FFTF spent fuel, high-level waste, and structural material waste as a function of decay time.

Appendix E. COMPARISON OF PWR, LMFBR, AND FFTF FUEL CYCLE MATERIAL CHARACTERISTICS FOR A SINGLE MATERIAL

Appendix E.1. Comparison of PWR, LMFBR, and FFTF Fuel Cycle Material Radioactivity for a Single Material

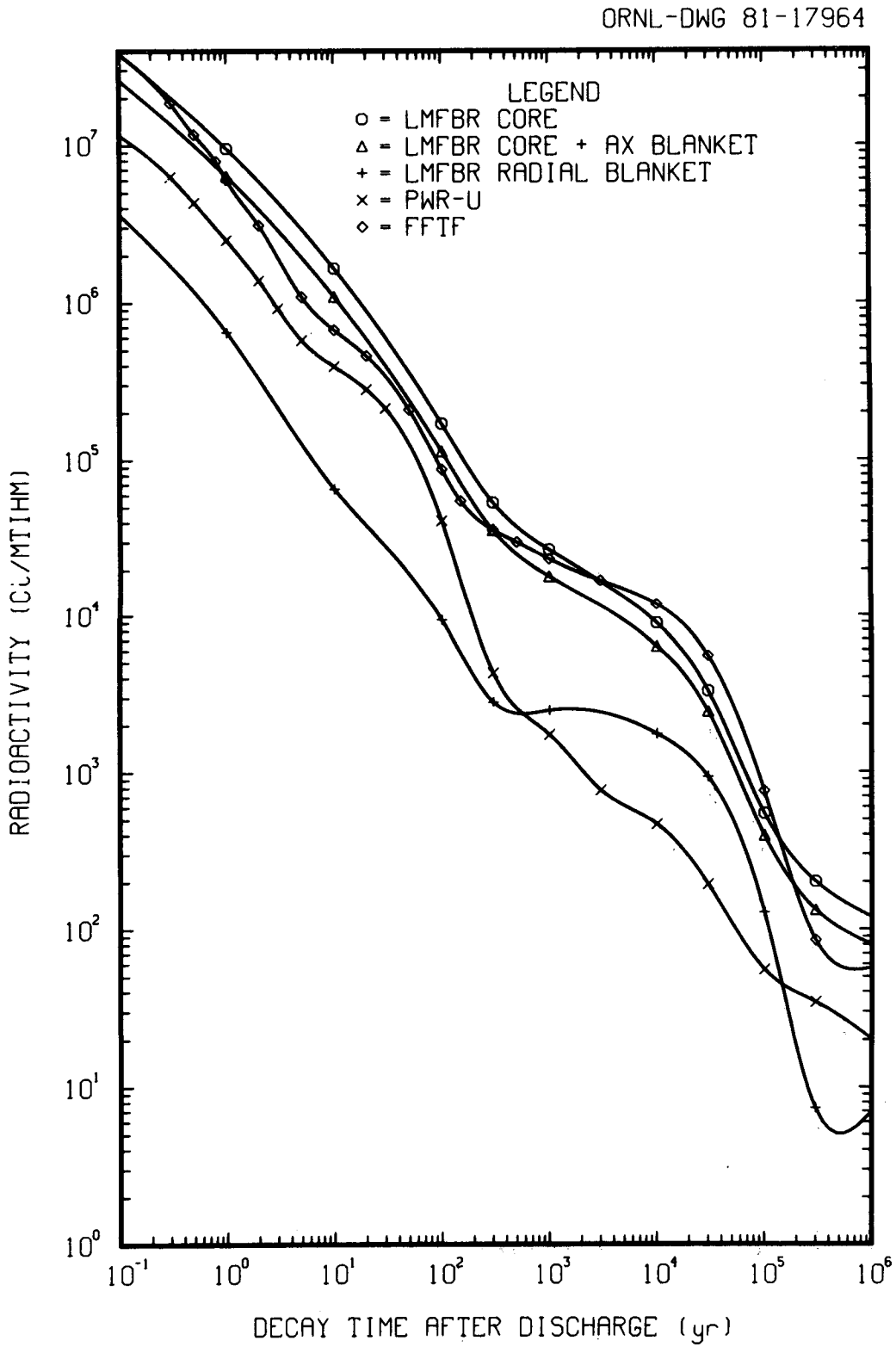

Fig. E.1. Radioactivity of PWR, LMFBR, and FFTF spent fuel as a function of decay time.

