Detailed presentation of the process of the methodology application

(completing the table)

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EGIRM Workshop
28 Feb – 1 Mar 2018

Completed methodology

Spent fuel and radioactive waste inventory presentation

Country:______________________
Date of inventorying:____________

SF/RW types (in national terms)		No strategy	SF reprocessing/ service		Disposal in:								
			home	abroad	UF-1		UF-2		NSF-1		NSF-2		Others
(A)		(B)	(C1)	(C2)	(D1)	(D2)	(E1)	(E2)	(F1)	(F2)	(G1)	(G2)	→
SF													
1.1. NPP													
1.2. Other reactors													
Radioactive waste													
2. HLW, [m^3]													
3. … class, [m3]													
4. … class, [m3]													
Equivalence with IAEA GSG-1	2.	HLW	HLW	HLW	HLW								
	3.												
	4.												

Footnotes when necessary

Presenting

- SF – [tHM];
- RW – [m^3]; “as disposed”, “as is” – can be,
- Disused sealed radioactive sources – [pieces];
- The “**SERVICER**” is country where the SF is to be reprocessed or any another service to be provided according to the international agreement;
- The “**USER**” is the country that used the nuclear fuel and sends it to “SERVICER” accordingly to international agreement for the reprocessing (other specified service);
- SF/RW transboundary movement can be reported by both parties (methodology should provide it).

Definitions

- **Implementer** – organisation responsible for developing, building and/or operating of nuclear facilities;
- **Methodology implementer** – national/international organisation/initiative/programme that uses the methodology in its activity.
- **Methodology user** – person which uses the methodology for presenting of inventory data (authorised) or to study national/international status of RW/SF management (authorisation not obligatory).

These definitions are used for methodology objectives.

Footnotes

- Superscript markers – 125.3[1] and short explanations in footnote when needed;
- Distribution on parts when RW – mix of solid and liquid, “as is” and “as disposed”, etc. [1] 125.3= 80 (liq)+10(sol)+25.3(cond);
- Sum of RW volume on different items - class, disposal route, etc. when needed;
- Distribution of RW volumes on origin or SF on types of reactors when requested;
- Description of specific situations when needed;
- Deciphering acronyms or abbreviations when necessary;
- Others

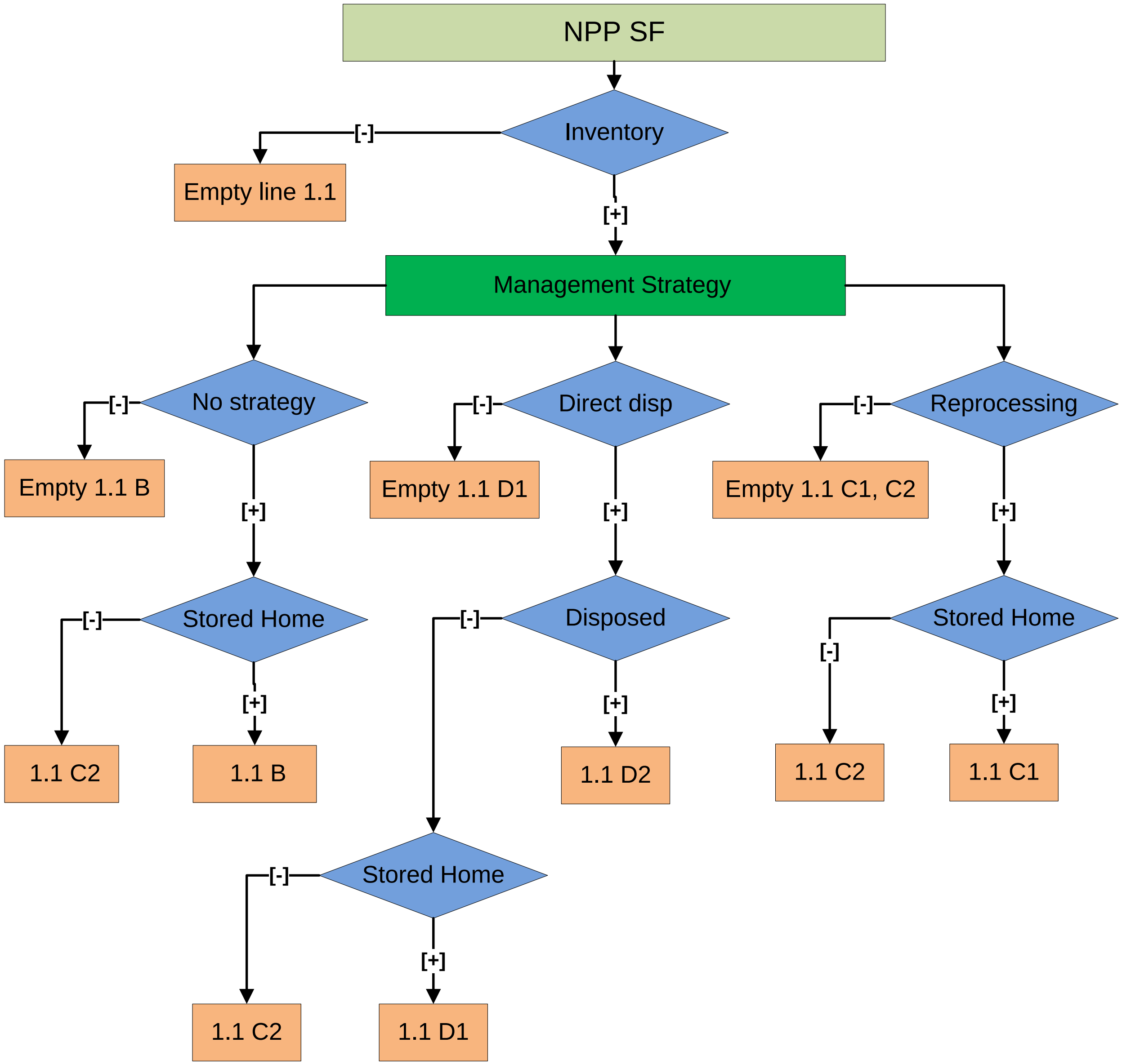
Disposal routes (main group)

