Waste Inventory for Near Surface Repository (NSR) – 13482

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ABSTRACT

The main characteristics, physical, chemical as well as radiological of the waste intended to be disposed of in the planned NSR are described. This description is mainly based on the waste inventory investigations performed by the Ignalina Nuclear Power Plant (INPP). The four different waste streams to be disposed of in the NSR are described and investigated.

WASTE INVENTORY

WASTE CLASSIFICATION

Currently the INPP generated and/or accepted for storage solid radioactive waste is classified according to radiological properties (surface dose rate level) into three groups:

- **Group 1** (Low Level Waste), surface dose rate 0.0006 - 0.3 mSv/h;
- **Group 2** (Intermediate Level Waste), surface dose rate > 0.3 - 10 mSv/h, and
- **Group 3** (High Level Waste), surface dose rate > 10 mSv/h.

This classification system is referred hereafter in the Report as “the Old” system. This “Old system” is applicable to the untreated existing Radioactive waste (RAW) only.

A “new” classification system is applicable to the treated and/or conditioned waste, where the waste is segregated according to surface dose rate and its ultimate destination (disposal method):

■**Class 0 waste for free release:** waste for which, taking into account clearance levels, application of radiation safety requirements established in the regulatory documents are beside the purpose;

■**Class A waste:** very low level waste includes radioactive waste with surface dose rate < 0.5mSv/h and that are allowed for disposal (at a very low level waste repository), provided that the radionuclides content complies with the corresponding acceptance criteria;

■**Class B and C waste:** short-lived low and intermediate level waste (LILW-SL) with surface dose rate 0.5 - 2 mSv/h (Class B) and > 2 mSv/h (Class C) for intermediate storage and further disposal in a NSR;

■**Class D and E waste:** long-lived low and intermediate level waste (LILW-LL) with surface dose rate < 10 mSv/h (Class D) and > 10 mSv/h (Class E) for interim storage and further disposal in intermediate depth or deep geological repository;

■**Class F waste:** spent sealed sources.

Radioactive waste treatment implemented at the INPP solid radioactive waste in addition are classified into:

- ■ Combustible / Non-combustible;
- ■ Compactable / Non-compactable;
- ■ Non-treatable;
- ■ Untreated solid waste Group 1 (a part not suitable for disposal in the very low level waste disposal facility) and Group 2 as well as decommissioning waste attributed to LILW-SL Class B or Class C will be conditioned and disposed of in the planned NSR.

WASTE ORIGIN

Operational waste is generated during the normal day-to-day operations of a plant from its start-up to final shutdown. These waste streams of organic materials such as cellulose and plastic, metals and various inorganic materials. Examples of operational wastes are redundant equipment, filters, ion exchange resins (IER) and sludge from the treatment of liquid effluents.

Decommissioning waste arise after shutdown of a facility. They consist mainly of building materials such as reinforced concrete, larger items of plant and equipment including pipework, process vessels and ventilation systems.

In accordance with the physical characteristic radioactive waste is classified into liquid, solid and gaseous waste.

Waste intended to be disposed of in the NSR for LILW-SL radioactive waste are from different sources, namely:

- ■ **Operational solid waste** loaded into existing storage facilities for solid LILW-SL at INPP (buildings 155, 155/1, 157, 157/1);
- ■ **Operational and decommissioning solidified liquid waste** loaded into temporary storage facility for liquid LILW-SL at INPP (building 158/2);
- ■ Decommissioning solid waste from INPP Unit 1 and 2.

Cemented IER, perlite and evaporated concentrate sludge

The main liquid radioactive waste generation sources are as follows:

- ■ Multiple circulation circuit (MCC);
- ■ Water of spent fuel pools;
- ■ INPP equipment decontamination solutions;
- ■ Sanitary inspection rooms;

■ Special laundry;

■ Controlled and uncontrolled leakages from equipment and pipelines, MCC, Control and protection system (CPS);

■ Drainage water;

■ Water after discharge of equipment and pipelines.

Liquid radioactive waste (LRW), both operational as well as arisen from INPP decommissioning activities, is treated and conditioned in INPP's Liquid Waste Treatment Facility.