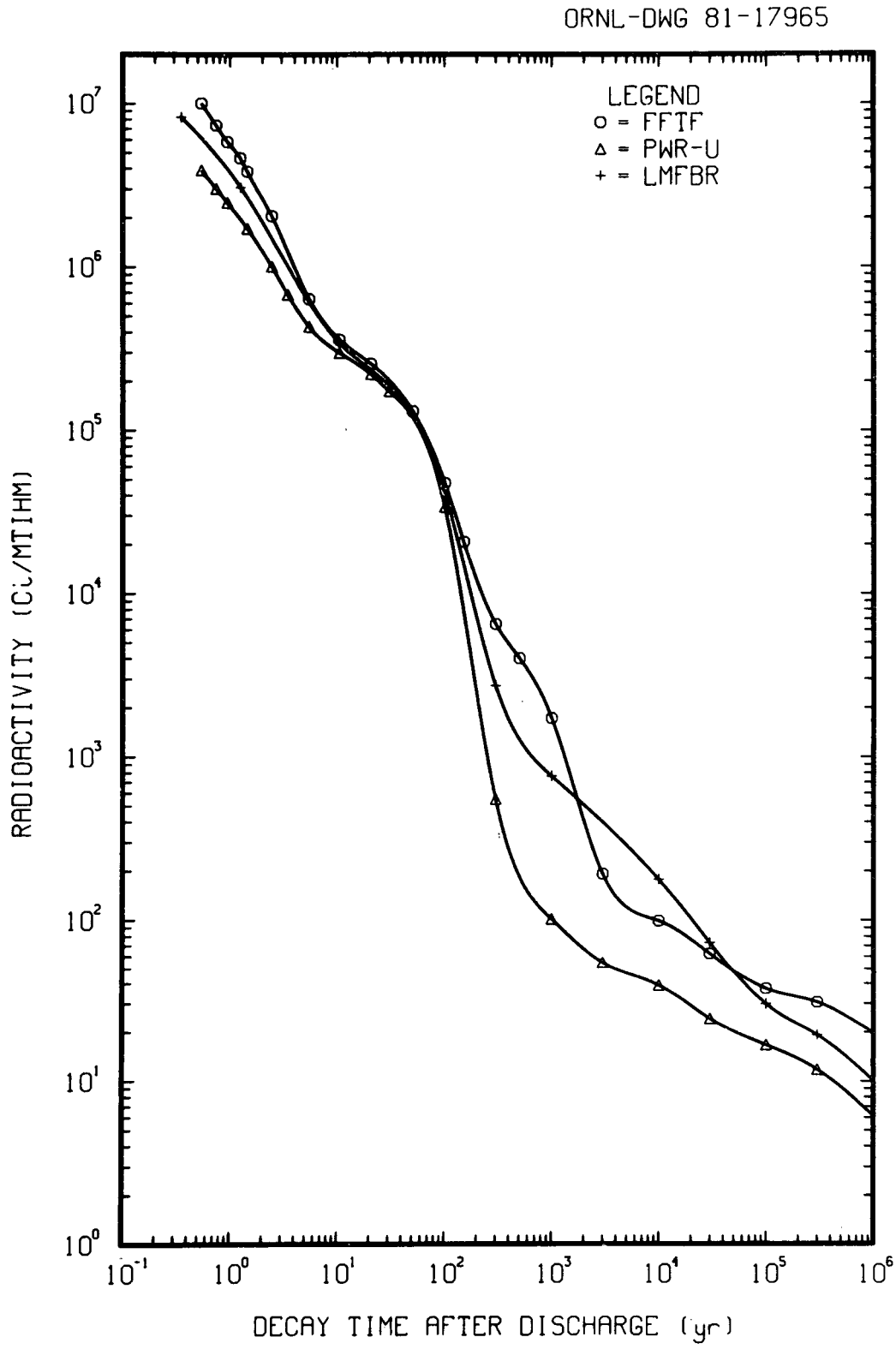

Fig. E.2. Radioactivity of PWR, LMFBR, and FFTF high-level waste as a function of decay time.