Type of facility	Features	RW classes (in terms of GSG-1) that can be disposed of	SSR-5 equivalent (1.14)
UF			
UF-1	- no direct, open connection with surface during construction or operation stage (i.e. ramp, shaft or borehole access); - intensive application of artificial barriers; - heat emission is considered in design; - package for SF/HLW/ILW – be sure.	SF; HLW; ILW; LLW; VLLW; (NORM; TENORM) – solid	Geological disposal
UF-2	- no direct, open connection with surface during construction or operation stage (i.e. ramp, shaft or borehole access); - rather wide application of artificial barriers; - heat emission is not considered in design; - package for ILW – be sure.	ILW; LLW; VLLW; (NORM; TENORM)	Disposal on intermediate depth + geological disposal + borehole disposal
NSF			
NSF-1	- open air at construction stage; sometimes also during operation; - rather wide application of artificial barriers; - heat emission is not considered in design; - package for ILW – be sure.	ILW; LLW; VLLW; (NORM; TENORM)	Near-surface disposal + disposal on intermediate depth (particularly)
NSF - 2	- open air at construction stage; sometimes also during operation; - minimally reasonable application of artificial barriers; - heat emission is not considered in design; - package for LLW – be sure.	LLW; VLW; (NORM; TENORM)	Near-surface disposal; Landfilling

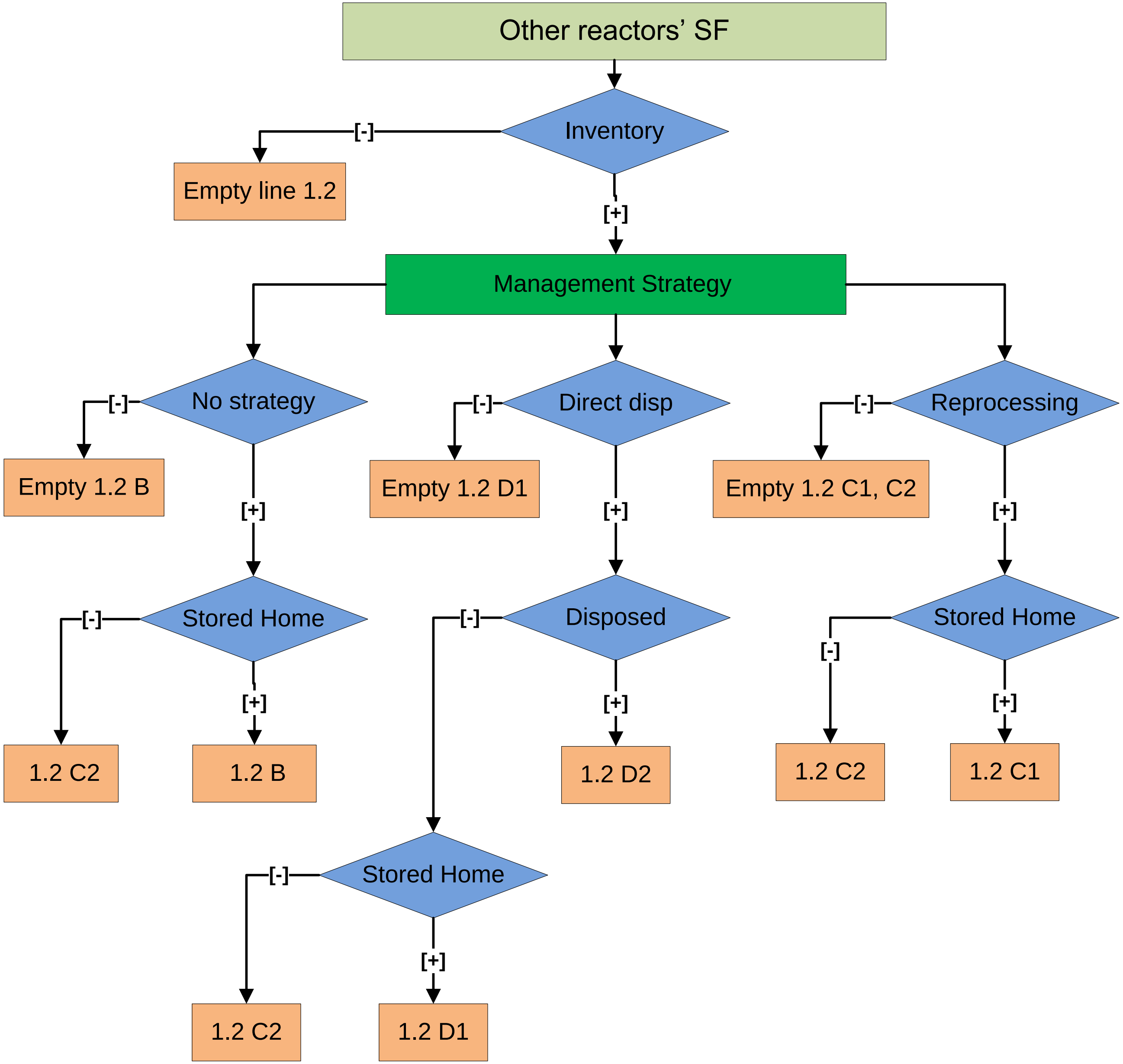
Disposal routes (additional group)

Type of route	Features	RW classes (in terms of the GSG-1) that can be disposed of	SSR-5 equivalent (1.14)
OTHER DISPOSAL ROUTES			
BH – 1	- no direct, open connection with the surface during construction and operation stage; - no excavated underground space for RW emplacement; - heat emission is not considered in design; - package for RW – possible.	DSRS, ILW, LLW	Intermediate depth boreholes
BH – 2	- no direct, open connection with the surface during construction and operation stage; - no excavated underground space for RW emplacement; - heat emission is considered in design; - package for RW required.	SF, HLW, DSRS (1st category)	Deep boreholes
BH – 3	- no direct, open connection with the surface during construction or operation stage; - conditional application of artificial barriers (only around boreholes); - heat emission is considered in design; - package for waste – no package.	Liquid ILW; LLW	No equivalent
SDL	Past practice of disposal, banned now, performed as dumping of liquid RW into sea/ocean.	LLW	Now banned
SDS	Past practice of disposal, banned now, performed as dumping of solid RW into sea/ocean.	ILW; LLW	Now banned

