Chapter 2 Generation and characteristics of TRU waste

This chapter summarises the generation and characteristics of TRU-waste.

2.1 Types and management of TRU waste

2.1.1 Facilities which produce waste

TRU waste is mainly generated in reprocessing facilities and MOX fuel fabrication facilities. Additionally, some waste is generated by facilities that manage returned low-level waste from abroad. At present, TRU waste is generated mainly in the Tokai reprocessing plant and the MOX fuel handling facility of JAEA. It is assumed that, in future, the amount of TRU waste will be increased by the addition of returned low-level waste from overseas reprocessing, operational waste generated by domestic private sector reprocessing and commercial MOX fuel fabrication and from dismantling of nuclear facilities after operations have ceased.

It is also assumed that there will be TRU waste from the reprocessing of MOX fuel, which has a high content of TRU nuclides, and FBR recycling. However, future plans in this area are still unclear and wastes from these sources are not included in the evaluation.

Furthermore, radioisotope (RI) and laboratory waste is also generated by research facilities with experimental reactor(s) that use nuclear fuel material and facilities that use radioisotopes. These wastes have a high content of alpha-emitting nuclides and are essentially the same as TRU waste. However, the volumes are very much smaller than those generated by reprocessing. The designing of facilities for shallow disposal (e.g. Sakai et al., 2001) and intermediate-depth disposal (e.g. Miyamoto et al., 2003) of these wastes is performed separately by the Japan Atomic Energy Agency (JAEA) and is not considered in this report.

2.1.2 Types of waste

(1) Radioactive waste generated during the operation of reprocessing facilities

Slightly different classifications of radioactive waste are used, depending on plant structure and waste management style. However, waste generated during the operation of reprocessing facilities can be classified into two broad groups as follows:

- Process waste, which is generated by operation
- Miscellaneous waste, which is generated by operation, maintenance and repair

Channel boxes (CB) and burnable poisons (BP) are also generated by commercial reprocessing facilities. Since these are separated from the fuel assembly before fuel element chopping, they are considered to have the same characteristics as the CB and BP generated by nuclear reactors. However, the volumes of CB and BP from commercial reprocessing facilities are added to the radioactive waste generated by reprocessing facilities (cf. Section. 2.2.2).

The origins and characteristics of process waste are relatively clear. The following radioactive wastes are generated by reprocessing of light water reactor fuel using the PUREX method (a wet method that is used by JAEA, commercial facilities, COGEMA and BNGS).

- Concentrated low-level liquid waste
- Solvent waste
- Spent resin
- Spent silver absorbent
- Hulls and ends
- Spent carbon
- Sludge (JAEA only)

Based on the waste characteristics, miscellaneous waste is classified into combustible, poorly combustible and incombustible waste. Radioactive waste with high nuclide concentrations generated in glove boxesand cells is classified as Group I. Waste with low nuclide concentrations generated outside glove boxes and cells is classified as Group II. Other radioactive wastes that have lower nuclide concentrations than Group II are classified as Group III.

- Combustible waste I, II, III
- Poorly combustible waste I, II, III
- Incombustible waste I, II, III

An overview of these wastes is provided in Table 2.1.2-1 and Figure 2.1.2-1.

The nomenclature used for radioactive wastes generated in Japan is standardized as far as possible. However, the names used by COGEMA and BNGS are retained for returned low-level waste.

(2) Radioactive waste generated by the operation of MOX fuel fabrication facilities and returned waste management facilities

The waste generated in MOX fuel fabrication facilities (private sector, JAEA) and returned waste management facilities is miscellaneous waste. This is classified as follows, according to the same principles as those applied to reprocessing waste:

- Combustible waste I, II
- Poorly combustible waste I, II
- Incombustible waste I, II

The characteristics of these wastes are the same as those of miscellaneous waste and are summarized in Table 2.1.2-1.

(3) Radioactive waste from dismantling

The dismantling of reprocessing plants and MOX fuel fabrication facilities produces various types of waste (private sector and JAEA). Metal waste such as equipment/apparatus and piping are contaminated by radioactive substances in the shielding cells and glove boxes. Additionally, some of the contaminated buildings generate concrete waste. There are also so-called secondary wastes produced during the decontamination of facilities and equipment during the dismantling operations. These secondary wastes include radioactive liquids, paper and cloth.

It is considered that the wastes generated by the dismantling of management facilities for returned waste are below the clearance level or these wastes are treated as non-radioactive.

The wastes from the dismantling of facilities are overviewed in Table 2.1.2-2.

Table 2.1.2-1 Radioactive wastes generated during operation

Type of waste		Generation	Main constituents, materials, etc.
Processing waste	Concentrated low-level liquid waste	Evaporative concentration of recovered concentrated acid generated processed carried out in the reprocessing facility, liquid waste produced during analysis, waste gas cleaning liquid, waste liquid produced by equipment decontamination, etc.	$NaNO_3$,$NaNO_2$,Na_2CO_3, Na_2HPO_4
	Solvent waste	Solvent waste residue generated by solvent treatment facilities, solvent renewed periodically during processing and consisting of mixtures of tributyl phosphate (TBP) and n-dodecan	TBP n-dodecan
	Spent resin	Organic ion exchanger used for purifying spent fuel storage pools	Ion exchange resin grains (resin beads) grain size: around 1 mm
	Spent carbon	Absorbent used for removing oil in waste liquid before the liquid is discharged into the ocean	Grain size: around 1 - 2 mm
	Hulls and ends	Residue left after the shearing and dissolution of fuel aggregates, composed of cladding tubes (hulls) and aggregates of terminal chips (ends). Hulls are mainly composed of zircaloy, ends are mainly composed of stainless steel	Zircaloy Stainless steel Inconel
	Spent silver absorbent	Solid grains of silica gel impregnated with silver nitride (private sector). Solid grains that support silver during ion exchange on zeolite (JAEA).	Silver content: ca. 12 wt% (private sector); ca. 38.7 wt% (JAEA) Grain size: ca. 1 - 2 mm
	Sludge (JAEA only)	Coagulated and sedimented precipitates generated by cleaning drainage water in the reprocessing facility	Fe_2O_3, $Fe(OH)_3$, $CaCO_3$, $NaNO_3$
Miscellaneous waste*1	Combustible waste I - III	Combustible waste (I) generated in glove boxes and cells Combustible wastes (II, III) generated outside glove boxes and cells	Paper, cloth, wood chips, vinyl acetate
	Poorly combustible waste I - III	Poorly combustible waste (I) generated in glove boxes and cells Poorly combustible wastes (II, III) generated outside glove boxes and cells	Vinyl chloride, rubber gloves
	Incombustible waste I - III	Incombustible waste (I) includes waste generated in glove boxes and cells and materials that are produced periodically during the operation of the reprocessing plant Incombustible waste (II, III) generated outside glove boxes and cells	Piping, indstrial tools, wire, bolts, nuts, pumps, motors (metal) Glass, concrete, heat insulation material
Channel boxes (CB) (private sector only)		Channel boxes of the fuel assembly which constitutes the nuclear reactor core in a boiling water reactor	Zircaloy, stainless steel
Burnable poisons (BP) (private sector only)		Material inserted into the fuel core of a pressurized water reactor to maintain uniform power output	Borosilicate glass, alumina pellets, stainless steel

*1: Miscellaneous waste is also generated by MOX fuel fabrication facilities and facilities for managing returnable waste.

Table 2.1.2-2 Radioactive waste generated by dismantling

Type of waste	Generation	Characteristics
Incombustible waste (metal)	Internal equipment, apparatus and ventilation equipment in areas (cells, glove boxes) contaminated by radioactive material	Towers and vessels, process cell lining, machinery piping, piping supports, fans, etc.
Incombustible waste (concrete)	Contaminated concrete chips generated by shaving (5 mm) the inner surface of contaminated cells	Concrete shavings
Secondary waste (combustible/poorly combustible/incombustible)	Contaminated materials generated by dismantling and decontamination in cells and glove boxes and ventilation of the operating area	Paper, cloth, wood chippings, HEPA filters, pre-filters
Secondary waste (decontamination waste liquid)	Waste liquid generated through decontamination of radioactive materials attached to piping of apparatus	Sodium nitrate solution

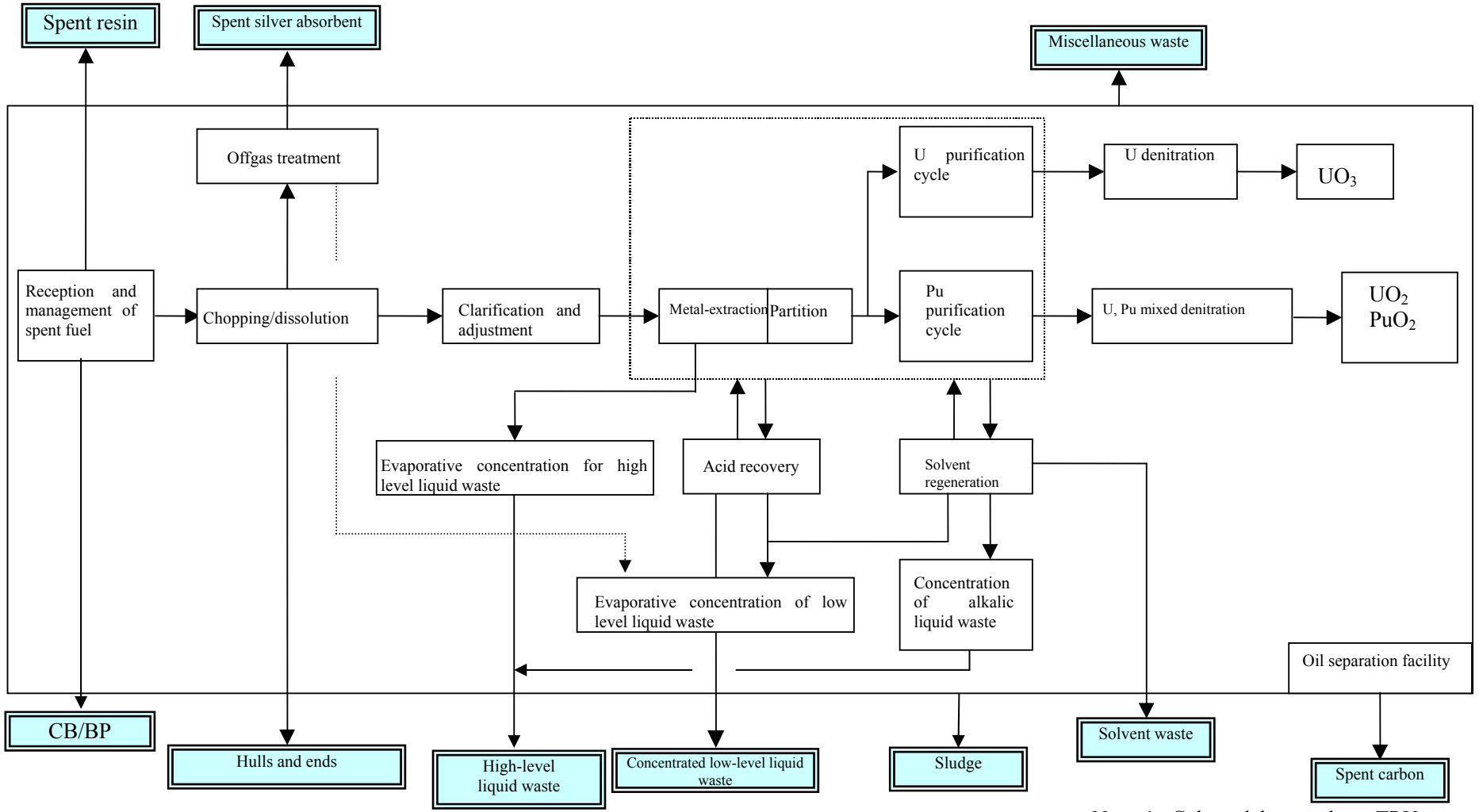

Figure 2.1.2-1 Reprocessing and generation of radioactive waste

2.1.3 Generation and management of TRU waste

Since full operation began in 1981, around 1,074 tU of spent fuel had been reprocessed at JAEA's Tokai reprocessing plant by March 2005. Around 19,000 m^3 of radioactive wastes, including conditioned wastes, untreated wastes and liquid wastes, are presently in storage. Since 1972, the MOX fuel handling facility has produced about 170 t of MOX fuel for the Joyo, Fugen and Monju reactors. Around 5,000 m^3 of radioactive waste was stored by the end of March 2005.

Until 1997, solidification with bitumen was carried out for concentrated low-level liquid waste such as that produced at the Tokai reprocessing plant. Processing by nuclide separation and/or evaporative solidification will be carried out in the future. Solvent waste treated by plastic solidification and burnout processing is undertaken for part of the combustible component of the solid waste. For radioactive waste produced in the plutonium handling facility, technologies for incineration of combustible waste and poorly combustible waste and for melting of incinerated ash and incombustible waste are developed separately.

In 1995, the high-level waste storage and management center began operation as a facility for receiving returned waste.

The design of a private MOX facility is now being reviewed and waste has not yet been generated.
The status of TRU waste generation at the end of March 2005 is shown in Table 2.1.3-1.

Table 2.1.3-1 Status of TRU waste generation

Classification	Waste type		Treatment method	Amount by the end of March 2005	
				Solidified waste (drum)	Untreated waste
JAEA reprocessing	Processed waste	Hulls and other waste	-	-	ca. 1,200 m^3
		Concentrated low-level liquid waste	Bitumen solidification	ca. 30,000	ca. 2,200 m^3
		Solvent waste	Plastic solidification	ca. 1,800	ca.100 m^3
		Sludge	-	-	ca.1,100 m^3
	Miscellaneous waste		Combustion	-	ca. 8,500 m^3
JAEA reprocessing total				ca. 31,800 (6,400 m^3)	ca.13,100m^3
JAEA MOX	Miscellaneous waste			ca.100	ca.5,300 m^3
JAEA total				ca.31,900 (ca.6,400 m^3)	ca.18,400 m^3
Commercial reprocessing	Process waste		-	-	-
	Miscellaneous waste		-	-	ca.1,640 m^3
Commercial MOX	Miscellaneous waste		-	-	-
Commercial management	Miscellaneous waste		-	-	ca.110 m^3
Private sector				-	ca.1,800 m^3
Total				ca.31,900 (ca.6,400 m^3)	ca.20,200 m^3

2.2 Projected waste volumes

2.2.1 Waste treatment and packaging

Although returned low-level waste is treated by bitumen solidification, most domestic waste is untreated, except for some waste produced by JAEA. The final treatment of waste is now being discussed. When considering disposal, it is necessary to specify the characteristics of disposal based on the characteristics of each type of domestic waste and its treatment method.

In this evaluation, the assumed waste treatment method is based on the current status of radioactive waste treatment technology, technical standards for waste packages and solidified material. The configuration of the waste is shown in Figure 2.2.1-1. The treatment method and packaging of waste are shown in Tables 2.2.1-1 and 2.2.1-2.

For some waste, such as spent silver absorbent and hulls and ends, stable solidification and waste packaging technologies are currently being developed (see Chapter 7). The aim is to improve the containment of I-129 and C-14, which are important nuclides for the radiation dose assessment. These developments are not considered in the estimated volumes of waste.

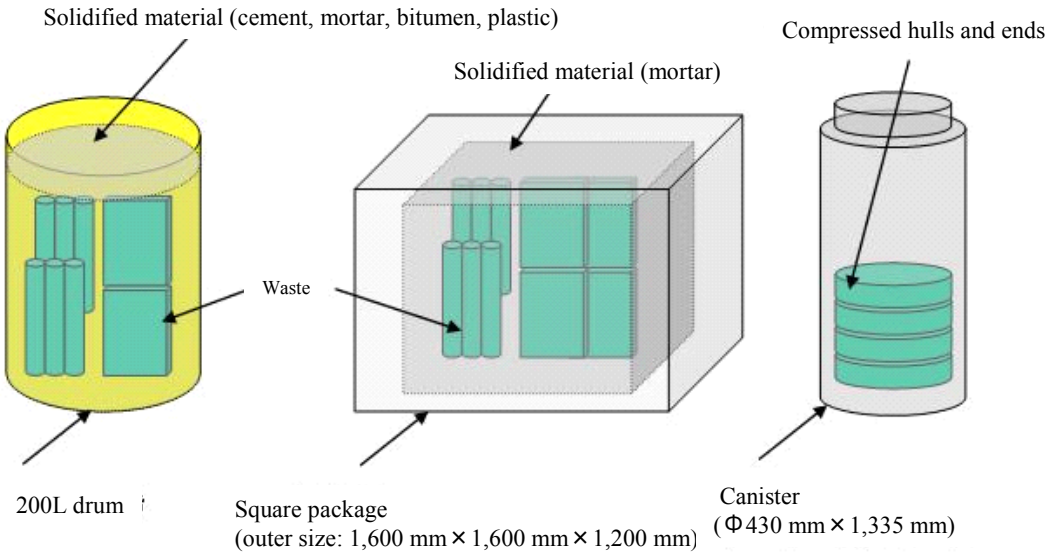

Figure 2.2.1-1 Waste configuration (domestic)

Table 2.2.1-1 Assumed waste treatment and packaging (facility operation)

	Type	Treatment method	Package	Solidification method	Remarks
Proces waste	Hulls and ends	Compression	Canister	-	Private sector, JAEA
	Concentrated low-level liquid wastes	Drying, granulation	200L drum	Mortar filling	Private sector
		Evaporative concentration	200L drum	Cement kneading	
		Evaporative concentration	200L drum	Bitumen	JAEA
		Nuclide separation→evaporation and solidification	200L drum	Cement kneading	
	Solvent waste	Dry distillation decomposition→hydrothermal solidification	200L drum	Mortar filling	Private sector
		Chemical treatment	200L drum	Plastic	JAEA
	Spent resin	Dehydration→combustion	200L drum	Cement kneading	Private sector, JAEA
	Spent carbon	Dehydration→combustion→ hydrothermal solidification	200L drum	Mortar filling	Private sector
		Dehydration→combustion→ melting	200L drum	Mortar filling	JAEA
	Spent silver absorbent	Dismantling of sorption material	200L drum	Cement kneading	Private sector, JAEA
	Sludge	Dehydration	200L drum	Cement kneading	JAEA
Miscellaneous waste	Combustible waste I	Combustion	200L drum	Cement kneading	Private sector
		Combustion→melting	200L drum	Mortar filling	JAEA
	Poorly combustible waste I	Combustion	200L drum	Cement kneading	Private sector
		Combustion→melting	200L drum	Mortar filling	JAEA
	Incombustible waste I	Melting or cutting	200L drum	Mortar filling	Private sector, JAEA
		Cutting	Square package	Mortar filling	Private sector
	Combustible waste II, III	Combustion→hydrothermal solidification	200L drum	Mortar filling	Private sector
		Combustion→melting	200L drum	Mortar filling	JAEA
	Poorly combustible waste II, III	Combustion or compression	200L drum	Cement kneading or mortar filling	Private sector
		Combustion→melting	200L drum	Mortar filling	JAEA
	Incombustible waste II, III	Melting or cutting	200L drum	Mortar filling	Private sector, JAEA
CB		Cutting	Square package	Mortar filling	Private sector
BP		Cutting	Square package	Mortar filling	Private sector

Table 2.2.1-2 Assumed waste treatment and packaging (facility dismantling)

Type	Treatment method	Package	Solidification method	Remarks
Incombustible waste (metal)	Melting or cutting	200L drum or square package	Mortar filling	Private sector, JAEA
Incombustible waste (concrete)	Grinding	200L drum or square package	Mortar filling	Private sector, JAEA
Secondary waste (decomtamination liquid waste)	Drying/granulation	200L drum or square package	Mortar filling	Private sector
	Nuclide separation→evaporative solidification	200L drum	Cement kneading	JAEA
Secondary waste (combustible)	Combustion or Combustion→hydrothermal solidification	200L drum or square package	Cement kneading or mortar filling	Private sector
	Combustion→melting	200L drum	Mortar filling	JAEA
Secondary waste (poorly combustible)	Combustion or compression	200L drum or square package	Cement kneading or mortar filling	Private sector
	Combustion→melting	200L drum	Mortar filling	JAEA
Secondary waste (incombustible)	Melting or cutting, compression	200L drum or square package	Mortar filling	Private sector, JAEA

2.2.2 Volumes of waste generated

A flowchart showing the estimated volumes of waste is presented in Figure 2.2.2-1. The volumes of TRU waste are calculated using the pre-conditions specified in Table 2.2.2-1. In the case of JAEA, the specified amounts of original waste are based on actual measurements. In the case of the private sector, the amounts are based on domestic and international design values or generation records. In contrast, assumed amounts of spent fuel for reprocessing are based on the design specification of each reprocessing facility. High combustion fuel and MOX fuel are not considered in this latter estimate. It is considered that the amounts estimated to be generated will change due to the requirement to specify these spent fuels and the actual operating conditions for each facility.

The total volumes generated, corresponding to the pre-conditions in Table 2.2.2-1 and the 1st TRU progress report, are shown in Table 2.2.2-2. The breakdown of the wastes is shown in Tables 2.2.2-3 to 2.2.2-11. Here, the amounts generated are estimated to be about 2.5 times higher than those reported in the 1st TRU progress report. The reason for this is that the new estimate includes dismantling waste from the private sector. It is considered reasonable to include these wastes in the estimation as they are similar to those considered in the 1st TRU progress report.

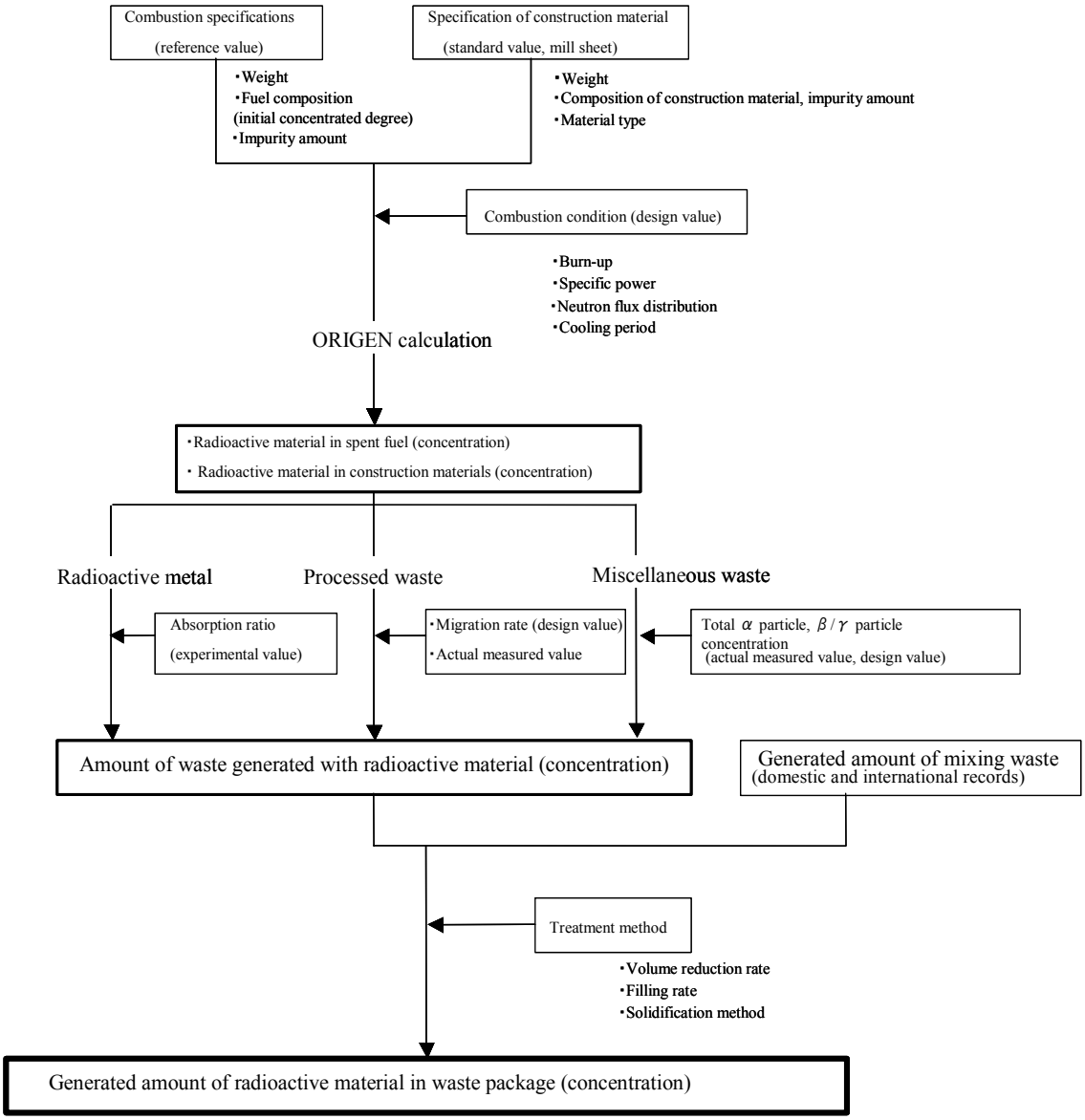

Figure 2.2.2-1 Flowchart showing the procedure for estimating volumes of radioactive materials (concentrations) and numbers of waste packages

Table 2.2.2-1 Pre-conditions for estimating waste volumes[1]

Waste classification		Pre-conditions for estimating waste volumes. Values in parentheses are the current accumulated volumes
Private sector	Reprocessing facility operational waste	-Facility scale: 800 tU/year -Amount of spent fuel (accumulated total): about 32,000 tU (ca. 25,000 tU) -The amount generated is estimated by assuming an operational period of about 40 years (about 30 years)
	MOX facility operational waste	-Facility scale: maximum 130 tHM/year -The amount generated is estimated by assuming an operational period of about 40 years (about 30 years)
	Management facility of returned waste operational waste	-The amount generated is estimated by assuming an operational period of about 40 years -Because of the small amount generated, it is included with reprocessing waste
	Dismantling waste of reprocessing facility	-Estimated amount of contaminated metal waste and concrete, such as towers and vessels, pipe assemblies and equipment and secondary waste which are generated during dismantling
	MOX facility dismantling waste	-Estimated amount of ventilation ducts, glove boxes and processing equipment from within glove boxes, and secondary waste which is generated during dismantling
	Management facility of returned waste, dismantling waste	-It is assumed that all the waste is below the clearance level
JAEA	Reprocessing facility for operational waste	-Accumulated quantity from processing up to fiscal year 2002: 1,009 tU -Operations according to plan during fiscal years 2003 to 2010 -Amounts of spent fuel processed: ca. 1,286 tU (ca. 2,550 tU) -Estimated amounts generated based on facility plans up to fiscal year 2048 (2035)
	MOX facility operational waste	-Accumulated quantity from operations, generated up to fiscal year 2002: ca. 167 t MOX -It is assumed that a constant volume of waste is generated annually, since past experience has shown that the quantities of waste generated do not depend on production -Estimates of the quantities to be generated are based on the facility plans up to fiscal year 2048 (2035)
	Reprocessing facility dismantling waste	-For all of the reprocessing plant parts, including reprocessing, separation and refinement plants, estimated amount of contaminated metal waste and concrete, such as towers and vessels, pipe assemblies and equipment and secondary waste which are generated during dismantling
	MOX facility dismantling waste	-For all of the facilities, including plutonium fuel 1st, 2nd and 3rd development laboratories which treat plutonium, estimated amount of ventilation ducts, glove boxes and processing equipment from within glove boxes, and secondary waste which is generated during dismantling
Returned low-level waste		-The planned number of waste packages is based on the reprocessing contracts with electric power suppliers, COGEMA and BNGS

1: Underlined text notes changes since the 1st TRU progress report (values in parentheses are values specified in the 1st TRU progress report).

Table 2.2.2-2 Estimated numbers of waste packages

Waste classification		Total amount generated (m^3)			
		1st TRU report		Present report	
Private sector	Reprocessing facility operational waste (except for CB/BP)	28,747	29,189	38,085	97,635
	Reprocessing facility operational waste (CB/BP)	0		12,366	
	MOX facility operational waste	442		922	
	Reprocessing dismantling waste	0		44,259	
	MOX dismantling waste	0		2,004	
JAEA	Waste from reprocessing operations	17,816	25,579	18,286	30,182
	MOX facility operational waste	1,995		1,307	
	Reprocessing facility dismantling waste	3,993		8,544	
	MOX facility dismantling waste	1,775		2,045	
Returned waste	COGEMA	1,172	1,172	937	12,457
	BNGS	0		11,520	
Total		55,940	55,940	140,274	140,274

Table 2.2.2-3 Estimated number of waste packages[1]

(private sector reprocessing operations)

Type of waste package	Package	Total amount generated	
		Number	m^3
Hulls and ends	Canister	24,150	4,685
Ash melt + Water in hulls can	200L drum	2,504	501
Water in hulls can	200L drum	700	140
Incombustible waste I (highly contaminated part: for melting treatment)	200L drum	10,223	2,045
Incombustible waste I (highly contaminated part: except for melting treatment)	200L drum	1,445	289
Incombustible waste I (moderately contaminated part)	200L drum	571	114
Incombustible waste I (less contaminated part)	200L drum	2,822	564
Incombustible waste I (hulls can)	200L drum	5,355	1,071
Incombustible waste I (special equipment waste container)	Square package	1,360	2,666
Combustible waste II	200L drum	4,245	849
Poorly combustible waste II	200L drum	21,365	4,273
Incombustible waste II (for melting treatment)	200L drum	24,955	4,991
Incombustible waste II (except for melting treatment)	200L drum	8,040	1,608
Incombustible waste II (transport container)	200L drum	11,935	2,387
Low-level concentrated liquid waste 1 (liquid waste generated during analysis)	200L drum	6,230	1,246
Low-level concentrated liquid waste 2 (other waste liquid from nitric acid)	200L drum	19,425	3,885
Low-level concentrated liquid waste 3 (transport container for spent fuel water)	200L drum	10,500	2,100
Solvent waste	200L drum	4,095	819
Spent carbon	200L drum	2,480	496
Spent silver absorbent	200L drum	1,520	304
Scrubber waste liquid	200L drum	15,260	3,052
CB	Square package	5,775	11,319
BP	Square package	534	1,047
Subtotal		185,489	50,450

1: Including miscellaneous waste generated by facilities managing returned waste

Table 2.2.2-4 Estimated number of waste packages generated (private sector MOX operation)

Type of waste package	Container	Total amount generated	
		Number	m^3
Ash melt	200L drum	1,171	234
Incombustible waste I (highly contaminated part: for melting treatment)	200L drum	592	118
Incombustible waste I (highly contaminated part: except for melting treatment)	200L drum	60	12
Incombustible waste I (moderately contaminated part)	200L drum	24	5
Incombustible waste I (less contaminated part)	200L drum	118	24
Combustible waste II	200L drum	305	61
Poorly combustible waste II	200L drum	2,295	459
Incombustible waste II (for melting treatment)	200L drum	35	7
Incombustible waste II (except for melting treatment)	200L drum	11	2
Subtotal		4,610	922

Table 2.2.2-5 Estimated waste packages (private sector reprocessing, dismantling)

Type of waste package	Container	Total amount generated	
		Number	m^3
Primary waste I (metal) (for melting treatment)	Square package	78	153
Primary waste I (metal) (except for melting treatment)	Square package	49	96
Primary waste II (metal) (for melting treatment)	Square package	1,314	2,575
Primary waste II (metal) (except for melting treatment)	Square package	827	1,621
Primary waste III (metal) (for melting treatment)	200L drum	33,448	6,690
Primary waste III (metal) (except for melting treatment)	200L drum	39,870	7,974
Contaminated concrete	Square package	684	1,341
Secondary waste I (combustible)	Square package	419	821
Secondary waste II (combustible)	200L drum	81,506	16,301
Secondary waste I (poorly combustible)	Square package	65	127
Secondary waste II (poorly combustible)	200L drum	22,145	4,429
Secondary waste I (incombustible)	Square package	10	20
Secondary waste II (incombustible)	200L drum	5,925	1,185
Systematic decontamination liquid waste I	Square package	78	153
Systematic decontamination liquid waste II	Square package	118	231
Systematic decontamination liquid waste III	200L drum	340	68
Partial decontamination liquid waste I	Square package	121	237
Partial decontamination liquid waste II	Square package	121	237
Subtotal		187,118	44,259

Table 2.2.2-6 Estimated waste packages (private sector MOX dismantling)

Type of waste package	Container	Total amount generated	
		Number	m^3
Primary waste I (metal)	Square package	99	194
Primary waste II (metal)	Square package	535	1,049
Primary waste III (metal)	200L drum	1,761	352
Secondary waste I (combustible)	Square package	13	25
Secondary waste II (combustible)	Square package	37	73
Secondary waste III (combustible)	200L drum	27	5
Secondary waste I (poorly combustible)	Square package	8	16
Secondary waste II (poorly combustible)	Square package	24	47
Secondary waste III (poorly combustible)	200L drum	649	130
Secondary waste I (incombustible)	Square package	14	27
Secondary waste II (incombustible)	Square package	42	82
Secondary waste III (incombustible)	200L drum	17	3
Subtotal		3,226	2,004

Table 2.2.2-7 Estimated waste packages (JAEA reprocessing operation)

Type of waste package	Container	Total amount generated	
		Number	m^3
Combustible waste I	200L drum	21	4
Combustible waste II	200L drum	18	4
Combustible waste III	200L drum	285	57
Poorly combustible waste I	200L drum	9	2
Poorly combustible waste II	200L drum	4	1
Poorly combustible waste III	200L drum	62	12
Incombustible waste I (metal- waste)	200L drum	993	199
Incombustible waste II (metal- waste)	200L drum	597	119
Incombustible waste III (metal- waste)	200L drum	4,782	956
Incombustible waste I (non-metal- waste)	200L drum	569	114
Incombustible waste II (non-metal- waste)	200L drum	354	71
Incombustible waste III (non-metal- waste)	200L drum	2,686	537
Incombustible waste I (non-metal)	200L drum	39	8
Incombustible waste II (non-metal)	200L drum	77	15
Incombustible waste III (non-metal)	200L drum	614	123
Clarification filter	200L drum	17	3
Incombustible waste in hulls can (metal- waste)	200L drum	166	33
Incombustible waste in hulls can (non-metal- waste)	200L drum	151	30
Iodine filter (spent silver absorbent)	200L drum	69	14
Hulls and ends	Canister	1,050	204
Bitumen solidified waste (MA[*1] series)	200L drum	16,671	3,334
Bitumen solidified waste (LA[*2] series)	200L drum	13,296	2,659
Slurry solidified waste (MA series acid)	200L drum	677	135
Slurry solidified waste (MA series alkaline)	200L drum	686	137
Slurry solidified waste (LA series alkaline)	200L drum	1,647	329
$NaNO_3$ solidified waste (MA series acid)	200L drum	5,628	1,126
$NaNO_3$ solidified waste (MA series alkaline)	200L drum	6,001	1,200
$NaNO_3$ solidified waste (LA series alkaline)	200L drum	13,221	2,644
Plastic solidified waste	200L drum	2,646	529
Chemical sludge	200L drum	14,129	2,826
Spent sand (pool water filtration)	200L drum	545	109
Water in hulls can	200L drum	23	5
Hull can (empty container)	200L drum	1,354	271
ST[*3] spent silica gel	200L drum	89	18
LWTF[*4] spent silica gel	200L drum	361	72
Sr/Cs absorbent	200L drum	400	80
Off-gas drying powder	200L drum	1,526	305
Subtotal		91,463	18,286

*1: Low-level radioactive liquid waste with relatively high radioactivity
*2: Low-level radioactive liquid waste with low radioactivity
*3: Facility for technical development of treatments for solvent waste
*4: Facility for technical development and treatment of radioactive waste with low radioactivity

Table 2.2.2-8 Estimated waste packages (JAEA MOX operation)

Type of waste package	Container	Total amount generated	
		Number	m^3
Combustible waste I	200L drum	803	161
Poorly combustible waste I	200L drum	131	26
Incombustible waste I (metal-waste)	200L drum	4,663	933
Incombustible waste II (metal-waste)	200L drum	17	3
Incombustible waste I (metal ingot)	200L drum	9	2
Incombustible waste II (metal ingot)	200L drum	11	2
Incombustible waste I (non-metal-waste)	200L drum	26	5
Incombustible waste I (non-metal)	200L drum	832	166
Incombustible waste II (non-metal)	200L drum	43	9
Subtotal		6,535	1,307

Table 2.2.2-9 Estimated waste packages (JAEA reprocessing, dismantling)

Type of waste package	Container	Total amount generated	
		Number	m^3
Primary incombustible waste I (metal)	200L drum	3,843	769
Primary incombustible waste II (metal)	200L drum	981	196
Primary incombustible waste III (metal)	200L drum	22,923	4,585
Primary incombustible waste I (concrete)	200L drum	142	28
Primary incombustible waste II (concrete)	200L drum	103	21
Primary incombustible waste III (concrete)	200L drum	1,154	231
Secondary decontamination waste liquid slurry solidified waste (MA series)	200L drum	960	192
Secondary decontamination waste liquid slurry solidified waste (LA series)	200L drum	87	17
Secondary decontamination waste liquid $NaNO_3$ solidified waste (MA series)	200L drum	8,267	1,653
Secondary decontamination waste liquid $NaNO_3$ solidified waste (LA series)	200L drum	699	140
Secondary combustible waste I	200L drum	12	2
Secondary combustible waste II	200L drum	32	6
Secondary combustible waste III	200L drum	451	90
Secondary poorly combustible waste I	200L drum	2	0.4
Secondary poorly combustible waste II	200L drum	8	2
Secondary poorly combustible waste III	200L drum	97	19
Secondary incombustible waste I (metal- waste)	200L drum	145	29
Secondary incombustible waste II (metal-waste	200L drum	42	8
Secondary incombustible waste III (metal-waste)	200L drum	1,625	325
Secondary incombustible waste I (non-metal- waste)	200L drum	47	9
Secondary incombustible waste II (non-metal-waste)	200L drum	99	20
Secondary incombustible waste III (non-metal-waste)	200L drum	788	158
Secondary incombustible waste I (non-metal)	200L drum	16	3
Secondary incombustible waste II (non-metal)	200L drum	13	3
Secondary incombustible waste III (non-metal)	200L drum	185	37
Subtotal		42,721	8,544

Table 2.2.2-10 Estimated waste packages (JAEA MOX dismantling)

Type of waste package	Container	Total amount generated	
		Number	m^3
Primary incombustible waste I (metal)	200L drum	8,945	1,789
Primary incombustible waste II (metal)	200L drum	117	23
Primary incombustible waste I (concrete)	200L drum	127	25
Primary incombustible waste II (concrete)	200L drum	2	0.4
Secondary combustible waste I	200L drum	449	90
Secondary incombustible waste I	200L drum	99	20
Secondary incombustible waste I (metal-waste)	200L drum	424	85
Secondary incombustible waste II (metal- waste)	200L drum	2	0.4
Secondary incombustible waste I (non-metal)	200L drum	58	12
Secondary incombustible waste II (non-metal)	200L drum	3	1
Subtotal		10,226	2,045

Table 2.2.2-11 Estimated waste packages (returned waste)

Type of waste package	Container	Total amount generated	
		Number	m^3
Storage container for solid wastes	Canister	3,600	684
Bitumen solidified waste	230L drum	1,100	253
Miscellaneous solid	1500L container	3,300	4,950
Magnox miscellaneous solid	1500L container	2,700	4,050
MEB[*1] cladding + barium carbonate cement solidified waste	500L drum	250	140
Cement solidified waste (hulls and ends: PWR)	500L drum	1,035	580
Cement solidified waste (hulls and ends: BWR)	500L drum	1,035	580
Magnox cement solidified waste	500L drum	900	504
Centrifuge cake cement solidified waste PWR	500L drum	630	353
Centrifuge cake cement solidified waste BWR	500L drum	650	364
Subtotal		15,200	12,457

*1:multi-element bottle

2.3 Concentrations of radioactive materials in waste packages

Reprocessing facility wastes include fission products such as Sr-90, Tc-99, I-129 and Cs-137 and products of neutron adsoption by uranium in the reactor core, such as Pu-239, Pu-241 and Am-241. In addition, radioactive materials such as C-14, Co-60 and Ni-63 generated by activation of engineered materials (stainless steel, zircaloy, etc.) are also included. The MOX fuel fabrication facility produces mainly isotopes of uranium and plutonium (U-235, U-238, Pu-238, Pu-239 and Pu-241).