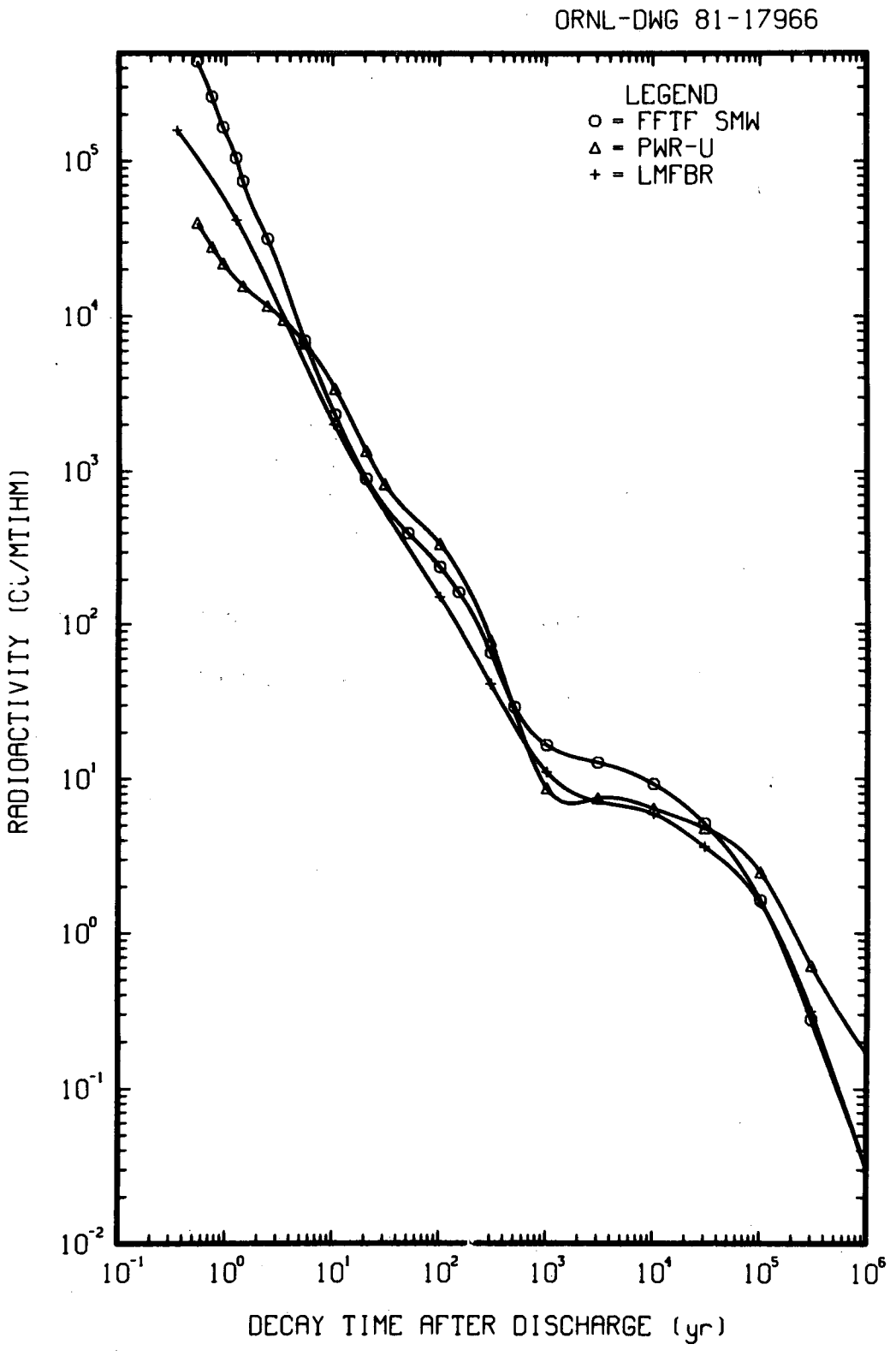

Fig. E.3. Radioactivity of PWR, LMFBR, and FFTF structural material waste as a function of decay time.

Appendix E.2. Comparison of PWR, LMFBR, and FFTF Fuel Cycle Material Thermal Power for a Single Material