A new Cementation Facility was commissioned at INPP in 2005, where spent ion exchange resins, perlite mixtures and sediments are cemented in 200 l drums. The drums are placed into concrete overpacks (eight drums per Framatome-ANP container licensed for storage) which are transported to the Temporary Storage Building situated on the INPP site. The drums in containers will be immobilized with cemented grout before final disposal.

Solid operational waste

The existing storage facilities for LILW-SL solid waste (buildings 155, 155/1, 157, 157/1) at INPP contain so-called Group 1, Group 2 and Group 3 waste. Solid Radioactive Waste (SRW) of Group 1 (part which is not suitable for disposal in the Landfill facility) and Group 2 generated during INPP operation period is candidate for disposal in the planned NSR. Group 3 waste is intermediate level long-lived radioactive waste which is not intended for disposal in NSR therefore is not discussed in the report. Existing waste would be retrieved for conditioning, characterization, classification and re-disposal.

Combustible Group 1 waste includes:

■ Paper, textile and plastic generated during the normal operation and service of the plant. These materials are used for cleaning purposes, as protective clothing, covers to protect equipment and surfaces against contamination, etc.;

■ Wood and wooden constructions which have been used inside the controlled area;

■ Filters, which have been used inside the controlled area for different purposes. These filters include various filter cartridges, HEPA filters, respiratory filter cartridges etc.;

■ PVC waste which consist of rolls of floor cover material and miscellaneous items like gloves, films, sheets, baskets etc.

Filter cartridges (potential activity concentration) and PVC waste (which incineration creates hazardous chlorine compounds) will not be incinerated and therefore are to be re-sorted and appropriately treated as non-combustible waste.

Non-combustible Group 1 waste includes:

■ Wide range of different metal items. The most common metals are stainless steel and carbon steel;

■ Construction materials like bricks, concrete, gypsum sheets and asbestos (it is attributed to hazardous non-radioactive waste, it is not acceptable);

■ Thermal insulation materials coming mainly of glass wool material in the form of sheets and heat insulation coating for pipe works;

■ Cables and casings, which include various types of electrical wires and cables with different kinds of coating materials (rubber, PVC, textile, etc.), casings of electrical and process equipment (paronite, metal, plastics, etc.);

■ Dry sediments, sands and other kinds of fine materials collected at different points inside the controlled area and also loaded in the storage compartments of the waste storage facility.

Group 2 waste consists mainly of replaced equipment, parts, components and elements, and maintenance service material originating from various locations.

Composition and structure of the Group 2 combustible waste do not differ much from Group 1 combustible waste. The waste is attributed to Group 2 waste because of its higher activity or contamination level.

Composition of Group 2 non-combustible waste differs to some extent from Group 1 non-combustible waste. The proportion of metal items in Group 2 as well as insulation materials is higher.

Solid decommissioning waste

Under Decommissioning Project B2/3/4, a new Solid Waste Management and Storage Facility (SWMSF) will be built by 2013-14 in order to characterize, treat, condition and store the interim storage retrieved operational SRW accumulated on the site as well as the future operational and decommissioning waste of the same type. Waste packages from the SWMSF are based on the KTZ 3.6.

During decommissioning much large-size LILW-SL SRW will arise not requiring SWMSF processing. Once the NSR becomes available this SRW may be disposed of without SWMSF treatment. It was decided that characterization of large size waste will be performed by waste package producer.

Hazardous Materials

Hazardous materials, which are radioactive, would have to be considered, they should be processed as radioactive waste taking into account their hazardous properties. Solid hazardous waste and liquid hazardous waste are separated. There are no radioactive hazardous materials identified for disposal in the NSR.

WASTE QUANTITIES

Liquid operational and decommissioning waste

The considered waste is: cemented IER, perlite and evaporated concentrate sludge.

Liquid radioactive waste is stored in tanks TW18B01 (spent ion-exchange resins, granular and powder, as well as filter-perlite) and TW18B02 (residue sediment of evaporator concentrate, perlite, dissolved and non-dissolved salts, mechanical impurities, products of corrosion). Currently newly accumulated spent ion-exchange resins are stored in tank TW11B03 (spent ion-exchange resins, granular and powder, as well as filter-perlite which fraction is less by 20% in comparison with waste in tank TW18B01). Based on indications by INPP the respective volume, density and mass of waste in the considered tanks are given in Table 1.