The concentrations of radioactive materials in each waste package are evaluated using the procedure shown in the flowchart in Figure 2.2.2-1. The constraints on the evaluation are shown in Table 2.3-1 and the effects of the degree of spent fuel burn-up on the waste are shown in Table 2.3-2.

The burn-up conditions for spent fuel shown in Table 2.3-2 are design values for each facility and neutron

flux distribution. Adsorption rates for hulls were obtained from actual measurements (JNFL, 1996). Further detailed calculations were carried out for C-14 as it is such an important nuclide from the point of view of long-term dose. This nuclide is known to be produced in engineered materials by (n, p) reaction with nitrogen. In order to estimate realistic values, a review of the actual measured quantities of impurity in each component was undertaken and the neutron flux distribution was evaluated.

The variations in concentrations of radioactive materials in TRU waste are shown in Figure 2.3-1 and the activity of radioactive materials in each waste package type are shown in Tables 2.3-3 to 2.3-8. As shown in the 1st TRU progress report, the concentrations of radioactive materials in TRU waste range from relatively high to relatively low values.

The estimated quantities of C-14 in hulls and ends based on reviews of neutron flux distribution and the amount of impurities are almost the same as those of waste packages from COGEMA and BNGS (McGinnes, 2002). The estimated values are therefore considered to be reasonable and are shown in Table 2.3-9.

TRU nuclides and activation products in the waste generally increase with degree of burn-up (cf. Appendix 2A). However, it is also considered that there will be no significant change in the characteristics of the waste packages. If there are no changes in the volumes of waste generated per unit of spent fuel, it is assumed that high burn-up rates will contribute to decreasing the quantity of TRU waste.

Table 2.3-1 Pre-conditions for determining concentrations of radioactive materials

Type of waste		Evaluation condition
Private sector	Waste from reprocessing operations	・The concentrations of radioactive materials in hulls and ends are specified based on the quantities of radioactive material in structural materials and spent fuel, which are calculated using ORIGEN2 and the conditions in Table 2.3-2. ・The concentrations of radioactive materials in concentrated low-level liquid waste, solvent waste, spent silver absorbent and spent carbon are specified by mass balance, using the total amount of radioactive material from the reprocessing plant, which is based in turn on the amount of radioactive material in spent fuel, calculated using ORIGEN2 and the conditions in Table 2.3-2 ・The concentrations of radioactive materials in miscellaneous wastes are specified using total concentrations of α-, β- and γ-emitting radioactive materials, based on the records of national and international reprocessing plants
	Waste from MOX operations	・The total concentrations of α-, β- and γ-emitting radioactive materials are specified based on the records of MOX fuel fabrication facilities
	Waste from returned waste management operations	・The total concentrations of α-, β- and γ-emitting radioactive materials are specified in addition to waste from reprocessing operations
	Dismantling waste	・The concentrations of radioactive materials are specified based on records for the renewal of JAEA facilities
JAEA	Waste from reprocessing operations	・The concentrations of radioactive material in hulls and ends are specified based on calculations using ORIGEN2 and the conditions in Table 2.3-2. ・The concentrations of radioactive materials in other waste are specified based on actual measured values and mass balance calculations.
	Waste from MOX operations	・Concentrations of radioactive materials are specified based on actual measured values
	Dismantling waste	・Estimated based on actual measurement of surface dose rate in the waste generated by previous renewal of equipment or based on the concentration distribution of radioactive material in operational waste
Returned low-level waste		・Presented by COGEMA and BNGS

Table 2.3-2 Variation in fission product content of reprocessing waste with the degree of burn-up of spent fuel

	Private sector reprocessing		JAEA reprocessing
Nuclear plant type	PWR	BWR*1	PWR
Initial concentration (%)	4.5	4.0	4
Burn-up degree (MWD/MTU)	45,000		28,000
Specific power (MW/MTU)	38	26	35
Neutron flux distribution of hulls and ends	fuel part: Average Upper nozzle: 1/10 of average value Upper plenum: 1/4 of average value Lower nozzle: 1/4 of average value		
Cooling time (a) (after removal from the reactor)	4		5
Proportion of fission products attached to hulls (%)	Tritium 70 Tc 3 Ru/Rh 5 Other FP 0.3 Actinides 0.2		0.2

*1: Only the CB evaluation

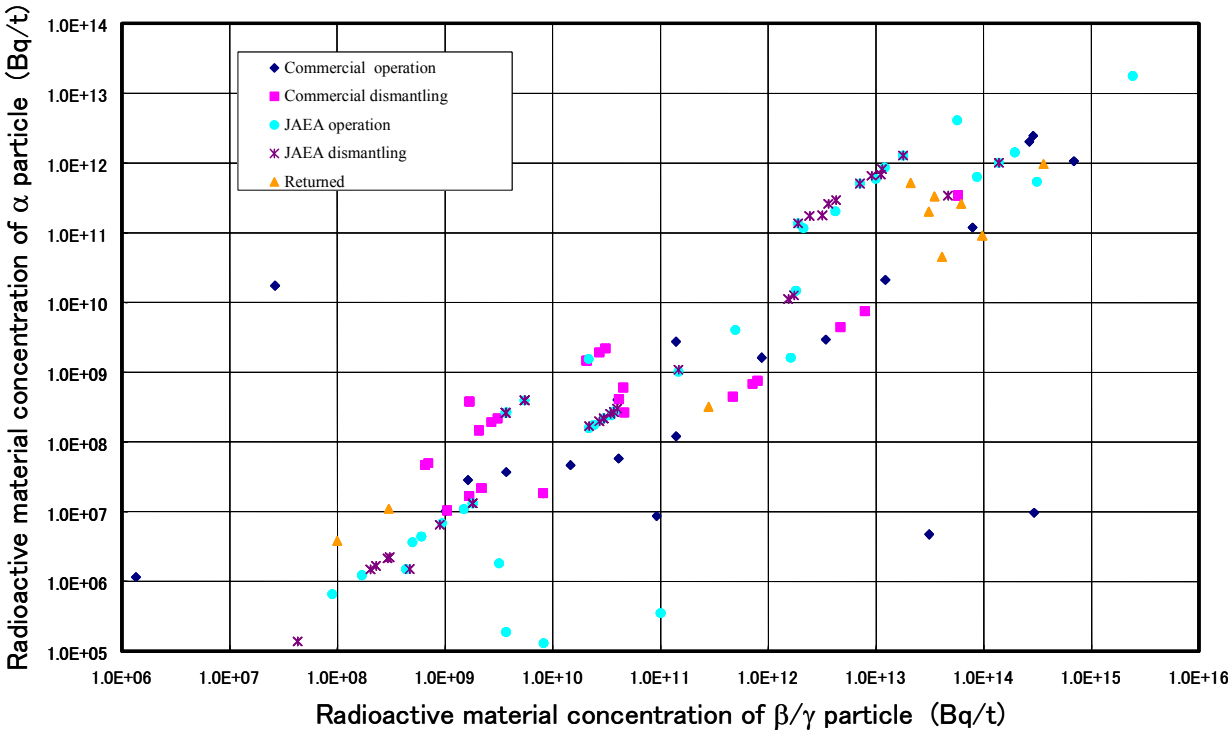

Figure 2.3-1 Distributions of radioactivity in TRU wastes from different sources

Table 2.3-3 Activity of radioactive materials in each waste package (Bq Mg^{-1}) (private sector)

	Type of waste package	Total α	Total βγ	H-3	C-14	Cl-36	Co-60	Ni-59	Ni-63	Se-79	Sr-90	Zr-93	Nb-94	Mo-93	Tc-99	Pd-107	Ag-108m
Private sector reprocessing and MOX operations	Hulls and ends	1.1E+12	6.9E+14	3.1E+13	2.1E+10	4.0E+08	5.8E+13	3.3E+11	5.0E+13	9.7E+07	1.6E+13	1.3E+10	1.2E+11	2.5E+09	2.9E+10	2.4E+07	1.0E+08
	Ash melt + Water in hulls can	2.5E+12	2.9E+14	4.5E+11	3.7E+08	5.2E+06	1.4E+11	3.0E+08	4.8E+10	2.2E+08	3.3E+13	1.1E+09	1.1E+08	1.4E+06	6.2E+09	4.9E+06	3.1E+05
	Water in hulls can	2.0E+12	2.7E+14	4.3E+11	2.0E+08	4.0E+06	2.2E+10	3.7E+06	5.6E+08	1.8E+08	3.0E+13	8.0E+08	5.7E+04	2.5E+04	5.5E+09	4.6E+06	0.0E+00
	Incombustible waste I (highly contaminated part: for melting treatment)	2.1E+10	1.2E+13	0.0E+00	1.7E+06	2.6E+04	4.1E+08	2.7E+06	3.5E+08	0.0E+00	4.8E+12	2.6E+08	6.5E+05	9.0E+04	1.8E+09	0.0E+00	1.2E+06
	Incombustible waste I (highly contaminated part: except for melting treatment)	1.2E+11	7.9E+13	0.0E+00	4.6E+06	3.5E+04	2.0E+09	1.8E+07	2.4E+09	0.0E+00	3.2E+13	1.8E+09	4.5E+06	6.1E+05	1.2E+10	0.0E+00	8.2E+06
	Incombustible waste I (moderately contaminated part: except for melting treatment)	3.0E+09	3.4E+12	0.0E+00	2.0E+05	1.6E+03	9.0E+07	8.0E+05	1.0E+08	0.0E+00	1.4E+12	7.8E+07	2.0E+05	2.7E+04	3.6E+05	0.0E+00	4.1E+06
	Incombustible waste I (less contaminated part: except for melting treatment)	1.2E+08	1.4E+11	0.0E+00	8.3E+03	6.4E+01	3.6E+06	3.3E+04	4.3E+06	0.0E+00	5.8E+10	3.2E+06	8.0E+03	1.1E+03	2.2E+07	0.0E+00	1.5E+04
	Incombustible waste I (hulls can)	1.6E+09	8.7E+11	1.5E+08	4.3E+07	8.4E+05	3.2E+11	2.6E+08	4.0E+10	1.1E+05	1.8E+10	7.7E+06	7.5E+07	2.1E+06	2.0E+07	2.8E+04	0.0E+00
	Incombustible waste I (special equipment waste, container)	2.7E+09	1.4E+11	0.0E+00	2.4E+05	4.9E+03	2.7E+07	4.5E+03	6.9E+05	0.0E+00	3.6E+10	9.8E+05	7.0E+01	3.0E+02	6.8E+06	0.0E+00	5.5E+03
	Combustible waste II	4.0E+08	4.0E+10	0.0E+00	9.1E+04	1.4E+03	3.9E+08	2.0E+05	3.0E+07	0.0E+00	1.0E+10	2.9E+05	5.5E+04	1.4E+03	2.0E+06	0.0E+00	1.8E+03
	Poorly combustible waste II	2.8E+07	1.6E+09	0.0E+00	2.6E+03	5.0E+01	1.1E+06	4.8E+02	7.3E+04	0.0E+00	3.8E+08	1.0E+04	1.2E+02	6.0E+00	7.1E+04	0.0E+00	5.8E+01
	Incombustible waste II (for melting treatment)	5.8E+07	4.1E+10	0.0E+00	3.4E+04	8.8E+02	1.7E+06	3.1E+05	1.2E+06	0.0E+00	1.6E+10	8.8E+05	2.3E+03	3.2E+02	6.2E+06	0.0E+00	4.9E+03
	Incombustible waste II (except for melting treatment)	1.0E+07	1.0E+09	0.0E+00	1.7E+03	3.5E+01	1.9E+05	3.5E+01	5.3E+03	0.0E+00	2.6E+08	7.3E+03	1.3E+00	2.3E+00	5.0E+04	0.0E+00	4.0E+01
	Incombustible waste II (transport container)	3.7E+07	3.7E+09	3.6E+06	2.8E+03	5.6E+01	3.1E+05	5.1E+01	7.9E+03	2.5E+03	4.2E+08	1.1E+04	8.1E-01	3.5E+00	7.8E+04	6.5E+02	6.3E+01
	Low-level concentrated liquid waste 1	1.7E+10	2.6E+07	2.6E+04	2.0E+01	4.0E-01	2.2E+03	3.7E-01	5.6E+01	1.8E+01	3.0E+06	8.1E+01	5.8E-03	2.5E-02	5.6E+02	4.7E+00	0.0E+00
	Low-level concentrated liquid waste 2	1.8E+07	8.1E+09	0.0E+00	0.0E+00	0.0E+00	7.0E+08	1.2E+06	1.9E+08	4.1E+03	6.7E+08	1.9E+04	3.4E+04	7.9E+03	1.4E+05	1.1E+03	0.0E+00
	Low-level concentrated liquid waste 3	0.0E+00	3.3E+09	3.9E+06	3.0E+03	6.0E+01	3.3E+05	5.6E+01	8.5E+03	2.7E+03	4.5E+08	1.2E+04	8.7E-01	3.8E+00	8.4E+04	7.0E+02	6.8E+01
	Solvent waste	4.7E+07	1.5E+10	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	4.1E+03	6.8E+08	1.8E+04	3.4E+04	0.0E+00	8.9E+05	1.1E+03	0.0E+00
	Spent carbon	1.2E+06	1.3E+06	0.0E+00	0.0E+00	0.0E+00	2.3E+05	4.0E+02	6.5E+04	3.8E-01	6.5E+04	1.7E+00	3.1E+00	2.6E+00	3.4E+02	9.9E-02	0.0E+00
	Spent silver absorbent	8.7E+06	9.2E+10	0.0E+00	0.0E+00	0.0E+00	4.6E+03	7.5E+00	1.2E+03	5.4E+02	9.2E+07	2.5E+03	4.6E+03	5.2E-02	0.0E+00	1.5E+02	0.0E+00
	Scrubber waste liquid	2.6E+01	3.2E+11	2.1E+09	0.0E+00	0.0E+00	7.0E+01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	4.4E-01	0.0E+00	0.0E+00
	CB	4.7E+06	3.1E+13	1.1E+09	2.9E+09	7.0E+07	3.5E+12	7.7E+09	1.2E+12	2.0E+05	3.7E+07	1.9E+09	9.1E+08	1.8E+07	3.4E+06	7.3E+01	1.2E+07
	BP	9.7E+06	2.9E+14	4.0E+10	1.5E+10	1.1E+07	5.1E+13	1.0E+11	1.6E+13	7.8E+06	1.6E+08	1.9E+05	6.6E+09	4.2E+08	1.9E+07	4.7E+01	4.0E+08
Private sector reprocessing, dismantling	Primary waste I (metal) (for melting treatment)	7.5E+09	7.9E+12	7.7E+09	6.0E+06	1.2E+05	6.6E+08	1.1E+05	1.7E+07	5.4E+06	8.9E+11	2.4E+07	1.7E+03	7.5E+03	1.7E+08	1.4E+06	1.4E+05
	Primary waste I (metal) (except for melting treatment)	4.4E+09	4.7E+12	4.6E+09	3.6E+06	7.1E+04	3.9E+08	6.5E+04	1.0E+07	3.2E+06	5.3E+11	1.4E+07	1.0E+03	4.4E+03	9.9E+07	8.3E+05	8.0E+04
	Primary waste II (metal) (for melting treatment)	7.5E+08	7.9E+11	7.7E+08	6.0E+05	1.2E+04	6.6E+07	1.1E+04	1.7E+06	5.4E+05	8.9E+10	2.4E+06	1.7E+02	7.5E+02	1.7E+07	1.4E+05	1.4E+04
	Primary waste II (metal) (except for melting treatment)	4.4E+08	4.7E+11	4.6E+08	3.6E+05	7.1E+03	3.9E+07	6.5E+03	1.0E+06	3.2E+05	5.3E+10	1.4E+06	1.0E+02	4.4E+02	9.9E+06	8.3E+04	8.0E+03
	Primary waste III (metal) (for melting treatment)	2.2E+07	2.2E+09	2.1E+06	1.7E+03	3.3E+01	1.8E+05	3.0E+01	4.6E+03	1.5E+03	2.5E+08	6.6E+03	4.8E-01	2.1E+00	4.6E+04	3.8E+02	3.7E+01
	Primary waste III (metal) (except for melting treatment)	1.0E+07	1.0E+09	1.0E+06	7.9E+02	1.6E+01	8.6E+04	1.5E+01	2.2E+03	7.1E+02	1.2E+08	3.2E+03	2.3E-01	9.8E-01	2.2E+04	1.8E+02	1.8E+01
	Contaminated concrete	6.8E+08	7.2E+11	7.0E+08	5.4E+05	1.1E+04	5.9E+07	1.0E+04	1.5E+06	4.9E+05	8.1E+10	2.2E+06	1.6E+02	6.8E+02	1.5E+07	1.3E+05	1.2E+04
	Secondary waste I (combustible)	6.0E+08	4.5E+10	4.4E+07	3.4E+04	6.8E+02	3.7E+06	6.3E+02	9.6E+04	3.1E+04	5.1E+09	1.4E+05	9.8E+00	4.3E+01	9.5E+05	8.0E+03	7.7E+02
	Secondary waste II (combustible)	4.1E+08	4.1E+10	4.0E+07	3.1E+04	6.2E+02	3.4E+06	5.7E+02	8.8E+04	2.8E+04	4.6E+09	1.3E+05	9.0E+00	3.9E+01	8.7E+05	7.3E+03	7.0E+02
	Secondary waste I (poorly combustible)	2.7E+08	4.6E+10	4.5E+07	3.5E+04	7.0E+02	3.8E+06	6.4E+02	9.8E+04	3.1E+04	5.2E+09	1.4E+05	1.0E+01	4.4E+01	9.7E+05	8.1E+03	7.9E+02
	Secondary waste II (poorly combustible)	1.7E+07	1.7E+09	1.6E+06	1.3E+03	2.5E+01	1.4E+05	2.3E+01	3.6E+03	1.1E+03	1.9E+08	5.1E+03	3.7E-01	1.6E+00	3.5E+04	2.9E+02	2.8E+01
	Secondary waste I (incombustible)	7.5E+08	7.9E+11	7.7E+08	6.0E+05	1.2E+04	6.6E+07	1.1E+04	1.7E+06	5.4E+05	8.9E+10	2.4E+06	1.7E+02	7.5E+02	1.7E+07	1.4E+05	1.4E+04
	Secondary waste II (incombustible)	2.2E+07	2.2E+09	2.1E+06	1.7E+03	3.3E+01	1.8E+05	3.0E+01	4.6E+03	1.5E+03	2.5E+08	6.6E+03	4.8E-01	2.1E+00	4.6E+04	3.8E+02	3.7E+01
	Systematic decontamination liquid waste I	3.4E+11	5.8E+13	5.6E+10	4.4E+07	8.7E+05	4.8E+09	8.0E+05	1.2E+08	3.9E+07	6.5E+12	1.8E+08	1.3E+04	5.5E+04	1.2E+09	1.0E+07	9.9E+05
	Systematic decontamination liquid waste II	3.8E+08	1.7E+09	1.6E+06	1.3E+03	2.5E+01	1.4E+05	2.3E+01	3.6E+03	1.1E+03	1.9E+08	5.1E+03	3.7E-01	1.6E+00	3.5E+04	3.0E+02	2.9E+01
	Systematic decontamination liquid waste III	1.8E+07	8.1E+09	7.9E+06	6.2E+03	1.2E+02	6.7E+05	1.1E+02	1.7E+04	5.5E+03	9.1E+08	2.5E+04	1.8E+00	7.7E+00	1.7E+05	1.4E+03	1.4E+02
	Partial decontamination liquid waste I	3.4E+11	5.8E+13	5.6E+10	4.4E+07	8.7E+05	4.8E+09	8.0E+05	1.2E+08	3.9E+07	6.5E+12	1.8E+08	1.3E+04	5.5E+04	1.2E+09	1.0E+07	9.9E+05
	Partial decontamination liquid waste II	3.8E+08	1.7E+09	1.6E+06	1.3E+03	2.5E+01	1.4E+05	2.3E+01	3.6E+03	1.1E+03	1.9E+08	5.1E+03	3.7E-01	1.6E+00	3.5E+04	3.0E+02	2.9E+01
Private sector MOX dismantling	Primary waste I (metal)	1.5E+09	2.1E+10	0.0E+00	8.1E-03	1.6E-04	8.8E-01	1.5E-04	2.3E-02	0.0E+00	1.2E+03	3.3E-02	2.3E-06	1.0E-05	2.3E-01	0.0E+00	1.8E-04
	Primary waste II (metal)	1.5E+08	2.1E+09	0.0E+00	8.1E-04	1.6E-05	8.8E-02	1.5E-05	2.3E-03	0.0E+00	1.2E+02	3.3E-03	2.3E-07	1.0E-06	2.3E-02	0.0E+00	1.8E-05
	Primary waste III (metal)	4.7E+07	6.5E+08	0.0E+00	2.6E-04	5.1E-06	2.8E-02	4.7E-06	7.2E-04	0.0E+00	3.8E+01	1.0E-03	7.4E-08	3.2E-07	7.2E-03	0.0E+00	5.8E-06
	Secondary waste I (combustible)	2.2E+09	3.1E+10	0.0E+00	1.2E-02	2.4E-04	1.3E+00	2.2E-04	3.4E-02	0.0E+00	1.8E+03	4.9E-02	3.5E-06	1.5E-05	3.4E-01	0.0E+00	2.7E-04
	Secondary waste II (combustible)	2.2E+08	3.1E+09	0.0E+00	1.2E-03	2.4E-05	1.3E-01	2.2E-05	3.4E-03	0.0E+00	1.8E+02	4.9E-03	3.5E-07	1.5E-06	3.4E-02	0.0E+00	2.7E-05
	Secondary waste III (combustible)	4.9E+07	7.0E+08	0.0E+00	2.7E-04	5.5E-06	3.0E-02	5.0E-06	7.7E-04	0.0E+00	4.1E+01	1.1E-03	7.9E-08	3.4E-07	7.6E-03	0.0E+00	6.2E-06
	Secondary waste I (poorly combustible)	1.9E+09	2.7E+10	0.0E+00	1.1E-02	2.1E-04	1.2E+00	1.9E-04	3.0E-02	0.0E+00	1.6E+03	4.3E-02	3.1E-06	1.3E-05	3.0E-01	0.0E+00	2.4E-04
	Secondary waste II (poorly combustible)	1.9E+08	2.7E+09	0.0E+00	1.1E-03	2.1E-05	1.2E-01	1.9E-05	3.0E-03	0.0E+00	1.6E+02	4.3E-03	3.1E-07	1.3E-06	3.0E-02	0.0E+00	2.4E-05
	Secondary waste III (poorly combustible)	1.7E+07	1.7E+09	0.0E+00	6.6E-04	1.3E-05	7.2E-02	1.2E-05	1.8E-03	0.0E+00	9.8E+01	2.6E-03	1.9E-07	8.2E-07	1.8E-02	0.0E+00	1.5E-05
	Secondary waste I (incombustible)	1.5E+09	2.1E+10	0.0E+00	8.1E-03	1.6E-04	8.8E-01	1.5E-04	2.3E-02	0.0E+00	1.2E+03	3.3E-02	2.3E-06	1.0E-05	2.3E-01	0.0E+00	1.8E-04
	Secondary waste II (incombustible)	1.5E+08	2.1E+09	0.0E+00	8.1E-04	1.6E-05	8.8E-02	1.5E-05	2.3E-03	0.0E+00	1.2E+02	3.3E-03	2.3E-07	1.0E-06	2.3E-02	0.0E+00	1.8E-05
	Secondary waste III (incombustible)	4.7E+07	6.5E+08	0.0E+00	2.6E-04	5.1E-06	2.8E-02	4.7E-06	7.2E-04	0.0E+00	3.8E+01	1.0E-03	7.4E-08	3.2E-07	7.2E-03	0.0E+00	5.8E-06