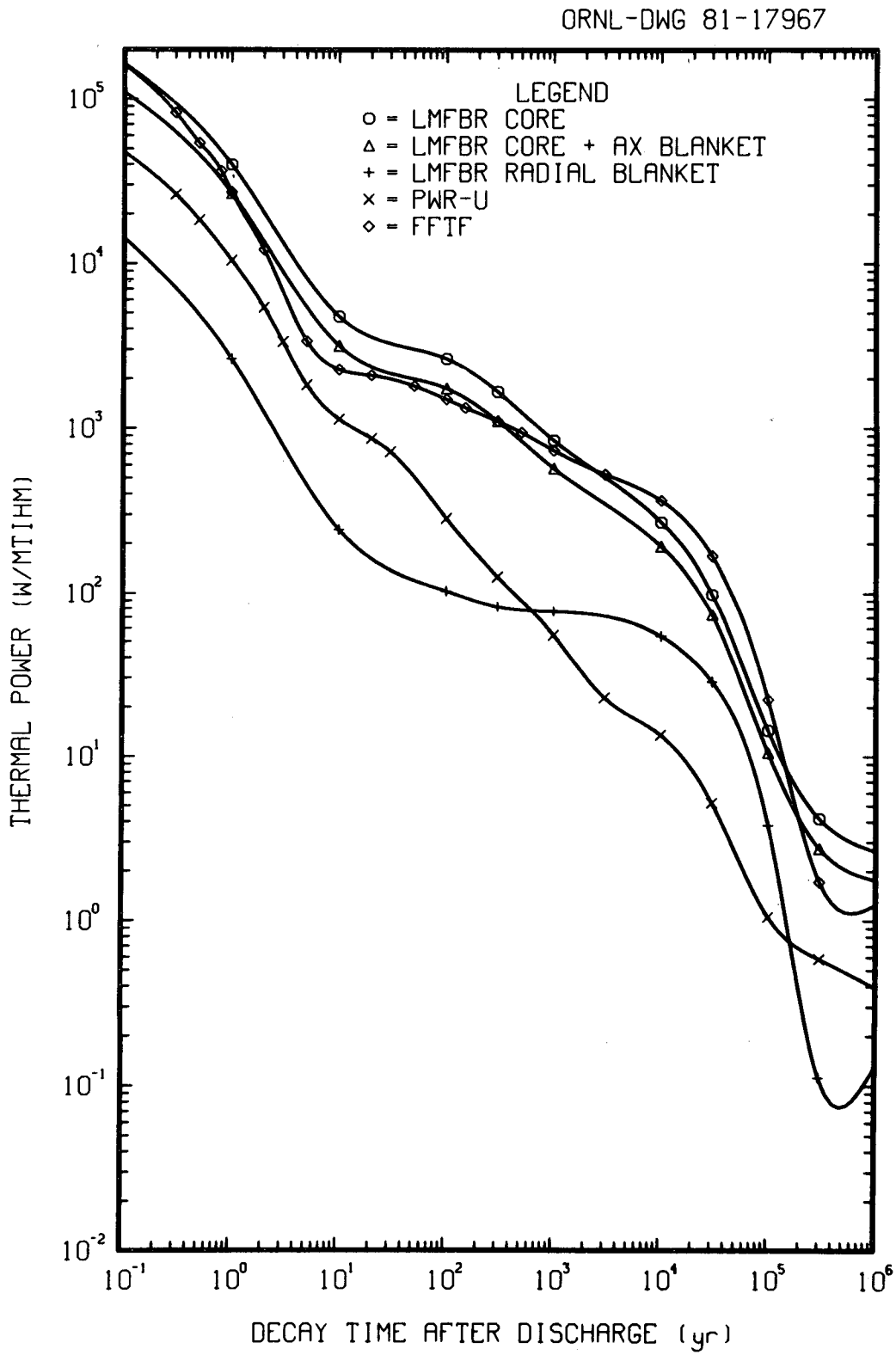

Fig. E.4. Thermal power of PWR, LMFBR, and FFTF spent fuel as a function of decay time.

