Overview of EGIRM Methodology

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Background

- The presentation scheme (table) provides a comprehensive view of spent fuel/radioactive waste (SF/RW) management in a specific country.
- It was developed and tested by a group of experts from a number of NEA member countries.
- The table combines SF and RW inventories and presents them through diverse national management strategies.
- The table and methodology can be used for compilation and aggregation of data from different countries on different levels.
- It can be used to document past practices, current inventories and/or future forecasts, at a local, regional or national level.
- It could also be added to the national inventory report as a simplified universal source of information about SF/RW management in a country.

Definitions

- The following definitions were therefore developed for the methodology:
  - The **"servicer"** is the country where the SF is to be reprocessed or where any other service is to be provided according to the international agreement.
  - The **"user"** is the country that used the nuclear fuel (i.e. generates the spent fuel) and then sent it to "servicer" according to international agreements for reprocessing (or any other specific service).
  - **"Nuclear power plants' spent fuel"** (NPP's SF) is fuel that was used in a reactor built and operated for the commercial production of electricity, extracted from the reactors and inventoried in the national inventory. RW formed after reprocessing of such SF is also included in the methodology objectives for nuclear power plants (when necessary to present separately).
  - **"Other reactors' spent fuel"** is fuel that was used in reactors built and operated for purposes other than commercial electricity production (such as science, medicine, transport, isotope production, etc.), extracted from the reactors and inventoried in the national inventory. RW formed after reprocessing of such SF is also included in the group "other reactors" (when necessary to present separately).

EGIRM Presenting Scheme

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, [m³]													
3. … class, [m3]													
4. … class, [m3]													
Equivalence with IAEA GSG-1	2.	HLW	HLW	HLW	HLW								
	3.												
	4.												

Table Details – Column (A)

- In column (A), a country should input the names of all classes of spent fuel and RW existing in the country in terms of the national classification.
  - Additional rows can be added to cover all of the national waste classes.

SF/RW types (in national terms)
(A)
SF
1.1. NPP
1.2. Other reactors
Radioactive waste
2. HLW, [m^3]
3. … class, [m3]
4. … class, [m3]

Table Details – Column (B)

- Column (B) is provided to input the SF or RW for which there is no currently defined strategy.
  - It could be SF/RW placed into a long-term storage facility and awaiting a decision. It also could include the RW collected as a result of past activities and currently stored in the storage facilities or in the places of origin without a long-term management strategy.
  - Since much of such RW may not be conditioned yet, it is acceptable to input this RW in the form of "as is" (raw or stored volume) with the relevant footnotes.
  - SF is reported in tHM.
  - SF or RW currently stored and awaiting reprocessing/disposal should not be input into Column (B), since it has a defined strategy.

SF/RW types (in national terms)	No strategy
(A)	(B)
SF	
1.1. NPP	
1.2. Other reactors	
Radioactive waste	
2. HLW, [m^3]	
3. … class, [m3]	
4. … class, [m3]	

Table Details – Column (C)

- Column (C) is provided to input all SF to be reprocessed and the resulting RW from SF that has been reprocessed, including SF sent abroad.
  - Column (C1) is provided to input all SF to be reprocessed in your country. This should also include the SF "imported" from the "user" countries and included into the national inventory of the "servicer" country.
  - Column (C2) is provided to input all SF you have sent to another country to be reprocessed there.

SF/RW types (in national terms)	SF reprocessing/ service	
	home	abroad
(A)	(C1)	(C2)
SF		
1.1. NPP		
1.2. Other reactors		
Radioactive waste		
2. HLW, [m^3]		
3. … class, [m3]		
4. … class, [m3]		

Table Details – Column (D)

- Column (D) is provided to input SF that is to be directly disposed of, HLW and RW decided to be disposed of into a UF-1 facility.
  - Column (D1) is provided to input SF & RW to be directly disposed of in accordance with the decided strategy.
    - UF-1 is the only acceptable path to dispose of SF and HLW
    - When a country decides to dispose of other types of RW in the UF-1, they should all be put into the relevant cells of (D1). It is preferred that all of the RW amounts should be input in the form of "as disposed".
  - Column (D2) is provided to input the SF/RW amounts that are already disposed of in the UF-1 facilities.