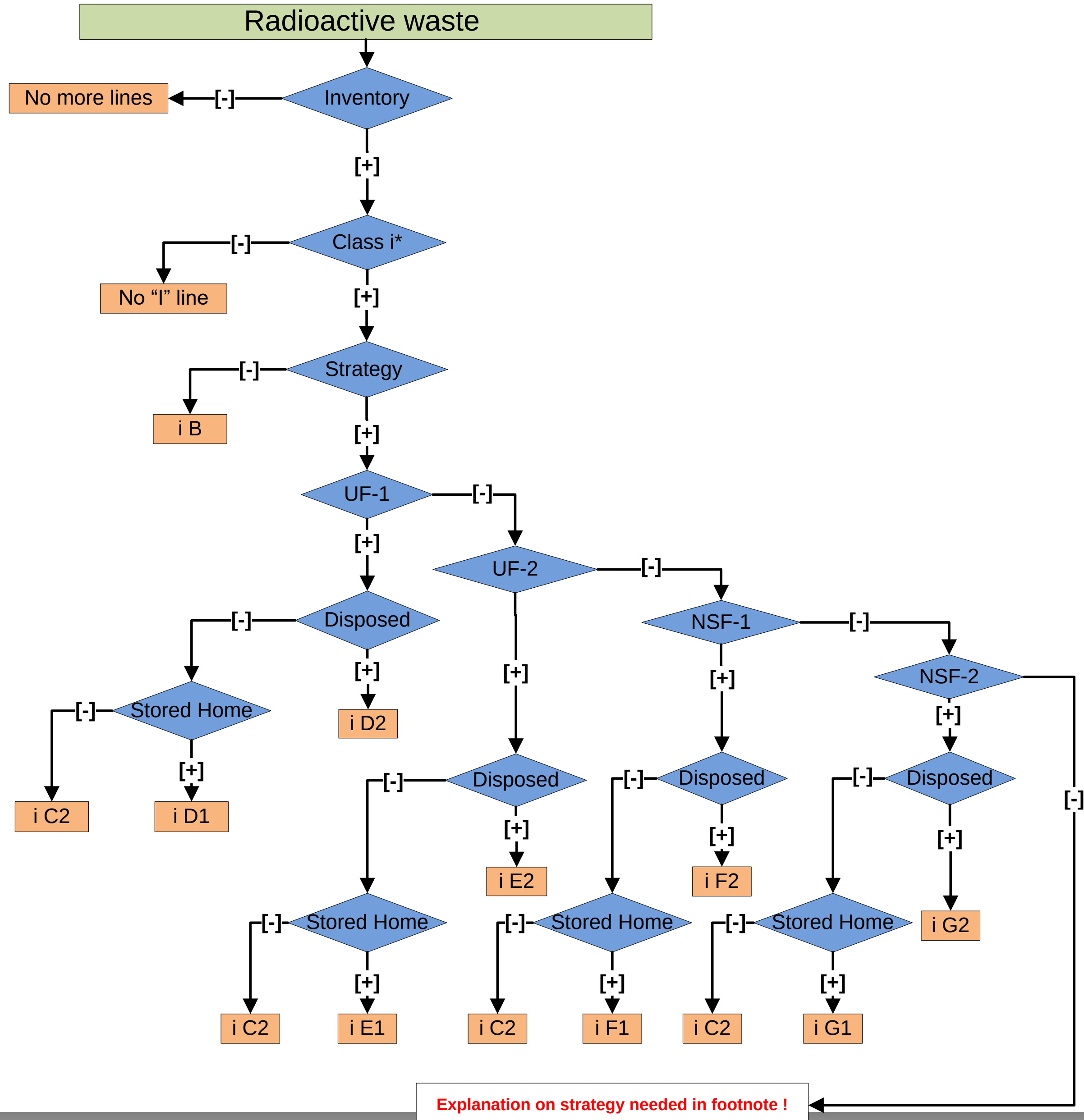
NPPs' SF


NPP SF
Inventory
[-]
Empty line 1.1
[+]
Management Strategy
No strategy
[-]
Empty 1.1 B
[+]
Stored Home
[-]
1.1 C2
[+]
1.1 B
Direct disp
[-]
Empty 1.1 D1
[+]
Disposed
[-]
Stored Home
[-]
1.1 C2
[+]
1.1 D1
[+]
1.1 D2
Reprocessing
[-]
Empty 1.1 C1, C2
[+]
Stored Home
[-]
1.1 C2
[+]
1.1 C1

ORs' SF


Other reactors' SF
Inventory
[-]
Empty line 1.2
[+]
Management Strategy
No strategy
[-]
Empty 1.2 B
[+]
Direct disp
[-]
Empty 1.2 D1
[+]
Reprocessing
[-]
Empty 1.2 C1, C2
[+]
Stored Home
[-]
[+]
1.2 C2
1.2 B
Disposed
[-]
[+]
1.2 D2
Stored Home
[-]
[+]
1.2 C2
1.2 C1
Stored Home
[-]
[+]
1.2 C2
1.2 D1

RW


Radioactive waste
Inventory
[-]
No more lines
[+]
Class i*
[-]
No “I” line
[+]
Strategy
[-]
i B
[+]
UF-1
[-]
UF-2
[-]
NSF-1
[-]
NSF-2
[+]
Disposed
[-]
Stored Home
[-]
i C2
[+]
i D1
[+]
i D2
[+]
Disposed
[-]
Stored Home
[-]
i C2
[+]
i E1
[+]
i E2
[+]
Disposed
[-]
Stored Home
[-]
i C2
[+]
i F1
[+]
i F2
[+]
Disposed
[-]
Stored Home
[-]
i C2
[+]
i G1
[+]
i G2
[-]
Explanation on strategy needed in footnote !

Before the table filling

In order to complete the table, information is needed on national:

- SF inventory (NPPs and other reactors) [tHM].
- RW inventory (in national classification); check the format of data in the inventory (m^3, "as is", "as disposed", physical status, stored and disposed of).
- RW classification transfer matrix into GSG-1 scheme (the majority of countries developed it for use in the NEWMDB).
- SF management strategy (law, governmental decree, state programme and other kinds of decisions).
- RW management strategy - disposal of (disposal routes for the RW classes). The absence of a strategy should also be noted.
- SF or RW sent to SERVICER country for reprocessing or other kinds of service for SF (treatment of RW) abroad.
- Foreign SF/RW imported for service from USER countries.