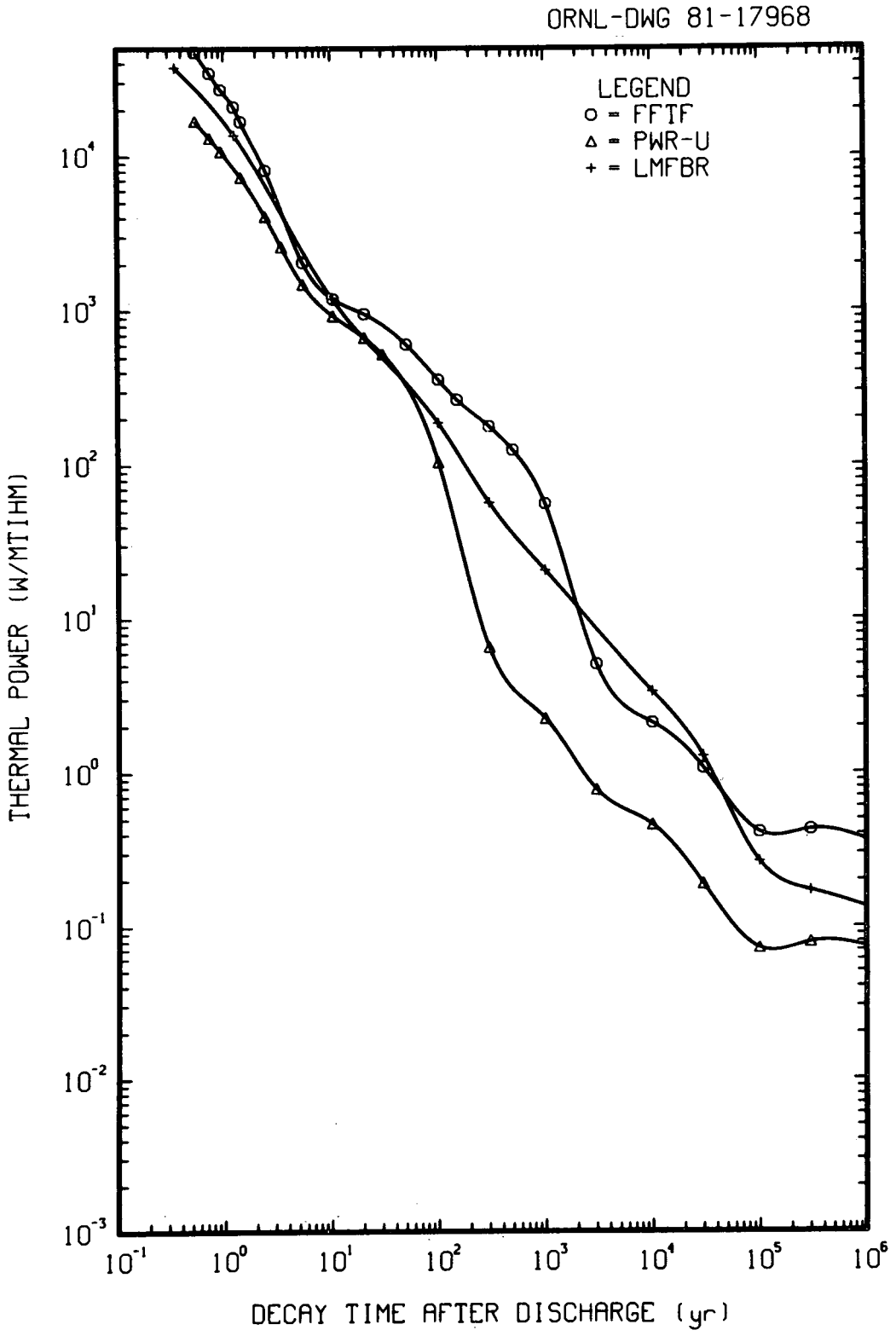

Fig. E.5. Thermal power of PWR, LMFBR, and FFTF high-level waste as a function of decay time.