Table 1. Quantity of liquid operational and decommissioning waste

Tank	Volume of operational waste (m^3)	Supposed volume of decommissioning waste (m^3)	Density (kg/l)	Total mass of waste (oper.+decom.) (t)
TW18B01	1 200	-	1.15	1 380
TW11B03	1 200	300	1.15	1 725
TW18B02	675	75	1.60	1 200
TOTAL	**3 075**	**375**		**4 305**

According to data provided in Table 1 in total it is foreseen to generate and receive for temporary storage up to 3 450 m^3 of spent ion-exchange resins, filter-perlite and vat residue sediment from INPP operation and decommissioning with approximate mass of 4 305 t.

Solid LILW-SL waste (solid operational and decommissioning waste)

Volumes and masses of untreated (raw) solid radioactive waste, which after treatment and conditioning intended to be disposed of in the planned NSR, are summarized in Table 2. Treatment and conditioning routs are also indicated in the table.

Table 2. Summary of volumes and masses of untreated radioactive waste

Intende	Operational waste								Decommissioning waste					
	Combustible				*Non-combustible* *				*Combustible*				*Non-combustible*	
	Group 1		*Group 2*		*Group 1*		*Group 2*		*Group 1*		*Group 2*			
	Volume (m^3)	Mass (t)	Volume (m^3)	Mass (t)	Volume (m^3)	Mass (t)	Volume (m^3)	Mass (t)	Volume (m^3)	Mass (t)	Volume (m^3)	Mass (t)	Volume (m^3)	Mass (t)
Incineration	2 450	980	1 860	465					6 486	1 109	8 960	1 38		
Supercompaction	2 135	273	429	138	263	54	2 744	1 501					27 050	14 275

Non-treatable													7 886	15 763 **30 038**
TOTAL	**4 585**	**1 253**	**2**	**603**	**263**	**54**	**2 744**	**1**	**6**	**1 109**	**8**	**1**	**34**	
	9 881 m^3 (3 411 t)								**50 382 m^3 (32 532 t)**					

* Considering total mass of non-combustible waste from Group 1 and 2 (1 555 t) to be treated in SWMSF it is estimated that the wooden framed filters would compose about 3% in mass.

WASTE RADIOLOGICAL CHARACTERISTICS

List of relevant radionuclides

A list of relevant radionuclides has been elaborated and is provided in Table 3. A justification of the selected relevant radionuclides and an approach to radionuclide screening-out is provided in documents, 38 radionuclides are considered as being relevant for the purpose of the NSR design studies and the Safety Assessment calculations.

^{59}Fe, **^{58}Co**, **^{95}Zr**, and **^{95}Nb** identified in INPP waste are excluded from further investigations due to their rather short half-lives (days) and negligible contribution to the safety assessments in both periods operational and post-closure.

Few radionuclides (**^{10}Be**, **^{41}Ca**, **^{93}Mo**, **^{108m}Ag**, **^{113m}Cd**, **^{121m}Sn**, **^{242}Pu**, and **^{242}Cm**) (hereafter extra radionuclides) not identified in Waste Streams of Ignalina NPP have been added based on the international (France) experience.

^{226}Ra is included based on our Radioactive waste management agency (RATA) information. However there should not be significant amount in waste from the INPP (in spent sealed sources mainly).

WASTE TREATMENT AND CONDITIONING

Cemented IER, perlite and evaporated concentrate sludge

The cement solidification facility (CSF) is installed inside Building 150, which is a part of the existing Liquid Waste Treatment Facility of INPP.

The waste package for cemented ion exchange resins, perlite and evaporated concentrate sludge is defined as:

- Solid waste form, i.e. the liquid radioactive waste immobilized in the binding agent matrix;
- Eight drums, made of painted carbon steel, closed by a lid with a screwed clamping ring, containing 200 l solidified liquid radioactive waste;
- A storage container (Framatome-ANP type) closed by a loose lid with a capacity for eight 200 l drums.