How to fill

NPP SF exists

YES

SFM strategy

YES

Direct disposal

Reprocessing

NO

HOME

ABROAD

Spent fuel and radioactive waste inventory presentation

Country:_________________________

Date of inventorying:______________

Type of SF or RW	Storage waiting a strategy	Reprocessing of SF/ RW (transboundary movement)		Disposal in UF-1		Disposal in UF-2		Disposal in NSF-1	
(A)	(B)	(C1)	(C2)	(D1)	(D2)	(E1)	E(2)	(F1)	(F2)
1. SF - reprocessing RW									
1.1. NPP									
1.1.1. SF [tHM]									
1.1.2. reprocessing HLW (HG), [m³]									
1.1.3. reprocessing RW (NHG), [m³]									

No strategy

To be disposed

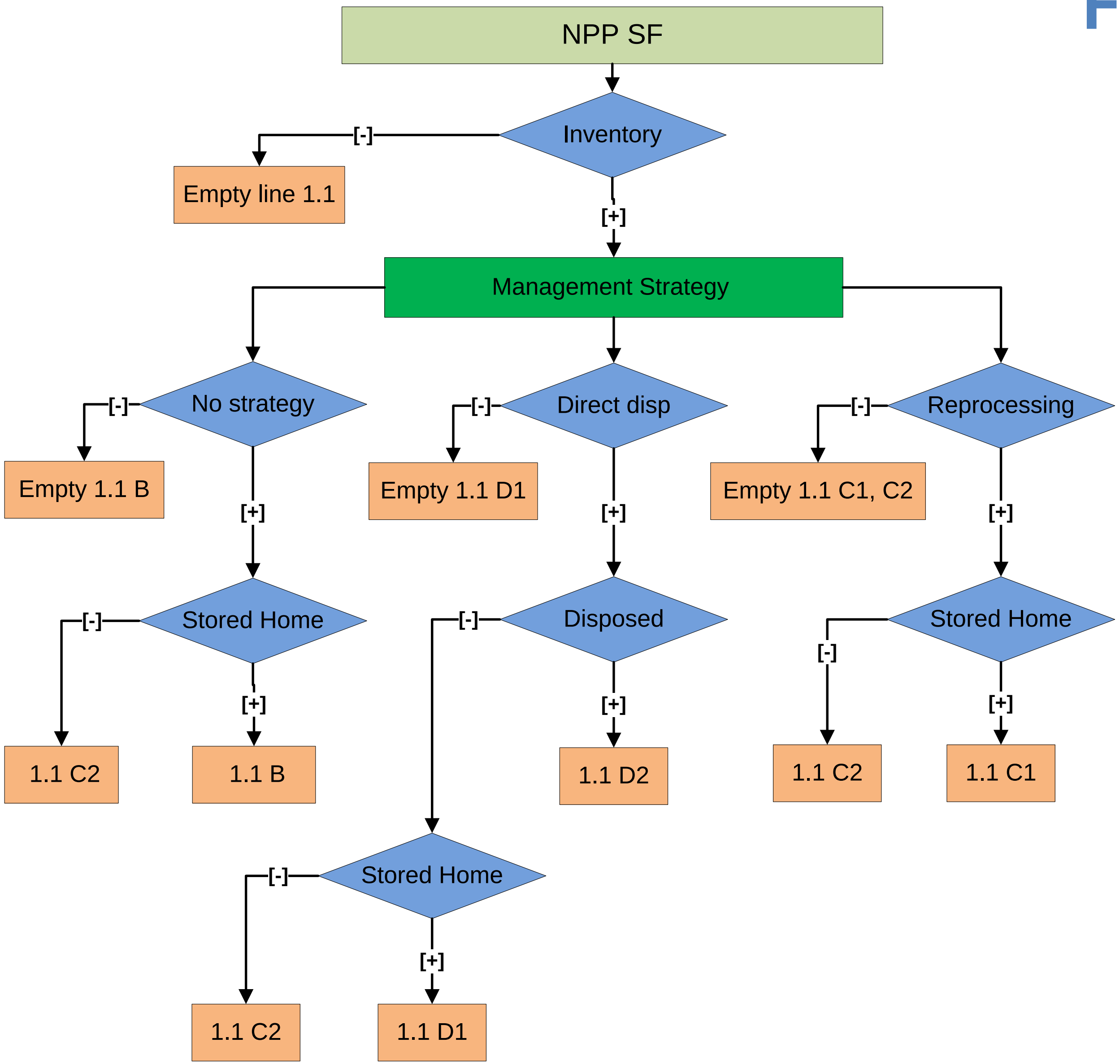
RW:

Now abroad

Disposed

To be sent to USER

Filling NPPs' SF



Filling NPPs' SF

Inventory

NO → Empty 1.1

YES →

- 124 tHM – no strategy;
- 1500 tHM – processing at home + 300tHM (AA) + 250 tHM (BB)
- 450 tHM – sent abroad to (FF) and 130 tHM to (GG)
- 630 tHM – direct disposal (wait for DGR)