SF/RW types (in national terms)	Disposal in:	
	UF-1	
(A)	(D1)	(D2)
SF		
1.1. NPP		
1.2. Other reactors		
Radioactive waste		
2. HLW, [m³]		
3. … class, [m3]		
4. … class, [m3]		

Table Details – Column (E)

- Column (E) is provided to input RW decided to be disposed of into a UF-2 facility.
  - Column (E1) is provided to input RW to be directly disposed of in accordance with the decided strategy.
    - UF-2 is applicable to all types of waste except SF and HLW
    - It is preferred that all of the RW amounts should be input in the form of "as disposed".
  - Column (E2) is provided to input the RW amounts that are already disposed of in the UF-2 facilities.

SF/RW types (in national terms)	Disposal in:	
	UF-2	
(A)	(E1)	(E2)
SF		
1.1. NPP		
1.2. Other reactors		
Radioactive waste		
2. HLW, [m^3]		
3. … class, [m3]		
4. … class, [m3]		

Table Details – Column (F)

- Column (F) is provided to input RW decided to be disposed of into a NSF-1 facility.
  - Column (F1) is provided to input RW to be directly disposed of in accordance with the decided strategy.
    - NSF-1 is applicable to most types of waste except SF and HLW
    - NSF type facilities usually have low limits on long-lived radionuclides
    - It is preferred that all of the RW amounts should be input in the form of "as disposed".
  - Column (F2) is provided to input the RW amounts that are already disposed of in the NSF-1 facilities.

SF/RW types (in national terms)	Disposal in:	
	NSF-1	
(A)	(F1)	(F2)
SF		
1.1. NPP		
1.2. Other reactors		
Radioactive waste		
2. HLW, [m³]		
3. … class, [m3]		
4. … class, [m3]		

Table Details – Column (G)

- Column (G) is provided to input RW decided to be disposed of into a NSF-2 facility.
  - Column (G1) is provided to input RW to be directly disposed of in accordance with the decided strategy.
    - NSF-2 is applicable to lower activity wastes such as VLLW and some low activity LLW due to minimal engineered barriers
    - NSF type facilities usually have low limits on long-lived radionuclides
    - It is preferred that all of the RW amounts should be input in the form of "as disposed".
  - Column (G2) is provided to input the RW amounts that are already disposed of in the NSF-2 facilities.

SF/RW types (in national terms)	Disposal in:	
	NSF-2	
(A)	(G1)	(G2)
SF		
1.1. NPP		
1.2. Other reactors		
Radioactive waste		
2. HLW, [m^3]		
3. … class, [m3]		
4. … class, [m3]		

Table Details – Additional Columns

- Additional columns can be added to the table to include disposal in other types of facilities. E.g.:
  - past practice of sea dumping
  - Disposal of liquids in deep injection wells
  - Etc.
- The number of extra columns is determined by the number of different disposal routes required

SF/RW types (in national terms)	Disposal in:
	Others
(A)	→
SF	
1.1. NPP	
1.2. Other reactors	
Radioactive waste	
2. HLW, [m^3]	
3. … class, [m3]	
4. … class, [m3]	

Table Details – SF Rows

- The SF (Spent Fuel) rows 1.1 and 1.2 are to input the amount of SF for NPPs and non-NPP reactors, respectively
  - The SF should be reported in tonnes of heavy metal (tHM)
  - Entries should only appear in columns (B), (C1), (C2) or (D1), as applicable
  - Once a country has established a UF-1 disposal facility and has begun disposing in it, data can appear in column (D2)