Three types of mixtures are used for producing of cement matrix series:

■ **Common Treatment (CT)** is used for mixture of waste from tanks TW18B01 and TW18B02 containing ion-exchange resins (R) granulated and powder-like (dry) within the margins 11 to 15% (mass.), filter-perlite (P) (dry) within the margins 4.5 to 6.5% (mass) and salts (S) (dry) within the margins 1.7 to 2.3% (mass); calculation of cement, bentonite and water is given for average values R = 13% (mass), P = 5.5% (mass), S = 2% (mass);

■ **Separate Resin/Perlite Treatment (SRT)** is used for mixture of waste from tank TW18B01 containing R+P within the margins 14.3 to 22.5% (mass) and S within the margins 1.7 to 2.3% (mass); calculation of cement, bentonite and water is given for average values R + P = 20% (mass), S = 2% (mass);

■ **Separate Concentrate/Perlite Treatment (SCT)** is used for mixture of waste from tank TW18B02 containing P within the margins 6.5 to 8.5% (mass) and S within the margins 8.3 to 11.3% (mass); calculation of cement, bentonite and water is given for average values P=7.5% (mass), S=9.8% (mass).

Cement composition should meet the calculated value of formula taking into consideration the ratio water/(cement+bentonite) within the margins 0.4 to 0.7 .

Average and maximal expected values of activity of cemented radioactive waste package with respect to series (CT, SRT and SCT) are presented in Table 3. Measurement of total and specificactivity of waste stored in tanks TW18B01 and TW18B02 have been performed in the INPP Radiation Protection Laboratory in 1996 .

Table 3. Nuclide content, average and maximal expected values of activity of cemented radioactive waste package (drum) (based on scaling factors derived for year 2004)

Radio-nuclides	**Max. expected value of activity in package (Bq) ***			**Average value of activity in package (Bq) ***		
	Series CT (60 kg + 26 kg, dry waste)	**Series SRT (76 kg, dry waste)**	**Series SCT (70 kg, dry waste)**	**Series CT (60 kg + 26 kg, dry waste)**	**Series SRT (76 kg, dry waste)**	**Series SCT (70 kg, dry waste)**
^{3}H	5.98E+05	6.26E+05	6.12E+05	5.98E+05	6.26E+05	6.12E+05
14C	1.90E+09	2.37E+09	8.89E+07	6.46E+08	7.93E+08	5.39E+07
^{54}Mn	1.29E+10	1.59E+10	1.00E+09	1.14E+10	1.41E+10	7.39E+08
^{58}Co	1.76E+08	1.76E+08	1.00E+08	1.42E+08	1.37E+08	9.10E+07
^{60}Co	1.81E+10	2.26E+10	8.47E+08	9.23E+09	1.13E+10	7.70E+08
^{59}Fe	1.20E+09	1.50E+09	3.39E+07	7.52E+08	9.39E+08	3.08E+07
^{59}Ni	2.90E+07	3.61E+07	1.36E+06	1.20E+07	1.47E+07	1.00E+06
^{63}Ni	3.45E+09	4.29E+09	1.61E+08	1.48E+09	1.81E+09	1.23E+08
^{90}Sr	8.05E+07	1.00E+08	3.76E+06	3.42E+07	4.20E+07	2.86E+06