	Type of waste package	Sn-126	I-129	Cs-135	Cs-137	Pu-241	Am-242m	U-233	U-234	U-235	U-236	U-238	Np-237	Pu-238	Pu-239	Pu-240	Pu-242	Am-241	Am-243	Cm-244	Cm-245
Private sector reprocessing and MOX operations	Hulls and ends	1.7E+08	7.1E+06	9.9E+07	2.2E+13	1.5E+13	1.1E+09	2.2E+05	7.1E+06	2.4E+06	4.3E+07	3.5E+07	5.4E+07	4.6E+11	4.0E+10	6.4E+10	2.7E+08	1.3E+11	3.0E+09	3.5E+11	3.7E+07
	Ash melt + Water in hulls can	3.6E+08	1.5E+07	2.0E+08	4.6E+13	3.4E+13	2.5E+09	3.7E+03	1.5E+07	5.2E+06	9.1E+07	7.5E+07	1.2E+08	1.1E+12	9.3E+10	1.5E+11	6.4E+08	2.9E+11	6.8E+09	8.0E+11	8.4E+07
	Water in hulls can	3.2E+08	1.3E+07	1.9E+08	4.1E+13	2.9E+13	2.2E+09	3.0E+03	1.3E+07	4.6E+06	8.1E+07	6.7E+07	1.0E+08	8.8E+11	7.7E+10	1.2E+11	5.1E+08	2.4E+11	5.6E+09	6.6E+11	7.0E+07
	Incombustible waste I (highly contaminated part: for melting treatment)	1.1E+08	8.8E+04	3.1E+07	6.8E+12	5.7E+11	1.8E+09	3.2E+01	1.0E+05	2.0E+04	3.6E+05	2.9E+05	3.3E+06	5.8E+09	4.8E+08	8.1E+08	3.3E+06	5.6E+09	1.5E+08	8.2E+09	2.2E+06
	Incombustible waste I (highly contaminated part: except for melting treatment)	7.2E+08	1.2E+05	2.1E+08	4.6E+13	1.2E+12	1.3E+10	1.8E+02	4.0E+05	4.9E+04	8.5E+05	7.0E+05	2.1E+07	2.8E+10	1.8E+09	3.6E+09	1.6E+07	3.5E+10	9.3E+08	4.9E+10	1.4E+07
	Incombustible waste I (moderately contaminated part: except for melting treatment)	3.1E+07	5.2E+03	9.1E+06	2.0E+12	2.2E+10	6.4E+09	4.5E+00	1.5E+04	1.3E+03	2.2E+04	1.8E+04	8.2E+05	4.7E+07	4.1E+06	1.5E+07	2.2E+04	1.3E+09	3.5E+07	1.5E+09	5.5E+05
	Incombustible waste I (less contaminated part: except for melting treatment)	1.3E+06	2.1E+02	3.7E+05	8.2E+10	8.9E+08	2.3E+07	1.8E-01	6.2E+02	5.2E+01	9.1E+02	7.5E+02	3.3E+04	1.9E+06	1.7E+05	6.3E+05	9.1E+02	5.3E+07	1.4E+06	6.3E+07	2.2E+04
	Incombustible waste I (hulls can)	1.9E+05	8.0E+03	1.1E+05	2.5E+10	2.3E+10	1.7E+06	2.5E+00	1.1E+04	3.7E+03	6.5E+04	5.4E+04	8.3E+04	7.1E+08	6.2E+07	9.8E+07	4.1E+05	1.9E+08	4.5E+06	5.3E+08	5.7E+04
	Incombustible waste I (special equipment waste, container)	4.0E+05	1.6E+04	2.3E+05	5.1E+10	5.3E+10	4.0E+06	4.1E+00	1.9E+04	6.4E+03	1.1E+05	9.2E+04	1.4E+05	1.2E+09	1.1E+08	1.7E+08	7.1E+05	3.3E+08	7.8E+06	9.2E+08	9.7E+04
	Combustible waste II	1.2E+05	4.6E+03	6.5E+04	1.4E+10	1.5E+10	1.2E+06	6.1E-01	1.1E+04	9.2E+02	1.6E+04	1.3E+04	2.2E+04	1.8E+08	1.5E+07	2.5E+07	1.0E+05	5.0E+07	1.2E+06	1.3E+08	1.5E+04
	Poorly combustible waste II	4.2E+03	1.7E+02	2.4E+03	5.2E+08	7.3E+08	5.4E+04	4.3E-02	1.3E+02	4.0E+01	6.9E+02	5.7E+02	1.4E+03	1.4E+07	1.0E+06	1.8E+06	7.8E+03	3.2E+06	7.5E+04	8.7E+06	9.3E+02
	Incombustible waste II (for melting treatment)	3.6E+05	9.1E+03	1.1E+05	2.3E+10	1.2E+09	6.2E+06	8.8E-02	3.4E+02	7.3E+01	1.9E+03	1.5E+03	1.1E+04	1.2E+07	1.0E+06	1.7E+06	6.9E+03	1.8E+07	4.7E+05	2.6E+07	7.1E+03
	Incombustible waste II (except for melting treatment)	2.9E+03	1.2E+02	1.7E+03	3.7E+08	3.8E+08	3.0E+04	1.5E-02	6.9E+01	2.3E+01	4.1E+02	3.4E+02	5.5E+02	4.5E+06	3.9E+05	6.2E+05	2.6E+03	1.3E+06	3.0E+04	3.4E+06	3.8E+02
	Incombustible waste II (transport container)	4.6E+03	1.9E+02	2.6E+03	5.8E+08	6.1E+08	4.5E+04	5.6E-02	2.5E+02	8.5E+01	1.5E+03	1.2E+03	1.9E+03	1.6E+07	1.4E+06	2.2E+06	9.4E+03	4.4E+06	1.0E+05	1.2E+07	1.3E+03
	Low-level concentrated liquid waste 1	3.3E+01	1.3E+00	1.9E+01	4.2E+06	4.3E+06	3.2E+02	2.6E+01	1.2E+05	4.0E+04	7.0E+05	5.8E+05	8.9E+05	7.6E+09	6.6E+08	1.1E+09	4.4E+06	2.1E+09	4.9E+07	5.7E+09	6.1E+05
	Low-level concentrated liquid waste 2	7.5E+03	4.9E+00	4.4E+03	9.6E+08	2.6E+08	1.1E+04	2.8E-02	1.7E+04	2.9E+02	5.1E+03	4.4E+03	2.7E+04	1.1E+07	9.5E+05	1.5E+06	6.3E+03	1.1E+06	2.7E+04	3.2E+06	3.4E+02
	Low-level concentrated liquid waste 3	4.9E+03	2.0E+02	2.8E+03	6.3E+08	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Solvent waste	7.4E+03	4.9E+00	4.3E+03	9.2E+08	2.0E+08	0.0E+00	7.0E-02	5.3E+04	9.5E+02	1.6E+04	1.4E+04	2.5E+06	3.6E+07	3.2E+06	5.1E+06	2.1E+04	4.9E+03	1.2E+02	1.4E+04	1.4E+00
	Spent carbon	6.9E-01	4.7E-04	4.0E-01	8.6E+04	7.3E+04	3.4E+01	1.7E-03	7.0E+04	1.3E+03	2.2E+04	1.8E+04	4.4E+03	1.5E+05	1.3E+04	2.1E+04	8.7E+01	2.2E+05	5.1E+03	6.1E+05	6.3E+01
	Spent silver absorbent	1.0E+03	9.2E+10	5.9E+02	1.3E+08	1.3E+08	1.0E+04	1.3E-02	1.1E+03	2.0E+01	3.5E+02	2.9E+02	0.0E+00	3.7E+06	3.3E+05	5.0E+05	2.2E+03	1.0E+06	2.4E+04	2.8E+06	3.0E+02
	Scrubber waste liquid	0.0E+00	3.4E-02	6.7E-03	1.5E+03	3.6E+02	0.0E+00	4.0E-08	2.8E-05	9.7E-06	1.7E-04	1.4E-04	8.2E-03	1.3E+01	1.1E+00	1.8E+00	7.4E-03	2.7E+00	6.4E-02	7.5E+00	8.0E-04
	CB	3.8E+02	1.4E+01	7.4E+02	3.7E+07	5.9E+07	6.0E+03	1.3E+04	1.4E+03	1.3E+00	3.0E+01	1.6E+02	6.4E+01	1.0E+06	1.5E+05	2.6E+05	1.4E+03	5.1E+05	1.9E+04	2.5E+06	2.6E+02
	BP	7.0E+02	4.1E+01	2.3E+04	1.6E+08	8.1E+06	6.5E+02	5.5E+05	4.7E+04	3.1E+00	1.1E+01	1.9E+01	1.2E+01	1.2E+05	2.1E+04	3.0E+04	1.5E+02	6.8E+04	1.8E+03	2.1E+05	2.2E+01
Private sector reprocessing, dismantling	Primary waste I (metal) (for melting treatment)	9.8E+06	4.0E+05	5.6E+06	1.2E+12	1.3E+12	9.7E+07	1.1E+01	5.0E+04	1.7E+04	3.0E+05	2.5E+05	3.8E+05	3.3E+09	2.9E+08	4.5E+08	1.9E+06	8.9E+08	2.1E+07	2.5E+09	2.6E+05
	Primary waste I (metal) (except for melting treatment)	5.8E+06	2.4E+05	3.3E+06	7.4E+11	7.7E+11	5.8E+07	6.7E+00	3.0E+04	1.0E+04	1.8E+05	1.5E+05	2.3E+05	1.9E+09	1.7E+08	2.7E+08	1.1E+06	5.3E+08	1.2E+07	1.5E+09	1.5E+05
	Primary waste II (metal) (for melting treatment)	9.8E+05	4.0E+04	5.6E+05	1.2E+11	1.3E+11	9.7E+06	1.1E+00	5.0E+03	1.7E+03	3.0E+04	2.5E+04	3.8E+04	3.3E+08	2.9E+07	4.5E+07	1.9E+05	8.9E+07	2.1E+06	2.5E+08	2.6E+04
	Primary waste II (metal) (except for melting treatment)	5.8E+05	2.4E+04	3.3E+05	7.4E+10	7.7E+10	5.8E+06	6.7E-01	3.0E+03	1.0E+03	1.8E+04	1.5E+04	2.3E+04	1.9E+08	1.7E+07	2.7E+07	1.1E+05	5.3E+07	1.2E+06	1.5E+08	1.5E+04
	Primary waste III (metal) (for melting treatment)	2.7E+03	1.1E+02	1.6E+03	3.4E+08	3.6E+08	2.7E+04	3.3E-02	1.5E+02	5.0E+01	8.7E+02	7.2E+02	1.1E+03	9.5E+06	8.3E+05	1.3E+06	5.5E+03	2.6E+06	6.1E+04	7.1E+06	7.6E+02
	Primary waste III (metal) (except for melting treatment)	1.3E+03	5.3E+01	7.4E+02	1.6E+08	1.7E+08	1.3E+04	1.6E-02	7.0E+01	2.4E+01	4.2E+02	3.5E+02	5.3E+02	4.5E+06	4.0E+05	6.3E+05	2.7E+03	1.2E+06	2.9E+04	3.4E+06	3.6E+02
	Contaminated concrete	8.8E+05	3.7E+04	5.1E+05	1.1E+11	1.2E+11	8.8E+06	1.0E+00	4.5E+03	1.6E+03	2.7E+04	2.2E+04	3.5E+04	2.9E+08	2.6E+07	4.1E+07	1.7E+05	8.0E+07	1.9E+06	2.2E+08	2.4E+04
	Secondary waste I (combustible)	5.5E+04	2.3E+03	3.2E+04	7.1E+09	7.4E+09	5.5E+05	9.1E-01	4.0E+03	1.4E+03	2.4E+04	2.0E+04	3.1E+04	2.6E+08	2.3E+07	3.6E+07	1.5E+05	7.1E+07	1.7E+06	2.0E+08	2.1E+04
	Secondary waste II (combustible)	5.1E+04	2.1E+03	2.9E+04	6.5E+09	6.7E+09	5.1E+05	6.2E-01	2.8E+03	9.5E+02	1.6E+04	1.4E+04	2.1E+04	1.8E+08	1.6E+07	2.5E+07	1.0E+05	4.9E+07	1.1E+06	1.4E+08	1.4E+04
	Secondary waste I (poorly combustible)	5.7E+04	2.4E+03	3.3E+04	7.3E+09	7.5E+09	5.7E+05	4.0E-01	1.8E+03	6.1E+02	1.1E+04	8.8E+03	1.4E+04	1.2E+08	1.0E+07	1.6E+07	6.8E+04	3.1E+07	7.4E+05	8.7E+07	9.2E+03
	Secondary waste II (poorly combustible)	2.1E+03	8.5E+01	1.2E+03	2.6E+08	2.7E+08	2.1E+04	2.5E-02	1.1E+02	3.8E+01	6.7E+02	5.5E+02	8.5E+02	7.3E+06	6.3E+05	1.0E+06	4.3E+03	2.0E+06	4.7E+04	5.5E+06	5.8E+02
	Secondary waste I (incombustible)	9.8E+05	4.0E+04	5.6E+05	1.2E+11	1.3E+11	9.7E+06	1.1E+00	5.0E+03	1.7E+03	3.0E+04	2.5E+04	3.8E+04	3.3E+08	2.9E+07	4.5E+07	1.9E+05	8.9E+07	2.1E+06	2.5E+08	2.6E+04
	Secondary waste II (incombustible)	2.7E+03	1.1E+02	1.6E+03	3.4E+08	3.6E+08	2.7E+04	3.3E-02	1.5E+02	5.0E+01	8.7E+02	7.2E+02	1.1E+03	9.5E+06	8.3E+05	1.3E+06	5.5E+03	2.6E+06	6.1E+04	7.1E+06	7.6E+02
	Systematic decontamination liquid waste I	7.1E+07	2.9E+06	4.1E+07	9.1E+12	9.5E+12	7.1E+08	5.2E+02	2.3E+06	7.8E+05	1.4E+07	1.1E+07	1.7E+07	1.5E+11	1.3E+10	2.1E+10	8.7E+07	4.0E+10	9.5E+08	1.1E+11	1.2E+07
	Systematic decontamination liquid waste II	2.1E+03	8.6E+01	1.2E+03	2.6E+08	2.7E+08	2.1E+04	5.7E-01	2.5E+03	8.7E+02	1.5E+04	1.3E+04	1.9E+04	1.7E+08	1.4E+07	2.3E+07	9.7E+04	4.5E+07	1.1E+06	1.2E+08	1.3E+04
	Systematic decontamination liquid waste III	1.0E+04	4.1E+02	5.8E+03	1.3E+09	1.3E+09	1.0E+05	2.8E-02	1.2E+02	4.2E+01	7.4E+02	6.1E+02	9.4E+02	8.0E+06	7.0E+05	1.1E+06	4.7E+03	2.2E+06	5.1E+04	6.0E+06	6.4E+02
	Partial decontamination liquid waste I	7.1E+07	2.9E+06	4.1E+07	9.1E+12	9.5E+12	7.1E+08	5.2E+02	2.3E+06	7.8E+05	1.4E+07	1.1E+07	1.7E+07	1.5E+11	1.3E+10	2.1E+10	8.7E+07	4.0E+10	9.5E+08	1.1E+11	1.2E+07
	Partial decontamination liquid waste II	2.1E+03	8.6E+01	1.2E+03	2.6E+08	2.7E+08	2.1E+04	5.7E-01	2.5E+03	8.7E+02	1.5E+04	1.3E+04	1.9E+04	1.7E+08	1.4E+07	2.3E+07	9.7E+04	4.5E+07	1.1E+06	1.2E+08	1.3E+04
Private sector MOX dismantling	Primary waste I (metal)	1.3E-02	5.4E-04	0.0E+00	1.7E+03	2.1E+10	1.4E+06	3.7E-01	1.6E+03	5.6E+02	9.8E+03	8.1E+03	6.3E+04	7.7E+08	4.9E+07	9.2E+07	4.3E+05	1.5E+08	3.5E+06	4.1E+08	4.3E+04
	Primary waste II (metal)	1.3E-03	5.4E-05	0.0E+00	1.7E+02	2.1E+09	1.4E+05	3.7E-02	1.6E+02	5.6E+01	9.8E+02	8.1E+02	6.3E+03	7.7E+07	4.9E+06	9.2E+06	4.3E+04	1.5E+07	3.5E+05	4.1E+07	4.3E+03
	Primary waste III (metal)	4.2E-04	1.7E-05	0.0E+00	5.3E+01	6.5E+08	4.4E+04	1.2E-02	5.2E+01	1.8E+01	3.1E+02	2.6E+02	2.0E+03	2.4E+07	1.6E+06	2.9E+06	1.4E+04	4.7E+06	1.1E+05	1.3E+07	1.4E+03
	Secondary waste I (combustible)	2.0E-02	8.1E-04	0.0E+00	2.5E+03	3.1E+10	2.1E+06	5.5E-01	2.4E+03	8.3E+02	1.4E+04	1.2E+04	9.4E+04	1.1E+09	7.3E+07	1.4E+08	6.4E+05	2.2E+08	5.2E+06	6.1E+08	6.4E+04
	Secondary waste II (combustible)	2.0E-03	8.1E-05	0.0E+00	2.5E+02	3.1E+09	2.1E+05	5.5E-02	2.4E+02	8.3E+01	1.4E+03	1.2E+03	9.4E+03	1.1E+08	7.3E+06	1.4E+07	6.4E+04	2.2E+07	5.2E+05	6.1E+07	6.4E+03
	Secondary waste III (combustible)	4.5E-04	1.8E-05	0.0E+00	5.7E+01	7.0E+08	4.7E+04	1.2E-02	5.5E+01	1.9E+01	3.3E+02	2.7E+02	2.1E+03	2.6E+07	1.6E+06	3.1E+06	1.4E+04	5.0E+06	1.2E+05	1.4E+07	1.5E+03
	Secondary waste I (poorly combustible)	1.7E-02	7.1E-04	0.0E+00	2.2E+03	2.7E+10	1.8E+06	4.8E-01	2.1E+03	7.4E+02	1.3E+04	1.1E+04	8.3E+04	1.0E+09	6.4E+07	1.2E+08	5.6E+05	1.9E+08	4.6E+06	5.4E+08	5.7E+04
	Secondary waste II (poorly combustible)	1.7E-03	7.1E-05	0.0E+00	2.2E+02	2.7E+09	1.8E+05	4.8E-02	2.1E+02	7.4E+01	1.3E+03	1.1E+03	8.3E+03	1.0E+08	6.4E+06	1.2E+07	5.6E+04	1.9E+07	4.6E+05	5.4E+07	5.7E+03
	Secondary waste III (poorly combustible)	1.1E-03	4.4E-05	0.0E+00	1.4E+02	1.7E+09	1.1E+05	4.2E-03	1.9E+01	6.4E+00	1.1E+02	9.2E+01	7.2E+02	8.7E+06	5.6E+05	1.0E+06	4.9E+03	1.7E+06	4.0E+04	4.6E+06	4.9E+02
	Secondary waste I (incombustible)	1.3E-02	5.4E-04	0.0E+00	1.7E+03	2.1E+10	1.4E+06	3.7E-01	1.6E+03	5.6E+02	9.7E+03	8.0E+03	6.3E+04	7.6E+08	4.9E+07	9.2E+07	4.3E+05	1.5E+08	3.5E+06	4.1E+08	4.3E+04
	Secondary waste II (incombustible)	1.3E-03	5.4E-05	0.0E+00	1.7E+02	2.1E+09	1.4E+05	3.7E-02	1.6E+02	5.6E+01	9.7E+02	8.0E+02	6.3E+03	7.6E+07	4.9E+06	9.2E+06	4.3E+04	1.5E+07	3.5E+05	4.1E+07	4.3E+03
	Secondary waste III (incombustible)	4.2E-04	1.7E-05	0.0E+00	5.3E+01	6.5E+08	4.4E+04	1.2E-02	5.2E+01	1.8E+01	3.1E+02	2.6E+02	2.0E+03	2.4E+07	1.6E+06	2.9E+06	1.4E+04	4.7E+06	1.1E+05	1.3E+07	1.4E+03

Table 2.3-4 Activity of radioactive materials in each waste package (Bq Mg^{-1}) (returned waste)

	Type of waste package	Total α	Total βγ	H-3	C-14	Cl-36	Co-60	Ni-59	Ni-63	Se-79	Sr-90	Zr-93	Nb-94	Mo-93	Tc-99	Pd-107	Ag-108m
COGEMA	Storage container for solid wastes	9.7E+11	3.6E+14	2.1E+13	2.0E+10	—	1.1E+14	—	3.9E+13	7.9E+07	2.0E+13	1.2E+10	—	—	3.3E+09	—	—
	Bitumen solidified waste	5.2E+11	2.1E+13	1.8E+10	—	—	1.8E+11	—	—	—	1.2E+12	—	—	—	1.8E+08	—	—
BNGS	Cement solidified waste (hulls and ends: PWR)	9.1E+10	9.7E+13	4.4E+12	1.4E+10	6.8E+04	2.5E+13	1.3E+11	1.7E+13	—	1.1E+12	5.5E+09	5.8E+10	—	2.7E+08	—	—
	Cement solidified waste (hulls and ends: BWR)	4.5E+10	4.1E+13	2.8E+12	6.7E+09	4.5E+04	6.1E+12	1.8E+10	2.3E+12	—	7.2E+11	4.3E+09	1.1E+09	—	1.7E+08	—	—
	MEB cladding + barium carbonate	3.2E+08	2.8E+11	2.0E+08	8.8E+10	1.3E+02	1.7E+11	—	—	—	3.0E+09	—	—	—	8.5E+05	—	—
	Magnox cement solidified waste	2.6E+11	6.2E+13	—	—	—	2.3E+12	—	—	—	3.8E+12	—	—	—	—	—	—
	Centrifuge cake cement solidified waste PWR	3.3E+11	3.5E+13	3.8E+09	3.3E+06	3.6E+04	—	—	—	—	8.4E+11	—	—	—	2.1E+08	—	—
	Centrifuge cake cement solidified waste BWR	2.0E+11	3.1E+13	2.4E+09	2.1E+06	2.3E+04	—	—	—	—	5.4E+11	—	—	—	1.3E+08	—	—
	Miscellaneous solid	3.8E+06	1.0E+08	6.3E+06	3.1E+04	—	1.3E+06	—	—	—	—	—	—	—	—	—	—
	Magnox miscellaneous solid	1.1E+07	3.0E+08	—	—	—	—	—	—	—	—	—	—	—	—	—	—

	Type of waste package	Sn-126	I-129	Cs-135	Cs-137	Pu-241	Am-242m	U-233	U-234	U-235	U-236	U-238	Np-237	Pu-238	Pu-239	Pu-240	Pu-242	Am-241	Am-243	Cm-244	Cm-245
COGEMA	Storage container for solid wastes	—	7.6E+06	1.0E+08	2.1E+13	1.4E+13	—	—	—	—	—	—	1.0E+07	6.7E+11	4.3E+10	7.4E+10	4.1E+08	2.5E+10	2.5E+10	1.4E+11	—
	Bitumen solidified waste	—	1.8E+08	—	2.4E+12	—	—	—	—	2.6E+06	—	2.6E+07	—	1.3E+11	1.5E+10	2.0E+10	—	3.4E+11	—	1.6E+10	—
BNGS	Cement solidified waste (hulls and ends: PWR)	—	4.7E+05	3.6E+07	7.7E+12	1.3E+12	—	—	4.6E+07	1.2E+06	5.7E+06	1.0E+07	4.3E+06	3.0E+10	8.4E+09	9.0E+09	—	2.8E+10	1.9E+08	1.4E+10	—
	Cement solidified waste (hulls and ends: BWR)	—	3.0E+05	2.7E+07	5.8E+12	7.1E+11	—	—	3.4E+07	9.9E+05	3.7E+06	1.0E+07	2.2E+06	1.2E+10	6.4E+09	6.8E+09	—	1.6E+10	7.2E+07	3.8E+09	—
	MEB cladding + barium carbonate	—	3.2E+08	1.9E+04	4.3E+09	4.2E+09	—	—	6.2E+04	1.0E+03	1.4E+04	1.7E+04	1.4E+04	1.2E+08	1.8E+07	2.8E+07	—	9.5E+07	7.8E+05	5.9E+07	—
	Magnox cement solidified waste	—	—	—	5.8E+12	6.3E+12	—	—	—	—	—	—	—	3.5E+10	5.0E+10	7.4E+10	—	3.7E+10	—	5.5E+09	—
	Centrifuge cake cement solidified waste PWR	—	3.9E+05	5.3E+06	7.2E+12	7.6E+12	—	—	2.0E+07	2.9E+05	3.9E+06	4.6E+06	3.8E+06	2.1E+11	3.1E+10	4.9E+10	1.6E+08	2.6E+10	2.2E+08	1.7E+10	—
	Centrifuge cake cement solidified waste BWR	—	2.4E+05	3.4E+06	6.8E+12	5.4E+12	—	—	1.4E+07	2.6E+05	2.5E+06	4.5E+06	1.9E+06	9.8E+10	3.0E+10	4.7E+10	1.0E+08	1.5E+10	7.7E+07	4.2E+09	—
	Miscellaneous solid	—	3.1E+04	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Magnox miscellaneous solid	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Table 2.3-5 Activity of radioactive materials in each waste package (Bq Mg^{-1}) (JAEA)