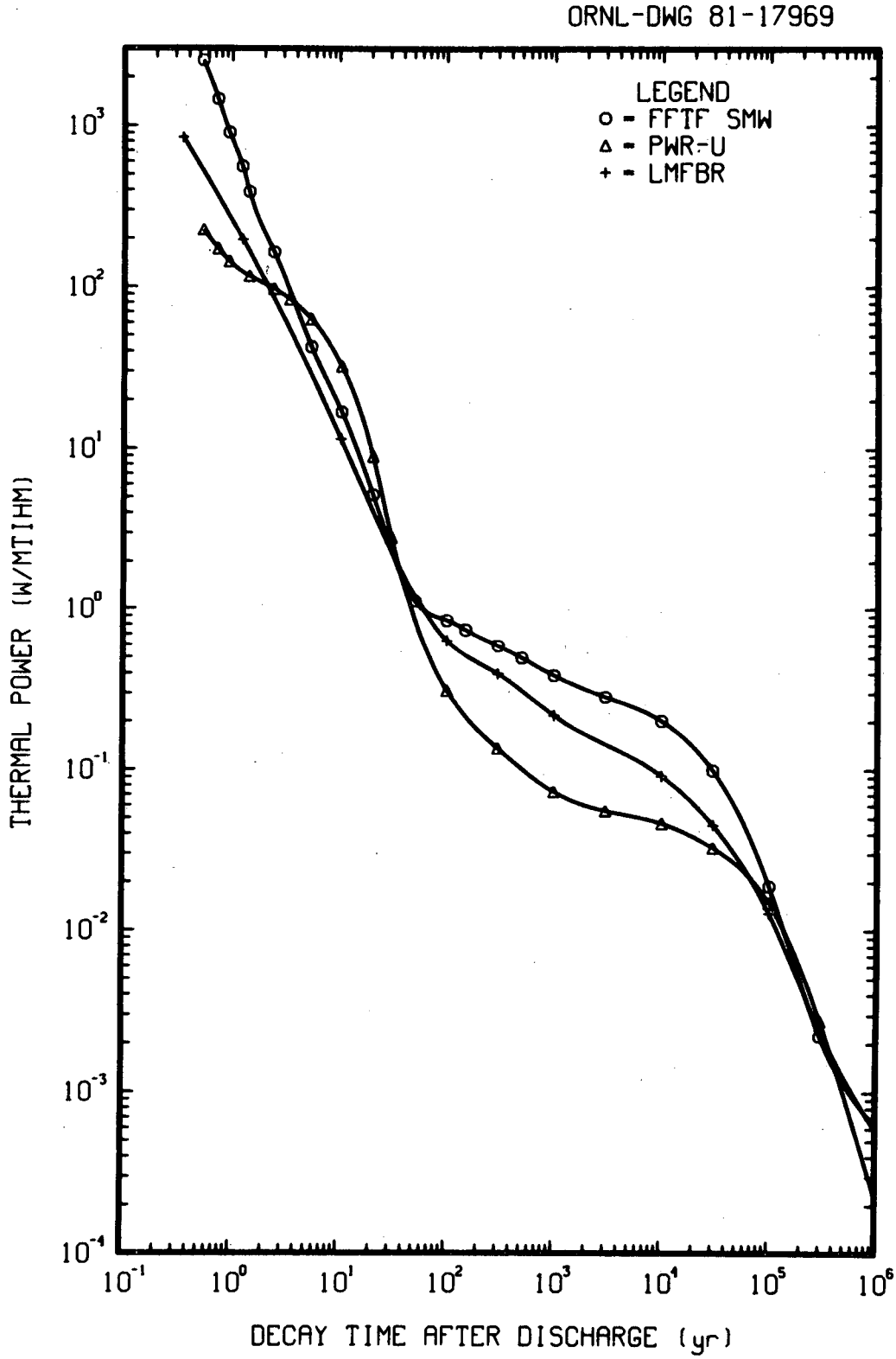

Fig. E.6. Thermal power of PWR, LMFBR, and FFTF structural material waste as a function of decay time.

Appendix E.3. Comparison of PWR, LMFBR, and FFTF Fuel Cycle Material Toxicity for a Single Material