^{94}Nb	1.87E+07	2.33E+07	8.73E+05	6.74E+06	8.28E+06	5.63E+05
^{95}Nb	1.75E+08	2.17E+08	9.24E+06	9.71E+07	1.20E+08	6.16E+06
^{95}Zr	1.85E+08	2.34E+08	< detection level	8.40E+07	1.06E+08	< detection level
^{99}Tc	2.97E+05	3.70E+05	1.39E+04	1.16E+05	1.43E+05	9.70E+03
129I	4.88E+03	6.07E+03	2.28E+02	1.91E+03	2.34E+03	1.59E+02
134Cs	1.40E+09	1.76E+09	3.70E+07	1.24E+09	1.56E+09	3.36E+07
137Cs	4.72E+09	5.85E+09	2.62E+08	2.19E+09	2.66E+09	2.38E+08
234U	8.23E+02	1.02E+03	3.85E+01	2.80E+02	3.44E+02	2.34E+01
235U	1.99E+01	2.48E+01	9.32E-01	6.73E+00	8.27E+00	5.62E-01
238U	1.69E+02	2.10E+02	7.89E+00	8.18E+01	1.00E+02	6.83E+00
237Np	3.10E+01	3.86E+01	1.45E+00	1.10E+01	1.35E+01	9.16E-01
238Pu	1.23E+05	1.53E+05	5.76E+03	4.34E+04	5.32E+04	3.62E+03
239Pu	1.04E+05	1.30E+05	4.86E+03	3.64E+04	4.46E+04	3.03E+03
240Pu	1.48E+05	1.85E+05	6.93E+03	5.24E+04	6.43E+04	4.37E+03
241Pu	4.61E+06	5.73E+06	2.15E+05	1.79E+06	2.20E+06	1.49E+05
241Am	3.34E+05	4.15E+05	1.56E+04	1.15E+05	1.42E+05	9.63E+03

* derived from measurements performed in the tanks in 1996.

Dose rate is not more than 20 mSv/h at the surface of package of cemented radioactive waste (200 ℓ drum).

Measurements of the waste packages (drums) with cemented spent resins have been carried out at INPP during 2005 - 2011. Data obtained from more than 6,700 drums (mainly from the waste loaded in the tank TW18B01) have been processed. Results of radiological characterization of cemented LRW packages are summarized in Table 4.

Table 4. Average activity for Cemented Liquid Waste (based on results of radiological characterization

Radionuclide	**Average value of activity in package (drum)**
^{3}H	5.25E+05
14C	1.73E+08
^{54}Mn	2.17E+07
^{60}Co	1.76E+09
^{59}Ni	3.22E+06
^{63}Ni	3.88E+08
^{90}Sr	8.58E+06

^{94}Nb	5.59E+06
^{99}Tc	3.11E+04
129I	5.12E+02
134Cs	9.32E+07
137Cs	2.63E+09
234U	7.52E+01
235U	1.81E+00
238U	2.20E+01
237Np	2.95E+00
238Pu	1.14E+04
239Pu	9.75E+03
240Pu	1.40E+04
241Pu	4.19E+05
241Am	3.08E+04
Average dose rate at distance of 0.1 m	1.62
Maximum dose rate at distance of 0.1 m	4

According to the radiological characterization results where presented. the maximum dose rate is less 4 mSv/h at the surface of 200 ***l*** drum.

After comparison of data presented in Table 2.6 and Table 2.7 the activity values presented in Table 2.6 are considered as highly conservative.

For NSR design preparation it is indicated to use dose rate at the surface of 200 ***l*** drum as follows:

■ average value 1.62 mSv/h and maximum value below 4 mSv/h for packages produced during 2005-2011 (as presented in Table 4);

■ maximum value 10 mSv/h for packages produced since 2012.

The ^{14}C specific activity related to inorganic and organic carbon compounds in spend IER (in tanks TW18B01 and TW11B03) has been investigated in 2011.

The fraction of ^{14}C associated with organic compounds for both storage tanks was rather variable and has been estimated 42 - 63% for storage tank TW18B01 and 30 - 63% for storage tank TW11B03.

Total activity of ^{14}C for Waste Stream I is estimated to: **9.22E+11 Bq**,

According to the measurements of produced drums with cemented IER at INPP the data of apical void in the cemented drums are the following:

■ The average height of the apical void in closed 200 l drums with cemented radioactive waste is 6.48 cm;

■ The standard deviation of the apical void is 0.8 cm.

Estimated volume of the waste processed at CSF makes about 450 m^3 per year.

Cemented solid LILW-SL waste

The main objectives of the solid waste treatment in the new facility (SWMSF) will be to:

- Retrieve waste from the existing storage buildings 155, 155/1, 157 and 157/1;
- Sort and condition waste from both the storage buildings and the INPP decommissioning;
- Reduce the waste volumes by incineration and compaction with high force compactor;
- Waste containerization and storage.

Solid waste treatment in the new SWMSF will include: incineration, super compaction and grouting.