	Type of waste package	Total α	Total βγ	H-3	C-14	Cl-36	Co-60	Ni-59	Ni-63	Se-79	Sr-90	Zr-93	Nb-94	Mo-93	Tc-99	Pd-107	Ag-108m	Sn-126	I-129	Cs-135	Cs-137	Pu-241	Am-242m	U-233	U-234	U-235	U-236	U-238	Np-237	Pu-238	Pu-239	Pu-240	Pu-242	Am-241	Am-243	Cm-244	Cm-245
JAEA reprocessing operation	Combustible waste I	1.0E+12	1.4E+14	1.3E+11	3.7E+06	7.7E+04	6.0E+10	2.4E+06	3.3E+08	1.1E+08	2.0E+13	5.3E+08	2.9E+04	1.2E+05	3.7E+09	2.2E+07	8.4E+05	1.8E+08	2.4E+05	1.2E+08	2.5E+13	2.3E+13	2.7E+09	6.6E+03	5.6E+08	1.0E+07	9.3E+07	1.0E+08	8.8E+07	4.4E+11	9.7E+10	1.2E+11	2.7E+08	2.3E+11	1.8E+09	1.2E+11	7.8E+06
	Combustible waste II	2.2E+08	3.0E+10	2.8E+07	8.0E+02	1.7E+01	1.3E+07	5.1E+02	7.1E+04	2.4E+04	4.3E+09	1.1E+05	6.3E+00	2.5E+01	8.1E+05	4.7E+03	1.8E+02	3.9E+04	5.2E+01	2.5E+04	5.4E+09	4.9E+09	5.8E+05	1.4E+00	1.2E+05	2.2E+03	2.0E+04	2.2E+04	1.9E+04	9.5E+07	2.1E+07	2.5E+07	5.8E+04	4.9E+07	4.0E+05	2.5E+07	1.7E+03
	Combustible waste III	1.3E+07	1.8E+09	1.7E+06	4.9E+01	1.0E+00	7.8E+05	3.1E+01	4.3E+03	1.5E+03	2.6E+08	6.9E+03	3.8E-01	1.5E+00	4.9E+04	2.9E+02	1.1E+01	2.4E+03	3.1E+00	1.5E+03	3.3E+08	2.9E+08	3.5E+04	8.6E-02	7.4E+03	1.3E+02	1.2E+03	1.3E+03	1.1E+03	5.8E+06	1.3E+06	1.5E+06	3.5E+03	3.0E+06	2.4E+04	1.5E+06	1.0E+02
	Poorly combustible waste I	6.3E+11	8.7E+13	8.1E+10	2.3E+06	4.8E+04	3.8E+10	1.5E+06	2.1E+08	7.1E+07	1.3E+13	3.3E+08	1.8E+04	7.4E+04	2.3E+09	1.4E+07	5.3E+05	1.1E+08	1.5E+05	7.3E+07	1.6E+13	1.4E+13	1.7E+09	4.1E+03	3.5E+08	6.4E+06	5.8E+07	6.4E+07	5.5E+07	2.8E+11	6.0E+10	7.3E+10	1.7E+08	1.4E+11	1.2E+09	7.2E+10	4.9E+06
	Poorly combustible waste II	2.2E+08	3.0E+10	2.8E+07	8.0E+02	1.7E+01	1.3E+07	5.1E+02	7.1E+04	2.4E+04	4.3E+09	1.1E+05	6.3E+00	2.5E+01	8.1E+05	4.7E+03	1.8E+02	3.9E+04	5.2E+01	2.5E+04	5.4E+09	4.9E+09	5.8E+05	1.4E+00	1.2E+05	2.2E+03	2.0E+04	2.2E+04	1.9E+04	9.5E+07	2.1E+07	2.5E+07	5.8E+04	4.9E+07	4.0E+05	2.5E+07	1.7E+03
	Poorly combustible waste III	1.3E+07	1.8E+09	1.7E+06	4.9E+01	1.0E+00	7.8E+05	3.1E+01	4.3E+03	1.5E+03	2.6E+08	6.9E+03	3.8E-01	1.5E+00	4.9E+04	2.9E+02	1.1E+01	2.4E+03	3.1E+00	1.5E+03	3.3E+08	2.9E+08	3.5E+04	8.6E-02	7.4E+03	1.3E+02	1.2E+03	1.3E+03	1.1E+03	5.8E+06	1.3E+06	1.5E+06	3.5E+03	3.0E+06	2.4E+04	1.5E+06	1.0E+02
	Incombustible waste I (metal-melting waste)	2.0E+11	4.2E+12	1.4E+09	4.1E+04	8.5E+02	6.6E+08	2.6E+04	3.6E+06	1.3E+06	2.2E+11	5.8E+06	3.2E+02	1.3E+03	4.2E+07	2.4E+05	9.3E+03	2.0E+06	2.6E+03	1.3E+06	2.8E+11	2.9E+12	3.0E+07	8.5E+01	8.5E+06	2.1E+05	1.0E+06	1.3E+06	2.3E+07	8.1E+10	2.8E+10	3.1E+10	6.5E+07	6.2E+10	2.0E+07	1.3E+09	8.6E+04
	Incombustible waste II (metal-melting waste)	2.7E+08	3.8E+10	3.5E+07	1.0E+03	2.1E+01	1.6E+07	6.4E+02	8.9E+04	3.1E+04	5.4E+09	1.4E+05	7.9E+00	3.2E+01	1.0E+06	5.9E+03	2.3E+02	4.9E+04	6.5E+01	3.2E+04	6.9E+09	6.1E+09	7.3E+05	1.8E+00	1.5E+05	2.8E+03	2.5E+04	2.8E+04	2.4E+04	1.2E+08	2.6E+07	3.2E+07	7.4E+04	6.2E+07	5.0E+05	3.1E+07	2.1E+03
	Incombustible waste III (metal-melting waste)	4.4E+06	6.0E+08	5.6E+05	1.6E+01	3.4E-01	2.6E+05	1.0E+01	1.4E+03	4.9E+02	8.7E+07	2.3E+03	1.3E-01	5.2E-01	1.6E+04	9.5E+01	3.7E+00	7.9E+02	1.0E+00	5.1E+02	1.1E+08	9.8E+07	1.2E+04	2.9E-02	2.5E+03	4.5E+01	4.1E+02	4.4E+02	3.8E+02	1.9E+06	4.2E+05	5.1E+05	1.2E+03	9.9E+05	8.0E+03	5.0E+05	3.4E+01
	Incombustible waste I (non-metal-melting waste)	5.9E+11	9.9E+12	1.7E+09	5.0E+04	1.0E+03	8.1E+08	3.2E+04	4.4E+06	1.5E+06	2.7E+11	7.1E+06	3.9E+02	1.6E+03	5.3E+07	3.0E+05	1.1E+04	2.4E+06	3.2E+03	1.6E+06	3.4E+11	8.4E+12	3.6E+07	1.3E+02	1.5E+07	4.3E+05	1.3E+06	1.9E+06	6.9E+07	2.4E+11	8.2E+10	9.0E+10	1.9E+08	1.8E+11	2.5E+07	1.6E+09	1.1E+05
	Incombustible waste II (non-metal-melting waste)	2.7E+08	3.7E+10	3.5E+07	1.0E+03	2.1E+01	1.6E+07	6.3E+02	8.8E+04	3.0E+04	5.3E+09	1.4E+05	7.8E+00	3.2E+01	1.0E+06	5.8E+03	2.3E+02	4.8E+04	6.4E+01	3.1E+04	6.7E+09	6.0E+09	7.2E+05	1.8E+00	1.5E+05	2.8E+03	2.5E+04	2.7E+04	2.3E+04	1.2E+08	2.6E+07	3.1E+07	7.2E+04	6.1E+07	4.9E+05	3.1E+07	2.1E+03
	Incombustible waste III (non-metal-melting waste)	6.9E+06	9.4E+08	8.8E+05	2.5E+01	5.2E-01	4.1E+05	1.6E+01	2.2E+03	7.7E+02	1.4E+08	3.6E+03	2.0E-01	8.0E-01	2.5E+04	1.5E+02	5.7E+00	1.2E+03	1.6E+00	7.9E+02	1.7E+08	1.5E+08	1.8E+04	4.5E-02	3.8E+03	7.0E+01	6.3E+02	6.9E+02	5.9E+02	3.0E+06	6.5E+05	8.0E+05	1.8E+03	1.5E+06	1.3E+04	7.8E+05	5.3E+01
	Incombustible waste I (non-metal)	1.2E+11	2.1E+12	5.2E+08	1.5E+04	3.1E+02	2.4E+08	9.5E+03	1.3E+06	4.6E+05	8.0E+10	2.1E+06	1.2E+02	4.8E+02	1.5E+07	8.8E+04	3.4E+03	7.3E+05	9.7E+02	4.7E+05	1.0E+11	1.7E+12	1.1E+07	3.4E+01	3.6E+06	9.8E+04	3.9E+05	5.2E+05	1.3E+07	4.6E+10	1.6E+10	1.8E+10	3.8E+07	3.6E+10	7.4E+06	4.6E+08	3.1E+04
	Incombustible waste II (non-metal)	1.7E+08	2.2E+10	2.1E+07	6.1E+02	1.2E+01	9.7E+06	3.8E+02	5.3E+04	1.8E+04	3.2E+09	8.5E+04	4.7E+00	1.9E+01	6.1E+05	3.5E+03	1.4E+02	2.9E+04	3.9E+01	1.9E+04	4.1E+09	3.7E+09	4.4E+05	1.1E+00	9.1E+04	1.7E+03	1.5E+04	1.6E+04	1.4E+04	7.3E+07	1.6E+07	1.9E+07	4.5E+04	3.8E+07	3.0E+05	1.9E+07	1.3E+03
	Incombustible waste III (non-metal)	3.6E+06	5.0E+08	4.7E+05	1.3E+01	2.8E-01	2.2E+05	8.5E+00	1.2E+03	4.1E+02	7.2E+07	1.9E+03	1.0E-01	4.3E-01	1.3E+04	7.9E+01	3.0E+00	6.5E+02	8.7E-01	4.2E+02	9.1E+07	8.1E+07	9.7E+03	2.4E-02	2.0E+03	3.7E+01	3.4E+02	3.7E+02	3.2E+02	1.6E+06	3.5E+05	4.2E+05	9.8E+02	8.2E+05	6.7E+03	4.2E+05	2.8E+01
	Clarification filter	1.8E+13	2.4E+15	2.3E+12	6.5E+07	1.3E+06	1.1E+12	4.2E+07	5.7E+09	2.0E+09	3.5E+14	9.2E+09	5.1E+05	2.1E+06	6.6E+10	3.8E+08	1.5E+07	3.2E+09	4.2E+06	2.0E+09	4.4E+14	4.0E+14	4.7E+10	1.2E+05	9.9E+09	1.8E+08	1.6E+09	1.8E+09	1.5E+09	7.8E+12	1.7E+12	2.1E+12	4.8E+09	4.0E+12	3.2E+10	2.0E+12	1.4E+08
	Incombustible waste in hulls can (metal-melting waste)	1.7E+08	2.4E+10	2.2E+07	6.4E+02	1.3E+01	1.0E+07	4.1E+02	5.6E+04	1.9E+04	3.4E+09	9.0E+04	5.0E+00	2.0E+01	6.4E+05	3.7E+03	1.4E+02	3.1E+04	4.1E+01	2.0E+04	4.3E+09	3.9E+09	4.6E+05	1.1E+00	9.7E+04	1.8E+03	1.6E+04	1.7E+04	1.5E+04	7.6E+07	1.7E+07	2.0E+07	4.7E+04	3.9E+07	3.2E+05	2.0E+07	1.3E+03
	Incombustible waste in hulls can (non-metal-melting waste)	1.8E+08	2.4E+10	2.3E+07	6.5E+02	1.3E+01	1.1E+07	4.2E+02	5.7E+04	2.0E+04	3.5E+09	9.2E+04	5.1E+00	2.1E+01	6.6E+05	3.8E+03	1.5E+02	3.2E+04	4.2E+01	2.0E+04	4.4E+09	3.9E+09	4.7E+05	1.2E+00	9.9E+04	1.8E+03	1.6E+04	1.8E+04	1.5E+04	7.8E+07	1.7E+07	2.1E+07	4.8E+04	4.0E+07	3.2E+05	2.0E+07	1.4E+03
	Iodine filter (spent silver absorbent)	0.0E+00	3.6E+08	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.6E+08	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Hulls and ends	5.4E+11	3.1E+14	1.0E+11	1.9E+10	3.2E+08	6.7E+13	2.5E+11	3.4E+13	6.3E+07	1.1E+13	1.7E+10	7.7E+10	1.4E+09	2.4E+09	1.2E+07	3.3E+07	9.7E+07	4.3E+06	6.2E+07	1.4E+13	1.2E+13	1.4E+09	1.8E+05	3.0E+08	5.5E+06	5.0E+07	5.4E+07	4.7E+07	2.4E+11	5.2E+10	6.3E+10	1.5E+08	1.2E+11	9.9E+08	6.2E+10	4.2E+06
	Bitumen solidified waste (MA series)	4.0E+09	5.0E+11	6.5E+09	9.3E+08	3.8E+07	2.7E+08	1.1E+04	1.5E+06	2.4E+05	1.2E+11	1.1E+06	6.1E+01	2.5E+02	4.1E+06	2.4E+04	9.2E+02	3.8E+05	8.7E+07	2.5E+05	5.3E+10	1.0E+11	2.9E+06	2.9E+01	2.5E+06	4.6E+04	4.2E+05	4.5E+05	3.9E+05	2.0E+09	4.3E+08	5.2E+08	1.2E+06	2.4E+08	2.0E+06	6.3E+08	2.9E+05
	Bitumen solidified waste (LA series)	2.4E+08	3.5E+10	1.5E+10	6.1E+07	1.6E+07	1.9E+06	7.4E+01	1.0E+04	3.3E+03	5.3E+09	1.5E+04	8.4E-01	3.4E+00	1.0E+05	5.8E+02	2.3E+01	5.2E+03	3.9E+07	3.4E+03	7.3E+08	7.1E+09	1.9E+05	2.1E+00	1.8E+05	3.2E+03	2.9E+04	3.2E+04	2.7E+04	1.4E+08	3.0E+07	3.7E+07	8.5E+04	1.6E+07	1.3E+05	8.9E+06	1.3E+04
	Slurry solidified waste (MA series acid)	1.5E+10	1.8E+12	2.4E+10	3.4E+07	1.4E+06	1.0E+09	3.9E+04	5.5E+06	8.8E+05	4.5E+11	4.1E+06	2.2E+02	9.1E+02	1.5E+07	8.7E+04	3.4E+03	1.4E+06	6.7E+06	9.0E+05	1.9E+11	3.7E+11	1.0E+07	1.1E+02	9.2E+06	1.7E+05	1.5E+06	1.7E+06	1.4E+06	7.2E+09	1.6E+09	1.9E+09	4.4E+06	8.9E+08	7.2E+06	2.3E+09	1.0E+06
	Slurry solidified waste (MA series alkaline)	1.6E+09	1.6E+12	2.6E+10	3.7E+09	1.5E+08	1.1E+09	4.3E+04	5.9E+06	9.6E+05	4.9E+11	4.4E+06	2.4E+02	1.0E+03	1.6E+07	9.5E+04	3.7E+03	1.5E+06	7.3E+08	9.8E+05	2.1E+11	4.0E+10	1.1E+06	1.2E+01	1.0E+06	1.8E+04	1.7E+05	1.8E+05	1.6E+05	7.9E+08	1.7E+08	2.1E+08	4.8E+05	9.7E+07	7.8E+05	2.5E+08	1.1E+05
	Slurry solidified waste (LA series alkaline)	1.0E+09	1.5E+11	6.4E+10	2.6E+08	6.6E+07	7.9E+06	3.1E+02	4.3E+04	1.4E+04	2.2E+10	6.4E+04	3.5E+00	1.4E+01	4.2E+05	2.5E+03	9.5E+01	2.2E+04	3.4E+08	1.4E+04	3.1E+09	3.0E+10	8.1E+05	8.7E+00	7.5E+05	1.4E+04	1.2E+05	1.3E+05	1.2E+05	5.9E+08	1.3E+08	1.5E+08	3.6E+05	6.8E+07	5.5E+05	3.8E+07	5.6E+04
	$NaNO_3$ solidified waste (MA series acid)	1.8E+06	3.2E+09	2.9E+09	4.2E+06	1.7E+02	1.1E+06	4.3E+01	5.9E+03	1.1E+02	5.6E+07	5.0E+02	2.8E-02	1.1E-01	1.8E+03	1.1E+01	4.1E-01	1.7E+02	8.3E+03	1.1E+02	2.4E+07	4.5E+07	1.3E+03	1.3E-02	1.1E+03	2.1E+01	1.9E+02	2.0E+02	1.8E+02	8.9E+05	1.9E+05	2.4E+05	5.5E+02	1.1E+05	8.8E+02	2.9E+05	1.3E+02
	$NaNO_3$ solidified waste (MA series alkaline)	1.9E+05	3.7E+09	3.0E+09	4.3E+08	1.8E+04	1.1E+06	4.4E+01	6.1E+03	1.1E+02	5.8E+07	5.2E+02	2.9E-02	1.2E-01	1.9E+03	1.1E+01	4.3E-01	1.8E+02	8.6E+05	1.1E+02	2.5E+07	4.7E+06	1.3E+02	1.4E-03	1.2E+02	2.1E+00	1.9E+01	2.1E+01	1.8E+01	9.2E+04	2.0E+04	2.4E+04	5.6E+01	1.1E+04	9.2E+01	3.0E+04	1.3E+01
	$NaNO_3$ solidified waste (LA series alkaline)	1.3E+05	8.2E+09	8.2E+09	3.3E+07	8.5E+03	8.8E+03	3.5E-01	4.8E+01	1.8E+00	2.9E+06	8.2E+00	4.5E-04	1.8E-03	5.4E+01	3.1E-01	1.2E-02	2.8E+00	4.4E+05	1.8E+00	3.9E+05	3.8E+06	1.0E+02	1.1E-03	9.5E+01	1.7E+00	1.6E+01	1.7E+01	1.5E+01	7.5E+04	1.6E+04	2.0E+04	4.6E+01	8.7E+03	7.1E+01	4.8E+03	7.2E+00
	Plastic solidified waste	1.5E+06	4.3E+08	0.0E+00	0.0E+00	6.4E+05	8.8E+04	1.8E-02	2.5E+00	8.6E-01	1.5E+05	4.0E+00	2.2E-04	8.9E-04	2.8E+01	1.6E-01	6.4E-03	1.4E+00	2.0E+06	8.8E-01	1.9E+05	3.4E+07	4.0E+03	9.8E-03	8.4E+02	1.5E+01	1.4E+02	1.5E+02	1.3E+02	6.6E+05	1.4E+05	1.7E+05	4.0E+02	3.4E+05	2.8E+03	1.7E+05	1.2E+01
	Chemical sludge	1.1E+07	1.5E+09	1.4E+06	4.0E+01	8.3E-01	6.5E+05	2.6E+01	3.5E+03	1.2E+03	2.2E+08	5.7E+03	3.1E-01	1.3E+00	4.0E+04	2.4E+02	9.1E+00	2.0E+03	2.6E+00	1.3E+03	2.7E+08	2.4E+08	2.9E+04	7.1E-02	6.1E+03	1.1E+02	1.0E+03	1.1E+03	9.4E+02	4.8E+06	1.0E+06	1.3E+06	2.9E+03	2.5E+06	2.0E+04	1.2E+06	8.4E+01
	Spent sand (pool water filtration)	1.6E+08	2.2E+10	2.0E+07	5.8E+02	1.2E+01	9.4E+06	3.7E+02	5.1E+04	1.8E+04	3.1E+09	8.2E+04	4.5E+00	1.8E+01	5.9E+05	3.4E+03	1.3E+02	2.8E+04	3.8E+01	1.8E+04	3.9E+09	3.5E+09	4.2E+05	1.0E+00	8.8E+04	1.6E+03	1.5E+04	1.6E+04	1.4E+04	6.9E+07	1.5E+07	1.8E+07	4.2E+04	3.6E+07	2.9E+05	1.8E+07	1.2E+03
	Water in hulls can	1.4E+12	2.0E+14	1.8E+11	5.3E+06	1.1E+05	8.5E+10	3.3E+06	4.6E+08	1.6E+08	2.8E+13	7.4E+08	4.1E+04	1.7E+05	5.3E+09	3.1E+07	1.2E+06	2.6E+08	3.4E+05	1.6E+08	3.6E+13	3.2E+13	3.8E+09	9.3E+03	8.0E+08	1.5E+07	1.3E+08	1.4E+08	1.2E+08	6.2E+11	1.4E+11	1.7E+11	3.8E+08	3.2E+11	2.6E+09	1.6E+11	1.1E+07
	Hulls can (empty container)	1.7E+08	2.4E+10	2.2E+07	6.4E+02	1.3E+01	1.0E+07	4.1E+02	5.6E+04	1.9E+04	3.4E+09	9.0E+04	5.0E+00	2.0E+01	6.4E+05	3.7E+03	1.4E+02	3.1E+04	4.1E+01	2.0E+04	4.3E+09	3.9E+09	4.6E+05	1.1E+00	9.7E+04	1.8E+03	1.6E+04	1.7E+04	1.5E+04	7.6E+07	1.7E+07	2.0E+07	4.7E+04	3.9E+07	3.2E+05	2.0E+07	1.3E+03
	ST spent silica gel	1.2E+04	9.7E+08	0.0E+00	0.0E+00	3.0E-02	7.0E+02	2.7E-02	3.8E+00	1.3E+00	2.3E+05	6.1E+00	3.4E-04	1.4E-03	4.3E+01	2.5E-01	9.8E-03	2.1E+00	2.1E+08	1.4E+00	2.9E+05	2.6E+05	3.1E+01	7.6E-05	6.5E+00	1.2E-01	1.1E+00	1.2E+00	1.0E+00	5.1E+03	1.1E+03	1.4E+03	3.1E+00	2.6E+03	2.1E+01	1.3E+03	9.1E-02
	LWTF spent silica gel	6.6E+05	9.0E+07	8.4E+04	2.4E+00	5.0E-02	3.9E+04	1.5E+00	2.1E+02	7.4E+01	1.3E+07	3.4E+02	1.9E-02	7.7E-02	2.4E+03	1.4E+01	5.5E-01	1.2E+02	1.6E-01	7.6E+01	1.6E+07	1.5E+07	1.8E+03	4.3E-03	3.7E+02	6.7E+00	6.1E+01	6.6E+01	5.7E+01	2.9E+05	6.3E+04	7.6E+04	1.8E+02	1.5E+05	1.2E+03	7.5E+04	5.1E+00
	Sr/Cs absorbent	3.5E+05	1.0E+11	5.7E+09	8.1E+08	3.3E+06	9.2E+06	3.6E+02	5.0E+04	8.7E+04	2.3E+10	4.0E+05	2.2E+01	9.1E+01	1.5E+06	8.7E+03	3.3E+02	1.4E+05	1.6E+06	9.0E+04	1.9E+10	8.8E+06	2.5E+02	2.6E-03	2.2E+02	4.0E+00	3.6E+01	4.0E+01	3.4E+01	1.7E+05	3.7E+04	4.6E+04	1.1E+02	2.1E+04	1.7E+02	5.5E+04	2.5E+01
	Off-gas drying powder	1.2E+06	1.7E+08	1.6E+05	4.5E+00	9.4E-02	7.3E+04	2.9E+00	4.0E+02	1.4E+02	2.4E+07	6.4E+02	3.5E-02	1.4E-01	4.6E+03	2.7E+01	1.0E+00	2.2E+02	2.9E-01	1.4E+02	3.1E+07	2.7E+07	3.3E+03	8.0E-03	6.9E+02	1.3E+01	1.1E+02	1.2E+02	1.1E+02	5.4E+05	1.2E+05	1.4E+05	3.3E+02	2.8E+05	2.2E+03	1.4E+05	9.5E+00
JAEA MOX operation	Combustible waste I	1.3E+12	1.8E+13	0.0E+00	0.0E+00	0.0E+00	2.3E+06	9.0E+01	1.2E+04	4.3E+03	2.3E+07	5.0E+02	2.8E-02	4.5E+00	4.6E+06	8.3E+02	3.2E+01	6.9E+03	0.0E+00	2.7E+01	5.8E+06	1.8E+13	1.3E+02	9.6E+02	1.8E+08	7.6E+06	1.4E+06	1.5E+07	1.5E+08	5.1E+11	1.8E+11	2.0E+11	4.2E+08	4.0E+11	8.9E+01	5.6E+03	3.8E-01
	Poorly combustible waste I	1.4E+11	1.9E+12	0.0E+00	0.0E+00	0.0E+00	2.4E+05	9.5E+00	1.3E+03	4.6E+02	2.4E+06	5.3E+01	2.9E-03	4.8E-01	4.8E+05	8.8E+01	3.4E+00	7.3E+02	0.0E+00	2.8E+00	6.1E+05	1.9E+12	1.4E+01	1.0E+02	1.9E+07	8.1E+05	1.5E+05	1.6E+06	1.6E+07	5.4E+10	1.9E+10	2.1E+10	4.4E+07	4.2E+10	9.5E+00	5.9E+02	4.0E-02
	Incombustible waste I (metal-melting waste)	8.6E+11	1.2E+13	0.0E+00	0.0E+00	0.0E+00	1.5E+06	6.1E+01	8.4E+03	2.9E+03	1.5E+07	3.4E+02	1.9E-02	3.0E+00	3.1E+06	5.6E+02	2.2E+01	4.6E+03	0.0E+00	1.8E+01	3.9E+06	1.2E+13	8.8E+01	6.4E+02	1.2E+08	5.1E+06	9.6E+05	9.9E+06	1.0E+08	3.4E+11	1.2E+11	1.3E+11	2.8E+08	2.7E+11	6.0E+01	3.8E+03	2.5E-01
	Incombustible waste II (metal-melting waste)	3.9E+08	5.5E+09	0.0E+00	0.0E+00	0.0E+00	7.0E+02	2.8E-02	3.8E+00	1.3E+00	7.0E+03	1.5E-01	8.5E-06	1.4E-03	1.4E+03	2.5E-01	9.8E-03	2.1E+00	0.0E+00	8.1E-03	1.8E+03	5.5E+09	4.0E-02	2.9E-01	5.5E+04	2.3E+03	4.4E+02	4.5E+03	4.6E+04	1.6E+08	5.5E+07	6.0E+07	1.3E+05	1.2E+08	2.7E-02	1.7E+00	1.2E-04
	Incombustible waste I (metal ingot)	1.5E+09	2.2E+10	0.0E+00	0.0E+00	0.0E+00	2.7E+03	1.1E-01	1.5E+01	5.2E+00	2.7E+04	6.0E-01	3.3E-05	5.4E-03	5.5E+03	1.0E+00	3.9E-02	8.3E+00	0.0E+00	3.2E-02	6.9E+03	2.2E+10	1.6E-01	1.1E+00	2.2E+05	9.2E+03	1.7E+03	1.8E+04	1.8E+05	6.1E+08	2.2E+08	2.4E+08	5.0E+05	4.8E+08	1.1E-01	6.7E+00	4.6E-04
	Incombustible waste II (metal ingot)	2.7E+08	3.7E+09	0.0E+00	0.0E+00	0.0E+00	4.7E+02	1.9E-02	2.6E+00	9.0E-01	4.7E+03	1.0E-01	5.7E-06	9.3E-04	9.5E+02	1.7E-01	6.7E-03	1.4E+00	0.0E+00	5.5E-03	1.2E+03	3.7E+09	2.7E-02	2.0E-01	3.7E+04	1.6E+03	3.0E+02	3.1E+03	3.1E+04	1.1E+08	3.7E+07	4.1E+07	8.7E+04	8.2E+07	1.9E-02	1.2E+00	7.9E-05
	Incombustible waste I (non-metal-melting waste)	4.1E+12	5.7E+13	0.0E+00	0.0E+00	0.0E+00	7.3E+06	2.9E+02	4.0E+04	1.4E+04	7.2E+07	1.6E+03	8.8E-02	1.4E+01	1.5E+07	2.6E+03	1.0E+02	2.2E+04	0.0E+00	8.5E+01	1.8E+07	5.7E+13	4.2E+02	3.0E+03	5.7E+08	2.4E+07	4.6E+06	4.7E+07	4.8E+08	1.6E+12	5.7E+11	6.2E+11	1.3E+09	1.3E+12	2.8E+02	1.8E+04	1.2E+00
	Incombustible waste I (non-metal)	5.1E+11	7.1E+12	0.0E+00	0.0E+00	0.0E+00	9.0E+05	3.6E+01	4.9E+03	1.7E+03	9.0E+06	2.0E+02	1.1E-02	1.8E+00	1.8E+06	3.3E+02	1.3E+01	2.7E+03	0.0E+00	1.1E+01	2.3E+06	7.1E+12	5.2E+01	3.8E+02	7.1E+07	3.0E+06	5.7E+05	5.9E+06	5.9E+07	2.0E+11	7.1E+10	7.8E+10	1.7E+08	1.6E+11	3.5E+01	2.2E+03	1.5E-01
	Incombustible waste II (non-metal)	2.6E+08	3.7E+09	0.0E+00	0.0E+00	0.0E+00	4.7E+02	1.8E-02	2.5E+00	8.8E-01	4.6E+03	1.0E-01	5.6E-06	9.2E-04	9.3E+02	1.7E-01	6.5E-03	1.4E+00	0.0E+00	5.4E-03	1.2E+03	3.7E+09	2.7E-02	1.9E-01	3.7E+04	1.6E+03	2.9E+02	3.0E+03	3.0E+04	1.0E+08	3.7E+07	4.0E+07	8.5E+04	8.1E+07	1.8E-02	1.1E+00	7.7E-05
JAEA reprocessing, dismantling	Primary incombustible waste I (metal)	1.8E+11	3.2E+12	7.3E+08	2.1E+04	4.4E+02	3.4E+08	1.3E+04	1.9E+06	6.4E+05	1.1E+11	3.0E+06	1.6E+02	6.7E+02	2.2E+07	1.2E+05	4.8E+03	1.0E+06	1.4E+03	6.6E+05	1.4E+11	2.5E+12	1.5E+07	4.8E+01	5.3E+06	1.5E+05	5.4E+05	7.4E+05	2.1E+07	7.1E+10	2.5E+10	2.7E+10	5.8E+07	5.4E+10	1.0E+07	6.5E+08	4.4E+04
	Primary incombustible waste II (metal)	3.0E+08	3.9E+10	3.7E+07	1.1E+03	2.2E+01	1.7E+07	6.7E+02	9.3E+04	3.2E+04	5.7E+09	1.5E+05	8.2E+00	3.4E+01	1.1E+06	6.2E+03	2.4E+02	5.1E+04	6.8E+01	3.3E+04	7.2E+09	6.6E+09	7.6E+05	1.9E+00	1.6E+05	2.9E+03	2.6E+04	2.9E+04	2.6E+04	1.3E+08	2.9E+07	3.5E+07	8.1E+04	6.9E+07	5.2E+05	3.3E+07	2.2E+03
	Primary incombustible waste III (metal)	2.2E+06	3.1E+08	2.9E+05	8.2E+00	1.7E-01	1.3E+05	5.2E+00	7.2E+02	2.5E+02	4.4E+07	1.2E+03	6.4E-02	2.6E-01	8.3E+03	4.8E+01	1.9E+00	4.0E+02	5.3E-01	2.6E+02	5.6E+07	5.0E+07	5.9E+03	1.5E-02	1.2E+03	2.3E+01	2.1E+02	2.2E+02	1.9E+02	9.8E+05	2.1E+05	2.6E+05	6.0E+02	5.0E+05	4.1E+03	2.5E+05	1.7E+01
	Primary incombustible waste I (concrete)	1.1E+10	1.5E+12	1.4E+09	4.1E+04	8.5E+02	6.7E+08	2.6E+04	3.6E+06	1.3E+06	2.2E+11	5.8E+06	3.2E+02	1.3E+03	4.1E+07	2.4E+05	9.3E+03	2.0E+06	2.7E+03	1.3E+06	2.8E+11	2.5E+11	3.0E+07	7.3E+01	6.3E+06	1.1E+05	1.0E+06	1.1E+06	9.7E+05	4.9E+09	1.1E+09	1.3E+09	3.0E+06	2.5E+09	2.0E+07	1.3E+09	8.7E+04
	Primary incombustible waste II (concrete)	2.0E+08	2.7E+10	2.5E+07	7.3E+02	1.5E+01	1.2E+07	4.6E+02	6.4E+04	2.2E+04	3.9E+09	1.0E+05	5.7E+00	2.3E+01	7.3E+05	4.3E+03	1.6E+02	3.5E+04	4.7E+01	2.3E+04	4.9E+09	4.4E+09	5.3E+05	1.3E+00	1.1E+05	2.0E+03	1.8E+04	2.0E+04	1.7E+04	8.7E+07	1.9E+07	2.3E+07	5.3E+04	4.5E+07	3.6E+05	2.3E+07	1.5E+03
	Primary incombustible waste III (concrete)	1.5E+06	2.0E+08	1.9E+05	5.5E+00	1.1E-01	8.8E+04	3.5E+00	4.8E+02	1.7E+02	2.9E+07	7.7E+02	4.3E-02	1.7E-01	5.5E+03	3.2E+01	1.2E+00	2.7E+02	3.5E-01	1.7E+02	3.7E+07	3.3E+07	4.0E+03	9.7E-03	8.3E+02	1.5E+01	1.4E+02	1.5E+02	1.3E+02	6.5E+05	1.4E+05	1.7E+05	4.0E+02	3.4E+05	2.7E+03	1.7E+05	1.2E+01
	Secondary decontamination waste liquid slurry solidified waste (MA series)	1.3E+10	1.7E+12	1.6E+09	4.7E+04	9.7E+02	7.5E+08	3.0E+04	4.1E+06	1.4E+06	2.5E+11	6.6E+06	3.6E+02	1.5E+03	4.7E+07	2.7E+05	1.1E+04	2.3E+06	3.0E+03	1.5E+06	3.2E+11	2.8E+11	3.4E+07	8.3E+01	7.1E+06	1.3E+05	1.2E+06	1.3E+06	1.1E+06	5.6E+09	1.2E+09	1.5E+09	3.4E+06	2.9E+09	2.3E+07	1.4E+09	9.8E+04
	Secondary decontamination waste liquid slurry solidified waste (LA series)	1.1E+09	1.5E+11	1.4E+08	4.0E+03	8.2E+01	6.4E+07	2.5E+03	3.5E+05	1.2E+05	2.1E+10	5.6E+05	3.1E+01	1.3E+02	4.0E+06	2.3E+04	9.0E+02	1.9E+05	2.6E+02	1.2E+05	2.7E+10	2.4E+10	2.9E+06	7.0E+00	6.0E+05	1.1E+04	9.9E+04	1.1E+05	9.3E+04	4.7E+08	1.0E+08	1.2E+08	2.9E+05	2.4E+08	2.0E+06	1.2E+08	8.4E+03
	Secondary decontamination waste liquid $NaNO_3$ solidified waste (MA series)	1.5E+06	4.7E+08	1.9E+08	5.6E+03	1.1E+00	7.9E+05	3.1E+01	4.3E+03	1.7E+02	3.0E+07	7.9E+02	4.3E-02	1.8E-01	5.6E+03	3.3E+01	1.3E+00	2.7E+02	3.6E+00	1.7E+02	3.8E+07	3.4E+07	4.0E+03	9.8E-03	8.4E+02	1.5E+01	1.4E+02	1.5E+02	1.3E+02	6.6E+05	1.4E+05	1.7E+05	4.1E+02	3.4E+05	2.8E+03	1.7E+05	1.2E+01
	Secondary decontamination waste liquid $NaNO_3$ solidified waste (LA series)	1.4E+05	4.3E+07	1.8E+07	5.1E+02	1.0E-01	7.2E+04	2.8E+00	3.9E+02	1.5E+01	2.7E+06	7.2E+01	4.0E-03	1.6E-02	5.1E+02	3.0E+00	1.1E-01	2.5E+01	3.3E-01	1.6E+01	3.4E+06	3.1E+06	3.7E+02	9.0E-04	7.7E+01	1.4E+00	1.3E+01	1.4E+01	1.2E+01	6.0E+04	1.3E+04	1.6E+04	3.7E+01	3.1E+04	2.5E+02	1.6E+04	1.1E+00
	Secondary combustible waste I	1.0E+12	1.4E+14	1.3E+11	3.7E+06	7.7E+04	6.0E+10	2.4E+06	3.3E+08	1.1E+08	2.0E+13	5.3E+08	2.9E+04	1.2E+05	3.7E+09	2.2E+07	8.4E+05	1.8E+08	2.4E+05	1.2E+08	2.5E+13	2.3E+13	2.7E+09	6.6E+03	5.6E+08	1.0E+07	9.3E+07	1.0E+08	8.8E+07	4.4E+11	9.7E+10	1.2E+11	2.7E+08	2.3E+11	1.8E+09	1.2E+11	7.8E+06
	Secondary combustible waste II	2.2E+08	3.0E+10	2.8E+07	8.0E+02	1.7E+01	1.3E+07	5.1E+02	7.1E+04	2.4E+04	4.3E+09	1.1E+05	6.3E+00	2.5E+01	8.1E+05	4.7E+03	1.8E+02	3.9E+04	5.2E+01	2.5E+04	5.4E+09	4.9E+09	5.8E+05	1.4E+00	1.2E+05	2.2E+03	2.0E+04	2.2E+04	1.9E+04	9.5E+07	2.1E+07	2.5E+07	5.8E+04	4.9E+07	4.0E+05	2.5E+07	1.7E+03
	Secondary combustible waste III	1.3E+07	1.8E+09	1.7E+06	4.9E+01	1.0E+00	7.8E+05	3.1E+01	4.3E+03	1.5E+03	2.6E+08	6.9E+03	3.8E-01	1.5E+00	4.9E+04	2.9E+02	1.1E+01	2.4E+03	3.1E+00	1.5E+03	3.3E+08	2.9E+08	3.5E+04	8.6E-02	7.4E+03	1.3E+02	1.2E+03	1.3E+03	1.1E+03	5.8E+06	1.3E+06	1.5E+06	3.5E+03	3.0E+06	2.4E+04	1.5E+06	1.0E+02
	Secondary poorly combustible waste I	3.4E+11	4.7E+13	4.4E+10	1.3E+06	2.6E+04	2.0E+10	8.0E+05	1.1E+08	3.8E+07	6.7E+12	1.8E+08	9.8E+03	4.0E+04	1.3E+09	7.4E+06	2.8E+05	6.1E+07	8.1E+04	3.9E+07	8.5E+12	7.6E+12	9.1E+08	2.2E+03	1.9E+08	3.5E+06	3.1E+07	3.4E+07	2.9E+07	1.5E+11	3.2E+10	3.9E+10	9.1E+07	7.7E+10	6.2E+08	3.9E+10	2.6E+06
	Secondary poorly combustible waste II	2.2E+08	3.0E+10	2.8E+07	8.0E+02	1.7E+01	1.3E+07	5.1E+02	7.1E+04	2.4E+04	4.3E+09	1.1E+05	6.3E+00	2.5E+01	8.1E+05	4.7E+03	1.8E+02	3.9E+04	5.2E+01	2.5E+04	5.4E+09	4.9E+09	5.8E+05	1.4E+00	1.2E+05	2.2E+03	2.0E+04	2.2E+04	1.9E+04	9.5E+07	2.1E+07	2.5E+07	5.8E+04	4.9E+07	4.0E+05	2.5E+07	1.7E+03
	Secondary poorly combustible waste III	1.3E+07	1.8E+09	1.7E+06	4.9E+01	1.0E+00	7.8E+05	3.1E+01	4.3E+03	1.5E+03	2.6E+08	6.9E+03	3.8E-01	1.5E+00	4.9E+04	2.9E+02	1.1E+01	2.4E+03	3.1E+00	1.5E+03	3.3E+08	2.9E+08	3.5E+04	8.6E-02	7.4E+03	1.3E+02	1.2E+03	1.3E+03	1.1E+03	5.8E+06	1.3E+06	1.5E+06	3.5E+03	3.0E+06	2.4E+04	1.5E+06	1.0E+02
	Secondary incombustible waste I (metal-melting waste)	6.5E+11	9.1E+12	1.0E+07	2.9E+02	6.1E+00	5.9E+06	2.3E+02	3.2E+04	1.1E+04	1.6E+09	4.2E+04	2.3E+00	1.2E+01	2.6E+06	2.1E+03	8.3E+01	1.8E+04	1.9E+01	9.2E+03	2.0E+09	9.1E+12	2.1E+05	4.2E+01	7.9E+06	3.3E+05	7.0E+04	6.5E+05	7.6E+07	2.6E+11	9.2E+10	1.0E+11	2.1E+08	2.0E+11	1.5E+05	9.1E+06	6.2E+02
	Secondary incombustible waste II (metal-melting waste)	2.5E+08	3.4E+10	3.2E+07	9.2E+02	1.9E+01	1.5E+07	5.9E+02	8.1E+04	2.8E+04	4.9E+09	1.3E+05	7.2E+00	2.9E+01	9.2E+05	5.4E+03	2.1E+02	4.5E+04	5.9E+01	2.9E+04	6.2E+09	5.6E+09	6.7E+05	1.6E+00	1.4E+05	2.5E+03	2.3E+04	2.5E+04	2.2E+04	1.1E+08	2.5E+07	3.0E+07	6.9E+04	5.8E+07	4.6E+05	2.8E+07	1.9E+03
	Secondary incombustible waste III (metal-melting waste)	1.7E+06	2.3E+08	2.1E+05	6.2E+00	1.3E-01	9.9E+04	3.9E+00	5.4E+02	1.9E+02	3.3E+07	8.7E+02	4.8E-02	2.0E-01	6.2E+03	3.6E+01	1.4E+00	3.0E+02	4.0E-01	1.9E+02	4.2E+07	3.7E+07	4.5E+03	1.1E-02	9.3E+02	1.7E+01	1.5E+02	1.7E+02	1.4E+02	7.3E+05	1.6E+05	1.9E+05	4.5E+02	3.8E+05	3.0E+03	1.9E+05	1.3E+01
	Secondary incombustible waste I (non-metal-melting waste)	6.8E+11	1.1E+13	1.6E+09	4.7E+04	9.8E+02	7.6E+08	3.0E+04	4.2E+06	1.4E+06	2.5E+11	6.7E+06	3.7E+02	1.5E+03	5.0E+07	2.8E+05	1.1E+04	2.3E+06	3.0E+03	1.5E+06	3.2E+11	9.6E+12	3.4E+07	1.3E+02	1.5E+07	4.7E+05	1.2E+06	1.9E+06	7.9E+07	2.7E+11	9.5E+10	1.0E+11	2.2E+08	2.1E+11	2.3E+07	1.5E+09	9.9E+04
	Secondary incombustible waste II (non-metal-melting waste)	2.7E+08	3.7E+10	3.4E+07	1.0E+03	2.1E+01	1.6E+07	6.3E+02	8.7E+04	3.0E+04	5.3E+09	1.4E+05	7.7E+00	3.2E+01	1.0E+06	5.8E+03	2.2E+02	4.8E+04	6.4E+01	3.1E+04	6.7E+09	6.0E+09	7.2E+05	1.8E+00	1.5E+05	2.7E+03	2.5E+04	2.7E+04	2.3E+04	1.2E+08	2.6E+07	3.1E+07	7.2E+04	6.1E+07	4.9E+05	3.1E+07	2.1E+03
	Secondary incombustible waste III (non-metal-melting waste)	6.5E+06	8.9E+08	8.4E+05	2.4E+01	5.0E-01	3.9E+05	1.5E+01	2.1E+03	7.3E+02	1.3E+08	3.4E+03	1.9E-01	7.6E-01	2.4E+04	1.4E+02	5.4E+00	1.2E+03	1.6E+00	7.5E+02	1.6E+08	1.5E+08	1.7E+04	4.3E-02	3.6E+03	6.7E+01	6.0E+02	6.6E+02	5.6E+02	2.9E+06	6.2E+05	7.6E+05	1.8E+03	1.5E+06	1.2E+04	7.5E+05	5.1E+01
	Secondary incombustible waste I (non-metal)	2.9E+11	4.3E+12	2.1E+08	6.0E+03	1.2E+02	9.7E+07	3.8E+03	5.3E+05	1.8E+05	3.2E+10	8.4E+05	4.7E+01	1.9E+02	7.0E+06	3.5E+04	1.4E+03	2.9E+05	3.9E+02	1.9E+05	4.0E+10	4.1E+12	4.3E+06	2.9E+01	4.4E+06	1.6E+05	1.8E+05	4.5E+05	3.4E+07	1.2E+11	4.1E+10	4.5E+10	9.5E+07	9.0E+10	3.0E+06	1.8E+08	1.3E+04
	Secondary incombustible waste II (non-metal)	1.7E+08	2.2E+10	2.0E+07	5.8E+02	1.2E+01	9.3E+06	3.7E+02	5.1E+04	1.8E+04	3.1E+09	8.2E+04	4.5E+00	1.8E+01	5.8E+05	3.4E+03	1.3E+02	2.8E+04	3.7E+01	1.8E+04	3.9E+09	3.7E+09	4.2E+05	1.0E+00	8.8E+04	1.6E+03	1.4E+04	1.6E+04	1.5E+04	7.4E+07	1.7E+07	2.0E+07	4.6E+04	3.9E+07	2.9E+05	1.8E+07	1.2E+03
	Secondary incombustible waste III (non-metal)	2.1E+06	2.9E+08	2.7E+05	7.9E+00	1.6E-01	1.3E+05	5.0E+00	7.0E+02	2.4E+02	4.2E+07	1.1E+03	6.2E-02	2.5E-01	7.9E+03	4.6E+01	1.8E+00	3.8E+02	5.1E-01	2.5E+02	5.4E+07	4.8E+07	5.7E+03	1.4E-02	1.2E+03	2.2E+01	2.0E+02	2.2E+02	1.9E+02	9.4E+05	2.0E+05	2.5E+05	5.8E+02	4.8E+05	3.9E+03	2.4E+05	1.7E+01
JAEA MOX dismantling	Primary incombustible waste I (metal)	2.6E+11	3.6E+12	0.0E+00	0.0E+00	0.0E+00	4.6E+05	1.8E+01	2.5E+03	8.8E+02	4.6E+06	1.0E+02	5.6E-03	9.1E-01	9.3E+05	1.7E+02	6.5E+00	1.4E+03	0.0E+00	5.4E+00	1.2E+06	3.6E+12	2.6E+01	1.9E+02	3.7E+07	1.5E+06	2.9E+05	3.0E+06	3.0E+07	1.0E+11	3.7E+10	4.0E+10	8.5E+07	8.0E+10	1.8E+01	1.1E+03	7.7E-02
	Primary incombustible waste II (metal)	3.9E+08	5.5E+09	0.0E+00	0.0E+00	0.0E+00	7.0E+02	2.8E-02	3.8E+00	1.3E+00	7.0E+03	1.5E-01	8.5E-06	1.4E-03	1.4E+03	2.5E-01	9.8E-03	2.1E+00	0.0E+00	8.1E-03	1.8E+03	5.5E+09	4.0E-02	2.9E-01	5.5E+04	2.3E+03	4.4E+02	4.5E+03	4.6E+04	1.6E+08	5.5E+07	6.0E+07	1.3E+05	1.2E+08	2.7E-02	1.7E+00	1.2E-04
	Primary incombustible waste I (concrete)	1.7E+11	2.4E+12	0.0E+00	0.0E+00	0.0E+00	3.1E+05	1.2E+01	1.7E+03	5.8E+02	3.1E+06	6.8E+01	3.7E-03	6.1E-01	6.2E+05	1.1E+02	4.3E+00	9.3E+02	0.0E+00	3.6E+00	7.8E+05	2.4E+12	1.8E+01	1.3E+02	2.4E+07	1.0E+06	1.9E+05	2.0E+06	2.0E+07	6.9E+10	2.4E+10	2.6E+10	5.6E+07	5.4E+10	1.2E+01	7.6E+02	5.1E-02
	Primary incombustible waste II (concrete)	2.6E+08	3.7E+09	0.0E+00	0.0E+00	0.0E+00	4.7E+02	1.8E-02	2.5E+00	8.8E-01	4.6E+03	1.0E-01	5.6E-06	9.2E-04	9.3E+02	1.7E-01	6.5E-03	1.4E+00	0.0E+00	5.4E-03	1.2E+03	3.7E+09	2.7E-02	1.9E-01	3.7E+04	1.6E+03	2.9E+02	3.0E+03	3.0E+04	1.0E+08	3.7E+07	4.0E+07	8.5E+04	8.1E+07	1.8E-02	1.1E+00	7.7E-05
	Secondary combustible waste I	1.3E+12	1.8E+13	0.0E+00	0.0E+00	0.0E+00	2.3E+06	9.0E+01	1.2E+04	4.3E+03	2.3E+07	5.0E+02	2.8E-02	4.5E+00	4.6E+06	8.3E+02	3.2E+01	6.9E+03	0.0E+00	2.7E+01	5.8E+06	1.8E+13	1.3E+02	9.6E+02	1.8E+08	7.6E+06	1.4E+06	1.5E+07	1.5E+08	5.1E+11	1.8E+11	2.0E+11	4.2E+08	4.0E+11	8.9E+01	5.6E+03	3.8E-01
	Secondary poorly combustible waste I	1.4E+11	1.9E+12	0.0E+00	0.0E+00	0.0E+00	2.4E+05	9.5E+00	1.3E+03	4.6E+02	2.4E+06	5.3E+01	2.9E-03	4.8E-01	4.8E+05	8.8E+01	3.4E+00	7.3E+02	0.0E+00	2.8E+00	6.1E+05	1.9E+12	1.4E+01	1.0E+02	1.9E+07	8.1E+05	1.5E+05	1.6E+06	1.6E+07	5.4E+10	1.9E+10	2.1E+10	4.4E+07	4.2E+10	9.5E+00	5.9E+02	4.0E-02
	Secondary incombustible waste I (metal-melting waste)	8.2E+11	1.1E+13	0.0E+00	0.0E+00	0.0E+00	1.5E+06	5.7E+01	8.0E+03	2.8E+03	1.5E+07	3.2E+02	1.8E-02	2.9E+00	2.9E+06	5.3E+02	2.0E+01	4.4E+03	0.0E+00	1.7E+01	3.7E+06	1.1E+13	8.3E+01	6.1E+02	1.2E+08	4.9E+06	9.2E+05	9.4E+06	9.5E+07	3.3E+11	1.1E+11	1.3E+11	2.7E+08	2.5E+11	5.7E+01	3.6E+03	2.4E-01
	Secondary incombustible waste II (metal-melting waste)	3.9E+08	5.5E+09	0.0E+00	0.0E+00	0.0E+00	7.0E+02	2.8E-02	3.8E+00	1.3E+00	7.0E+03	1.5E-01	8.5E-06	1.4E-03	1.4E+03	2.5E-01	9.8E-03	2.1E+00	0.0E+00	8.1E-03	1.8E+03	5.5E+09	4.0E-02	2.9E-01	5.5E+04	2.3E+03	4.4E+02	4.5E+03	4.6E+04	1.6E+08	5.5E+07	6.0E+07	1.3E+05	1.2E+08	2.7E-02	1.7E+00	1.2E-04
	Secondary incombustible waste I (non-metal)	5.1E+11	7.1E+12	0.0E+00	0.0E+00	0.0E+00	9.0E+05	3.6E+01	4.9E+03	1.7E+03	9.0E+06	2.0E+02	1.1E-02	1.8E+00	1.8E+06	3.3E+02	1.3E+01	2.7E+03	0.0E+00	1.1E+01	2.3E+06	7.1E+12	5.2E+01	3.8E+02	7.1E+07	3.0E+06	5.7E+05	5.9E+06	5.9E+07	2.0E+11	7.1E+10	7.8E+10	1.7E+08	1.6E+11	3.5E+01	2.2E+03	1.5E-01
	Secondary incombustible waste II (non-metal)	2.6E+08	3.7E+09	0.0E+00	0.0E+00	0.0E+00	4.7E+02	1.8E-02	2.5E+00	8.8E-01	4.6E+03	1.0E-01	5.6E-06	9.2E-04	9.3E+02	1.7E-01	6.5E-03	1.4E+00	0.0E+00	5.4E-03	1.2E+03	3.7E+09	2.7E-02	1.9E-01	3.7E+04	1.6E+03	2.9E+02	3.0E+03	3.0E+04	1.0E+08	3.7E+07	4.0E+07	8.5E+04	8.1E+07	1.8E-02	1.1E+00	7.7E-05

Table 2.3-6 Activity of radioactive materials in each waste package (Bq) (private sector)