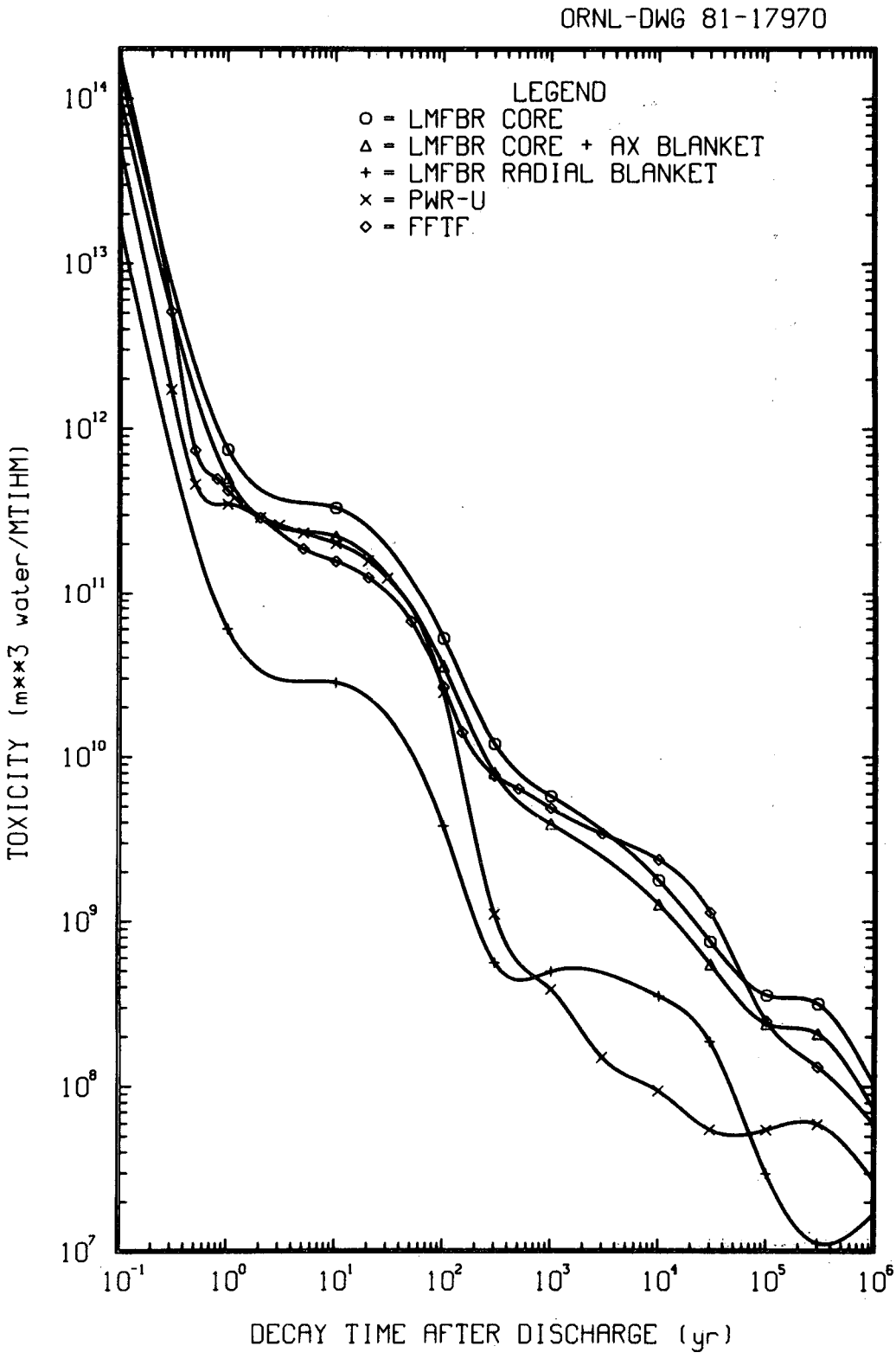

Fig. E.7. Toxicity of PWR, LMFBR, and FFTF spent fuel as a function of decay time.

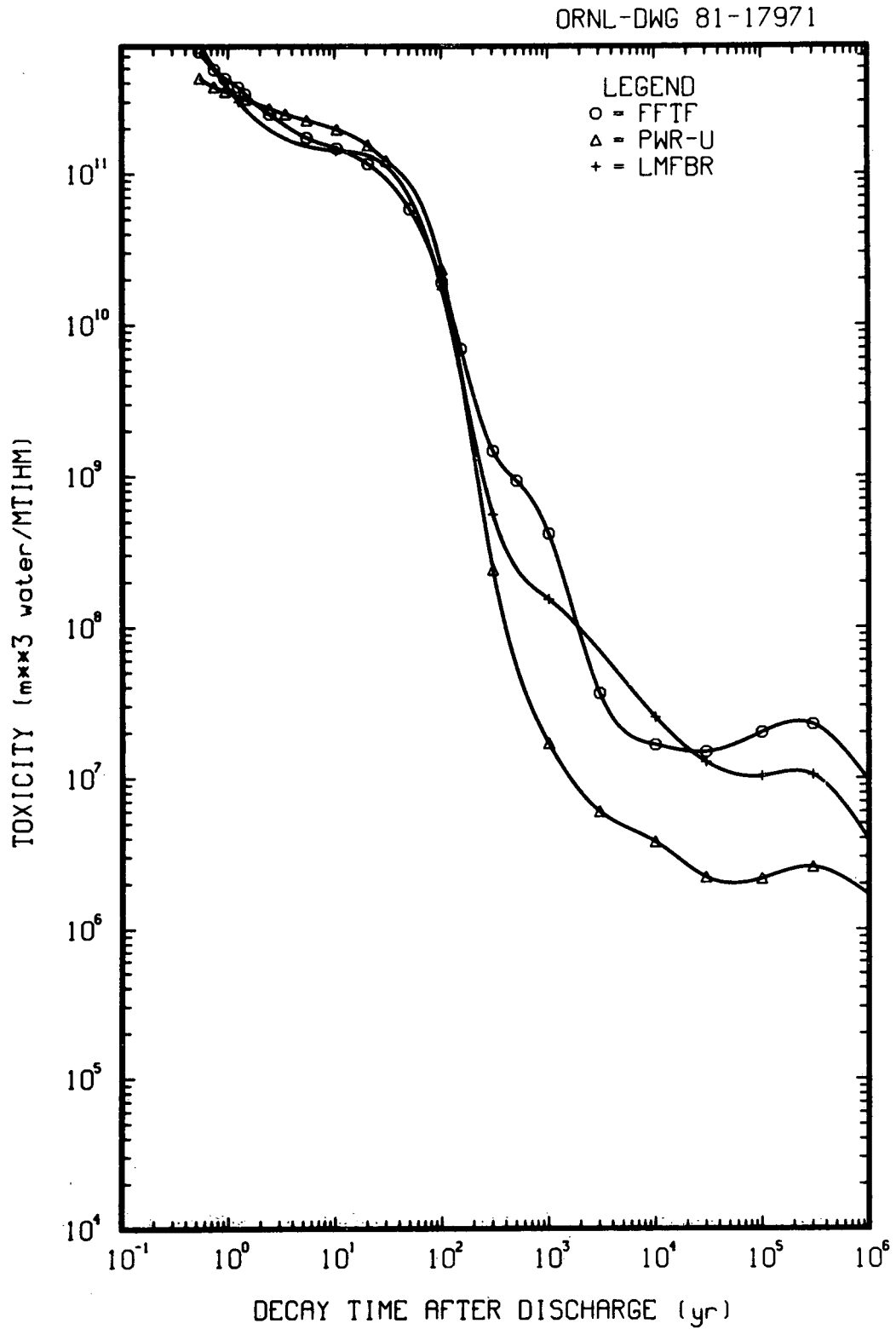

Fig. E.8. Toxicity of PWR, LMFBR, and FFTF high-level waste as a function of decay time.