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												

NPPs' SF

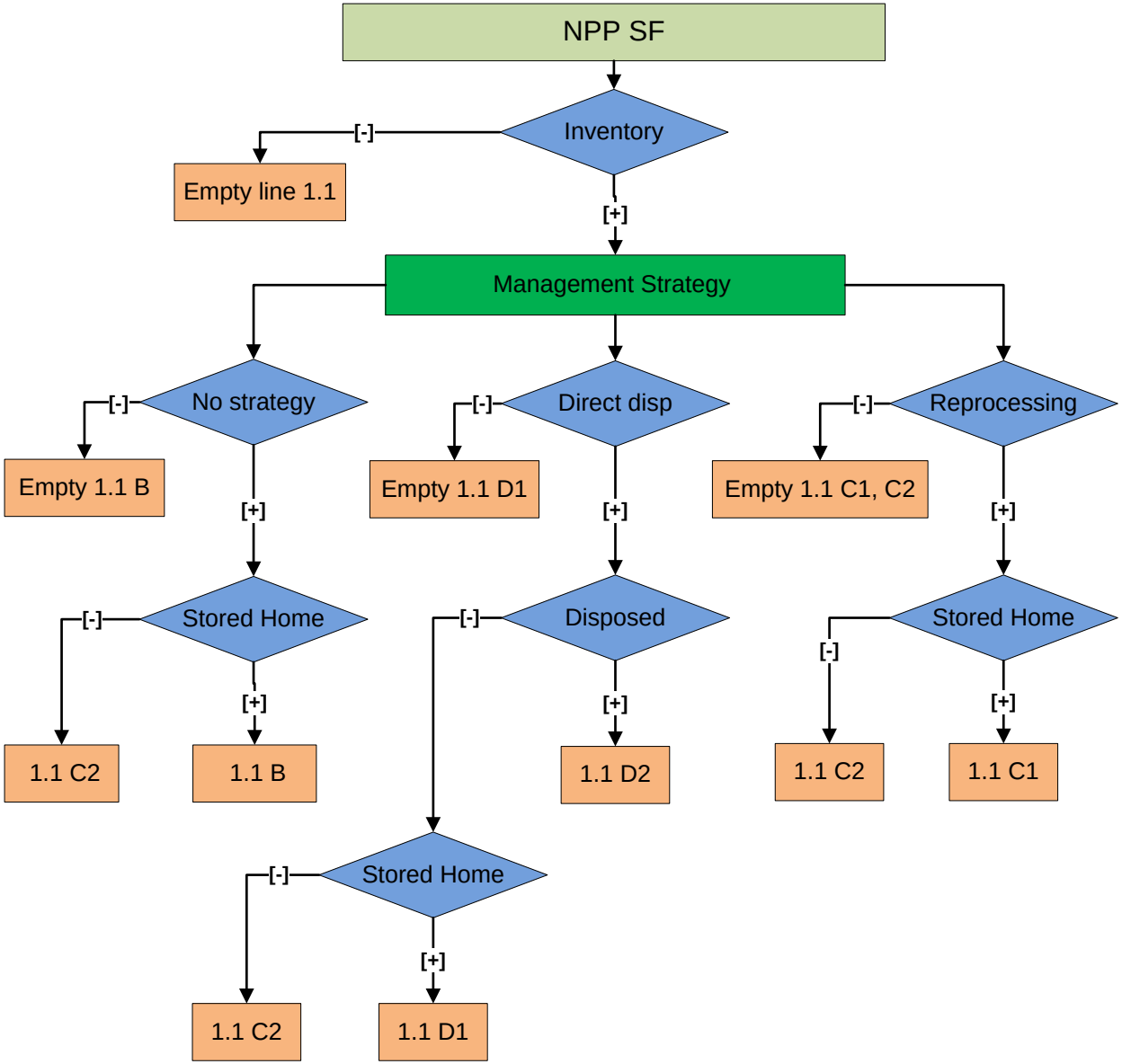


Table Details – RW Rows

- The RW (Radioactive Waste) rows 2, 3, 4, etc are to input the amount of RW for each of the national waste classes
  - Additional rows can be added to cover each national waste class
  - RW should be reported in cubic metres (m^3), preferably converted to an "as-disposed" volume
  - Disused sealed radioactive sources (DSRS) when specified as a RW class should be reported in pieces (pcs) and a relevant remark should be made in the table.

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)	→
Radioactive waste												
2. HLW, [m^3]												
3. … class, [m3]												
4. … class, [m3]												

Table Details – GSG-1 Rows

- The GSG-1 equivalency rows are to input how each of the national waste classes corresponds to the IAEA GSG-1 waste classes VLLW, LLW, ILW, HLW, etc
  - Additional rows can be added to cover each national waste class
  - Approximate percentages can be used where a national waste class may span several GSG-1 classes (e.g. National Class "A" waste might be 10% IAEA VLLW, 80% LLW and 10% ILW)