Group	Type of waste package	Total α	Total β γ	H-3	C-14	Cl-36	Co-60	Ni-59	Ni-63	Se-79	Sr-90	Zr-93	Nb-94	Mo-93	Tc-99	Pd-107	Ag-108m
Private sector reprocessing and MOX operations	Hulls and ends	2.2E+16	1.4E+19	6.5E+17	4.4E+14	8.3E+12	1.2E+18	6.8E+15	1.0E+18	2.0E+12	3.2E+17	2.7E+14	2.4E+15	5.1E+13	6.0E+14	5.0E+11	2.1E+12
	Ash melt + Water in hulls can	3.9E+15	4.6E+17	7.1E+14	5.8E+11	8.1E+09	2.3E+14	4.7E+11	7.5E+13	3.5E+11	5.2E+16	1.7E+12	1.8E+11	2.2E+09	9.8E+12	7.7E+09	4.8E+08
	Water in hulls can	6.1E+14	8.0E+16	1.3E+14	6.0E+10	1.2E+09	6.6E+12	1.1E+09	1.7E+11	5.4E+10	8.9E+15	2.4E+11	1.7E+07	7.5E+06	1.7E+12	1.4E+09	0.0E+00
	Incombustible waste I (highly contaminated part: for melting treatment)	2.0E+14	1.2E+17	0.0E+00	1.6E+10	2.5E+08	3.9E+12	2.5E+10	3.3E+12	0.0E+00	4.6E+16	2.5E+12	6.2E+09	8.6E+08	1.7E+13	0.0E+00	1.1E+10
	Incombustible waste I (highly contaminated part: except for melting treatment)	1.0E+14	6.8E+16	0.0E+00	4.0E+09	3.0E+07	1.7E+12	1.6E+10	2.0E+12	0.0E+00	2.8E+16	1.5E+12	3.8E+09	5.3E+08	1.1E+13	0.0E+00	7.0E+09
	Incombustible waste I (moderately contaminated part: except for melting treatment)	1.0E+12	1.2E+15	0.0E+00	6.9E+07	5.3E+05	3.0E+10	2.7E+08	3.5E+10	0.0E+00	4.8E+14	2.6E+10	6.7E+07	9.1E+06	1.2E+08	0.0E+00	1.4E+09
	Incombustible waste I (less contaminated part: except for melting treatment)	2.0E+11	2.3E+14	0.0E+00	1.4E+07	1.1E+05	6.1E+09	5.5E+07	7.1E+09	0.0E+00	9.6E+13	5.3E+09	1.3E+07	1.8E+06	3.7E+10	0.0E+00	2.4E+07
	Incombustible waste I (hulls can)	6.8E+12	3.7E+15	6.4E+11	1.8E+11	3.5E+09	1.4E+15	1.1E+12	1.7E+14	4.5E+08	7.4E+13	3.2E+10	3.1E+11	8.7E+09	8.4E+10	1.2E+08	0.0E+00
	Incombustible waste I (special equipment waste, container)	1.2E+13	6.2E+14	0.0E+00	1.1E+09	2.2E+07	1.2E+11	2.0E+07	3.0E+09	0.0E+00	1.6E+14	4.3E+09	3.1E+05	1.3E+06	3.0E+10	0.0E+00	2.4E+07
	Combustible waste II	7.2E+11	7.2E+13	0.0E+00	1.6E+08	2.6E+06	7.0E+11	3.5E+08	5.4E+10	0.0E+00	1.9E+13	5.2E+08	9.9E+07	2.5E+06	3.6E+09	0.0E+00	3.2E+06
	Poorly combustible waste II	2.4E+11	1.4E+13	0.0E+00	2.2E+07	4.3E+05	9.5E+09	4.1E+06	6.2E+08	0.0E+00	3.2E+12	8.8E+07	1.0E+06	5.1E+04	6.1E+08	0.0E+00	4.9E+05
	Incombustible waste II (for melting treatment)	1.4E+12	9.9E+14	0.0E+00	8.2E+08	2.1E+07	4.0E+10	7.5E+09	3.0E+10	0.0E+00	4.0E+14	2.1E+10	5.6E+07	7.7E+06	1.5E+11	0.0E+00	1.2E+08
	Incombustible waste II (except for melting treatment)	4.7E+10	4.6E+12	0.0E+00	7.9E+06	1.6E+05	8.7E+08	1.6E+05	2.4E+07	0.0E+00	1.2E+12	3.3E+07	5.7E+03	1.0E+04	2.3E+08	0.0E+00	1.8E+05
	Incombustible waste II (transport container)	2.3E+11	2.3E+13	2.3E+10	1.8E+07	3.5E+05	1.9E+09	3.3E+05	5.0E+07	1.6E+07	2.6E+12	7.1E+07	5.1E+03	2.2E+04	4.9E+08	4.1E+06	4.0E+05
	Low-level concentrated liquid waste 1	4.5E+13	6.9E+10	6.7E+07	5.2E+04	1.0E+03	5.7E+06	9.6E+02	1.5E+05	4.7E+04	7.8E+09	2.1E+05	1.5E+01	6.5E+01	1.5E+06	1.2E+04	0.0E+00
	Low-level concentrated liquid waste 2	1.5E+11	6.6E+13	0.0E+00	0.0E+00	0.0E+00	5.7E+12	9.9E+09	1.5E+12	3.4E+07	5.5E+12	1.5E+08	2.7E+08	6.4E+07	1.2E+09	8.6E+06	0.0E+00
	Low-level concentrated liquid waste 3	0.0E+00	1.4E+13	1.7E+10	1.3E+07	2.6E+05	1.4E+09	2.4E+05	3.7E+07	1.2E+07	1.9E+12	5.2E+07	3.8E+03	1.6E+04	3.6E+08	3.0E+06	2.9E+05
	Solvent waste	7.6E+10	2.4E+13	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	6.7E+06	1.1E+12	3.0E+07	5.5E+07	0.0E+00	1.4E+09	1.8E+06	0.0E+00
	Spent carbon	1.1E+09	1.3E+09	0.0E+00	0.0E+00	0.0E+00	2.2E+08	4.0E+05	6.3E+07	3.7E+02	6.3E+07	1.7E+03	3.1E+03	2.5E+03	3.3E+05	9.7E+01	0.0E+00
	Spent silver absorbent	4.8E+09	5.1E+13	0.0E+00	0.0E+00	0.0E+00	2.5E+06	4.2E+03	6.6E+05	3.0E+05	5.1E+10	1.4E+06	2.5E+06	2.9E+01	0.0E+00	8.0E+04	0.0E+00
	Scrubber waste liquid	1.7E+05	2.1E+15	1.4E+13	0.0E+00	0.0E+00	4.6E+05	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.9E+03	0.0E+00	0.0E+00
	CB	3.7E+11	2.5E+18	8.6E+13	2.3E+14	5.5E+12	2.8E+17	6.1E+14	9.4E+16	1.6E+10	2.9E+12	1.5E+14	7.2E+13	1.4E+12	2.7E+11	5.7E+06	9.1E+11
	BP	7.0E+10	2.1E+18	2.9E+14	1.1E+14	7.8E+10	3.7E+17	7.4E+14	1.1E+17	5.7E+10	1.1E+12	1.4E+09	4.8E+13	3.1E+12	1.4E+11	3.4E+05	2.9E+12
Private sector reprocessing, dismantling	Primary waste I (metal) (for melting treatment)	6.0E+12	6.4E+15	6.2E+12	4.8E+09	9.6E+07	5.3E+11	8.9E+07	1.4E+10	4.3E+09	7.2E+14	1.9E+10	1.4E+06	6.0E+06	1.3E+11	1.1E+09	1.1E+08
	Primary waste I (metal) (except for melting treatment)	2.0E+12	2.2E+15	2.1E+12	1.6E+09	3.3E+07	1.8E+11	3.0E+07	4.6E+09	1.5E+09	2.4E+14	6.6E+09	4.7E+05	2.0E+06	4.6E+10	3.8E+08	3.7E+07
	Primary waste II (metal) (for melting treatment)	1.0E+13	1.1E+16	1.0E+13	8.1E+09	1.6E+08	8.9E+11	1.5E+08	2.3E+10	7.3E+09	1.2E+15	3.3E+10	2.3E+06	1.0E+07	2.3E+11	1.9E+09	1.8E+08
	Primary waste II (metal) (except for melting treatment)	3.5E+12	3.7E+15	3.6E+12	2.8E+09	5.5E+07	3.0E+11	5.1E+07	7.8E+09	2.5E+09	4.1E+14	1.1E+10	8.0E+05	3.5E+06	7.7E+10	6.5E+08	6.2E+07
	Primary waste III (metal) (for melting treatment)	6.9E+11	6.9E+13	6.7E+10	5.3E+07	1.0E+06	5.7E+09	9.6E+05	1.5E+08	4.7E+07	7.8E+12	2.1E+08	1.5E+04	6.5E+04	1.5E+09	1.2E+07	1.2E+06
	Primary waste III (metal) (except for melting treatment)	2.4E+11	2.4E+13	2.3E+10	1.8E+07	3.6E+05	2.0E+09	3.3E+05	5.0E+07	1.6E+07	2.7E+12	7.2E+07	5.2E+03	2.2E+04	5.0E+08	4.2E+06	4.0E+05
	Contaminated concrete	3.8E+12	4.1E+15	4.0E+12	3.1E+09	6.1E+07	3.4E+11	5.6E+07	8.7E+09	2.8E+09	4.6E+14	1.2E+10	8.9E+05	3.8E+06	8.6E+10	7.2E+08	6.9E+07
	Secondary waste I (combustible)	2.1E+12	1.6E+14	1.5E+11	1.2E+08	2.4E+06	1.3E+10	2.2E+06	3.3E+08	1.1E+08	1.8E+13	4.8E+08	3.4E+04	1.5E+05	3.3E+09	2.8E+07	2.7E+06
	Secondary waste II (combustible)	1.3E+13	1.3E+15	1.3E+12	1.0E+09	2.0E+07	1.1E+11	1.8E+07	2.8E+09	9.1E+08	1.5E+14	4.0E+09	2.9E+05	1.3E+06	2.8E+10	2.3E+08	2.3E+07
	Secondary waste I (poorly combustible)	1.4E+11	2.5E+13	2.4E+10	1.9E+07	3.7E+05	2.1E+09	3.4E+05	5.3E+07	1.7E+07	2.8E+12	7.5E+07	5.4E+03	2.3E+04	5.2E+08	4.4E+06	4.2E+05
	Secondary waste II (poorly combustible)	1.3E+11	1.3E+13	1.3E+10	1.0E+07	2.0E+05	1.1E+09	1.9E+05	2.8E+07	9.1E+06	1.5E+12	4.1E+07	2.9E+03	1.3E+04	2.8E+08	2.4E+06	2.3E+05
	Secondary waste I (incombustible)	7.7E+10	8.2E+13	7.9E+10	6.2E+07	1.2E+06	6.8E+09	1.1E+06	1.7E+08	5.6E+07	9.2E+12	2.5E+08	1.8E+04	7.7E+04	1.7E+09	1.4E+07	1.4E+06
	Secondary waste II (incombustible)	1.2E+11	1.2E+13	1.2E+10	9.3E+06	1.9E+05	1.0E+09	1.7E+05	2.6E+07	8.4E+06	1.4E+12	3.7E+07	2.7E+03	1.2E+04	2.6E+08	2.2E+06	2.1E+05
	Systematic decontamination liquid waste I	2.2E+14	3.7E+16	3.6E+13	2.8E+10	5.5E+08	3.0E+12	5.1E+08	7.8E+10	2.5E+10	4.1E+15	1.1E+11	8.0E+06	3.4E+07	7.7E+11	6.4E+09	6.2E+08
	Systematic decontamination liquid waste II	3.6E+11	1.6E+12	1.6E+09	1.2E+06	2.4E+04	1.3E+08	2.2E+04	3.4E+06	1.1E+06	1.8E+11	4.9E+06	3.5E+02	1.5E+03	3.4E+07	2.8E+05	2.7E+04
	Systematic decontamination liquid waste III	2.6E+09	1.2E+12	1.1E+09	8.8E+05	1.8E+04	9.6E+07	1.6E+04	2.5E+06	7.9E+05	1.3E+11	3.5E+06	2.5E+02	1.1E+03	2.4E+07	2.0E+05	2.0E+04
	Partial decontamination liquid waste I	3.3E+14	5.7E+16	5.5E+13	4.3E+10	8.6E+08	4.7E+12	7.9E+08	1.2E+11	3.9E+10	6.4E+15	1.7E+11	1.2E+07	5.3E+07	1.2E+12	1.0E+10	9.7E+08
	Partial decontamination liquid waste II	3.7E+11	1.6E+12	1.6E+09	1.2E+06	2.5E+04	1.4E+08	2.3E+04	3.5E+06	1.1E+06	1.9E+11	5.0E+06	3.6E+02	1.6E+03	3.5E+07	2.9E+05	2.8E+04
Private sector MOX dismantling	Primary waste I (metal)	1.5E+12	2.1E+13	0.0E+00	8.3E+00	1.6E-01	9.0E+02	1.5E-01	2.3E+01	0.0E+00	1.2E+06	3.3E+01	2.4E-03	1.0E-02	2.3E+02	0.0E+00	1.9E-01
	Primary waste II (metal)	8.1E+11	1.1E+13	0.0E+00	4.5E+00	8.9E-02	4.9E+02	8.2E-02	1.3E+01	0.0E+00	6.6E+05	1.8E+01	1.3E-03	5.6E-03	1.2E+02	0.0E+00	1.0E-01
	Primary waste III (metal)	7.8E+10	1.1E+12	0.0E+00	4.3E-01	8.6E-03	4.7E+01	7.9E-03	1.2E+00	0.0E+00	6.4E+04	1.7E+00	1.2E-04	5.4E-04	1.2E+01	0.0E+00	9.7E-03
	Secondary waste I (combustible)	2.3E+11	3.3E+12	0.0E+00	1.3E+00	2.6E-02	1.4E+02	2.4E-02	3.7E+00	0.0E+00	1.9E+05	5.2E+00	3.7E-04	1.6E-03	3.6E+01	0.0E+00	2.9E-02
	Secondary waste II (combustible)	6.7E+10	9.4E+11	0.0E+00	3.7E-01	7.4E-03	4.0E+01	6.8E-03	1.0E+00	0.0E+00	5.5E+04	1.5E+00	1.1E-04	4.6E-04	1.0E+01	0.0E+00	8.3E-03
	Secondary waste III (combustible)	5.3E+08	7.5E+09	0.0E+00	2.9E-03	5.8E-05	3.2E-01	5.4E-05	8.2E-03	0.0E+00	4.4E+02	1.2E-02	8.4E-07	3.6E-06	8.2E-02	0.0E+00	6.6E-05
	Secondary waste I (poorly combustible)	1.3E+11	1.8E+12	0.0E+00	7.0E-01	1.4E-02	7.7E+01	1.3E-02	2.0E+00	0.0E+00	1.0E+05	2.8E+00	2.0E-04	8.7E-04	2.0E+01	0.0E+00	1.6E-02
	Secondary waste II (poorly combustible)	3.8E+10	5.4E+11	0.0E+00	2.1E-01	4.2E-03	2.3E+01	3.9E-03	5.9E-01	0.0E+00	3.1E+04	8.5E-01	6.1E-05	2.6E-04	5.9E+00	0.0E+00	4.7E-03
	Secondary waste III (poorly combustible)	3.9E+09	3.9E+11	0.0E+00	1.5E-01	3.1E-03	1.7E+01	2.8E-03	4.3E-01	0.0E+00	2.3E+04	6.2E-01	4.4E-05	1.9E-04	4.3E+00	0.0E+00	3.5E-03
	Secondary waste I (incombustible)	2.1E+11	3.0E+12	0.0E+00	1.2E+00	2.3E-02	1.3E+02	2.1E-02	3.3E+00	0.0E+00	1.7E+05	4.7E+00	3.4E-04	1.5E-03	3.2E+01	0.0E+00	2.6E-02
	Secondary waste II (incombustible)	6.3E+10	8.9E+11	0.0E+00	3.5E-01	7.0E-03	3.8E+01	6.4E-03	9.8E-01	0.0E+00	5.2E+04	1.4E+00	1.0E-04	4.4E-04	9.7E+00	0.0E+00	7.9E-03
	Secondary waste III (incombustible)	7.5E+08	1.1E+10	0.0E+00	4.2E-03	8.3E-05	4.5E-01	7.6E-05	1.2E-02	0.0E+00	6.2E+02	1.7E-02	1.2E-06	5.2E-06	1.2E-01	0.0E+00	9.3E-05

Type of waste package	Sn-126	I-129	Cs-135	Cs-137	Pu-241	Am-242m	U-233	U-234	U-235	U-236	U-238	Np-237	Pu-238	Pu-239	Pu-240	Pu-242	Am-241	Am-243	Cm-244	Cm-245
Hulls and ends	3.5E+12	1.5E+11	2.0E+12	4.5E+17	3.1E+17	2.3E+13	4.6E+09	1.5E+11	5.0E+10	8.7E+11	7.2E+11	1.1E+12	9.5E+15	8.3E+14	1.3E+15	5.6E+12	2.6E+15	6.1E+13	7.1E+15	7.6E+11
Ash melt + Water in hulls can	5.7E+11	2.4E+10	3.1E+11	7.3E+16	5.4E+16	4.0E+12	5.9E+06	2.4E+10	8.2E+09	1.4E+11	1.2E+11	2.0E+11	1.7E+15	1.5E+14	2.4E+14	1.0E+12	4.5E+14	1.1E+13	1.3E+15	1.3E+11
Water in hulls can	9.8E+10	4.0E+09	5.6E+10	1.2E+16	8.6E+15	6.5E+11	9.2E+05	4.1E+09	1.4E+09	2.4E+10	2.0E+10	3.1E+10	2.6E+14	2.3E+13	3.7E+13	1.5E+11	7.2E+13	1.7E+12	2.0E+14	2.1E+10
Incombustible waste I (highly contaminated part: for melting treatment)	1.0E+12	8.4E+08	2.9E+11	6.5E+16	5.4E+15	1.8E+13	3.0E+05	9.9E+08	1.9E+08	3.4E+09	2.8E+09	3.1E+10	5.5E+13	4.5E+12	7.7E+12	3.2E+10	5.3E+13	1.4E+12	7.8E+13	2.1E+10
Incombustible waste I (highly contaminated part: except for melting treatment)	6.1E+11	1.0E+08	1.8E+11	3.9E+16	1.1E+15	1.1E+13	1.5E+05	3.5E+08	4.2E+07	7.3E+08	6.0E+08	1.8E+10	2.4E+13	1.6E+12	3.1E+12	1.3E+10	3.0E+13	7.9E+11	4.2E+13	1.2E+10
Incombustible waste I (moderately contaminated part: except for melting treatment)	1.1E+10	1.8E+06	3.1E+09	6.8E+14	7.4E+12	2.2E+12	1.5E+03	5.1E+06	4.3E+05	7.5E+06	6.2E+06	2.8E+08	1.6E+10	1.4E+09	5.2E+09	7.5E+06	4.4E+11	1.2E+10	5.2E+11	1.9E+08
Incombustible waste I (less contaminated part: except for melting treatment)	2.1E+09	3.6E+05	6.2E+08	1.4E+14	1.5E+12	3.8E+10	3.0E+02	1.0E+06	8.7E+04	1.5E+06	1.3E+06	5.6E+07	3.2E+09	2.8E+08	1.0E+09	1.5E+06	8.9E+10	2.4E+09	1.0E+11	3.7E+07
Incombustible waste I (hulls can)	8.1E+08	3.4E+07	4.7E+08	1.0E+14	9.7E+13	7.3E+09	1.0E+04	4.5E+07	1.6E+07	2.7E+08	2.3E+08	3.5E+08	3.0E+12	2.6E+11	4.1E+11	1.7E+09	8.1E+11	1.9E+10	2.2E+12	2.4E+08
Incombustible waste I (special equipment waste, container)	1.8E+09	7.3E+07	1.0E+09	2.2E+14	2.3E+14	1.8E+10	1.8E+04	8.3E+07	2.8E+07	4.9E+08	4.1E+08	6.3E+08	5.4E+12	4.7E+11	7.5E+11	3.1E+09	1.5E+12	3.4E+10	4.1E+12	4.3E+08
Combustible waste II	2.1E+08	8.2E+06	1.2E+08	2.6E+13	2.7E+13	2.1E+09	1.1E+03	2.0E+07	1.7E+06	2.9E+07	2.4E+07	3.9E+07	3.2E+11	2.8E+10	4.4E+10	1.9E+08	9.0E+10	2.1E+09	2.4E+11	2.7E+07
Poorly combustible waste II	3.6E+07	1.4E+06	2.0E+07	4.5E+12	6.2E+12	4.7E+08	3.7E+02	1.1E+06	3.4E+05	5.9E+06	4.9E+06	1.2E+07	1.2E+11	8.7E+09	1.5E+10	6.7E+07	2.7E+10	6.4E+08	7.4E+10	8.0E+06
Incombustible waste II (for melting treatment)	8.7E+09	2.2E+08	2.5E+09	5.6E+14	2.9E+13	1.5E+11	2.1E+03	8.3E+06	1.8E+06	4.5E+07	3.7E+07	2.7E+08	2.8E+11	2.4E+10	4.1E+10	1.7E+08	4.3E+11	1.1E+10	6.2E+11	1.7E+08
Incombustible waste II (except for melting treatment)	1.3E+07	5.3E+05	7.6E+06	1.7E+12	1.7E+12	1.4E+08	7.0E+01	3.2E+05	1.1E+05	1.9E+06	1.5E+06	2.5E+06	2.0E+10	1.8E+09	2.9E+09	1.2E+07	5.8E+09	1.4E+08	1.6E+10	1.7E+06
Incombustible waste II (transport container)	2.9E+07	1.2E+06	1.7E+07	3.7E+12	3.8E+12	2.9E+08	3.5E+02	1.6E+06	5.4E+05	9.4E+06	7.7E+06	1.2E+07	1.0E+11	8.9E+09	1.4E+10	6.0E+07	2.8E+10	6.5E+08	7.7E+10	8.2E+06
Low-level concentrated liquid waste 1	8.5E+04	3.5E+03	4.9E+04	1.1E+10	1.1E+10	8.4E+05	6.9E+04	3.0E+08	1.0E+08	1.8E+09	1.5E+09	2.3E+09	2.0E+13	1.7E+12	2.7E+12	1.2E+10	5.4E+12	1.3E+11	1.5E+13	1.6E+09
Low-level concentrated liquid waste 2	6.1E+07	4.0E+04	3.6E+07	7.8E+12	2.1E+12	8.8E+07	2.3E+02	1.4E+08	2.4E+06	4.2E+07	3.6E+07	2.2E+08	8.7E+10	7.7E+09	1.2E+10	5.2E+07	9.1E+09	2.2E+08	2.6E+10	2.8E+06
Low-level concentrated liquid waste 3	2.1E+07	8.8E+05	1.2E+07	2.7E+12	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Solvent waste	1.2E+07	7.9E+03	7.0E+06	1.5E+12	3.3E+11	0.0E+00	0.0E+00	8.5E+07	1.5E+06	2.6E+07	2.2E+07	4.0E+09	5.8E+10	5.1E+09	8.2E+09	3.4E+07	8.0E+06	1.9E+05	2.2E+07	2.3E+03
Spent carbon	6.8E+02	4.7E-01	3.9E+02	8.5E+07	7.2E+07	3.4E+04	1.7E+00	6.9E+07	1.2E+06	2.1E+07	1.8E+07	4.3E+06	1.5E+08	1.3E+07	2.0E+07	8.6E+04	2.1E+08	5.0E+06	6.0E+08	6.2E+04
Spent silver absorbent	5.7E+05	5.1E+13	3.3E+05	7.2E+10	7.5E+10	5.7E+06	7.2E+00	6.4E+05	1.1E+04	1.9E+05	1.6E+05	0.0E+00	2.1E+09	1.8E+08	2.8E+08	1.2E+06	5.8E+08	1.3E+07	1.6E+09	1.7E+05
Scrubber waste liquid	0.0E+00	2.2E+02	4.4E+01	9.8E+06	2.4E+06	0.0E+00	2.6E-04	1.8E-01	6.3E-02	1.1E+00	9.1E-01	5.4E+01	8.3E+04	7.3E+03	1.2E+04	4.9E+01	1.8E+04	4.2E+02	4.9E+04	5.2E+00
CB	3.0E+07	1.1E+06	5.9E+07	2.9E+12	4.6E+12	4.8E+08	1.1E+09	1.1E+08	1.0E+05	2.3E+06	1.2E+07	5.0E+06	8.0E+10	1.2E+10	2.0E+10	1.1E+08	4.0E+10	1.5E+09	1.9E+11	2.0E+07
BP	5.1E+06	3.0E+05	1.7E+08	1.2E+12	5.9E+10	4.7E+06	4.0E+09	3.4E+08	2.2E+04	7.9E+04	1.4E+05	8.4E+04	8.4E+08	1.5E+08	2.2E+08	1.1E+06	4.9E+08	1.3E+07	1.5E+09	1.6E+05
Primary waste I (metal) (for melting treatment)	7.8E+09	3.2E+08	4.5E+09	1.0E+15	1.0E+15	7.8E+10	9.1E+03	4.0E+07	1.4E+07	2.4E+08	2.0E+08	3.1E+08	2.6E+12	2.3E+11	3.6E+11	1.5E+09	7.1E+11	1.7E+10	2.0E+12	2.1E+08
Primary waste I (metal) (except for melting treatment)	2.7E+09	1.1E+08	1.5E+09	3.4E+14	3.5E+14	2.7E+10	3.1E+03	1.4E+07	4.7E+06	8.2E+07	6.8E+07	1.0E+08	8.9E+11	7.8E+10	1.2E+11	5.2E+08	2.4E+11	5.7E+09	6.7E+11	7.1E+07
Primary waste II (metal) (for melting treatment)	1.3E+10	5.5E+08	7.6E+09	1.7E+15	1.8E+15	1.3E+11	1.5E+04	6.8E+07	2.3E+07	4.1E+08	3.4E+08	5.2E+08	4.4E+12	3.9E+11	6.1E+11	2.6E+09	1.2E+12	2.8E+10	3.3E+12	3.5E+08
Primary waste II (metal) (except for melting treatment)	4.5E+09	1.9E+08	2.6E+09	5.8E+14	6.0E+14	4.5E+10	5.2E+03	2.3E+07	8.0E+06	1.4E+08	1.1E+08	1.8E+08	1.5E+12	1.3E+11	2.1E+11	8.8E+08	4.1E+11	9.7E+09	1.1E+12	1.2E+08
Primary waste III (metal) (for melting treatment)	8.5E+07	3.5E+06	4.9E+07	1.1E+13	1.1E+13	8.5E+08	1.0E+03	4.6E+06	1.6E+06	2.8E+07	2.3E+07	3.5E+07	3.0E+11	2.6E+10	4.2E+10	1.8E+08	8.2E+10	1.9E+09	2.3E+11	2.4E+07
Primary waste III (metal) (except for melting treatment)	2.9E+07	1.2E+06	1.7E+07	3.7E+12	3.9E+12	2.9E+08	3.6E+02	1.6E+06	5.4E+05	9.4E+06	7.8E+06	1.2E+07	1.0E+11	9.0E+09	1.4E+10	6.0E+07	2.8E+10	6.6E+08	7.7E+10	8.2E+06
Contaminated concrete	5.0E+09	2.1E+08	2.9E+09	6.4E+14	6.6E+14	5.0E+10	5.8E+03	2.6E+07	8.8E+06	1.5E+08	1.3E+08	2.0E+08	1.7E+12	1.5E+11	2.3E+11	9.8E+08	4.5E+11	1.1E+10	1.3E+12	1.3E+08
Secondary waste I (combustible)	1.9E+08	8.0E+06	1.1E+08	2.5E+13	2.6E+13	1.9E+09	3.1E+03	1.4E+07	4.8E+06	8.3E+07	6.9E+07	1.1E+08	9.1E+11	7.9E+10	1.3E+11	5.3E+08	2.5E+11	5.8E+09	6.8E+11	7.3E+07
Secondary waste II (combustible)	1.6E+09	6.8E+07	9.5E+08	2.1E+14	2.2E+14	1.6E+10	2.0E+04	8.9E+07	3.1E+07	5.3E+08	4.4E+08	6.8E+08	5.8E+12	5.1E+11	8.0E+11	3.4E+09	1.6E+12	3.7E+10	4.4E+12	4.6E+08
Secondary waste I (poorly combustible)	3.1E+07	1.3E+06	1.8E+07	3.9E+12	4.1E+12	3.0E+08	2.2E+02	9.5E+05	3.3E+05	5.7E+06	4.7E+06	7.3E+06	6.2E+10	5.4E+09	8.6E+09	3.6E+07	1.7E+10	4.0E+08	4.7E+10	5.0E+06
Secondary waste II (poorly combustible)	1.6E+07	6.8E+05	9.5E+06	2.1E+12	2.2E+12	1.6E+08	2.0E+02	8.9E+05	3.1E+05	5.3E+06	4.4E+06	6.8E+06	5.8E+10	5.1E+09	8.1E+09	3.4E+07	1.6E+10	3.7E+08	4.4E+10	4.7E+06
Secondary waste I (incombustible)	1.0E+08	4.2E+06	5.8E+07	1.3E+13	1.3E+13	1.0E+09	1.2E+02	5.2E+05	1.8E+05	3.1E+06	2.6E+06	3.9E+06	3.4E+10	2.9E+09	4.7E+09	2.0E+07	9.1E+09	2.2E+08	2.5E+10	2.7E+06
Secondary waste II (incombustible)	1.5E+07	6.3E+05	8.7E+06	1.9E+12	2.0E+12	1.5E+08	1.9E+02	8.2E+05	2.8E+05	4.9E+06	4.1E+06	6.3E+06	5.3E+10	4.7E+09	7.4E+09	3.1E+07	1.5E+10	3.4E+08	4.0E+10	4.3E+06
Systematic decontamination liquid waste I	4.5E+10	1.9E+09	2.6E+10	5.7E+15	6.0E+15	4.5E+11	3.3E+05	1.4E+09	5.0E+08	8.6E+09	7.1E+09	1.1E+10	9.4E+13	8.2E+12	1.3E+13	5.5E+10	2.5E+13	6.0E+11	7.1E+13	7.5E+09
Systematic decontamination liquid waste II	2.0E+06	8.2E+04	1.1E+06	2.5E+11	2.6E+11	2.0E+07	5.5E+02	2.4E+06	8.4E+05	1.5E+07	1.2E+07	1.9E+07	1.6E+11	1.4E+10	2.2E+10	9.3E+07	4.3E+10	1.0E+09	1.2E+11	1.3E+07
Systematic decontamination liquid waste III	1.4E+06	5.9E+04	8.2E+05	1.8E+11	1.9E+11	1.4E+07	4.0E+00	1.7E+04	6.0E+03	1.0E+05	8.7E+04	1.3E+05	1.1E+09	1.0E+08	1.6E+08	6.7E+05	3.1E+08	7.3E+06	8.6E+08	9.1E+04
Partial decontamination liquid waste I	7.0E+10	2.9E+09	4.0E+10	8.9E+15	9.3E+15	7.0E+11	5.0E+05	2.2E+09	7.7E+08	1.3E+10	1.1E+10	1.7E+10	1.5E+14	1.3E+13	2.0E+13	8.5E+10	4.0E+13	9.3E+11	1.1E+14	1.2E+10
Partial decontamination liquid waste II	2.0E+06	8.4E+04	1.2E+06	2.6E+11	2.7E+11	2.0E+07	5.6E+02	2.5E+06	8.6E+05	1.5E+07	1.2E+07	1.9E+07	1.6E+11	1.4E+10	2.3E+10	9.5E+07	4.4E+10	1.0E+09	1.2E+11	1.3E+07
Primary waste I (metal)	1.3E+01	5.5E-01	0.0E+00	1.7E+06	2.1E+13	1.4E+09	3.8E+02	1.7E+06	5.7E+05	9.9E+06	8.2E+06	6.5E+07	7.8E+11	5.0E+10	9.4E+10	4.4E+08	1.5E+11	3.5E+09	4.2E+11	4.4E+07
Primary waste II (metal)	7.2E+00	3.0E-01	0.0E+00	9.3E+05	1.1E+13	7.6E+08	2.0E+02	9.0E+05	3.1E+05	5.4E+06	4.4E+06	3.5E+07	4.2E+11	2.7E+10	5.1E+10	2.4E+08	8.1E+10	1.9E+09	2.2E+11	2.4E+07
Primary waste III (metal)	7.0E-01	2.9E-02	0.0E+00	8.9E+04	1.1E+12	7.3E+07	2.0E+01	8.7E+04	3.0E+04	5.2E+05	4.3E+05	3.4E+06	4.1E+10	2.6E+09	4.9E+09	2.3E+07	7.8E+09	1.8E+08	2.2E+10	2.3E+06
Secondary waste I (combustible)	2.1E+00	8.7E-02	0.0E+00	2.7E+05	3.3E+12	2.2E+08	5.9E+01	2.6E+05	8.9E+04	1.6E+06	1.3E+06	1.0E+07	1.2E+11	7.8E+09	1.5E+10	6.9E+07	2.3E+10	5.5E+08	6.5E+10	6.9E+06
Secondary waste II (combustible)	6.0E-01	2.5E-02	0.0E+00	7.7E+04	9.4E+11	6.3E+07	1.7E+01	7.4E+04	2.5E+04	4.4E+05	3.7E+05	2.9E+06	3.5E+10	2.2E+09	4.2E+09	2.0E+07	6.7E+09	1.6E+08	1.9E+10	2.0E+06
Secondary waste III (combustible)	4.8E-03	2.0E-04	0.0E+00	6.1E+02	7.5E+09	5.0E+05	1.3E-01	5.9E+02	2.0E+02	3.5E+03	2.9E+03	2.3E+04	2.8E+08	1.8E+07	3.3E+07	1.5E+05	5.3E+07	1.3E+06	1.5E+08	1.6E+04
Secondary waste I (poorly combustible)	1.1E+00	4.7E-02	0.0E+00	1.5E+05	1.8E+12	1.2E+08	3.2E+01	1.4E+05	4.9E+04	8.5E+05	7.0E+05	5.5E+06	6.6E+10	4.2E+09	8.0E+09	3.7E+07	1.3E+10	3.0E+08	3.5E+10	3.8E+06
Secondary waste II (poorly combustible)	3.4E-01	1.4E-02	0.0E+00	4.4E+04	5.4E+11	3.6E+07	9.6E+00	4.2E+04	1.5E+04	2.5E+05	2.1E+05	1.6E+06	2.0E+10	1.3E+09	2.4E+09	1.1E+07	3.8E+09	9.0E+07	1.1E+10	1.1E+06
Secondary waste III (poorly combustible)	2.5E-01	1.0E-02	0.0E+00	3.2E+04	3.9E+11	2.6E+07	9.8E-01	4.3E+03	1.5E+03	2.6E+04	2.2E+04	1.7E+05	2.0E+09	1.3E+08	2.5E+08	1.1E+06	3.9E+08	9.3E+06	1.1E+09	1.2E+05
Secondary waste I (incombustible)	1.9E+00	7.8E-02	0.0E+00	2.4E+05	3.0E+12	2.0E+08	5.3E+01	2.3E+05	8.0E+04	1.4E+06	1.2E+06	9.1E+06	1.1E+11	7.0E+09	1.3E+10	6.1E+07	2.1E+10	5.0E+08	5.8E+10	6.2E+06
Secondary waste II (incombustible)	5.7E-01	2.4E-02	0.0E+00	7.3E+04	8.9E+11	6.0E+07	1.6E+01	7.0E+04	2.4E+04	4.2E+05	3.5E+05	2.7E+06	3.3E+10	2.1E+09	4.0E+09	1.8E+07	6.3E+09	1.5E+08	1.8E+10	1.9E+06
Secondary waste III (incombustible)	6.8E-03	2.8E-04	0.0E+00	8.6E+02	1.1E+10	7.1E+05	1.9E-01	8.4E+02	2.9E+02	5.0E+03	4.1E+03	3.3E+04	3.9E+08	2.5E+07	4.7E+07	2.2E+05	7.6E+07	1.8E+06	2.1E+08	2.2E+04

Table 2.3-7 Activity of radioactive materials in each waste package (Bq) (returned waste)