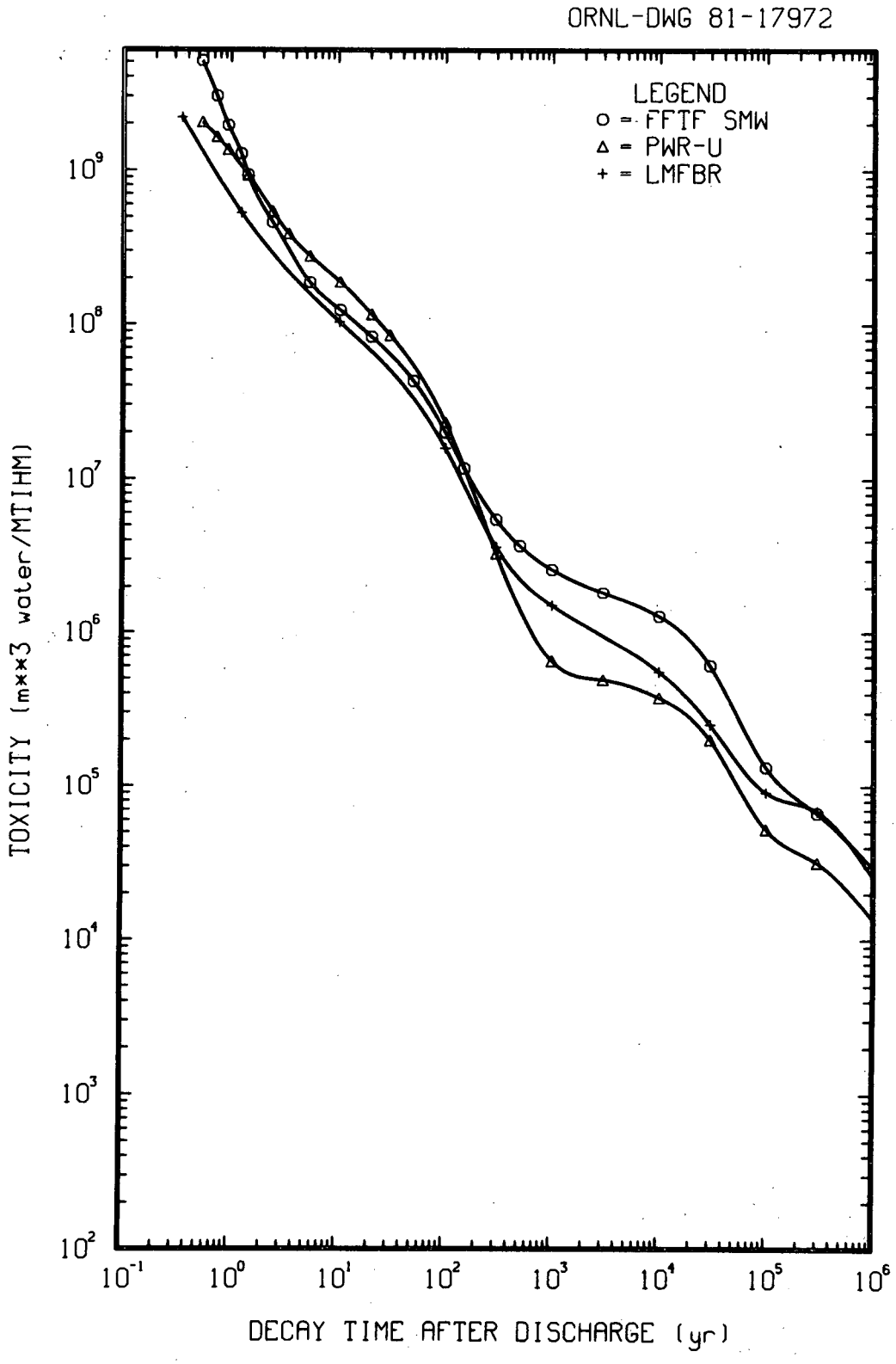

Fig. E.9. Toxicity of PWR, LMFBR, and FFTF structural material waste as a function of decay time.

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