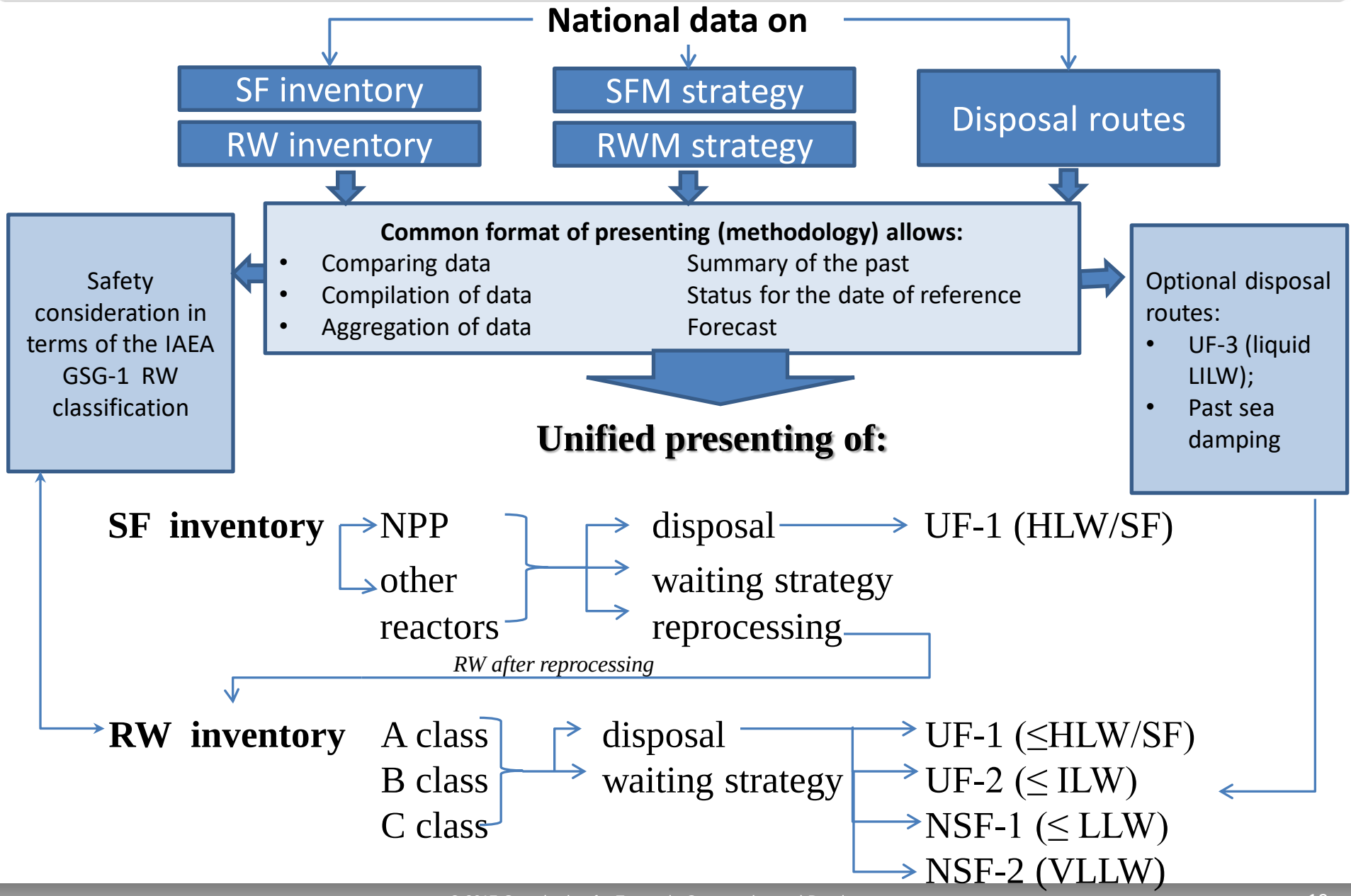
SF/RW types (in national terms)		No strategy	SF reprocessing/ service		Disposal in:								
			home	abroad	UF-1		UF-2		NSF-1		NSF-2		Others
(A)		(B)	(C1)	(C2)	(D1)	(D2)	(E1)	(E2)	(F1)	(F2)	(G1)	(G2)	→
Equivalence with IAEA GSG-1	2.	HLW	HLW	HLW	HLW								
	3.												
	4.												

Table Details – Explanatory Footnotes

- Explanatory footnotes can be added to the bottom of the table where required. E.g.:
  - To explain how a particular waste type or disposal method fits into a national scheme
  - To explain the contributory elements of a presented total (e.g. x tons of fuel reprocessed for Country A, y tons for Country B, etc)
- Example:
  - Superscript markers in the cells – 125.3[1] and short explanations in footnote;
  - Distribution on parts when RW – mix of solid and liquid, “as is” and “as disposed”, etc. [1] is 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



Further Information

- Additional details and examples will be provided in subsequent presentations of this workshop
- Full details and background material can be found in recent NEA reports:
  - "*National Inventories and Management Strategies for Spent Nuclear Fuel and Radioactive Waste: Methodology for Common Presentation of Data*", NEA No. 7323 (2016)
  - "*National Inventories and Management Strategies for Spent Nuclear Fuel and Radioactive Waste: Extended Methodology for the Common Presentation of Data*", NEA No. 7371 (2017)

Questions?