Group	Type of waste package	Total α	Total β γ	H-3	C-14	Cl-36	Co-60	Ni-59	Ni-63	Se-79	Sr-90	Zr-93	Nb-94	Mo-93	Tc-99	Pd-107	Ag-108m
COGEMA	Storage container for solid wastes	2.5E+15	9.0E+17	5.4E+16	5.0E+13	—	2.8E+17	—	9.7E+16	2.0E+11	5.0E+16	3.1E+13	—	—	8.3E+12	—	—
	Bitumen solidified waste	1.4E+14	5.7E+15	5.0E+12	—	—	5.0E+13	—	—	—	3.3E+14	—	—	—	5.0E+10	—	—
BNGS	Cement solidified waste (hulls and ends: PWR)	1.4E+14	1.5E+17	6.8E+15	2.2E+13	1.1E+08	3.9E+16	2.0E+14	2.6E+16	—	1.7E+15	8.6E+12	9.0E+13	—	4.2E+11	—	—
	Cement solidified waste (hulls and ends: BWR)	7.3E+13	6.6E+16	4.5E+15	1.1E+13	7.3E+07	9.8E+15	2.9E+13	3.7E+15	—	1.2E+15	7.0E+12	1.8E+12	—	2.8E+11	—	—
	MEB cladding + barium carbonate	8.9E+10	7.8E+13	5.7E+10	2.4E+13	3.6E+04	4.8E+13	—	—	—	8.4E+11	—	—	—	2.4E+08	—	—
	Magnox cement solidified waste	2.8E+14	6.7E+16	—	—	—	2.4E+15	—	—	—	4.1E+15	—	—	—	—	—	—
	Centrifuge cake cement solidified waste PWR	2.4E+14	2.5E+16	2.7E+12	2.4E+09	2.6E+07	—	—	—	—	6.1E+14	—	—	—	1.5E+11	—	—
	Centrifuge cake cement solidified waste BWR	1.5E+14	2.3E+16	1.8E+12	1.6E+09	1.7E+07	—	—	—	—	4.0E+14	—	—	—	9.9E+10	—	—
	Miscellaneous solid	2.0E+10	5.4E+11	3.3E+10	1.7E+08	—	6.6E+09	—	—	—	—	—	—	—	—	—	—
	Magnox miscellaneous solid	4.9E+10	1.3E+12	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Type of waste package	Sn-126	I-129	Cs-135	Cs-137	Pu-241	Am-242m	U-233	U-234	U-235	U-236	U-238	Np-237	Pu-238	Pu-239	Pu-240	Pu-242	Am-241	Am-243	Cm-244	Cm-245
Storage container for solid wastes	—	1.9E+10	2.6E+11	5.4E+16	3.6E+16	—	—	—	—	—	—	2.6E+10	1.7E+15	1.1E+14	1.9E+14	1.0E+12	6.3E+13	6.3E+13	3.4E+14	—
Bitumen solidified waste	—	5.0E+10	—	6.6E+14	—	—	—	—	7.2E+08	—	7.2E+09	—	3.5E+13	4.1E+12	5.6E+12	—	9.4E+13	—	4.4E+12	—
Cement solidified waste (hulls and ends: PWR)	—	7.3E+08	5.7E+10	1.2E+16	2.0E+15	—	—	7.2E+10	1.9E+09	8.9E+09	1.6E+10	6.7E+09	4.8E+13	1.3E+13	1.4E+13	—	4.4E+13	3.0E+11	2.2E+13	—
Cement solidified waste (hulls and ends: BWR)	—	4.8E+08	4.4E+10	9.3E+15	1.1E+15	—	—	5.6E+10	1.6E+09	6.0E+09	1.7E+10	3.5E+09	1.9E+13	1.0E+13	1.1E+13	—	2.6E+13	1.2E+11	6.2E+12	—
MEB cladding + barium carbonate	—	9.0E+10	5.4E+06	1.2E+12	1.2E+12	—	—	1.7E+07	2.9E+05	3.9E+06	4.6E+06	3.8E+06	3.3E+10	5.0E+09	7.7E+09	—	2.7E+10	2.2E+08	1.6E+10	—
Magnox cement solidified waste	—	—	—	6.3E+15	6.8E+15	—	—	—	—	—	—	—	3.8E+13	5.4E+13	7.9E+13	—	4.0E+13	—	6.0E+12	—
Centrifuge cake cement solidified waste PWR	—	2.8E+08	3.8E+09	5.2E+15	5.5E+15	—	—	1.4E+10	2.1E+08	2.8E+09	3.3E+09	2.8E+09	1.5E+14	2.3E+13	3.5E+13	1.1E+11	1.9E+13	1.6E+11	1.2E+13	—
Centrifuge cake cement solidified waste BWR	—	1.8E+08	2.5E+09	5.0E+15	4.0E+15	—	—	1.1E+10	2.0E+08	1.8E+09	3.3E+09	1.4E+09	7.3E+13	2.3E+13	3.5E+13	7.5E+10	1.1E+13	5.8E+10	3.1E+12	—
Miscellaneous solid	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Magnox miscellaneous solid	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Table 2.3-8 Activity of radioactive materials in each waste package (Bq) (JAEA)

	Type of waste package	Total α	Total β γ	H-3	C-14	Cl-36	Co-60	Ni-59	Ni-63	Se-79	Sr-90	Zr-93	Nb-94	Mo-93	Tc-99	Pd-107
JAEA reprocessing operation	Combustible waste I	1.1E+13	1.5E+15	1.4E+12	4.1E+07	8.5E+05	6.6E+11	2.6E+07	3.6E+09	1.3E+09	2.2E+14	5.8E+09	3.2E+05	1.3E+06	4.1E+10	2.4E+08
	Combustible waste II	2.0E+09	2.7E+11	2.5E+08	7.2E+03	1.5E+02	1.2E+08	4.6E+03	6.3E+05	2.2E+05	3.9E+10	1.0E+06	5.6E+01	2.3E+02	7.2E+06	4.2E+04
	Combustible waste III	1.9E+09	2.6E+11	2.4E+08	7.0E+03	1.4E+02	1.1E+08	4.4E+03	6.1E+05	2.1E+05	3.7E+10	9.8E+05	5.4E+01	2.2E+02	7.0E+06	4.1E+04
	Poorly combustible waste I	3.2E+12	4.3E+14	4.1E+11	1.2E+07	2.4E+05	1.9E+11	7.4E+06	1.0E+09	3.6E+08	6.3E+13	1.6E+09	9.1E+04	3.7E+05	1.2E+10	6.8E+07
	Poorly combustible waste II	4.3E+08	6.0E+10	5.6E+07	1.6E+03	3.3E+01	2.6E+07	1.0E+03	1.4E+05	4.9E+04	8.6E+09	2.3E+05	1.3E+01	5.1E+01	1.6E+06	9.4E+03
	Poorly combustible waste III	4.1E+08	5.6E+10	5.2E+07	1.5E+03	3.1E+01	2.4E+07	9.6E+02	1.3E+05	4.6E+04	8.1E+09	2.1E+05	1.2E+01	4.8E+01	1.5E+06	8.8E+03
	Incombustible waste I (metal-melting waste)	1.6E+14	3.3E+15	1.1E+12	3.3E+07	6.7E+05	5.3E+11	2.1E+07	2.9E+09	9.9E+08	1.7E+14	4.6E+09	2.5E+05	1.0E+06	3.3E+10	1.9E+08
	Incombustible waste II (metal-melting waste)	1.3E+11	1.8E+13	1.7E+10	4.9E+05	1.0E+04	7.8E+09	3.1E+05	4.3E+07	1.5E+07	2.6E+12	6.8E+07	3.8E+03	1.5E+04	4.9E+08	2.8E+06
	Incombustible waste III (metal-melting waste)	1.7E+10	2.3E+12	2.2E+09	6.2E+04	1.3E+03	1.0E+09	3.9E+04	5.5E+06	1.9E+06	3.3E+11	8.8E+06	4.8E+02	2.0E+03	6.2E+07	3.6E+05
	Incombustible waste I (non-metal-melting waste)	1.7E+14	2.8E+15	5.0E+11	1.4E+07	3.0E+05	2.3E+11	9.1E+06	1.3E+09	4.4E+08	7.7E+13	2.0E+09	1.1E+05	4.6E+05	1.5E+10	8.4E+07
	Incombustible waste II (non-metal-melting waste)	4.8E+10	6.5E+12	6.1E+09	1.8E+05	3.6E+03	2.8E+09	1.1E+05	1.5E+07	5.4E+06	9.4E+11	2.5E+07	1.4E+03	5.6E+03	1.8E+08	1.0E+06
	Incombustible waste III (non-metal-melting waste)	9.2E+09	1.3E+12	1.2E+09	3.4E+04	7.0E+02	5.5E+08	2.2E+04	3.0E+06	1.0E+06	1.8E+11	4.8E+06	2.6E+02	1.1E+03	3.4E+07	2.0E+05
	Incombustible waste I (non-metal)	2.1E+12	3.8E+13	9.4E+09	2.7E+05	5.6E+03	4.3E+09	1.7E+05	2.4E+07	8.2E+06	1.4E+12	3.8E+07	2.1E+03	8.6E+03	2.8E+08	1.6E+06
	Incombustible waste II (non-metal)	5.8E+09	7.9E+11	7.3E+08	2.1E+04	4.4E+02	3.4E+08	1.3E+04	1.9E+06	6.4E+05	1.1E+11	3.0E+06	1.6E+02	6.7E+02	2.1E+07	1.2E+05
	Incombustible waste III (non-metal)	1.0E+09	1.4E+11	1.3E+08	3.8E+03	7.8E+01	6.1E+07	2.4E+03	3.3E+05	1.2E+05	2.0E+10	5.4E+05	3.0E+01	1.2E+02	3.8E+06	2.2E+04
	Clarification filter	2.5E+14	3.4E+16	3.2E+13	9.2E+08	1.9E+07	1.5E+13	5.8E+08	8.0E+10	2.8E+10	4.9E+15	1.3E+11	7.1E+06	2.9E+07	9.2E+11	5.4E+09
	Incombustible waste in hulls can (metal-melting waste)	2.3E+10	3.2E+12	3.0E+09	8.5E+04	1.8E+03	1.4E+09	5.4E+04	7.5E+06	2.6E+06	4.6E+11	1.2E+07	6.6E+02	2.7E+03	8.5E+07	5.0E+05
	Incombustible waste in hulls can (non-metal-melting waste)	1.3E+10	1.8E+12	1.7E+09	5.0E+04	1.0E+03	8.0E+08	3.2E+04	4.4E+06	1.5E+06	2.7E+11	7.0E+06	3.9E+02	1.6E+03	5.0E+07	2.9E+05
	Iodine filter (spent silver absorbent)	0.0E+00	1.1E+10	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Hulls and ends	4.0E+14	2.3E+17	7.6E+13	1.4E+13	2.3E+11	4.9E+16	1.8E+14	2.5E+16	4.6E+10	7.9E+15	1.3E+13	5.7E+13	1.0E+12	1.8E+12	8.6E+09
	Bitumen solidified waste (MA series)	1.9E+13	2.3E+15	3.0E+13	4.3E+12	1.8E+11	1.3E+12	5.0E+07	7.0E+09	1.1E+09	5.8E+14	5.2E+09	2.9E+05	1.2E+06	1.9E+10	1.1E+08
	Bitumen solidified waste (LA series)	9.0E+11	1.3E+14	5.7E+13	2.3E+11	5.9E+10	7.0E+09	2.7E+05	3.8E+07	1.2E+07	2.0E+13	5.7E+07	3.1E+03	1.3E+04	3.7E+08	2.2E+06
	Slurry solidified waste (MA series acid)	4.2E+12	5.1E+14	6.8E+12	9.7E+09	3.9E+08	2.8E+11	1.1E+07	1.5E+09	2.5E+08	1.3E+14	1.2E+09	6.4E+04	2.6E+05	4.2E+09	2.5E+07
	Slurry solidified waste (MA series alkaline)	4.6E+11	4.7E+14	7.5E+12	1.1E+12	4.3E+10	3.1E+11	1.2E+07	1.7E+09	2.8E+08	1.4E+14	1.3E+09	7.0E+04	2.9E+05	4.7E+09	2.7E+07
	Slurry solidified waste (LA series alkaline)	7.0E+11	1.0E+14	4.4E+13	1.8E+11	4.6E+10	5.4E+09	2.1E+05	3.0E+07	9.5E+06	1.5E+13	4.4E+07	2.4E+03	9.9E+03	2.9E+08	1.7E+06
	$NaNO_3$ solidified waste (MA series acid)	4.2E+09	7.3E+12	6.8E+12	9.7E+09	3.9E+05	2.5E+09	9.8E+04	1.4E+07	2.5E+05	1.3E+11	1.2E+06	6.4E+01	2.6E+02	4.2E+06	2.5E+04
	$NaNO_3$ solidified waste (MA series alkaline)	4.6E+08	9.1E+12	7.5E+12	1.1E+12	4.3E+07	2.8E+09	1.1E+05	1.5E+07	2.8E+05	1.4E+11	1.3E+06	7.0E+01	2.9E+02	4.7E+06	2.7E+04
	$NaNO_3$ solidified waste (LA series alkaline)	7.0E+08	4.4E+13	4.4E+13	1.8E+11	4.6E+07	4.8E+07	1.9E+03	2.6E+05	9.5E+03	1.5E+10	4.4E+04	2.4E+00	9.9E+00	2.9E+05	1.7E+03
	Plastic solidified waste	1.4E+09	4.1E+11	0.0E+00	0.0E+00	6.1E+08	8.4E+07	1.7E+01	2.4E+03	8.2E+02	1.4E+08	3.8E+03	2.1E-01	8.5E-01	2.7E+04	1.6E+02
	Chemical sludge	6.6E+10	9.1E+12	8.5E+09	2.4E+05	5.0E+03	3.9E+09	1.6E+05	2.1E+07	7.4E+06	1.3E+12	3.5E+07	1.9E+03	7.8E+03	2.5E+08	1.4E+06
	Spent sand (pool water filtration)	3.7E+10	5.1E+12	4.7E+09	1.4E+05	2.8E+03	2.2E+09	8.7E+04	1.2E+07	4.2E+06	7.3E+11	1.9E+07	1.1E+03	4.3E+03	1.4E+08	8.0E+05
	Water in hulls can	1.4E+13	2.0E+15	1.8E+12	5.3E+07	1.1E+06	8.5E+11	3.3E+07	4.6E+09	1.6E+09	2.8E+14	7.4E+09	4.1E+05	1.7E+06	5.3E+10	3.1E+08
	Hulls can (empty container)	1.9E+11	2.6E+13	2.4E+10	6.9E+05	1.4E+04	1.1E+10	4.4E+05	6.1E+07	2.1E+07	3.7E+12	9.8E+07	5.4E+03	2.2E+04	7.0E+08	4.1E+06
	ST spent silica gel	4.4E+05	3.7E+10	0.0E+00	0.0E+00	1.1E+00	2.6E+04	1.0E+00	1.4E+02	5.0E+01	8.8E+06	2.3E+02	1.3E-02	5.2E-02	1.6E+03	9.6E+00
	LWTF spent silica gel	1.0E+08	1.4E+10	1.3E+07	3.8E+02	7.8E+00	6.1E+06	2.4E+02	3.3E+04	1.1E+04	2.0E+09	5.3E+04	2.9E+00	1.2E+01	3.8E+05	2.2E+03
	Sr/Cs absorbent	6.0E+07	1.7E+13	9.8E+11	1.4E+11	5.7E+08	1.6E+09	6.2E+04	8.6E+06	1.5E+07	3.9E+12	7.0E+07	3.8E+03	1.6E+04	2.6E+08	1.5E+06
	Off-gas drying powder	8.1E+08	1.1E+11	1.0E+08	3.0E+03	6.1E+01	4.8E+07	1.9E+03	2.6E+05	9.1E+04	1.6E+10	4.2E+05	2.3E+01	9.4E+01	3.0E+06	1.7E+04
JAEA MOX operation	Combustible waste I	5.7E+14	7.9E+15	0.0E+00	0.0E+00	0.0E+00	1.0E+09	4.0E+04	5.5E+06	1.9E+06	1.0E+10	2.2E+05	1.2E+01	2.0E+03	2.0E+09	3.7E+05
	Poorly combustible waste I	9.0E+12	1.3E+14	0.0E+00	0.0E+00	0.0E+00	1.6E+07	6.3E+02	8.7E+04	3.0E+04	1.6E+08	3.5E+03	1.9E-01	3.1E+01	3.2E+07	5.8E+03
	Incombustible waste I (metal-melting waste)	3.2E+15	4.5E+16	0.0E+00	0.0E+00	0.0E+00	5.7E+09	2.3E+05	3.1E+07	1.1E+07	5.7E+10	1.3E+06	6.9E+01	1.1E+04	1.1E+10	2.1E+06
	Incombustible waste II (metal-melting waste)	5.5E+09	7.7E+10	0.0E+00	0.0E+00	0.0E+00	9.8E+03	3.9E-01	5.3E+01	1.8E+01	9.8E+04	2.1E+00	1.2E-04	1.9E-02	2.0E+04	3.6E+00
	Incombustible waste I (metal ingot)	9.3E+09	1.3E+11	0.0E+00	0.0E+00	0.0E+00	1.6E+04	6.5E-01	9.0E+01	3.1E+01	1.6E+05	3.6E+00	2.0E-04	3.2E-02	3.3E+04	6.0E+00
	Incombustible waste II (metal ingot)	1.9E+09	2.6E+10	0.0E+00	0.0E+00	0.0E+00	3.3E+03	1.3E-01	1.8E+01	6.3E+00	3.3E+04	7.3E-01	4.0E-05	6.5E-03	6.6E+03	1.2E+00
	Incombustible waste I (non-metal-melting waste)	5.3E+13	7.4E+14	0.0E+00	0.0E+00	0.0E+00	9.4E+07	3.7E+03	5.1E+05	1.8E+05	9.4E+08	2.1E+04	1.1E+00	1.9E+02	1.9E+08	3.4E+04
	Incombustible waste I (non-metal)	1.9E+14	2.7E+15	0.0E+00	0.0E+00	0.0E+00	3.5E+08	1.4E+04	1.9E+06	6.6E+05	3.5E+09	7.6E+04	4.2E+00	6.8E+02	6.9E+08	1.3E+05
	Incombustible waste II (non-metal)	5.2E+09	7.3E+10	0.0E+00	0.0E+00	0.0E+00	9.3E+03	3.7E-01	5.1E+01	1.8E+01	9.3E+04	2.0E+00	1.1E-04	1.8E-02	1.9E+04	3.4E+00
JAEA reprocessing, dismantling	Primary incombustible waste I (metal)	5.5E+14	9.8E+15	2.3E+12	6.5E+07	1.3E+06	1.0E+12	4.1E+07	5.7E+09	2.0E+09	3.5E+14	9.2E+09	5.1E+05	2.1E+06	6.7E+10	3.8E+08
	Primary incombustible waste II (metal)	2.4E+11	3.1E+13	2.9E+10	8.3E+05	1.7E+04	1.3E+10	5.3E+05	7.3E+07	2.5E+07	4.4E+12	1.2E+08	6.5E+03	2.6E+04	8.3E+08	4.9E+06
	Primary incombustible waste III (metal)	4.1E+10	5.6E+12	5.2E+09	1.5E+05	3.1E+03	2.4E+09	9.6E+04	1.3E+07	4.6E+06	8.1E+11	2.1E+07	1.2E+03	4.8E+03	1.5E+08	8.8E+05
	Primary incombustible waste I (concrete)	7.3E+11	1.0E+14	9.3E+10	2.7E+06	5.5E+04	4.3E+10	1.7E+06	2.4E+08	8.2E+07	1.4E+13	3.8E+08	2.1E+04	8.5E+04	2.7E+09	1.6E+07
	Primary incombustible waste II (concrete)	9.3E+09	1.3E+12	1.2E+09	3.4E+04	7.1E+02	5.5E+08	2.2E+04	3.0E+06	1.0E+06	1.8E+11	4.8E+06	2.7E+02	1.1E+03	3.4E+07	2.0E+05
	Primary incombustible waste III (concrete)	7.9E+08	1.1E+11	1.0E+08	2.9E+03	6.0E+01	4.7E+07	1.8E+03	2.6E+05	8.9E+04	1.6E+10	4.1E+05	2.3E+01	9.2E+01	2.9E+06	1.7E+04
	Secondary decontamination waste liquid slurry solidified waste (MA series)	5.1E+12	7.0E+14	6.5E+11	1.9E+07	3.9E+05	3.0E+11	1.2E+07	1.7E+09	5.7E+08	1.0E+14	2.7E+09	1.5E+05	6.0E+05	1.9E+10	1.1E+08
	Secondary decontamination waste liquid slurry solidified waste (LA series)	4.0E+10	5.5E+12	5.1E+09	1.5E+05	3.0E+03	2.4E+09	9.4E+04	1.3E+07	4.5E+06	7.9E+11	2.1E+07	1.1E+03	4.7E+03	1.5E+08	8.6E+05
	Secondary decontamination waste liquid $NaNO_3$ solidified waste (MA series)	5.1E+09	1.6E+12	6.5E+11	1.9E+07	3.9E+03	2.7E+09	1.1E+05	1.5E+07	5.7E+05	1.0E+11	2.7E+06	1.5E+02	6.0E+02	1.9E+07	1.1E+05
	Secondary decontamination waste liquid $NaNO_3$ solidified waste (LA series)	3.9E+07	1.2E+10	5.1E+09	1.5E+05	3.0E+01	2.1E+07	8.1E+02	1.1E+05	4.4E+03	7.8E+08	2.1E+04	1.1E+00	4.6E+00	1.5E+05	8.5E+02
	Secondary combustible waste I	6.1E+12	8.3E+14	7.8E+11	2.2E+07	4.6E+05	3.6E+11	1.4E+07	2.0E+09	6.8E+08	1.2E+14	3.2E+09	1.7E+05	7.1E+05	2.2E+10	1.3E+08
	Secondary combustible waste II	3.5E+09	4.8E+11	4.5E+08	1.3E+04	2.6E+02	2.1E+08	8.2E+03	1.1E+06	3.9E+05	6.9E+10	1.8E+06	1.0E+02	4.1E+02	1.3E+07	7.5E+04
	Secondary combustible waste III	3.0E+09	4.1E+11	3.8E+08	1.1E+04	2.3E+02	1.8E+08	7.0E+03	9.7E+05	3.3E+05	5.9E+10	1.6E+06	8.6E+01	3.5E+02	1.1E+07	6.4E+04
	Secondary poorly combustible waste I	3.4E+11	4.7E+13	4.4E+10	1.3E+06	2.6E+04	2.0E+10	8.0E+05	1.1E+08	3.8E+07	6.7E+12	1.8E+08	9.8E+03	4.0E+04	1.3E+09	7.4E+06
	Secondary poorly combustible waste II	8.7E+08	1.2E+11	1.1E+08	3.2E+03	6.6E+01	5.2E+07	2.0E+03	2.8E+05	9.8E+04	1.7E+10	4.5E+05	2.5E+01	1.0E+02	3.2E+06	1.9E+04
	Secondary poorly combustible waste III	6.4E+08	8.8E+10	8.3E+07	2.4E+03	4.9E+01	3.8E+07	1.5E+03	2.1E+05	7.3E+04	1.3E+10	3.4E+05	1.9E+01	7.6E+01	2.4E+06	1.4E+04
	Secondary incombustible waste I (metal-melting waste)	7.6E+13	1.1E+15	1.2E+09	3.4E+04	7.0E+02	6.8E+08	2.7E+04	3.7E+06	1.3E+06	1.8E+11	4.8E+06	2.7E+02	1.3E+03	3.0E+08	2.5E+05
	Secondary incombustible waste II (metal-melting waste)	8.6E+09	1.2E+12	1.1E+09	3.1E+04	6.5E+02	5.0E+08	2.0E+04	2.8E+06	9.5E+05	1.7E+11	4.4E+06	2.4E+02	9.9E+02	3.1E+07	1.8E+05
	Secondary incombustible waste III (metal-melting waste)	2.2E+09	3.0E+11	2.8E+08	8.0E+03	1.7E+02	1.3E+08	5.1E+03	7.0E+05	2.4E+05	4.3E+10	1.1E+06	6.2E+01	2.5E+02	8.0E+06	4.7E+04
	Secondary incombustible waste I (non-metal-melting waste)	1.6E+13	2.7E+14	3.9E+10	1.1E+06	2.3E+04	1.8E+10	7.2E+05	1.0E+08	3.5E+07	6.1E+12	1.6E+08	8.8E+03	3.6E+04	1.2E+09	6.7E+06
	Secondary incombustible waste II (non-metal-melting waste)	1.3E+10	1.8E+12	1.7E+09	5.0E+04	1.0E+03	8.0E+08	3.2E+04	4.4E+06	1.5E+06	2.7E+11	7.0E+06	3.9E+02	1.6E+03	5.0E+07	2.9E+05
	Secondary incombustible waste III (non-metal-melting waste)	2.6E+09	3.5E+11	3.3E+08	9.5E+03	2.0E+02	1.5E+08	6.0E+03	8.3E+05	2.9E+05	5.1E+10	1.3E+06	7.4E+01	3.0E+02	9.5E+06	5.6E+04
	Secondary incombustible waste I (non-metal)	2.0E+12	3.0E+13	1.5E+09	4.2E+04	8.6E+02	6.8E+08	2.7E+04	3.7E+06	1.3E+06	2.2E+11	5.9E+06	3.3E+02	1.3E+03	4.9E+07	2.5E+05
	Secondary incombustible waste II (non-metal)	1.0E+09	1.3E+11	1.2E+08	3.5E+03	7.2E+01	5.6E+07	2.2E+03	3.1E+05	1.1E+05	1.9E+10	4.9E+05	2.7E+01	1.1E+02	3.5E+06	2.0E+04
	Secondary incombustible waste III (non-metal)	1.8E+08	2.5E+10	2.3E+07	6.7E+02	1.4E+01	1.1E+07	4.3E+02	5.9E+04	2.0E+04	3.6E+09	9.5E+04	5.2E+00	2.1E+01	6.7E+05	3.9E+03
JAEA MOX dismantling	Primary incombustible waste I (metal)	1.9E+15	2.6E+16	0.0E+00	0.0E+00	0.0E+00	3.3E+09	1.3E+05	1.8E+07	6.3E+06	3.3E+10	7.3E+05	4.0E+01	6.5E+03	6.6E+09	1.2E+06
	Primary incombustible waste II (metal)	3.7E+10	5.2E+11	0.0E+00	0.0E+00	0.0E+00	6.6E+04	2.6E+00	3.6E+02	1.2E+02	6.6E+05	1.4E+01	7.9E-04	1.3E-01	1.3E+05	2.4E+01
	Primary incombustible waste I (concrete)	1.0E+13	1.4E+14	0.0E+00	0.0E+00	0.0E+00	1.8E+07	7.1E+02	9.8E+04	3.4E+04	1.8E+08	3.9E+03	2.2E-01	3.5E+01	3.6E+07	6.5E+03
	Primary incombustible waste II (concrete)	2.6E+08	3.7E+09	0.0E+00	0.0E+00	0.0E+00	4.7E+02	1.8E-02	2.5E+00	8.8E-01	4.6E+03	1.0E-01	5.6E-06	9.2E-04	9.3E+02	1.7E-01
	Secondary combustible waste I	3.2E+14	4.4E+15	0.0E+00	0.0E+00	0.0E+00	5.6E+08	2.2E+04	3.1E+06	1.1E+06	5.6E+09	1.2E+05	6.8E+00	1.1E+03	1.1E+09	2.1E+05
	Secondary poorly combustible waste I	6.8E+12	9.5E+13	0.0E+00	0.0E+00	0.0E+00	1.2E+07	4.8E+02	6.6E+04	2.3E+04	1.2E+08	2.7E+03	1.5E-01	2.4E+01	2.4E+07	4.4E+03
	Secondary incombustible waste I (metal-melting waste)	2.8E+14	3.9E+15	0.0E+00	0.0E+00	0.0E+00	4.9E+08	1.9E+04	2.7E+06	9.3E+05	4.9E+09	1.1E+05	6.0E+00	9.7E+02	9.9E+08	1.8E+05
	Secondary incombustible waste II (metal-melting waste)	7.9E+08	1.1E+10	0.0E+00	0.0E+00	0.0E+00	1.4E+03	5.5E-02	7.6E+00	2.6E+00	1.4E+04	3.1E-01	1.7E-05	2.8E-03	2.8E+03	5.1E-01
	Secondary incombustible waste I (non-metal)	1.4E+13	1.9E+14	0.0E+00	0.0E+00	0.0E+00	2.4E+07	9.6E+02	1.3E+05	4.6E+04	2.4E+08	5.4E+03	3.0E-01	4.8E+01	4.9E+07	8.9E+03
	Secondary incombustible waste II (non-metal)	2.6E+08	3.7E+09	0.0E+00	0.0E+00	0.0E+00	4.7E+02	1.8E-02	2.5E+00	8.8E-01	4.6E+03	1.0E-01	5.6E-06	9.2E-04	9.3E+02	1.7E-01