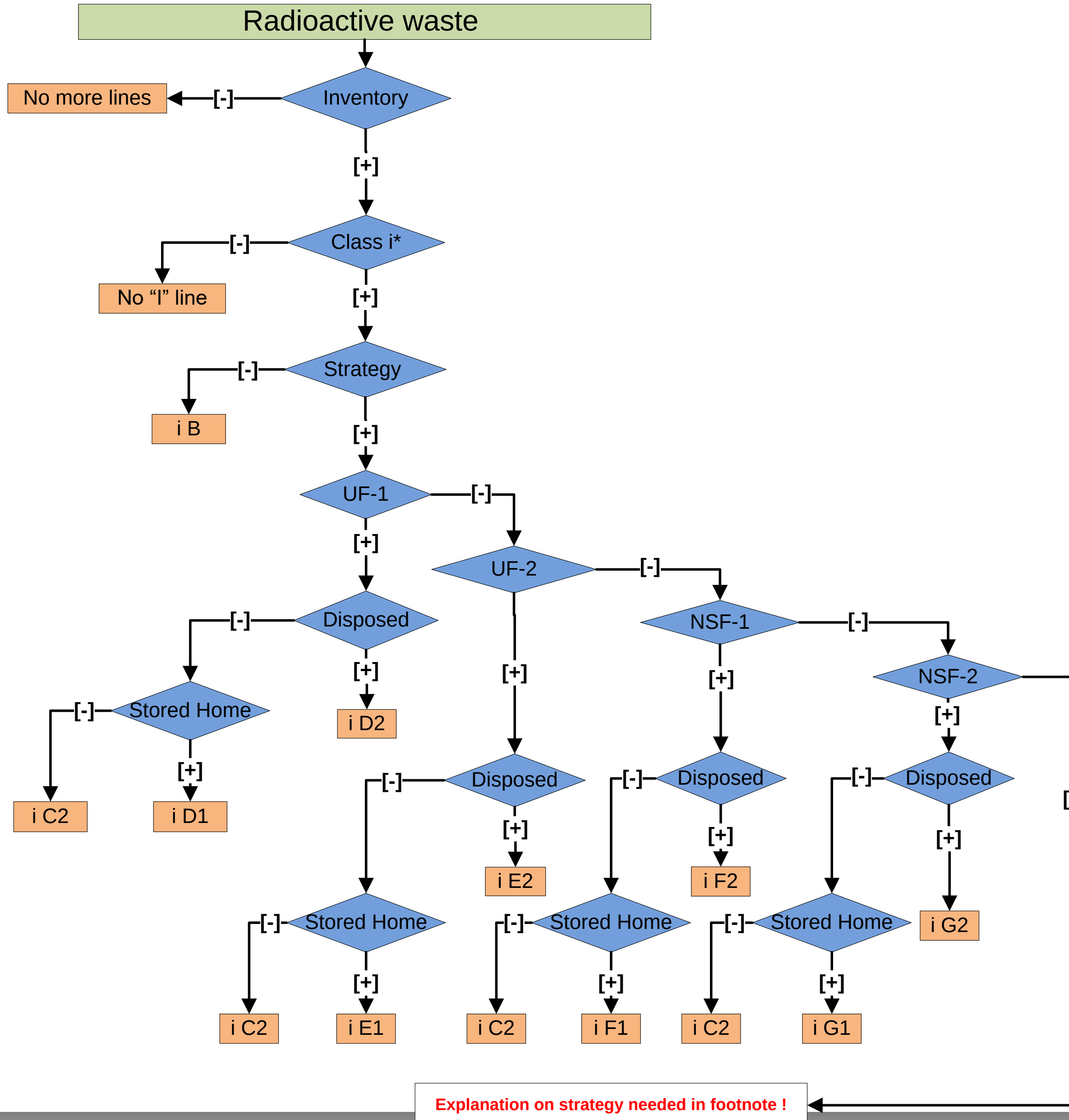
SF/RW types (in national terms)	No strategy	SF reprocessing/ service		Disposal in:								
		home	abroad	UF-1		UF-2		NSF-1		NSF-2		Others
(A)	(B)	(C1)	(C2)	(D1)	(D2)	(E1)	(E2)	(F1)	(F2)	(G1)	(G2)	→
SF												
1.1. NPP	124	2050[1]	580[2]	630								
1.2. Other reactors												

[1] – 2050 tHM = 1500 tHM (own) + 300 tHM (AA) + 250 tHM (BB)

[2] – 580 tHM = 450 tHM (FF) + 130 tHM (GG)

→ 230 tHM (PWR) + 220 tHM (BWR) – extended table

Filling RW


Radioactive waste
Inventory
No more lines
[-]
[+]
Class i*
No "I" line
Strategy
i B
UF-1
UF-2
NSF-1
NSF-2
Disposed
Stored Home
i C2
i D1
i D2
i E1
i E2
i F1
i F2
i G1
i G2
Explanation on strategy needed in footnote !

Filling, HLW

HLW Inv.

NO → Go to next class

YES →

National HLW equivalent to GSG-1 HLW;
16800 m^3 will be disposed in DGR (implementation is anticipated in 2030);
210 m^3 of liquid HLW stored waiting decision on treatment;
12 m^3 vitrified are stored in (FF) to be sent back;
25 m^3 vitrified from (AA) and 13 m^3 from (BB) are stored waiting shipment there;

Spent fuel and radioactive waste inventory presentation

Country:_______________________

Date of inventorying:____________

SF/RW types (in national terms)		No strategy	SF reprocessing/ service		Disposal in:								
			home	abroad	UF-1		UF-2		NSF-1		NSF-2		Others
(A)		(B)	(C1)	(C2)	(D1)	(D2)	(E1)	(E2)	(F1)	(F2)	(G1)	(G2)	→
2. HLW, [m^3]			38[3]	12[2]	17010[1]								
3. … class, [m3]													
4. … class, [m3]													
Equivalence with IAEA GSG-1	2.		HLW	HLW	HLW								
	3.												
	4.												

[1] 17010 m^3 = 16800 m^3 (cond.) + 210 m^3 (liquid)

[2] 12 m^3 – to be imported from (FF)

[3] 38 m^3 = 25 m^3 to be sent in (AA) + 13 m^3 to be sent in (BB)

Filling, Class 2

Class 2 Inv.

NO → Go to next class

YES →

National Class equivalent to GSG-1 ILW (80%) and LLW (10%);
3000 m³ (GSG-1 ILW) will be disposed in DGR (together with HLW);
300 m³ (GSG-1 ILW) stored waiting decision on disposal route;
5000 m³ (GSG-1 ILW-20% and LLW-80%) are disposed in UF-2;
1400 m³ (GSG-1 LLW) are disposed in NSF-1;

Spent fuel and radioactive waste inventory presentation

Country:______________________
Date of inventorying:____________

SF/RW types (in national terms)		No strategy	SF reprocessing/ service		Disposal in:								
			home	abroad	UF-1		UF-2		NSF-1		NSF-2		Others
(A)		(B)	(C1)	(C2)	(D1)	(D2)	(E1)	(E2)	(F1)	(F2)	(G1)	(G2)	→
2. HLW, [m³]													
3. 2 class, [m3]		300			3000			5000[1]		1400			
4. 3 class, [m3]													
Equivalence with IAEA GSG-1	2.												
	3.	ILW			ILW			ILW+LLW		LLW			
	4.												