Incineration leads, for combustible waste with a specific weight in the range 150 - 300 kg/m^3, to a mass reduction by factor of 17. Combustible waste (operational + decommissioning) represents ca. 12% of the total amount of solid untreated RAW and less than 1% taking into account mass reduction factor from incineration. In addition, the main activity contribution resulting from cemented IER, no significant reduction of conservatism by the loss of volatile radionuclides during incineration is expected. Efforts needed for these investigations would not be in correspondence to the effect and it is therefore considered conservatively that the scaling factors remain the same. The ashes will be loaded into standard 200 l drums (100 kg ashes/drum) these being super-compacted and the pallets will be loaded and immobilized into concrete containers (KTZ 3.6). Approximately 2 320 drums with ashes will be produced.

Super Compaction. Waste compactor force is 15 000 kN, reduction ratio is 4 to 8.

Grouting. For grouting purposes a density for the cement of 1 900 kg/m^3 is assumed.

For NSR design preparation it is indicated to use maximum dose rate 2 mSv/h at any point on any external surface of KTZ 3.6 concrete container.

WASTE PACKAGING

For disposing in the NSR will be used 200 l drums, FRAMATOME ANP and KTZ containers.

200 l drums

Parameters of 200 l drums are provided in Table 5.

Table 5. Parameters of 200 ℓ drum [21]

Parameter	Unit	Value
Dimensions:		
- diameter (external) - diameter (internal) - height - wall thickness - bottom thickness - lid thickness	mm mm mm mm mm mm	597 ± 1.5 552 882 ± 3 1.5 3.0 2.0
Mass:		
- empty with lid and ring - maximum filled drum with lid and ring - average for filled drum with lid and ring (from measurements of produced drums)	kg kg kg	33.62 450 380

Reinforced concrete storage container filled with cemented radioactive waste packages is designed for loading by stacking in 5 rows, for loadings after the empty space inside the container is filled with “clean” (not contaminated) concrete and for loadings resulted by design earthquake.

FRAMATOME ANP container

Parameters of concrete overpack container type FRAMATOME ANP are provided in Table 6.

Table 6. Parameters of FRAMATOME ANP type container

Parameter	Unit	Value
Dimensions:		
- external dimensions - length - width - height - wall/bottom thickness - lid thickness	mm mm mm mm mm	3 000 ± 5 1 500 ± 5 1 288 ± 2 120 +4, -0 115 ± 3
Mass:		
- empty without lid - lid - potential concrete grouting (before final disposal) - maximum filled with eight drums and grouted	kg kg kg kg	4 414 ± 3 % 366 ± 3 % 3 840 13 220

Reinforced concrete storage container filled with cemented radioactive waste packages is designed for loading by stacking in 5 rows.

KTZ 3.6 container

Parameter of concrete KTZ 3.6 concrete container are provided in Table 7.

Table 7 Parameters of KTZ 3.6 container

Parameter	Unit	Value
Dimensions:		
External dimensions: - length - width - height	mm mm mm	2 400 - 5 1 620 - 4 1 650 - 5
Internal dimensions: - length - width - height	mm mm mm	2 100 + 4 1 320 + 2 1 315 ± 2
Inner volume	m^3	3.6 + 0.1
Outer volume	m^3	6.42
Container wall thickness	mm	150 ± 1
Mass:		
Mass of empty container and lid	kg	≤ 6,250
Lid mass	kg	≤ 1 000
Total mass (including waste and cement filling)	kg	≤ 15 000

Containers are designed following the IP-2 standard

Quantity of waste packages

Cemented liquid waste

Table 8. Produced and planned quantities of IER waste

	Produced		**Planned for**		**TOTAL**	
Package type, pcs.	**Packages**	**Containers**	**Packages**	**Containers**	**Packages**	**Containers**
Cold testing	16	2	-	-	16	2
Hot testing	16	2	-	-	16	2

Long (additional condensate remove)	25	3	80	10	105	13
SRT *	6 076	760	17 000	2 125	23 076	2 885
SCT **	16	2	21 250	2 655	21 266	2 657
CT ***	71	9	Not planned		71	9
TOTAL	**6 220**	**778**	**38 330**	**4 790**	**44 550**	**5 568**

Operational and decommissioning solid waste

About 21718 drums will be loaded with *combustible* and *non-combustible* operational waste. It is estimated that 895 containers amounting 5746 m^3 will be necessary for immobilization of the drums after super compaction.