	Type of waste package	Ag-108m	Sn-126	I-129	Cs-135	Cs-137	Pu-241	Am-242m	U-233	U-234	U-235	U-236	U-238	Np-237	Pu-238	Pu-239	Pu-240	Pu-242	Am-241	Am-243	Cm-244	Cm-245
JAEA reprocessing operation	Combustible waste I	9.3E+06	2.0E+09	2.6E+06	1.3E+09	2.8E+14	2.5E+14	3.0E+10	7.2E+04	6.2E+09	1.1E+08	1.0E+09	1.1E+09	9.6E+08	4.9E+12	1.1E+12	1.3E+12	3.0E+09	2.5E+12	2.0E+10	1.3E+12	8.6E+07
	Combustible waste II	1.6E+03	3.5E+05	4.7E+02	2.3E+05	4.9E+10	4.4E+10	5.2E+06	1.3E+01	1.1E+06	2.0E+04	1.8E+05	2.0E+05	1.7E+05	8.6E+08	1.9E+08	2.3E+08	5.3E+05	4.4E+08	3.6E+06	2.2E+08	1.5E+04
	Combustible waste III	1.6E+03	3.4E+05	4.5E+02	2.2E+05	4.7E+10	4.2E+10	5.0E+06	1.2E+01	1.1E+06	1.9E+04	1.7E+05	1.9E+05	1.6E+05	8.3E+08	1.8E+08	2.2E+08	5.1E+05	4.3E+08	3.4E+06	2.2E+08	1.5E+04
	Poorly combustible waste I	2.6E+06	5.7E+08	7.5E+05	3.6E+08	7.9E+13	7.1E+13	8.4E+09	2.1E+04	1.8E+09	3.2E+07	2.9E+08	3.2E+08	2.7E+08	1.4E+12	3.0E+11	3.7E+11	8.5E+08	7.1E+11	5.8E+09	3.6E+11	2.5E+07
	Poorly combustible waste II	3.6E+02	7.8E+04	1.0E+02	5.0E+04	1.1E+10	9.7E+09	1.2E+06	2.8E+00	2.4E+05	4.4E+03	4.0E+04	4.4E+04	3.8E+04	1.9E+08	4.1E+07	5.0E+07	1.2E+05	9.8E+07	7.9E+05	5.0E+07	3.4E+03
	Poorly combustible waste III	3.4E+02	7.3E+04	9.7E+01	4.7E+04	1.0E+10	9.1E+09	1.1E+06	2.7E+00	2.3E+05	4.2E+03	3.8E+04	4.1E+04	3.5E+04	1.8E+08	3.9E+07	4.7E+07	1.1E+05	9.2E+07	7.5E+05	4.7E+07	3.2E+03
	Incombustible waste I (metal-melting waste)	7.4E+06	1.6E+09	2.1E+06	1.0E+09	2.2E+14	2.3E+15	2.4E+10	6.7E+04	6.8E+09	1.7E+08	8.3E+08	1.0E+09	1.9E+10	6.4E+13	2.2E+13	2.4E+13	5.2E+10	4.9E+13	1.6E+10	1.0E+12	6.8E+07
	Incombustible waste II (metal-melting waste)	1.1E+05	2.4E+07	3.1E+04	1.5E+07	3.3E+12	2.9E+12	3.5E+08	8.5E+02	7.3E+07	1.3E+06	1.2E+07	1.3E+07	1.1E+07	5.8E+10	1.3E+10	1.5E+10	3.5E+07	3.0E+10	2.4E+08	1.5E+10	1.0E+06
	Incombustible waste III (metal-melting waste)	1.4E+04	3.0E+06	4.0E+03	1.9E+06	4.2E+11	3.8E+11	4.5E+07	1.1E+02	9.4E+06	1.7E+05	1.6E+06	1.7E+06	1.5E+06	7.4E+09	1.6E+09	1.9E+09	4.5E+06	3.8E+09	3.1E+07	1.9E+09	1.3E+05
	Incombustible waste I (non-metal-melting waste)	3.2E+06	7.0E+08	9.2E+05	4.5E+08	9.7E+13	2.4E+15	1.0E+10	3.6E+04	4.2E+09	1.2E+08	3.7E+08	5.5E+08	2.0E+10	6.7E+13	2.3E+13	2.6E+13	5.5E+10	5.2E+13	7.1E+09	4.4E+11	3.0E+07
	Incombustible waste II (non-metal-melting waste)	4.0E+04	8.6E+06	1.1E+04	5.5E+06	1.2E+12	1.1E+12	1.3E+08	3.1E+02	2.7E+07	4.9E+05	4.4E+06	4.8E+06	4.1E+06	2.1E+10	4.6E+09	5.5E+09	1.3E+07	1.1E+10	8.7E+07	5.5E+09	3.7E+05
	Incombustible waste III (non-metal-melting waste)	7.7E+03	1.7E+06	2.2E+03	1.1E+06	2.3E+11	2.1E+11	2.5E+07	6.0E+01	5.1E+06	9.4E+04	8.5E+05	9.3E+05	8.0E+05	4.0E+09	8.8E+08	1.1E+09	2.5E+06	2.1E+09	1.7E+07	1.1E+09	7.1E+04
	Incombustible waste I (non-metal)	6.1E+04	1.3E+07	1.7E+04	8.4E+06	1.8E+12	3.0E+13	1.9E+08	6.0E+02	6.5E+07	1.8E+06	6.9E+06	9.3E+06	2.4E+08	8.3E+11	2.9E+11	3.2E+11	6.8E+08	6.4E+11	1.3E+08	8.3E+09	5.7E+05
	Incombustible waste II (non-metal)	4.8E+03	1.0E+06	1.4E+03	6.6E+05	1.4E+11	1.3E+11	1.5E+07	3.7E+01	3.2E+06	5.8E+04	5.3E+05	5.8E+05	5.0E+05	2.5E+09	5.6E+08	6.7E+08	1.6E+06	1.3E+09	1.0E+07	6.5E+08	4.4E+04
	Incombustible waste III (non-metal)	8.6E+02	1.8E+05	2.4E+02	1.2E+05	2.6E+10	2.3E+10	2.7E+06	6.7E+00	5.7E+05	1.0E+04	9.5E+04	1.0E+05	8.9E+04	4.5E+08	9.8E+07	1.2E+08	2.8E+05	2.3E+08	1.9E+06	1.2E+08	8.0E+03
	Clarification filter	2.1E+08	4.4E+10	5.9E+07	2.9E+10	6.2E+15	5.5E+15	6.6E+11	1.6E+06	1.4E+11	2.5E+09	2.3E+10	2.5E+10	2.1E+10	1.1E+14	2.4E+13	2.9E+13	6.7E+10	5.6E+13	4.5E+11	2.8E+13	1.9E+09
	Incombustible waste in hulls can (metal-melting waste)	1.9E+04	4.1E+06	5.5E+03	2.7E+06	5.8E+11	5.1E+11	6.1E+07	1.5E+02	1.3E+07	2.3E+05	2.1E+06	2.3E+06	2.0E+06	1.0E+10	2.2E+09	2.7E+09	6.2E+06	5.2E+09	4.2E+07	2.6E+09	1.8E+05
	Incombustible waste in hulls can (non-metal-melting waste)	1.1E+04	2.4E+06	3.2E+03	1.6E+06	3.4E+11	3.0E+11	3.6E+07	8.8E+01	7.5E+06	1.4E+05	1.2E+06	1.4E+06	1.2E+06	5.9E+09	1.3E+09	1.6E+09	3.6E+06	3.0E+09	2.5E+07	1.5E+09	1.0E+05
	Iodine filter (spent silver absorbent)	0.0E+00	0.0E+00	1.1E+10	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Hulls and ends	2.4E+10	7.1E+10	3.2E+09	4.6E+10	9.9E+15	8.9E+15	1.1E+12	1.3E+08	2.2E+11	4.1E+09	3.7E+10	4.0E+10	3.4E+10	1.7E+14	3.8E+13	4.6E+13	1.1E+11	9.0E+13	7.3E+11	4.5E+13	3.1E+09
	Bitumen solidified waste (MA series)	4.3E+06	1.8E+09	4.1E+11	1.1E+09	2.5E+14	4.7E+14	1.3E+10	1.4E+05	1.2E+10	2.1E+08	1.9E+09	2.1E+09	1.8E+09	9.2E+12	2.0E+12	2.4E+12	5.6E+09	1.1E+12	9.2E+09	3.0E+12	1.3E+09
	Bitumen solidified waste (LA series)	8.4E+04	1.9E+07	1.4E+11	1.3E+07	2.7E+12	2.6E+13	7.1E+08	7.7E+03	6.6E+08	1.2E+07	1.1E+08	1.2E+08	1.0E+08	5.2E+11	1.1E+11	1.4E+11	3.2E+08	6.0E+10	4.9E+08	3.3E+10	5.0E+07
	Slurry solidified waste (MA series acid)	9.5E+05	4.0E+08	1.9E+09	2.6E+08	5.5E+13	1.0E+14	3.0E+09	3.0E+04	2.6E+09	4.8E+07	4.3E+08	4.7E+08	4.0E+08	2.1E+12	4.5E+11	5.4E+11	1.3E+09	2.5E+11	2.0E+09	6.6E+11	3.0E+08
	Slurry solidified waste (MA series alkaline)	1.1E+06	4.4E+08	2.1E+11	2.8E+08	6.1E+13	1.2E+13	3.3E+08	3.4E+03	2.9E+08	5.3E+06	4.8E+07	5.2E+07	4.5E+07	2.3E+11	4.9E+10	6.0E+10	1.4E+08	2.8E+10	2.3E+08	7.3E+10	3.3E+07
	Slurry solidified waste (LA series alkaline)	6.6E+04	1.5E+07	2.4E+11	9.8E+06	2.1E+12	2.1E+13	5.6E+08	6.0E+03	5.2E+08	9.4E+06	8.5E+07	9.3E+07	8.0E+07	4.1E+11	8.8E+10	1.1E+11	2.5E+08	4.7E+10	3.8E+08	2.6E+10	3.9E+07
	$NaNO_3$ solidified waste (MA series acid)	9.6E+02	4.0E+05	1.9E+07	2.6E+05	5.5E+10	1.0E+11	3.0E+06	3.0E+01	2.6E+06	4.8E+04	4.3E+05	4.7E+05	4.1E+05	2.1E+09	4.5E+08	5.4E+08	1.3E+06	2.5E+08	2.0E+06	6.6E+08	3.0E+05
	$NaNO_3$ solidified waste (MA series alkaline)	1.1E+03	4.4E+05	2.1E+09	2.8E+05	6.1E+10	1.2E+10	3.3E+05	3.4E+00	2.9E+05	5.3E+03	4.8E+04	5.2E+04	4.5E+04	2.3E+08	4.9E+07	6.0E+07	1.4E+05	2.8E+07	2.3E+05	7.3E+07	3.3E+04
	$NaNO_3$ solidified waste (LA series alkaline)	6.6E+01	1.5E+04	2.4E+09	9.8E+03	2.1E+09	2.1E+10	5.6E+05	6.0E+00	5.2E+05	9.4E+03	8.5E+04	9.3E+04	8.0E+04	4.1E+08	8.8E+07	1.1E+08	2.5E+05	4.7E+07	3.8E+05	2.6E+07	3.9E+04
	Plastic solidified waste	6.1E+00	1.3E+03	1.9E+09	8.4E+02	1.8E+08	3.2E+10	3.8E+06	9.4E+00	8.0E+05	1.5E+04	1.3E+05	1.4E+05	1.2E+05	6.3E+08	1.4E+08	1.7E+08	3.9E+05	3.2E+08	2.6E+06	1.6E+08	1.1E+04
	Chemical sludge	5.5E+04	1.2E+07	1.6E+04	7.6E+06	1.7E+12	1.5E+12	1.8E+08	4.3E+02	3.7E+07	6.7E+05	6.1E+06	6.7E+06	5.7E+06	2.9E+10	6.3E+09	7.7E+09	1.8E+07	1.5E+10	1.2E+08	7.6E+09	5.1E+05
	Spent sand (pool water filtration)	3.1E+04	6.6E+06	8.8E+03	4.3E+06	9.2E+11	8.2E+11	9.9E+07	2.4E+02	2.1E+07	3.8E+05	3.4E+06	3.7E+06	3.2E+06	1.6E+10	3.5E+09	4.3E+09	9.9E+06	8.3E+09	6.7E+07	4.2E+09	2.9E+05
	Water in hulls can	1.2E+07	2.6E+09	3.4E+06	1.6E+09	3.6E+14	3.2E+14	3.8E+10	9.3E+04	8.0E+09	1.5E+08	1.3E+09	1.4E+09	1.2E+09	6.2E+12	1.4E+12	1.7E+12	3.8E+09	3.2E+12	2.6E+10	1.6E+12	1.1E+08
	Hulls can (empty container)	1.6E+05	3.4E+07	4.5E+04	2.2E+07	4.7E+12	4.2E+12	5.0E+08	1.2E+03	1.0E+08	1.9E+06	1.7E+07	1.9E+07	1.6E+07	8.2E+10	1.8E+10	2.2E+10	5.0E+07	4.2E+10	3.4E+08	2.1E+10	1.5E+06
	ST spent silica gel	3.7E-01	8.0E+01	8.0E+09	5.1E+01	1.1E+07	9.9E+06	1.2E+03	2.9E-03	2.5E+02	4.5E+00	4.1E+01	4.5E+01	3.8E+01	2.0E+05	4.2E+04	5.2E+04	1.2E+02	1.0E+05	8.1E+02	5.1E+04	3.4E+00
	LWTF spent silica gel	8.5E+01	1.8E+04	2.4E+01	1.2E+04	2.5E+09	2.3E+09	2.7E+05	6.6E-01	5.7E+04	1.0E+03	9.4E+03	1.0E+04	8.8E+03	4.5E+07	9.7E+06	1.2E+07	2.7E+04	2.3E+07	1.9E+05	1.2E+07	7.9E+02
	Sr/Cs absorbent	5.8E+04	2.4E+07	2.8E+08	1.5E+07	3.3E+12	1.5E+09	4.3E+04	4.4E-01	3.8E+04	6.9E+02	6.2E+03	6.8E+03	5.9E+03	3.0E+07	6.4E+06	7.8E+06	1.8E+04	3.6E+06	2.9E+04	9.5E+06	4.3E+03
	Off-gas drying powder	6.7E+02	1.4E+05	1.9E+02	9.3E+04	2.0E+10	1.8E+10	2.2E+06	5.3E+00	4.5E+05	8.2E+03	7.4E+04	8.1E+04	7.0E+04	3.5E+08	7.7E+07	9.3E+07	2.2E+05	1.8E+08	1.5E+06	9.2E+07	6.2E+03
JAEA MOX operation	Combustible waste I	1.4E+04	3.0E+06	0.0E+00	1.2E+04	2.5E+09	7.9E+15	5.8E+04	4.2E+05	8.0E+10	3.4E+09	6.3E+08	6.5E+09	6.6E+10	2.3E+14	8.0E+13	8.7E+13	1.8E+11	1.8E+14	4.0E+04	2.5E+06	1.7E+02
	Poorly combustible waste I	2.2E+02	4.8E+04	0.0E+00	1.9E+02	4.0E+07	1.3E+14	9.1E+02	6.7E+03	1.3E+09	5.3E+07	1.0E+07	1.0E+08	1.0E+09	3.6E+12	1.3E+12	1.4E+12	2.9E+09	2.8E+12	6.3E+02	3.9E+04	2.7E+00
	Incombustible waste I (metal-melting waste)	8.0E+04	1.7E+07	0.0E+00	6.7E+04	1.4E+10	4.5E+16	3.3E+05	2.4E+06	4.5E+11	1.9E+10	3.6E+09	3.7E+10	3.7E+11	1.3E+15	4.5E+14	4.9E+14	1.0E+12	9.9E+14	2.2E+05	1.4E+07	9.5E+02
	Incombustible waste II (metal-melting waste)	1.4E-01	3.0E+01	0.0E+00	1.1E-01	2.5E+04	7.7E+10	5.6E-01	4.1E+00	7.7E+05	3.3E+04	6.2E+03	6.3E+04	6.4E+05	2.2E+09	7.7E+08	8.4E+08	1.8E+06	1.7E+09	3.8E-01	2.4E+01	1.6E-03
	Incombustible waste I (metal ingot)	2.3E-01	5.0E+01	0.0E+00	1.9E-01	4.2E+04	1.3E+11	9.4E-01	6.9E+00	1.3E+06	5.5E+04	1.0E+04	1.1E+05	1.1E+06	3.7E+09	1.3E+09	1.4E+09	3.0E+06	2.9E+09	6.5E-01	4.0E+01	2.7E-03
	Incombustible waste II (metal ingot)	4.7E-02	1.0E+01	0.0E+00	3.9E-02	8.4E+03	2.6E+10	1.9E-01	1.4E+00	2.6E+05	1.1E+04	2.1E+03	2.1E+04	2.2E+05	7.4E+08	2.6E+08	2.9E+08	6.1E+05	5.8E+08	1.3E-01	8.1E+00	5.5E-04
	Incombustible waste I (non-metal-melting waste)	1.3E+03	2.8E+05	0.0E+00	1.1E+03	2.4E+08	7.4E+14	5.4E+03	3.9E+04	7.4E+09	3.2E+08	5.9E+07	6.1E+08	6.2E+09	2.1E+13	7.4E+12	8.1E+12	1.7E+10	1.6E+13	3.7E+03	2.3E+05	1.6E+01
	Incombustible waste I (non-metal)	4.9E+03	1.0E+06	0.0E+00	4.0E+03	8.7E+08	2.7E+15	2.0E+04	1.5E+05	2.7E+10	1.2E+09	2.2E+08	2.2E+09	2.3E+10	7.7E+13	2.7E+13	3.0E+13	6.3E+10	6.0E+13	1.4E+04	8.5E+05	5.8E+01
	Incombustible waste II (non-metal)	1.3E-01	2.8E+01	0.0E+00	1.1E-01	2.3E+04	7.3E+10	5.3E-01	3.9E+00	7.3E+05	3.1E+04	5.9E+03	6.0E+04	6.1E+05	2.1E+09	7.3E+08	8.0E+08	1.7E+06	1.6E+09	3.6E-01	2.3E+01	1.5E-03
JAEA reprocessing, dismantling	Primary incombustible waste I (metal)	1.5E+07	3.2E+09	4.2E+06	2.0E+09	4.4E+14	7.8E+15	4.7E+10	1.5E+05	1.6E+10	4.5E+08	1.7E+09	2.3E+09	6.3E+10	2.2E+14	7.6E+13	8.3E+13	1.8E+11	1.7E+14	3.2E+10	2.0E+12	1.4E+08
	Primary incombustible waste II (metal)	1.9E+05	4.0E+07	5.4E+04	2.6E+07	5.6E+12	5.2E+12	6.0E+08	1.5E+03	1.3E+08	2.3E+06	2.1E+07	2.3E+07	2.1E+07	1.0E+11	2.3E+10	2.8E+10	6.4E+07	5.4E+10	4.1E+08	2.6E+10	1.7E+06
	Primary incombustible waste III (metal)	3.4E+04	7.3E+06	9.7E+03	4.7E+06	1.0E+12	9.1E+11	1.1E+08	2.7E+02	2.3E+07	4.2E+05	3.8E+06	4.1E+06	3.5E+06	1.8E+10	3.9E+09	4.7E+09	1.1E+07	9.2E+09	7.5E+07	4.7E+09	3.2E+05
	Primary incombustible waste I (concrete)	6.1E+05	1.3E+08	1.7E+05	8.4E+07	1.8E+13	1.6E+13	1.9E+09	4.7E+03	4.1E+08	7.4E+06	6.7E+07	7.3E+07	6.3E+07	3.2E+11	6.9E+10	8.4E+10	2.0E+08	1.6E+11	1.3E+09	8.3E+10	5.6E+06
	Primary incombustible waste II (concrete)	7.7E+03	1.7E+06	2.2E+03	1.1E+06	2.3E+11	2.1E+11	2.5E+07	6.0E+01	5.2E+06	9.5E+04	8.6E+05	9.3E+05	8.0E+05	4.1E+09	8.9E+08	1.1E+09	2.5E+06	2.1E+09	1.7E+07	1.1E+09	7.2E+04
	Primary incombustible waste III (concrete)	6.6E+02	1.4E+05	1.9E+02	9.1E+04	2.0E+10	1.8E+10	2.1E+06	5.1E+00	4.4E+05	8.0E+03	7.3E+04	7.9E+04	6.8E+04	3.5E+08	7.5E+07	9.1E+07	2.1E+05	1.8E+08	1.4E+06	9.0E+07	6.1E+03
	Secondary decontamination waste liquid slurry solidified waste (MA series)	4.3E+06	9.2E+08	1.2E+06	5.9E+08	1.3E+14	1.1E+14	1.4E+10	3.3E+04	2.9E+09	5.2E+07	4.7E+08	5.1E+08	4.4E+08	2.2E+12	4.9E+11	5.9E+11	1.4E+09	1.2E+12	9.3E+09	5.8E+11	4.0E+07
	Secondary decontamination waste liquid slurry solidified waste (LA series)	3.3E+04	7.2E+06	9.5E+03	4.6E+06	1.0E+12	8.9E+11	1.1E+08	2.6E+02	2.2E+07	4.1E+05	3.7E+06	4.0E+06	3.5E+06	1.7E+10	3.8E+09	4.6E+09	1.1E+07	9.0E+09	7.3E+07	4.6E+09	3.1E+05
	Secondary decontamination waste liquid $NaNO_3$ solidified waste (MA series)	4.3E+03	9.2E+05	1.2E+04	5.9E+05	1.3E+11	1.1E+11	1.4E+07	3.3E+01	2.9E+06	5.2E+04	4.7E+05	5.1E+05	4.4E+05	2.2E+09	4.9E+08	5.9E+08	1.4E+06	1.2E+09	9.3E+06	5.8E+08	4.0E+04
	Secondary decontamination waste liquid $NaNO_3$ solidified waste (LA series)	3.3E+01	7.1E+03	9.4E+01	4.6E+03	9.9E+08	8.8E+08	1.1E+05	2.6E-01	2.2E+04	4.0E+02	3.6E+03	4.0E+03	3.4E+03	1.7E+07	3.8E+06	4.6E+06	1.1E+04	8.9E+06	7.2E+04	4.5E+06	3.1E+02
	Secondary combustible waste I	5.1E+06	1.1E+09	1.4E+06	7.0E+08	1.5E+14	1.4E+14	1.6E+10	4.0E+04	3.4E+09	6.2E+07	5.6E+08	6.1E+08	5.3E+08	2.7E+12	5.8E+11	7.0E+11	1.6E+09	1.4E+12	1.1E+10	6.9E+11	4.7E+07
	Secondary combustible waste II	2.9E+03	6.2E+05	8.3E+02	4.0E+05	8.7E+10	7.8E+10	9.3E+06	2.3E+01	1.9E+06	3.5E+04	3.2E+05	3.5E+05	3.0E+05	1.5E+09	3.3E+08	4.0E+08	9.3E+05	7.9E+08	6.3E+06	4.0E+08	2.7E+04
	Secondary combustible waste III	2.5E+03	5.3E+05	7.1E+02	3.4E+05	7.4E+10	6.6E+10	7.9E+06	1.9E+01	1.7E+06	3.0E+04	2.7E+05	3.0E+05	2.6E+05	1.3E+09	2.8E+08	3.5E+08	8.0E+05	6.7E+08	5.4E+06	3.4E+08	2.3E+04
	Secondary poorly combustible waste I	2.8E+05	6.1E+07	8.1E+04	3.9E+07	8.5E+12	7.6E+12	9.1E+08	2.2E+03	1.9E+08	3.5E+06	3.1E+07	3.4E+07	2.9E+07	1.5E+11	3.2E+10	3.9E+10	9.1E+07	7.7E+10	6.2E+08	3.9E+10	2.6E+06
	Secondary poorly combustible waste II	7.3E+02	1.6E+05	2.1E+02	1.0E+05	2.2E+10	1.9E+10	2.3E+06	5.7E+00	4.9E+05	8.9E+03	8.0E+04	8.8E+04	7.5E+04	3.8E+08	8.3E+07	1.0E+08	2.3E+05	2.0E+08	1.6E+06	9.9E+07	6.7E+03
	Secondary poorly combustible waste III	5.4E+02	1.2E+05	1.5E+02	7.5E+04	1.6E+10	1.4E+10	1.7E+06	4.2E+00	3.6E+05	6.6E+03	6.0E+04	6.5E+04	5.6E+04	2.8E+08	6.2E+07	7.5E+07	1.7E+05	1.5E+08	1.2E+06	7.4E+07	5.0E+03
	Secondary incombustible waste I (metal-melting waste)	9.6E+03	2.1E+06	2.2E+03	1.1E+06	2.3E+11	1.1E+15	2.5E+07	4.9E+03	9.2E+08	3.9E+07	8.1E+06	7.6E+07	8.8E+09	3.0E+13	1.1E+13	1.2E+13	2.5E+10	2.3E+13	1.7E+07	1.1E+09	7.2E+04
	Secondary incombustible waste II (metal-melting waste)	7.1E+03	1.5E+06	2.0E+03	9.8E+05	2.1E+11	1.9E+11	2.3E+07	5.5E+01	4.7E+06	8.7E+04	7.8E+05	8.5E+05	7.5E+05	3.8E+09	8.3E+08	1.0E+09	2.3E+06	2.0E+09	1.5E+07	9.7E+08	6.6E+04
	Secondary incombustible waste III (metal-melting waste)	1.8E+03	3.9E+05	5.2E+02	2.5E+05	5.4E+10	4.8E+10	5.8E+06	1.4E+01	1.2E+06	2.2E+04	2.0E+05	2.2E+05	1.9E+05	9.5E+08	2.1E+08	2.5E+08	5.8E+05	4.9E+08	4.0E+06	2.5E+08	1.7E+04
	Secondary incombustible waste I (non-metal-melting waste)	2.6E+05	5.5E+07	7.3E+04	3.5E+07	7.7E+12	2.3E+14	8.2E+08	3.0E+03	3.6E+08	1.1E+07	3.0E+07	4.7E+07	1.9E+09	6.5E+12	2.3E+12	2.5E+12	5.3E+09	5.0E+12	5.6E+08	3.5E+10	2.4E+06
	Secondary incombustible waste II (non-metal-melting waste)	1.1E+04	2.4E+06	3.2E+03	1.6E+06	3.4E+11	3.0E+11	3.6E+07	8.8E+01	7.5E+06	1.4E+05	1.2E+06	1.4E+06	1.2E+06	5.9E+09	1.3E+09	1.6E+09	3.6E+06	3.0E+09	2.5E+07	1.5E+09	1.0E+05
	Secondary incombustible waste III (non-metal-melting waste)	2.1E+03	4.6E+05	6.1E+02	3.0E+05	6.4E+10	5.7E+10	6.9E+06	1.7E+01	1.4E+06	2.6E+04	2.4E+05	2.6E+05	2.2E+05	1.1E+09	2.5E+08	3.0E+08	6.9E+05	5.8E+08	4.7E+06	2.9E+08	2.0E+04
	Secondary incombustible waste I (non-metal)	9.5E+03	2.0E+06	2.7E+03	1.3E+06	2.8E+11	2.9E+13	3.0E+07	2.0E+02	3.1E+07	1.2E+06	1.2E+06	3.2E+06	2.4E+08	8.1E+11	2.9E+11	3.1E+11	6.7E+08	6.3E+11	2.1E+07	1.3E+09	8.8E+04
	Secondary incombustible waste II (non-metal)	7.9E+02	1.7E+05	2.2E+02	1.1E+05	2.4E+10	2.2E+10	2.5E+06	6.1E+00	5.3E+05	9.6E+03	8.7E+04	9.5E+04	9.0E+04	4.4E+08	1.0E+08	1.2E+08	2.8E+05	2.4E+08	1.7E+06	1.1E+08	7.3E+03
	Secondary incombustible waste III (non-metal)	1.5E+02	3.3E+04	4.3E+01	2.1E+04	4.5E+09	4.1E+09	4.9E+05	1.2E+00	1.0E+05	1.9E+03	1.7E+04	1.8E+04	1.6E+04	8.0E+07	1.7E+07	2.1E+07	4.9E+04	4.1E+07	3.3E+05	2.1E+07	1.4E+03
JAEA MOX dismantling	Primary incombustible waste I (metal)	4.6E+04	1.0E+07	0.0E+00	3.9E+04	8.4E+09	2.6E+16	1.9E+05	1.4E+06	2.6E+11	1.1E+10	2.1E+09	2.1E+10	2.2E+11	7.4E+14	2.6E+14	2.8E+14	6.1E+11	5.8E+14	1.3E+05	8.1E+06	5.5E+02
	Primary incombustible waste II (metal)	9.2E-01	2.0E+02	0.0E+00	7.7E-01	1.7E+05	5.2E+11	3.8E+00	2.8E+01	5.2E+06	2.2E+05	4.1E+04	4.3E+05	4.3E+06	1.5E+10	5.2E+09	5.6E+09	1.2E+07	1.1E+10	2.6E+00	1.6E+02	1.1E-02
	Primary incombustible waste I (concrete)	2.5E+02	5.4E+04	0.0E+00	2.1E+02	4.5E+07	1.4E+14	1.0E+03	7.5E+03	1.4E+09	6.0E+07	1.1E+07	1.2E+08	1.2E+09	4.0E+12	1.4E+12	1.5E+12	3.3E+09	3.1E+12	7.0E+02	4.4E+04	3.0E+00
	Primary incombustible waste II (concrete)	6.5E-03	1.4E+00	0.0E+00	5.4E-03	1.2E+03	3.7E+09	2.7E-02	1.9E-01	3.7E+04	1.6E+03	2.9E+02	3.0E+03	3.0E+04	1.0E+08	3.7E+07	4.0E+07	8.5E+04	8.1E+07	1.8E-02	1.1E+00	7.7E-05
	Secondary combustible waste I	7.9E+03	1.7E+06	0.0E+00	6.6E+03	1.4E+09	4.4E+15	3.2E+04	2.4E+05	4.5E+10	1.9E+09	3.5E+08	3.6E+09	3.7E+10	1.3E+14	4.4E+13	4.8E+13	1.0E+11	9.8E+13	2.2E+04	1.4E+06	9.4E+01
	Secondary poorly combustible waste I	1.7E+02	3.7E+04	0.0E+00	1.4E+02	3.0E+07	9.5E+13	6.9E+02	5.1E+03	9.5E+08	4.0E+07	7.6E+06	7.8E+07	7.9E+08	2.7E+12	9.5E+11	1.0E+12	2.2E+09	2.1E+12	4.7E+02	3.0E+04	2.0E+00
	Secondary incombustible waste I (metal-melting waste)	6.9E+03	1.5E+06	0.0E+00	5.8E+03	1.2E+09	3.9E+15	2.8E+04	2.1E+05	3.9E+10	1.7E+09	3.1E+08	3.2E+09	3.2E+10	1.1E+14	3.9E+13	4.2E+13	9.0E+10	8.6E+13	1.9E+04	1.2E+06	8.2E+01
	Secondary incombustible waste II (metal-melting waste)	2.0E-02	4.2E+00	0.0E+00	1.6E-02	3.5E+03	1.1E+10	8.0E-02	5.9E-01	1.1E+05	4.7E+03	8.8E+02	9.0E+03	9.2E+04	3.1E+08	1.1E+08	1.2E+08	2.6E+05	2.4E+08	5.5E-02	3.4E+00	2.3E-04
	Secondary incombustible waste I (non-metal)	3.4E+02	7.4E+04	0.0E+00	2.8E+02	6.2E+07	1.9E+14	1.4E+03	1.0E+04	1.9E+09	8.2E+07	1.5E+07	1.6E+08	1.6E+09	5.5E+12	1.9E+12	2.1E+12	4.5E+09	4.2E+12	9.6E+02	6.0E+04	4.1E+00
	Secondary incombustible waste II (non-metal)	6.5E-03	1.4E+00	0.0E+00	5.4E-03	1.2E+03	3.7E+09	2.7E-02	1.9E-01	3.7E+04	1.6E+03	2.9E+02	3.0E+03	3.0E+04	1.0E+08	3.7E+07	4.0E+07	8.5E+04	8.1E+07	1.8E-02	1.1E+00	7.7E-05

Table 2.3-9 Comparison of quantities of major nuclides in different radioactive materials, per unit hulls and ends

	Activity of radioactive material (Bq/container)			
	Private sector	JAEA	COGEMA	BNGS
Mass of waste	480 kg	500 kg	772 kg	442 kg
C-14	1.8×10^{10}	1.3×10^{10}	7.1×10^{9}	2.2×10^{10}
Cl-36	3.4×10^{8}	2.2×10^{8}	2.1×10^{7}	2.0×10^{8}
Ni-63	4.3×10^{13}	2.4×10^{13}	2.9×10^{13}	2.2×10^{13}
Co-60	5.0×10^{13}	4.7×10^{13}	1.6×10^{14}	3.4×10^{13}
Sr-90	1.3×10^{13}	7.5×10^{12}	1.0×10^{13}	1.9×10^{12}
Nb-94	1.0×10^{11}	5.4×10^{10}	2.9×10^{10}	6.9×10^{10}
Tc-99	2.5×10^{10}	1.7×10^{9}	2.9×10^{9}	4.6×10^{8}
I-129	6.0×10^{6}	3.0×10^{6}	7.1×10^{7}	8.0×10^{5}
Cs-137	1.9×10^{13}	9.5×10^{12}	1.1×10^{13}	1.4×10^{13}
Total α	9.0×10^{11}	3.8×10^{11}	1.5×10^{11}	1.4×10^{11}

2.4 Waste package classification

The activity of radioactive material in TRU wastes covers a wide range. Hence, based on the reference concept in Japan (see JNC, 2000 for details), it is necessary to classify waste packages depending on their activity. Disposal can then be optimized based on this classification.

In this report, a summary is given of the method for classifying waste packages for three disposal concepts: shallow disposal in concrete vaults, intermediate-depth disposal and deep geological disposal.

Several types of dismantling waste are estimated to be below the clearance level for waste destined for shallow trench disposal in which no engineered structures are necessary. However, this report assumes that the waste that is appropriate for trench disposal will be disposed of in concrete vaults. Consequently, only the above three disposal concepts are evaluated further here.

2.4.1 Principles for waste package classification

The upper limit of activity of power plant waste which is suitable for concrete vault disposal and intermediate-depth disposal is legally specified according to government regulations on nuclear power plant waste. Basically, the classification for concrete vault disposal and intermediate-depth disposal is based on the upper limit of concentration for TRU waste and geological disposal is selected for the remaining waste.

The nuclide composition of TRU waste is different from that of nuclear power plant waste. In this report, the important nuclides used for classification of TRU-waste were those for which relative importance (D/C) is within 0.001 times maximum D/C, where C is a minimum value equivalent to the concentration of radioactive material that would give an exposure of 10 μSv/y when all exposure pathways are considered

together, and D the average concentration of a radionuclide in the waste package.

The values of equivalent concentration (C) corresponding to a dose of 10 μSv/y for each nuclide in each disposal concept were the same as those derived for power plant waste by a special division on nuclear safety standards of the Nuclear Safety Commission of Japan (NSC, 1986, 1992, 2000). Values of C for nuclides that were not evaluated in this source have been estimated here using the same method.

The average activities of radionuclides in each waste package (D) were estimated by considering the nuclide composition of representative TRU waste, considered to be mainly spent fuel and radioactive metal. The results of the evaluation of relative importance (D/C) are shown in Table 2.4.1-1. The activity which is used for the classification of additional nuclides is shown in Table 2.4.1-2.

Since the average activity of radioactive material in each waste package is different, the activity equivalent to an exposure of 10 μSv/y is used as the guideline for disposal classification. However, the total concentration of α-emitting nuclides for intermediate-depth disposal is not classified using a value of 10 μSv/y but, instead, a guideline of 1 GBq M/g is used.

Table 2.4.1-1 Relative important nuclides

Relative importance	Concrete vault disposal		Intermediate-depth disposal	
	Spent fuel	Activated metal	Spent fuel	Activated metal
within 1 times maximum D/C	Sr-90 Pu-241 Am-241	Ni-63 Co-60 Nb-94	U-238 Pu-238,241	Cl-36 Zr-93
within 0.1 times maximum D/C	Tc-99 Cs-137 Pu-238,239,240	C-14 Cl-36 Ni-59	Tc-99 U-234 Np-237 Am-241	C-14 Tc-99
within 0.01 times maximum D/C	U-238 Np-237 Am-242m,243 Cm-244	Zr-93 Mo-93 Tc-99 Ag-108m	I-129 U-235,236 Pu-239 Am-242m	-

Table 2.4.1-2 Activities used to decide form of waste disposal (Bq Mg^{-1})

Radionuclide	Concrete vault disposal		Intermediate-depth disposal	
	Regulatory value ×1/10 (10 μSv/y equivalent)	Additional (10 μSv/y equivalent)	Regulatory value ×1/10 (10 μSv/y equivalent)	Additional (10 μSv/y equivalent)
C-14	3.7×10^{9}	-	5.2×10^{13}	-
Cl-36	-	-	1.0×10^{10}	-
Co-60	1.11×10^{12}	-	-	-
Ni-59	-	2.9×10^{10}	-	-
Ni-63	1.11×10^{11}	-	-	-
Sr-90	7.4×10^{9}	-	-	-
Zr-93	-	1.5×10^{10}	-	1.8×10^{12}
Mo-93	-	7.8×10^{8}	-	-
Nb-94	-	1.1×10^{9}	-	-
Tc-99	-	1.9×10^{7}	8.2×10^{10}	-
Ag-108m	-	4.1×10^{8}	-	-
I-129	-	2.1×10^{7}	-	3.1×10^{9}
Cs-137	1.11×10^{11}	-	-	-
Np-237	-	-	1.3×10^{9}	-
Total α	1.11×10^{8}	-	-	1.0×10^{9} *1

*1: Rough guideline value for classification

2.4.2 Type, quantity and characteristics of waste packages

Of the total volume of TRU waste of approximately 140,300 m^3, it is estimated that waste packages for concrete vault disposal, intermediate-depth disposal and deep geological disposal comprise about 88,400 m^3 (about 63%), 25,200 m^3 (about 18%) and 26,600 m^3 (about 19%), respectively (Table 2.4.2-1). The amounts of radionuclides in wastes intended for each type of disposal are shown in Table 2.4.2-2.

A representative waste package which is classified as being suitable for deep geological disposal contains spent silver absorbent with a high content of I-129, hulls and ends with high contents of β- γ- and α-emitting nuclides and solidified bitumen that includes $NaNO_3$. A typical waste package classified as being suitable for intermediate-depth disposal or concrete vault disposal contains solids such as CB, BP and miscellaneous waste.

Table 2.4.2-1 Volume of waste packages in each disposal category

(m^3)

Waste type	Concrete vault disposal	Intermediate-depth disposal	Deep geological disposal	Total
Commercial reprocessing facility operational waste	24,175	13,215	13,060	50,450
Commercial MOX facility operational waste	492	61	369	922
Commercial reprocessing facility dismantling waste	36,647	6,974	639	44,260
Commercial MOX facility dismantling waste	491	1,250	263	2,004
JAEA reprocessing facility operational waste	10,388	3,410	4,488	18,286
JAEA MOX facility operational waste	0	14	1,293	1,307
JAEA reprocessing facility dismantling waste	7,238	256	1,051	8,544
JAEA MOX facility dismantling waste	0	25	2,020	2,045
Returned radioactive waste (COGEMA)	0	0	937	937
Returned radioactive waste (BNGS)	9,000	0	2,520	11,520
Total	88,431	25,205	26,640	140,274

Table 2.4.2-2 Activities of major nuclides in each disposal category

Nuclide	Radionuclide activity (Bq)		
	Concrete vault disposal	Intermediate-depth disposal	Geological disposal
H-3	7.4×10^{13}	4.5×10^{14}	7.1×10^{17}
C-14	1.3×10^{12}	3.4×10^{14}	5.7×10^{14}
Cl-36	7.5×10^{8}	5.6×10^{12}	8.8×10^{12}
Co-60	5.9×10^{12}	6.5×10^{17}	1.6×10^{18}
Ni-59	1.8×10^{10}	1.4×10^{15}	7.2×10^{15}
Ni-63	1.6×10^{12}	2.1×10^{17}	1.2×10^{18}
Se-79	1.1×10^{9}	8.6×10^{10}	2.7×10^{12}
Sr-90	6.8×10^{14}	2.2×10^{15}	5.9×10^{17}
Zr-93	3.2×10^{10}	1.5×10^{14}	3.1×10^{14}
Nb-94	4.0×10^{8}	1.2×10^{14}	2.6×10^{15}
Mo-93	7.5×10^{7}	4.5×10^{12}	5.2×10^{13}
Tc-99	2.2×10^{11}	8.0×10^{11}	6.6×10^{14}
Pd-107	2.8×10^{8}	3.3×10^{9}	5.5×10^{11}
Ag-108m	1.7×10^{8}	3.8×10^{12}	2.1×10^{12}
Sn-126	1.3×10^{10}	2.3×10^{10}	6.1×10^{12}
I-129	6.7×10^{9}	1.5×10^{11}	5.2×10^{13}
Cs-135	4.3×10^{9}	1.4×10^{10}	3.4×10^{12}
Cs-137	9.5×10^{14}	3.0×10^{15}	7.6×10^{17}
Pu-241	2.9×10^{14}	3.2×10^{15}	5.7×10^{17}
Am-242m	2.1×10^{11}	2.4×10^{11}	6.2×10^{13}
Total $\beta\,\gamma$	5.0×10^{15}	4.6×10^{18}	1.7×10^{19}
U-233	2.6×10^{4}	5.0×10^{9}	4.7×10^{9}
U-234	4.9×10^{8}	1.7×10^{9}	1.7×10^{12}
U-235	4.3×10^{7}	6.9×10^{7}	1.1×10^{11}
U-236	7.5×10^{8}	1.0×10^{9}	1.2×10^{12}
U-238	6.2×10^{8}	9.2×10^{8}	1.1×10^{12}
Np-237	5.3×10^{9}	1.3×10^{9}	2.4×10^{12}
Pu-238	7.1×10^{12}	1.1×10^{13}	1.7×10^{16}
Pu-239	6.3×10^{11}	1.1×10^{12}	2.4×10^{15}
Pu-240	9.9×10^{11}	1.7×10^{12}	3.2×10^{15}
Pu-242	4.1×10^{9}	6.6×10^{9}	1.1×10^{13}
Am-241	2.4×10^{12}	3.0×10^{12}	6.1×10^{15}
Am-243	5.6×10^{10}	6.7×10^{10}	2.1×10^{14}
Cm-244	5.7×10^{12}	7.8×10^{12}	9.4×10^{15}
Cm-245	7.4×10^{8}	8.7×10^{8}	9.8×10^{11}
Total α	1.7×10^{13}	2.5×10^{13}	3.9×10^{16}

2.5 Characteristics of waste packages

2.5.1 Contents of waste packages

Waste packages have varied contents, including $NaNO_3$s, TBP, incinerated ash and metal, as shown in Tables 2.1.2-1 to 2.1.2-2 in Section 2.1.2. In addition, cement and bitumen are used to immobilize the waste. Knowledge of the amounts of these constituents is essential for designing a disposal facility and performing a safety assessment. This information is also necessary for the following evaluation in Chapter 3. In this report, these amounts are calculated for each waste package by considering the treatment method and filling ratio.

The quantities of $NaNO_3$ and organic materials which are considered to be important for disposal are shown in Tables 2.5.1-1 and 2.5.1-2 respectively. The quantities of other components included in these materials are shown in Tables 2.5.1-3 to 2.5.1-5.