[1] 5000 m³ = 1000 m³ (GSG-1 ILW) + 4000 m³ (GSG-1 LLW)

Examples. RWMC web page

www.oecd-nea.org/rwm/profiles/index.html

Radioactive waste management

Radioactive Waste Management Programmes in NEA Member Countries

Information on the waste management and decommissioning programmes of individual member countries of the NEA are presented in **country profiles** and **country reports**. Both documents aim to provide topical descriptions of national situations according to a common template; they include information about the sources, types and quantities of waste as well as how and by whom they are managed. Country profiles provide abridged information that allows for rapid familiarisation with the country situation; country reports provide detailed information for in-depth understanding. Both documents are subject to regular updates.

Country profiles and reports

Australia Profile 2009	France Profile 2016 Report 2015	Mexico Profile 2005	Slovenia Profile 2013 Report 2014
Austria Profile 2016 Report 2011	Germany Profile 2016	Netherlands Profile 2008 Report 2007	Spain Profile 2013
Belgium Profile 2013 Profile 2010	Hungary Profile 2009 Report 2009	Norway Profile 2005	Sweden Profile 2013 Report 2013
Canada Profile 2015 Report 2008	Italy Profile 2013 Report 2013	Poland Profile 2011	Switzerland Profile 2011 Report 2011
Czech Republic Profile 2013 Report 2008	Japan Profile 2011 Report 2011	Russian Federation Profile 2014 Report 2014	United Kingdom Profile 2011 Report 2011
Finland Profile 2016 Report 2014	Republic of Korea Profile 2016 Report 2014	Slovak Republic Profile 2005	United States Profile 2011 Report 2011

Reports and profiles are in pdf format.

Related links

NEA member country profiles

NEA press kit: Radioactive waste management

NEA radioactive waste management programme

IAEA Radioactive Waste Management Database

Regulatory Infrastructure in the Field of Disposal in NEA Member Countries
This document summarises the relevant regulatory information as of December 2009. The Regulatory Function and Radioactive Waste Management: International Overview (NEA No. 6041, Paris, 2005) is the report for which this information was first collected and commented upon. The publication remains valid for the considerations it provides.

Last reviewed: 12 April 2016

Italy. National profile.

SOURCES, TYPES AND QUANTITIES OF WASTE

Waste sources and categories

In addition to the radioactive waste that have been generated by NPPs and the associated experimental nuclear fuel-cycle facilities, radioactive waste also arises from use of radioisotopes in medical, research and industrial applications.

Category GT 26	International classification	Volume (Activity)
Category I	VLLW	4300 m^3 (0,2 TBq)
Category II	LLW short lived	22200 m^3 (700 TBq)
Category III	ILW and HLW	1700 m^3 (2454 TBq)

Source (Category)	Volume (Activity)
Industry, Hospital, etc..(I and II)	3650 m^3 (1 TBq)
Reactors (II)	8250 m^3 (435 TBq)
Fuel Cycle facilities (II and III)	6700 m^3 (2540 TBq)
Research	9600 m^3 (135 TBq)

In connection with the mentioned road map, the Legislative Decree 31/2010 establishes the new procedure for the localization and the construction of a national repository for the LLW disposal and the ILW-HLW long term storage, and assigns to SOGIN the role of the Implementer responsible for the construction and operation of the national repository. Legislative Decree 31/2010 also assigns SOGIN the role to propose areas suitable for the localization of the facility based upon criteria established by the IAEA and the national Agency for Nuclear Safety. The steps to be made in order to realize a national storage facility foresees public consultations and involvement of the interested Regions and Local Authority in the decisional process.

However, due to the debates after the Fukushima accident, the time schedule foreseen by the Legislative Decree has been postponed.

In 2012, ISPRA has been charged with the task to develop a Regulatory Guide on technical siting criteria for the identification of potential area where to realize a LLW near surface disposal facility and an Interim storage for ILW and HLW. Final issue of the Guide is foreseen by June 2013.

Waiting for the implementation of this new procedure and for the availability of a national facility, radioactive waste are being stored in the nuclear installations of origin. Action plans are in progress to enhance the safety level of waste by implementing specific treatment and conditioning projects, by refurbishing existing buildings or by realizing new storage facilities on the sites. New facilities will also be used to ensure temporary storage capacity for waste resulting from decommissioning activities.

Conditioning and decommissioning

Preliminary dismantling activities as well as the conditioning of the radioactive waste are on going at the shutdown SOGIN nuclear power plants and fuel cycle facilities.

The **Garigliano** 150 net MWe BWR was operated from 1963 to 1978. The plant has been totally defuelled and several activities have been performed such as a light decontamination and drainage of the vessel, primary circuit and spent fuel pit; dry low-level operational wastes compaction, cementation of liquid and semiliquid (sludge) radioactive waste. The decommissioning licence has been issued in 2012.

The **Latina** 153 net MWe GCR was operated since 1962 up to 1987. The plant has been totally defuelled; the primary circuit has been filled with dry air, and blowers and portions of the primary circuit outside the reactor building have been dismantled. Dismantling of the turbine building has been completed in 2012.

The **Trino** 260 net MWe PWR was operated from 1965 to 1987 for the equivalent of about eleven full power years; a limited quantity of spent fuel is still present in the spent fuel pool; no major decommissioning activities have been performed. Decontamination of the primary circuit has been completed. The decommissioning licence has been issued in 2012.

The **Caorso** 860 net MWe BWR was operated from 1981 to 1986. Decontamination of the circulation loops and clean-up have been completed in 2003. Dismantling activities on the turbine building, RHR tower and off-gas system are in progress.

As far as the fuel cycle facilities are concerned, all of them are at present shut down and managing their nuclear materials and/or radioactive waste, before starting decontamination and dismantling operations.