Table 2.5.1-1 Quantities of $NaNO_3$ in the various waste packages

Waste package			Volume of waste package (m^3)	Quantity of $NaNO_3$	
				(kg/package)	(Mg)
Commercial reprocessing facility operational waste	Concentrated low-level liquid waste 1	a	6,230	185	1,153
	Concentrated low-level liquid waste 2	c	19,425	185	3,594
Comemecial reprocessing facility dismantling waste	Systematic decontamination waste liquid I	a	78	740	58
	Systematic decontamination waste liquid II	b	118	740	87
	Systematic decontamination waste liquid III	c	340	185	63
	Partial decontamination waste liquid I	a	121	740	90
	Partial decontamination waste liquid II	b	121	740	90
JAEA reprocessing facility operational waste	Bitumen solidified waste (MA series)	a	16,671	103	1,722
	Bitumen solidified waste (LA series)	b	13,296	103	1,373
	Slurry solidified waste (MA series acid)	a	677	46	31
	Slurry solidified waste (MA series alkaline)	a	686	46	31
	Slurry solidified waste (LA series alkaline)	a	1,647	46	75
	$NaNO_3$ solidified waste (MA series acid)	c	5,628	66	371
	$NaNO_3$ solidified waste (MA series alkaline)	c	6,001	66	396
	$NaNO_3$ solidified waste (LA series alkaline)	c	13,221	66	873
JAEA reprocessing facility dismantling waste	Secondary decomtamination waste liquid slurry solidified waste (MA series)	a	960	46	44
	Secondary decomtamination waste liquid slurry solidified waste (LA series)	a	87	46	4
	Secondary decontamination waste, liquid $NaNO_3$ solidified waste (MA series)	c	8,267	66	546
	Secondary decontamination waste, liquid $NaNO_3$ solidified waste (LA series)	c	699	66	46
Returned	Bitumen solidified waste	a	1,100	40	44
	MEB cladding + barium carbonate slurry, cement solidified waste	a	250	3	1
Subtotal for deep geological disposal (a)			28,507	-	3,251
Subtotal for intermediate-depth disposal (b)			13,535	-	1,550
Subtotal for concrete vault disposal (c)			53,581	-	5,888
Total			95,623	-	10,689

Table 2.5.1-2 Quantities of organic material in the various waste packages

Type of waste package			Volume of waste package (m^3)	Type of organic material	Quantity of organic	
					(kg/package)	(Mg)
JAEA reprocessing operations	Hulls and ends	a	1,050	Cellulose	0.5	1
	Bitumen solidified waste (MA series)	a	16,671	Bitumen	147	2,446
				TBP	0.162	3
	Bitumen solidified waste (LA series)	b	13,296	Bitumen	147	1,951
				TBP	0.162	2
	Plastic solidified waste	c	2,646	Epoxy resin	60	159
				TBP	60	159
Returned	Bitumen solidified waste	a	1,100	Bitumen	140	154
Subtotal for deep geological disposal (a)			18,821	-	-	2,604
Subtotal for intermediate-depth disposal (b)			13,296	-	-	1,953
Subtotal for concrete vault disposal (c)			2,646	-	-	318
Total			34,763	-	-	4,875

Table 2.5.1-3 Contents of each waste package (private sector)

Class	Type of waste package	Total amount of waste		Weight of contents per unit waste package (kg/unit)												Total weight of contens (ton)												
		Number	m^3	Container		Contents								Immobilization material			Container		Contents								Immobilization material		
				Carbon steel	Stainless steel	Carbon steel	Stainless steel	Zircalloy	Nitrate	Borate	TBP	NaCl	Cellulose	Cement	Bitumen	Epoxy resin	Carbon steel	Stainless steel	Carbon steel	Stainless steel	Zircalloy	Nitrate	Borate	TBP	NaCl	Cellulose	Cement	Bitumen	Epoxy resin
Private sector reprocessing and MOX operations	Hulls and ends	24,150	4,685		130		288	432										3,140		6,955	10,433							
	Ash melt + Water in hulls can	3,675	735		30									250				110								919		
	Water in hulls can	700	140		30									250				21								175		
	Incombustible waste I (highly contaminated part: for melting treatment)	10,815	2,163		30	514								59				324	5,559							638		
	Incombustible waste I (highly contaminated part: except for melting treatment)	1,505	301		30		160							378				45		241						569		
	Incombustible waste I (moderately contaminated part: except for melting treatment)	595	119		30		160							378				18		95						225		
	Incombustible waste I (less contaminated part: except for melting treatment)	2,940	588		30		160							378				88		470						1,111		
	Incombustible waste I (hulls can)	5,355	1,071		30		455							300				161		2,437						1,607		
	Special equipment waste	208	408	8800			11400							1100			1,830			2,371						229		
	Secial equipment waste container	1,152	2,258	8800			1052							3800			10,138			1,212						4,378		
	Combustible waste II	4,550	910		90									176				410								801		
	Poorly combustible waste II	23,660	4,732		120									78				2,839								1,845		
	Incombustible waste II (for melting treatment)	24,990	4,998		30	673								59				750	16,818							1,474		
	Incombustible waste II (except for melting treatment)	8,050	1,610		30		160							378				242		1,288						3,043		
	Incombustible waste II (transport container)	11,935	2,387		30		80							420				358		955						5,013		
	Solvent waste	4,095	819		90									176				369								721		
	Low-level concentrated liquid waste 1	6,230	1,246		30				185					204				187				1,153				1,271		
	Low-level concentrated liquid waste 2	19,425	3,885		30				185					204				583				3,594				3,963		
	Low-level concentrated liquid waste 3	10,500	2,100		30					6.24				220				315					66			2,310		
	Spent carbon	2,480	496		90									176				223								436		
	Spent silver absorbent	1,520	304		30									244				46								371		
	Scrubber waste liquid	15,260	3,052		30							17		250				458							259	3,815		
	CB	5,775	11,319	8800	120			906						3820			50,820	693			5,232					22,061		
	BP	534	1,047	8800	120		782							3910			4,699	64		418						2,088		
	Subtotal	190,099	51,372	-	-	-	-	-	-	-	-	-	-	-	-	-	67,487	11,442	22,377	16,442	15,665	4,746	66		259	59,061		
Private sector reprocessing, dismantling	Primary waste I (metal) (for melting treatment)	78	153	8800		2692								2670			686		210							208		
	Primary waste I (metal) (except for melting treatment)	49	96	8800		1600								3700			431		78							181		
	Primary waste II (metal) (for melting treatment)	1,314	2,575	8800		2692								2670			11,563		3,537							3,508		
	Primary waste II (metal) (except for melting treatment)	827	1,621	8800		1600								3700			7,278		1,323							3,060		
	Primary waste III (metal) (for melting treatment)	33,448	6,690		30	650								271				1,003	21,741							9,064		
	Primary waste III (metal) (except for melting treatment)	39,870	7,974		30	160								378				1,196	6,379							15,071		
	Contaminated concrete	684	1,341	8800										2020			6,019									1,382		
	Secondary waste I (combustible)	419	821	8800	120									3440			3,687	50								1,441		
	Secondary waste II (combustible)	81,506	16,301		90									176				7,336								14,345		
	Secondary waste I (poorly combustible)	65	127	8800	120									3440			572	8								224		
	Secondary waste II (poorly combustible)	22,145	4,429		120									78				2,657								1,727		
	Secondary waste I (incombustible)	10	20	8800		2692								2670			88		27							27		
	Secondary waste II (incombustible)	5,925	1,185		30	650								271				178	3,851							1,606		
	Systematic decontamination liquid waste I	78	153	8800					740					3250			686					58				254		
	Systematic decontamination liquid waste II	118	231	8800					740					3250			1,038					87				384		
	Systematic decontamination liquid waste III	340	68		30				185					204				10				63				69		
	Partial decontamination liquid waste I	121	237	8800					740					3250			1,065					90				393		
	Partial decontamination liquid waste II	121	237	8800					740					3250			1,065					90				393		
	Subtotal	187,118	44,259	-	-	-	-	-	-	-	-	-	-	-	-	-	34,179	12,439	37,147			387				53,337		
Private sector MOX dismantling	Primary waste I (metal)	99	194	8800		2692								2670			871		267							264		
	Primary waste II (metal)	535	1,049	8800		2692								2670			4,708		1,440							1,428		
	Primary waste III (metal)	1,761	352		30	650								271				53	1,145							477		
	Secondary waste I (combustible)	13	25	8800	120									3440			114	2								45		
	Secondary waste II (combustible)	37	73	8800	120									3440			326	4								127		
	Secondary waste III (combustible)	27	5		90									176				2								5		
	Secondary waste I (poorly combustible)	8	16	8800	120									3440			70	1								28		
	Secondary waste II (poorly combustible)	24	47	8800	120									3440			211	3								83		
	Secondary waste III (poorly combustible)	649	130		120									78				78								51		
	Secondary waste I (incombustible)	14	27	8800		2692								2670			123		38							37		
	Secondary waste II (incombustible)	42	82	8800		2692								2670			370		113							112		
	Secondary waste III (incombustible)	17	3		30	650								271				1	11							5		
	Subtotal	3,226	2,004	-	-	-	-	-	-	-	-	-	-	-	-	-	6,794	143	3,013							2,662		
Total		380,443	97,636	-	-	-	-	-	-	-	-	-	-	-	-	-	108,460	24,024	62,538	16,442	15,665	5,133	66		259	115,060		

Table 2.5.1-4 Contents of each waste package (returned waste)

Class	Type of waste package	Total amount of waste		Weight of contents per unit waste package (kg/unit)													Total weight of contens (ton)												
		Number	m^3	Container		Contents								Immobilization material			Container		Contents								Immobilization material		
				Carbon steel	Stainless steel	Carbon steel	Stainless steel	Zircalloy	Nitrate	Borate	TBP	NaCl	Cellulose	Cement	Bitumen	Epoxy resin	Carbon steel	Stainless steel	Carbon steel	Stainless steel	Zircalloy	Nitrate	Borate	TBP	NaCl	Cellulose	Cement	Bitumen	Epoxy resin
COGEMA	Storage container for solid wastes	3,600	684		91	60	247	393										328	216	889	1,415								
	Bitumen solidified waste	1,100	253		20				40						140			22				44						154	
	Subtotal	4,700	937															350	216	889	1,415	44					154	
BNGS	Cement solidified waste (hulls and ends: PWR)	1,035	580		115		78	363						938				119		81	376					971		
	Cement solidified waste (hulls and ends: BWR)	1,035	580		115		68	449						914				119		70	465					946		
	MEB cladding + barium carbonate	250	140		135				3					660				34				1				165		
	Magnox cement solidified waste	900	504		130		0.57	0.26						914				117		1	0.2					823		
	Centrifuge cake cement solidified waste PWR	630	353		135		0.06	0.001						754				85		0.04	0.001					475		
	Centrifuge cake cement solidified waste BWR	650	364		135		0.06	0.001						754				88		0.04	0.001					490		
	Miscellaneous solid	3,300	4,950	200		140											660		462										
	Magnox miscellaneous solid	2,700	4,050	200		140											540		378										
	Subtotal	10,500	11,520	-	-	-	-	-	-	-	-	-	-	-	-	-	1,200	562	840	152	841	1				3,870		
Total		15,200	12,457	-	-	-	-	-	-	-	-	-	-	-	-	-	1,200	911	1,056	1,041	2,255	45				3,870	154	

Table 2.5.1-5 Contents of each waste package (JAEA)

Class	Type of waste package	Total amount of waste		Weight of contents per unit waste package (kg/unit)												Total weight of contens (ton)											
		Number	m^3	Container		Contents								Immobilization material			Container		Contents								Immobilization material		
				Carbon steel	Stainless steel	Carbon steel	Stainless steel	Zircalloy	Nitrate	Borate	TBP	NaCl	Cellulose	Cement	Bitumen	Epoxy resin	Carbon steel	Stainless steel	Carbon steel	Stainless steel	Zircalloy	Nitrate	Borate	TBP	NaCl	Cellulose	Cement	Bitumen	Epoxy resin
JAEA reprocessing operation	Combustible waste I	21	4	30										90			1									2		
	Combustible waste II	18	4	30										90			1									2		
	Combustible waste III	285	57	30										90			9									26		
	Poorly combustible waste I	9	2	30										90			0.3									1		
	Poorly combustible waste II	4	1	30										90			0.1									0.4		
	Poorly combustible waste III	62	12	30										90			2									6		
	Incombustible waste I (metal-melting waste)	993	199	30		235	235							220			30		233	233						218		
	Incombustible waste II (metal-melting waste)	597	119	30		235	235							220			18		140	140						131		
	Incombustible waste III (metal-melting waste)	4,782	956	30		235	235							220			143		1,124	1,124						1,052		
	Incombustible waste I (non-metal-melting waste)	569	114	30										90			17									51		
	Incombustible waste II (non-metal-melting waste)	354	71	30										90			11									32		
	Incombustible waste III (non-metal-melting waste)	2,686	537	30										90			81									242		
	Incombustible waste I (non-metal)	39	8	30										250			1									10		
	Incombustible waste II (non-metal)	77	15	30										250			2									19		
	Incombustible waste III (non-metal)	614	123	30										250			18									154		
	Clarification filter	17	3	30			470							220			1			8						4		
	Incombustible waste in hulls can (metal-melting waste)	166	33	30		235	235							220			5		39	39						37		
	Incombustible waste in hulls can (non-metal-melting waste)	151	30	30										90			5									14		
	Iodine filter (spent silver absorbent)	69	14	30										400			2									27		
	Hulls and ends	1,050	204		110		140	450					1					116		147	473				1			
	Bitumen solidified waste (MA series)	16,671	3,334	30					103		0				147		500					1,722		3			2,446	
	Bitumen solidified waste (LA series)	13,296	2,659	30					103		0				147		399					1,373		2			1,951	
	Slurry solidified waste (MA series acid)	677	135	30					46	31				260			20					31	21			176		
	Slurry solidified waste (MA series alkaline)	686	137	30					46	31				260			21					31	21			178		
	Slurry solidified waste (LA series alkaline)	1,647	329	30					46	31				260			49					75	51			428		
	$NaNO_3$ solidified waste (MA series acid)	5,628	1,126	30					66	29				260			169					371	162			1,463		
	$NaNO_3$ solidified waste (MA series alkaline)	6,001	1,200	30					66	29				260			180					396	173			1,560		
	$NaNO_3$ solidified waste (LA series alkaline)	13,221	2,644	30					66	29				260			397					873	381			3,437		
	Plastic solidified waste	2,646	529	30							60					60	79							159				159
	Chemical sludge	14,129	2,826	30										400			424									5,652		
	Spent sand (pool water filtration)	545	109	30										400			16									218		
	Water in hulls can	23	5	30										400			1									9		
	Hulls can (empty container)	1,354	271	30			470							220			41			636						298		
	ST spent silica gel	89	18	30										400			3									36		
	LWTF spent silica gel	361	72	30										400			11									144		
	Sr/Cs absorbent	400	80	30										280			12									112		
	Off-gas drying powder	1,526	305	30								120		400			46								183		610		
	Subtotal	91,463	18,286	-	-	-	-	-	-	-	-	-	-	-	-	-	2,712	116	1,536	2,328	473	4,872	810	164	183	1	16,349	4,397	159
JAEA MOX operation	Combustible waste I	803	161	30			120							200			24			96						161		
	Poorly combustible waste I	131	26	30										90			4									12		
	Poorly combustible waste II																											
	Incombustible waste I (metal-melting waste)	4,663	933	30		235	235							220			140		1,096	1,096						1,026		
	Incombustible waste II (metal-melting waste)	17	3	30		235	235							220			1		4	4						4		
	Incombustible waste I (metal ingot)	9	2	30		150	150							320			0.3		1	1						3		
	Incombustible waste II (metal ingot)	11	2	30		150	150							320			0.3		2	2						4		
	Incombustible waste I (non-metal-melting waste)	26	5	30										90			1									2		
	Incombustible waste II (non-metal-melting waste)																											
	Incombustible waste I (non-metal)	832	166	30										250			25									208		
	Incombustible waste II (non-metal)	43	9	30										250			1									11		
	Subtotal	6,535	1,307	-	-	-	-	-	-	-	-	-	-	-	-	-	196		1,103	1,199						1,429		
JAEA reprocessing, dismantling	Primary incombustible waste I (metal)	3,843	769	30		235	235							220			115		903	903						845		
	Primary incombustible waste II (metal)	981	196	30		235	235							220			29		231	231						216		
	Primary incombustible waste III (metal)	22,923	4,585	30		235	235							220			688		5,387	5,387						5,043		
	Primary incombustible waste I (concrete)	142	28	30										250			4									36		
	Primary incombustible waste II (concrete)	103	21	30										250			3									26		
	Primary incombustible waste III (concrete)	1,154	231	30										250			35									289		
	Secondary decontamination waste liquid slurry solidified waste (MA series)	960	192	30					46	31				190			29					44	30			182		
	Secondary decontamination waste liquid slurry solidified waste (LA series)	87	17	30					46	31				190			3					4	3			17		
	Secondary decontamination waste liquid $NaNO_3$ solidified waste (MA series)	8,267	1,653	30					66	29				190			248					546	238			1,571		
	Secondary decontamination waste liquid $NaNO_3$ solidified waste (LA series)	699	140	30					66	29				190			21					46	20			133		
	Secondary combustible waste I	12	2	30										90			0.4									1		
	Secondary combustible waste II	32	6	30										90			1									3		
	Secondary combustible waste III	451	90	30										90			14									41		
	Secondary poorly combustible waste I	2	0.4	30										90			0.1									0.2		
	Secondary poorly combustible waste II	8	2	30										90			0.2									1		
	Secondary poorly combustible waste III	97	19	30										90			3									9		
	Secondary incombustible waste I (metal-melting waste)	145	29	30		235	235							220			4		34	34						32		
	Secondary incombustible waste II (metal-melting waste)	42	8	30		235	235							220			1		10	10						9		
	Secondary incombustible waste III (metal-melting waste)	1,625	325	30		235	235							220			49		382	382						358		
	Secondary incombustible waste I (non-metal-melting waste)	47	9	30										90			1									4		
	Secondary incombustible waste II (non-metal-melting waste)	99	20	30										90			3									9		
	Secondary incombustible waste III (non-metal-melting waste)	788	158	30										90			24									71		
	Secondary incombustible waste I (non-metal)	16	3	30										250			0.5									4		
	Secondary incombustible waste II (non-metal)	13	3	30										250			0.4									3		
	Secondary incombustible waste III (non-metal)	185	37	30										250			6									46		
	Subtotal	42,721	8,544	-	-	-	-	-	-	-	-	-	-	-	-	-	1,282		6,946	6,946		639	291			8,947		
JAEA MOX dismantling	Primary incombustible waste I (metal)	8,945	1,789	30		235	235							220			268		2,102	2,102						1,968		
	Primary incombustible waste II (metal)	117	23	30		235	235							220			4		27	27						26		
	Primary incombustible waste I (concrete)	127	25	30										250			4									32		
	Primary incombustible waste II (concrete)	2	0.4	30										250			0.1									1		
	Secondary combustible waste I	449	90	30			120							200			13			54						90		
	Secondary poorly combustible waste I	99	20	30										90			3									9		
	Secondary poorly combustible waste II																											
	Secondary incombustible waste I (metal-melting waste)	424	85	30		235	235							220			13		100	100						93		
	Secondary incombustible waste II (metal-melting waste)	2	0.4	30		235	235							220			0.1		0.5	0.5						0.4		
	Secondary incombustible waste I (non-metal)	58	12	30										250			2									15		
	Secondary incombustible waste II (non-metal)	3	1	30										250			0.1									1		
	Subtotal	10,226	2,045	-	-	-	-	-	-	-	-	-	-	-	-	-	307		2,230	2,284						2,234		
	Total	150,945	30,183	-	-	-	-	-	-	-	-	-	-	-	-	-	4,497	116	11,815	12,757	473	5,511	1,100	164	183	1	28,959	4,397	159

2.5.2 Heat generated by waste packages

To design a disposal facility and perform a safety assessment, it is essential to know the amount of heat generated by waste packages, in addition to its waste content. The generated heat is calculated from the concentrations of radioactive materials as described in Section 2.3 and is shown in Table 2.5.2-1. This section summarizes the details of waste packages that generate more than 1W of heat.

Table 2.5.2-1 Calorific power of various waste packages

Waste package		Calorific power (W per package)	Volume of waste (m^3)
Commercial reprocessing facility operational waste	Hulls and ends	61	4,685
	Ash melt + hull can waste	20	735
	Hull can water	19	140
	Incombustible decontamination liquid waste I (highly contaminated part: for dissolving melt)	2	301
Commercial reprocessing facility dismantling waste	Decontamination waste liquid series I	45	153
	Partial decontamination waste liquid series I	45	237
JAEA reprocessing facility operational waste	Combustible waste I	6	4
	Poorly combustible waste I	4	2
	Clarification filter	168	3
	Hulls and ends	26	204
	Hull can water	7	5
JAEA reprocessing facility dismantling waste	Secondary combustible waste I	6	2
	Secondary poorly combustible waste I	2	0.4
JAEA MOX facility dismantling waste	Secondary combustible waste I	1	90
	Secondary incombustible waste I (metal-melting waste)	1	85
COGEMA	Storage container for solid	40	684
BNGS	Cement solidified waste (hulls and ends: PWR)	21	580
	Cement solidified waste (hulls and ends: BWR)	7	580
	Magnox cement solidified waste	6	504
	Centrifuge cage cement solidified waste PWR, BWR	6	717

The changes with time in heat production were evaluated for high heat generation commercial hulls and ends and the results are shown in Figure 2.5.2-1. If the duration of storage before disposal is assumed to be 25 years, the heat production rate will decrease by an order of magnitude.

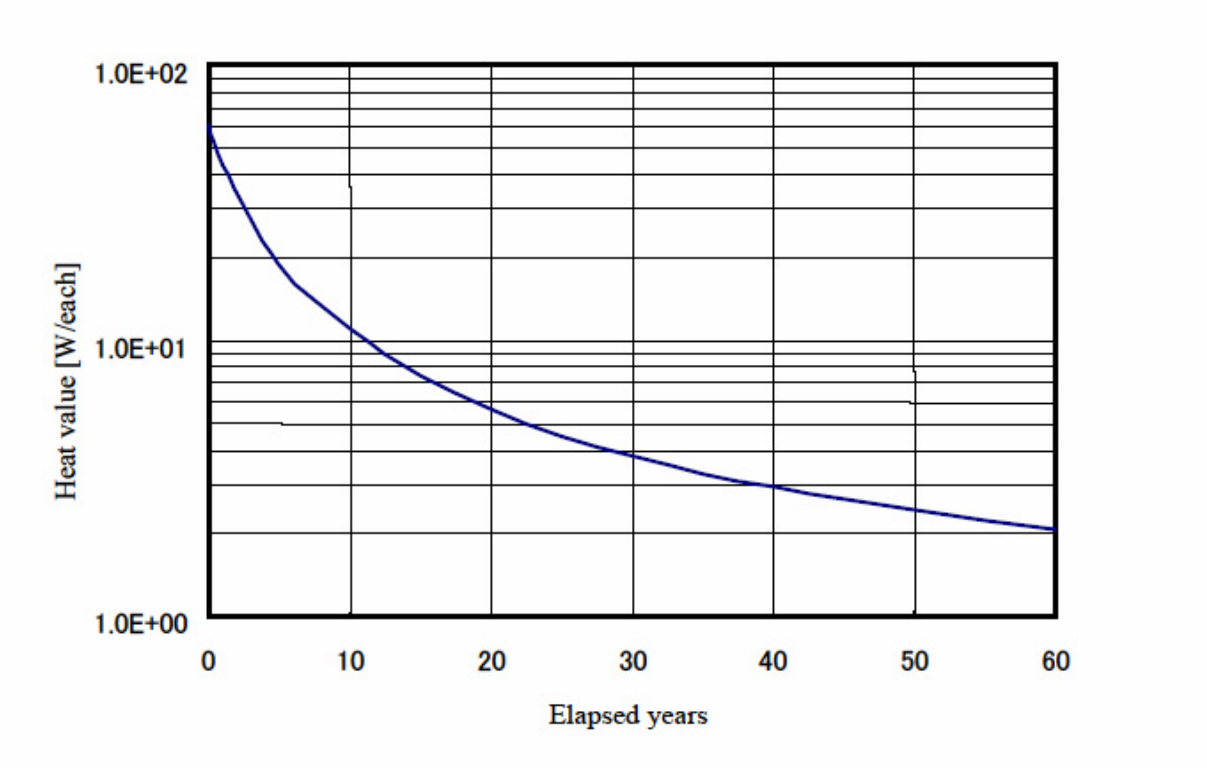

Figure 2.5.2-1 Change with time in heat production in a waste package containing commercial hulls and ends

2.5.3 Classifying waste based on waste package characteristics

Classifying waste packages for disposal is based on a range of characteristics that are described here. Although this report gives examples of sorting based on waste package characteristics, the actual sorting of waste packages will be carried out considering the design of disposal facilities and safety assessments

(1) Classification based on immobilization material

Classifying of waste packages according to immobilization material is shown in Table 2.5.3-1. Note that, although cement, bitumen and resins are all used as immobilization media, some wastes, such as hulls and ends, do not require immobilization.

Table 2.5.3-1 Waste packages sorted by immobilization media

Solidification material	Waste package		Volume (m^3)
Bitumen	JAEA reprocessing	Bitumen solidified waste	6,246
	Returned COGEMA	Bitumen solidified waste	
Resin	JAEA reprocessing	Resin solidified waste	529
None	Commercial reprocessing	Hulls and ends	5,573
	JAEA reprocessing	Hulls and ends	
	Returned COGEMA	Storage container for solid waste	
Cementitious	Other waste packages		127,926
Total			140,274

(2) Classification based on waste package form

200L drums, canisters and square packages are currently the planned forms, but special packages are planned for returned waste. As the form of a waste package will significantly affect emplacement efficiency during disposal, it may be the case that disposal will depend on this parameter (Table 2.5.3-2).

Table 2.5.3-2 Sorting of waste packages by form

Waste package type	Waste package		Volume (m^3)
Canister	Commercial reprocessing operations	Hulls and ends	5,573
	JAEA reprocessing operations	Hulls and ends	
	Returned by COGEMA	Storage container for solid	
Square package	Commercial reprocessing operation	CB, BP, special equipment waste container	24,158
	Commercial reprocessing operation/MOX dismantling	Incombustible waste	
1500L container	Returned by BNGS	Miscellaneous solid, Magnox miscellaneous solid	9,000
500L drum	Returned by BNGS	Centrifuge cake slurry	2,520
200L drum	Other waste packages		99,023
Total			140,274

(3) Classification by content

Classification could be carried out based on the content of $NaNO_3$ and organic material (Table 2.5.3-3), which may affect radionuclide releases in both these wastes directly but also in other waste forms indirectly (see details in Chapter 4).

Table 2.5.3-3 Sorting of waste packages by content

Content	Waste package		Volume (m^3)
$NaNO_3$ *1	Commercial reprocessing operations	Low-level concentrated waste liquid 1, 2	20,617
	JAEA reprocessing operations	Bitumen solidified waste, slurry solidified waste, $NaNO_3$	
	Commercial reprocessing operations	Decontamination waste liquid series, partial decontamination waste liquid	
	JAEA reprocessing, dismantling	Secondary decontamination waste liquid	
	Returned by COGEMA	Bitumen solidified waste	
	Returned by BNGS	MEB cladding + barium slurry solidified waste	
Organic material	JAEA reprocessing operations	Hulls and ends, plastic solidified waste	733
Not included	Other waste packages		118,924
Total			140,274

*1: Wastes that include both $NaNO_3$ and organic materials are grouped under $NaNO_3$.

(4) Classification by heat production

Classification of waste packages with high and low heat production is shown in Table 2.5.3-4.

Table 2.5.3-4 Sorting of waste packages by heat production rate

Heat production rate	Waste package		Volume (m^3)
High (≥ 1 [W/package])	Commercial reprocessing operations	Hulls and ends	9,711
	JAEA reprocessing operations	Hulls and ends, clarification filter	
	Returned	Storage container for solid	
Low (< 1 [W/package])	Other waste package		130,562
Total			140,274

(5) Classification by C-14 and I-129 content

Classification of waste packages depending on the concentrations of C-14 and I-129 in the waste is shown in Table 2.5.3-5.

Table 2.5.3-5 Sorting by C-14 and I-129 content

Isotope	Waste package		Volume (m^3)
High C-14 content	Commercial reprocessing	Hulls and ends, CB, BP	19,348
	JAEA reprocessing	Hulls and ends	
	Returned COGEMA	Storage container for solids	
	Returned BNGS	Cement solidified waste (hulls and ends) MEB clad + barium carbonate slurry solidified waste	
High I-129 content	Commercial reprocessing	Spent silver absorbent	4,254
	JAEA reprocessing	Spent silver absorbent, bitumen solidified waste, slurry solidified waste	
Others	Other waste packages		116,673
Total			140,274

2.5.4 Classification of waste packages for deep geological disposal

In the 1st TRU progress report, the sorting of waste packages was performed by consideringthe characteristics of the waste packages, and the requirements of the EBS for each sorting droup were executed. Here, the waste package characteristics are basically the same as those described in the 1st TRU progress report and the sorting of waste packages for geological disposal was therefore performed in the same manner (detailed below).

2.5.4.1 Classification concept

The classification concept for waste package is as follows.

(1) Type and activity of nuclides

Of the nuclides in the waste, it is considered that the most significant from the viewpoint of dose are I-129 and C-14. These are long-lived nuclides and it is assumed that they are not retarded significantly by sorption in the EBS or natural barrier. Hence, waste packages that include large amounts of these nuclides are sorted into a specific group for subsequent handling.

(2) Heat generation

Wastes that generate relatively large amounts of heat are sorted into a special group to allow the thermal effect on the engineered barriers to be taken into account.

(3) Content of chemical material

Wastes that contain large amounts of potentially problematic materials, such as $NaNO_3$, that could possibly affect radionuclide solubility and retardation are sorted into a special group.

2.5.4.2 Results of classifying waste packages for geological disposal

Considering the above classification concept, 4 groups of waste packages have been defined (see Tables 2.5.4-1 and 2.5.4-2).

Table 2.5.4-1 Sorting of wastes

Group	Major waste types	Volume of waste	Basis for sorting
1	Spent silver absorbent, cement-solidified waste	318 m^3	Wastes which include large amounts of I-129 with poor sorption properties in the EBS and host rock
2	Hulls and ends compressed stage container, cement-solidified waste	6,732 m^3	Wastes which include large amounts of C-14 with poor sorption properties in the EBS and host rock, and which have relatively high heat production
3	Bitumen-solidified waste and mortar filling waste of low-level concentrated liquid waste	6,175 m^3	Wastes which have high contents of $NaNO_3$
4	Combustible, poorly combustible, incombustible waste, mortar filling	13,416 m^3	Other wastes

Table 2.5.4-2 Breakdown of sorting for waste packages (continued on next page)

Group	Waste package type[*1]		Amount generated	
			Number	m^3
1	Commercial reprocessing operations	Spent silver absorbent	1,520	304
	JAEA reprocessing operations	Iodine filter (spent silver absorbent)	69	14
	Subtotal		1,589	318
2	Commercial reprocessing operations	Hulls and ends	24,150	4,685
	Commercial reprocessing operations	Hulls and ends	1,050	204
	COGEMA	Storage container for solids	3,600	684
	BNGS	Cement solidified waste (hulls and ends)	2,070	1,159
	Subtotal		30,870	6,732
3	Commercial reprocessing operations	Low-level concentrated waste liquid I	6,230	1,246
	Commercial reprocessing operations	Series/partial decontamination waste liquid I	199	390
	JAEA reprocessing operations	Bitumen solidified waste (MA series acid)	16,671	3,334
		Slurry solidified waste (MA series acid)	3,010	602
	JAEA reprocessing operations	Secondary decontamination waste liquid slurry solidified waste	1,047	209
	COGEMA	Bitumen solidified waste	1,100	253
	BNGS	MEB cladding + barium carbonate slurry cement solidified waste	250	140
	Subtotal		28,507	6,175
4	Commercial operations	Ash melt + hull can water, hull can water	4,375	875
		Combustible waste I	18,270	3,654
		Special equipment and container	1,360	2,666
	Commercial reprocessing dismantling	Primary waste I (metal)	127	249
	Commercial MOX dismantling	Primary waste I (metal)	99	194
		Secondary waste I (combustible, poorly combustible, incombustible)	35	69
	JAEA reprocessing operations	Combustible, poorly combustible, incombustible I	1,631	326
		Clarification filter	17	3
		Hull can water	23	5
	JAEA MOX operations	Combustible, poorly combustible, incombustible I	6,464	1,293
	JAEA reprocessing, dismantling	Primary incombustible waste I (metal)	3,843	769
		Primary incombustible waste I (concrete)	142	28
		Secondary combustible, poorly combustible, incombustible waste I	222	44

	JAEA MOX dismantling	Primary incombustible waste I (metal)	8,945	1,789
		Primary incombustible waste I (concrete)	127	25
		Secondary combustible, poorly combustible, incombustible waste I	1,030	206
	BNGS	Magnox cement solidified waste	900	504
		Centrifuge cake cement solidified waste	1,280	717
	Subtotal		48,890	13,416
Total			109,856	26,640

*1: Volume of similar type wate is compiled.

2.6 Summary

The results described previously are summarised below.

- Based on current operational plans, the total TRU waste volume is estimated to be about 140,000 m^3 (or about 700,000 200L drums). Although this is an increase from the 1st TRU progress report, the estimated value is considered to be reasonable because it now includes commercial dismantling waste.
- A more realistic evaluation was performed using the activity of radioactive material, by considering the neutron flux distribution and by reviewing actual measured quantities of impurities in sample spent fuel assemblies. The results of this evaluation are considered to be reasonable since they are almost the same as values in COGEMA and BNGS waste package data.
- As in the 1st TRU progress report, the activities of radioactive material in each waste package differ widely. Therefore, based on the information provided by the electricity utilities, the wastes are classified into those suitable for concrete vault disposal, intermediate-depth disposal and deep geological disposal.
- The effect on disposal of the various waste package forms should be considered, as should the effect of $NaNO_3$ and organic materials in these wastes.
- Since the main features of the waste packages have not changed from those in the 1st TRU progress report, the classification of waste packages for deep geological disposal was carried out based on the original sorting concept in that report.

2.7 Future tasks

In order to design and evaluate a disposal facility, it is important to understand the characteristics and quantities of radioactive materials in the waste packages. Hence, the following issues are considered to be important for future consideration.

- There is a need for improved databases containing the quantities and characteristics of radioactive materials in the wastes that have already been generated and that will be generated in the future.
- Consideration needs to be given to validation methods for waste packages, such as non-destructive methods for measuring the activity of radioactive materials in individual waste packages.

References

JNFL (1996): Behaviour of nuclides under shearing, dissolution, separation, purification, acid recovery and solvent recovery processes in the reprocessing plant, Japan Nuclear Fuel Limited, JNFS R-91-002, 1st revision. [written in Japanese]

McGinnes (2002): Model radioactive waste inventory for reprocessing waste and spent, Nagra Technical Report NTB 01-01.

Miyamoto, Y., Kawagoshi, H. and Ohgo, T. (2003): Conceptual Design of Disposal Facility Below the Generally Used Depth for Radioactive Waste from Medical, Industrial and Research Facilities, Japan Nuclear Cycle Development Institute, JNC Technical Review, No. 20, pp. 23-30.

NSC (1986): Reference Radionuclide Concentration Values for Low-level Radioactive Solid Waste to be Land Disposed (Interim Report), The Committee on Safety Regulations of Radioactive Waste, Nuclear Safety Commission of Japan, December, 1986. [written in Japanese]

NSC (1992): Reference Radionuclide Concentration Values for Low-level Radioactive Solid Waste to be Land Disposed (2nd Interim Report), Special Committee on Safety Standards for Radioactive Waste, Nuclear Safety Commission of Japan, February, 1992. [written in Japanese]

NSC (2000): Reference Radionuclide Concentration Values for Low-level Radioactive Solid Waste to be Land Disposed (3rd Interim Report), Special Committee on Safety Standards for Radioactive Waste, Nuclear Safety Commission of Japan, June, 2000. [written in Japanese]

Sakai, A., Yoshimori, M., Okoshi, M., Yamamoto, T. and Abe, M. (2001): Conceptual Designs of Near Surface Disposal Facility for Radioactive Waste Arising from the Facilities Using Radioisotopes and Research Facilities for Nuclear Energy Development and Utilization, Japan Atomic Energy Research Institute, JAERI-Tech 2001-018.