5

SF - separately

Italy. EGIRM table

Spent fuel and radioactive waste inventory presentation

Country: Italy______________
Date of inventorying:___31.12.2013

SF/RW types (in national terms)	No strategy	SF reprocessing/ service		Disposal of in:									
		home	abroad	UF-1		UF-2		NSF-1		NSF-2		SDL	SDS
(A)	(B)	(C1)	(C2)	(D1)	(D2)	(E1)	(E2)	(F1)	(F2)	(G1)	(G2)	(H1)	(H2)
1. SF													
1.1. NPP, [tHM]		27.7	1848.25[1]										
1.2. Other reactors, [tHM]	2.74												
2. HLW, [m³]			40[2]										
3. ILW, [m³]	5540[4]		34[3]										
4. LLW, [m³]								31986[5]					23
5. VLLW, [m³]								3870[6]					
Equivalence with IAEA GSG-1 classification — 2.			HLW										
3.	ILW		ILW										
4.								LLW					LLW
5.								VLLW					

1) 1848.25 = 963.2 tHM (UK) before 1978 without RW return + 678 tHM (UK) in 1978-2005 with RW return of + 207.75 tHM (Fr)

2) 40 = 20 m^3 of vitrified HLW from UK (substitution of ILW-LLW with only HLW is in discussion) - 20 m^3 of vitrified HLW from Fr – volumes refer to canisters

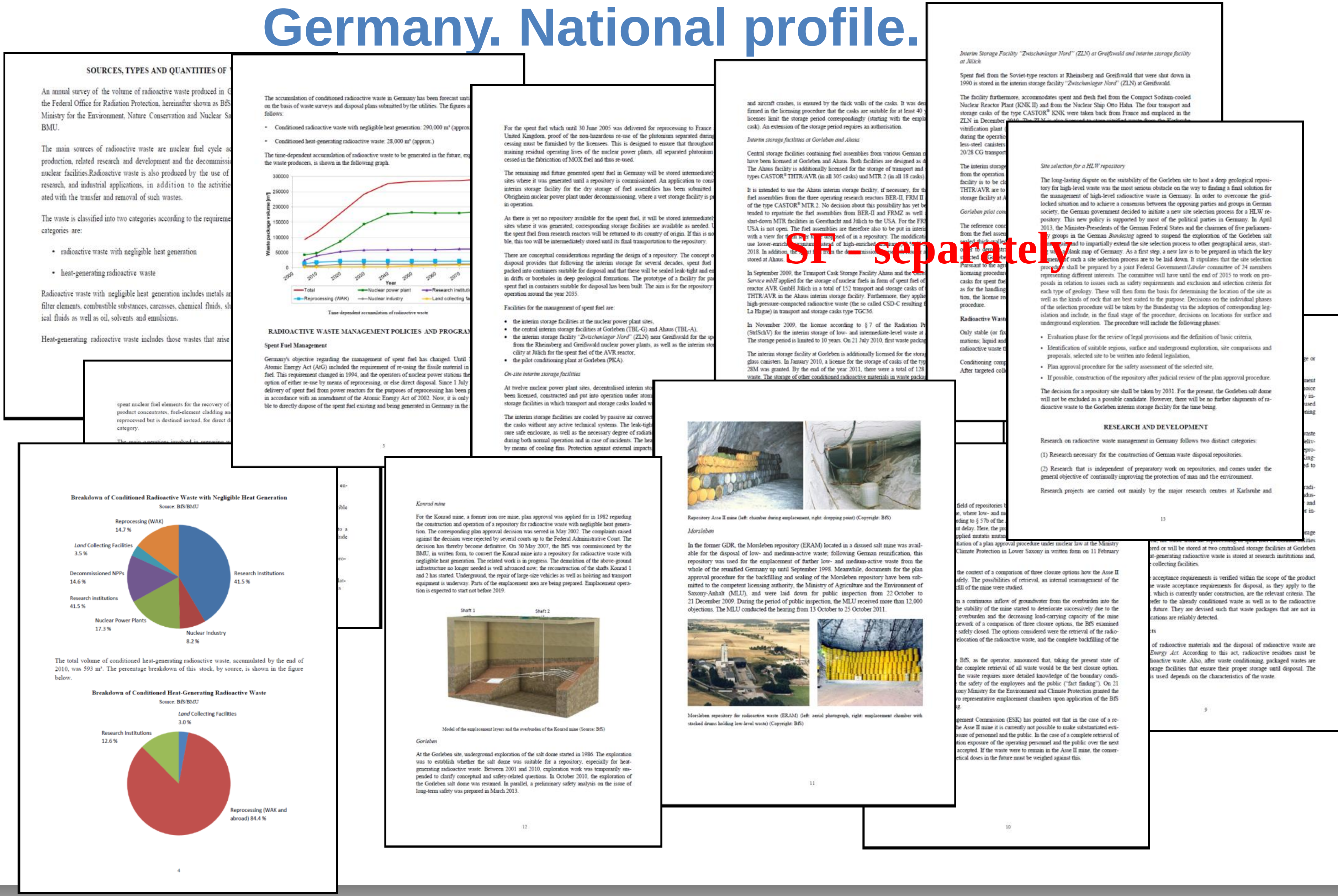
3) ILW to be returned from Fr

4) 5540 = 2360 m^3 (estimate for the final volume of the conditioned Liquid ILW from pilot reprocessing plants (EUREX and ITREC, still to be conditioned) +
3180 m^3 (estimates for the final volumes after conditioning)

5)31986 = 6371 m^3 (estimate for the final volume of conditioned LLW from pilot reprocessing plants (EUREX and ITREC, mainly still to be conditioned) +
25255 m^3 (estimates for the final volumes after conditioning)

6)Estimates for the final volumes after conditioning

Germany. National profile.



SF – separately

Germany. EGIRM table.

Spent fuel and radioactive waste inventory presentation

Country: Germany________________

Date of inventorying:_31.12.2013

SF/RW types (in national terms)	No strategy	SF reprocessing/ service		Disposal of in:							
		home	abroad	UF-1		UF-2		NSF-1		NSF-2	
(A)	(B)	(C1)	(C2)	(D1)	(D2)	(E1)	(E2)	(F1)	(F2)	(G1)	(G2)
1. SF											
1.1. NPP, [tHM]				8216							
1.2. Other reactors, [tHM]				9.5							
2. RW with HG, [m³]			859 [1)]	569[2)]							
3. RW with negligible HG [m³]						120.000[3)]	83683[4)]				
Equivalence with IAEA GSG-1 classification 2.			HLW/ILW	HLW							
3.						LLW/ILW	LLW/ILW				

[1)] HLW stored in UK and Fr and to be sent back 764 m^3 (Fr) + 103 m^3 (UK)

[2)] 569 = 554 m^3 after NPP SF reprocessing (volume given "as is" – 180 l canisters) + 15 m^3 after other reactors' SF reprocessing;

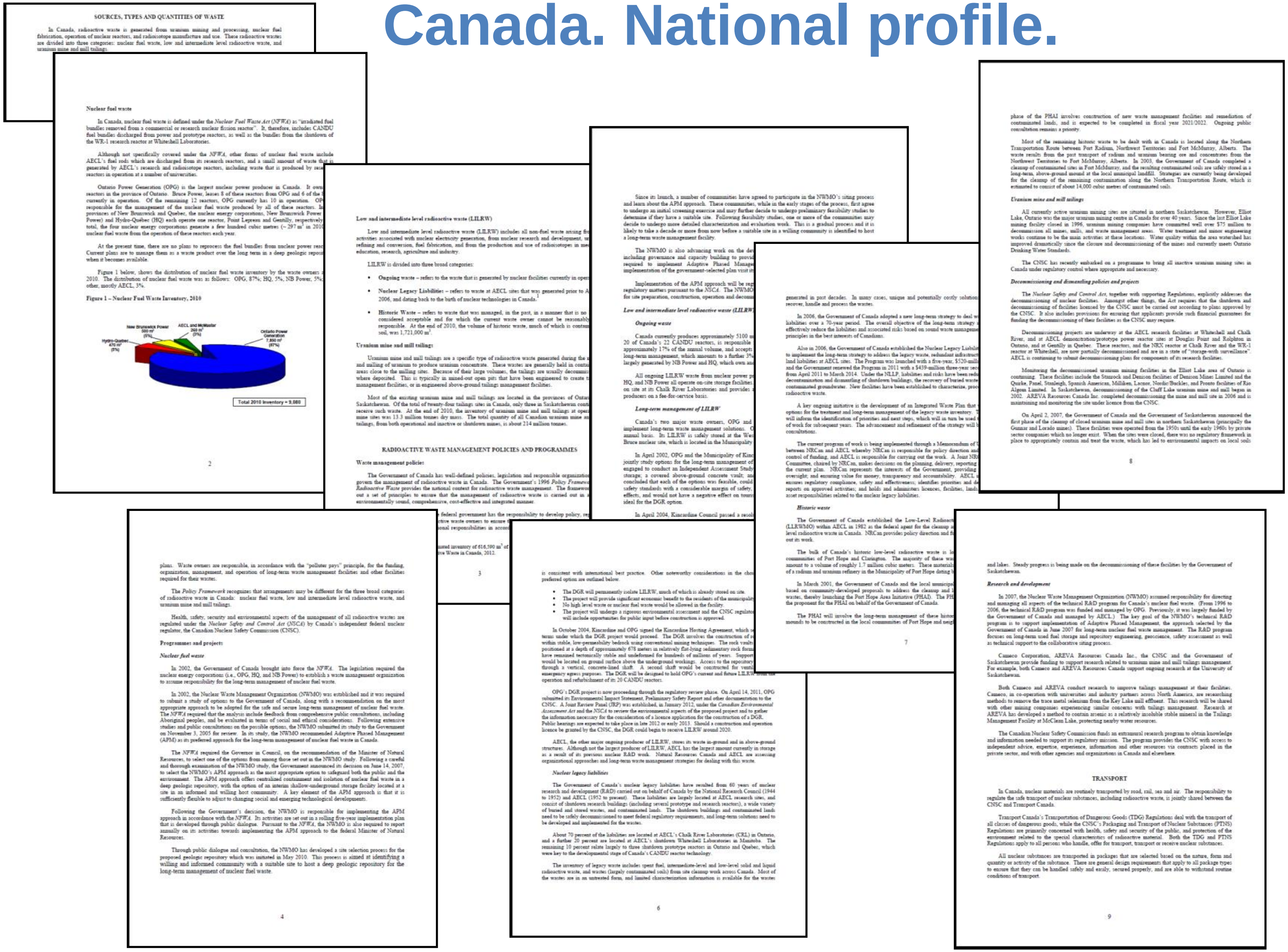
UF-1: future HLW disposal

UF-2: Konrad; Morsleben; Asse

[3)] RW to be disposed in UF-2 "Konrad";

[4)] 83683 = 36753 m^3 (disposed in UF-2 "Morsleben") + 46930 m^3 (disposed in UF-2 "Asse") (in future, retrieval from "Asse" is planned and will increase the "to be disposed of" volume).

Canada. National profile.



Canada. EGIRM table.

Spent fuel and radioactive waste inventory presentation

Country:_Canada_______________

Date of inventorying:___31.12.2013[c]

SF/RW types (in national terms)		No strategy	SF reprocessing/ service		Disposal of in:								
			home	abroad	UF-1		UF-2		NSF-1		NSF-2		Optional
(A)		(B)	(C1)	(C2)	(D1)	(D2)	(E1)	(E2)	(F1)	(F2)	(G1)	(G2)	→
1. SF													
1.1. NPP, [tHM]					46970[a]								
1.2. Other reactors, [tHM][b]					489[a]								
2. Other HLW, [m^3]													
3. LLW, [m^3]		18892[e]					84210[d]		144737[e]		2104832[e]		
4. ILW, [m^3]		20700[e]					14070[d]						
Equivalence with IAEA GSG-1 classification	1.1.2												
	1.1.3												
	1.2.2												
	1.2.3												
	2.												
	3.	LLW					LLW		LLW		VLLW[f]		
	4.	ILW					ILW						
	5.												

a) Reference plan for all spent fuel is deep geological disposal.

b) "Other reactors" includes research reactors as well as prototype and demonstration power reactors.

c) Data from "Canadian National Report for the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management", 5th report, Oct 2014.

d) Data in column (E1) is for waste owner OPG.

e) Data in columns (B), (F1) and (G1) is for waste owners other than OPG (i.e., CNL, HQ, NBP, Cameco, etc)

f) Data in column (G1) is mostly low activity contaminated soils from historic practices, considered to be LLW under Canadian classification, but essentially equivalent to GSG-1 VLLW

Table extension potential

- The table can be extended to address needs of a country or requirements/requests from an international programme;
- The extension ability of the table will be presented in the next item;
- The table extension can provide a value when the common understanding of terms is provided:
    - Types of reactors in accordance with the IAEA typology;
    - Categories of DSRSs in accordance with national categorisation (correlation with IAEA categories is needed);
    - Clear explanation of other terms can be given in appendix to the table (e.g. location, type of research reactor, etc.)