About 151617 drums will be loaded with *combustible* and *non-combustible* decommissioning waste. It is estimated that 3246 containers amounting 20840 m^3 will be necessary for immobilization of that waste after super compaction.

2,868 containers amounting 18413 m^3 are foreseen for not super compacted *non-combustible* decommissioning waste.

Expected quantities of the conditioned solid operational and decommissioning waste are summarized in Table 9.

Table 9. Expected quantities of the conditioned solid waste from INPP operation and decommissioning

Waste type	Number of drums (pellets)	Number of containers (B2/3/4 type)	Volume of containers (m^3)
Operational waste *Group 1 and 2* (*combustible and non-combustible*)	21 718	895	5 746
Decommissioning waste *class B and C* (*combustible and non-combustible*)	151 617	3 246	20 840
Decommissioning waste (large items) *class B and C* (*non-combustible, non-treatable*)	-	2 868	18 413
TOTAL	**17 335**	**7 009**	**44 999**

Overall more than 7 000 containers comprising approximately 45 000 m^3 of conditioned solid

WASTE STREAMS

Main data

Considering LILW-SL INPP operational and decommissioning waste attributed to class B and class
C two main waste streams should be distinguished:

- Liquid waste, and
- Solid waste.

Treatment of liquid waste containing ion-exchange resins and perlite (candidate for disposal in the planned NSR) is performed by cementation (see Section 2.5.1). Approx. 44 550 of 200 ***l*** drums are going to be placed into 5 568 concrete overpacks in the Cement Solidification Facility. The concrete overpack of Framatome-ANP type is candidate for the final disposal in the NSR if it will be licensed.

The INPP decommissioning support project B2/3/4 provides for the construction of the solid waste management and storage facility where operational waste generated on the territory of the power plant as well as decommissioning waste will be sorted, treated, conditioned and temporarily stored. In addition to other functions, this facility will provide the following features: to sort waste according to characteristic activity and physical features, to reduce them in size (to cut, etc.), to compact by high force compactor, to incinerate in the incineration facility, to pack, to immobilize (to backfill waste with grouting material), to characterize waste and to temporarily store waste.

Radioactive waste already accumulated in Ignalina NPP will be unloaded from the existing storage facilities (buildings 155, 155/1, 157, 157/1) and transported to the new facility where they will be characterized, conditioned, packed and placed into interim storage.

Solid operational as well as decommissioning waste is segregated into combustible and non-combustible waste. The most part of the combustible waste will be incinerated and supercompacted with the following immobilization of the pallets into concrete containers.

Solid RAW after conditioning will be disposed of in the following forms:

- Solid waste pellets compacted by high force compactor,
- Ash pellets compacted by high force compactor,
- Non-treatable (large-size) solid waste.

In summary four waste streams of conditioned LILW-SL intended to be disposed of in the NSR are distinguished, see Table 11.

Table 11. Waste streams intended to dispose of in the NSR

Waste Stream	Package description	Volume (m^3)	Containers	
			Number	Type
I	Eight 200 ℓ drums immobilized into FRAMATOME-ANP type concrete containers with Cemented Liquid RAW (IER, Perlite and Evaporated Concentrate Sludge) from INPP operation and decommissioning	~32 294	5 568	F-ANP
II	KTZ 3.6 (B2/3/4) type containers with Cemented Operational Solid RAW (Group 1 and 2) incinerated and super-compacted combustible and super-compacted non- combustible waste.	~5 746	895	KTZ 3.6
III	KTZ 3.6 (B2/3/4) type containers with Cemented Decommissioning RAW incinerated and super-compacted combustible and super-compacted non-combustible waste.	~20 840	3 246	KTZ 3.6
IV	KTZ 3.6 (B/2/3/4) or other type containers with cemented non-treatable (large-size) non-combustible waste arising from INPP decommissioning.	~18 413	2 868	KTZ 3.6
	TOTAL	**77 293**	**12 577**	

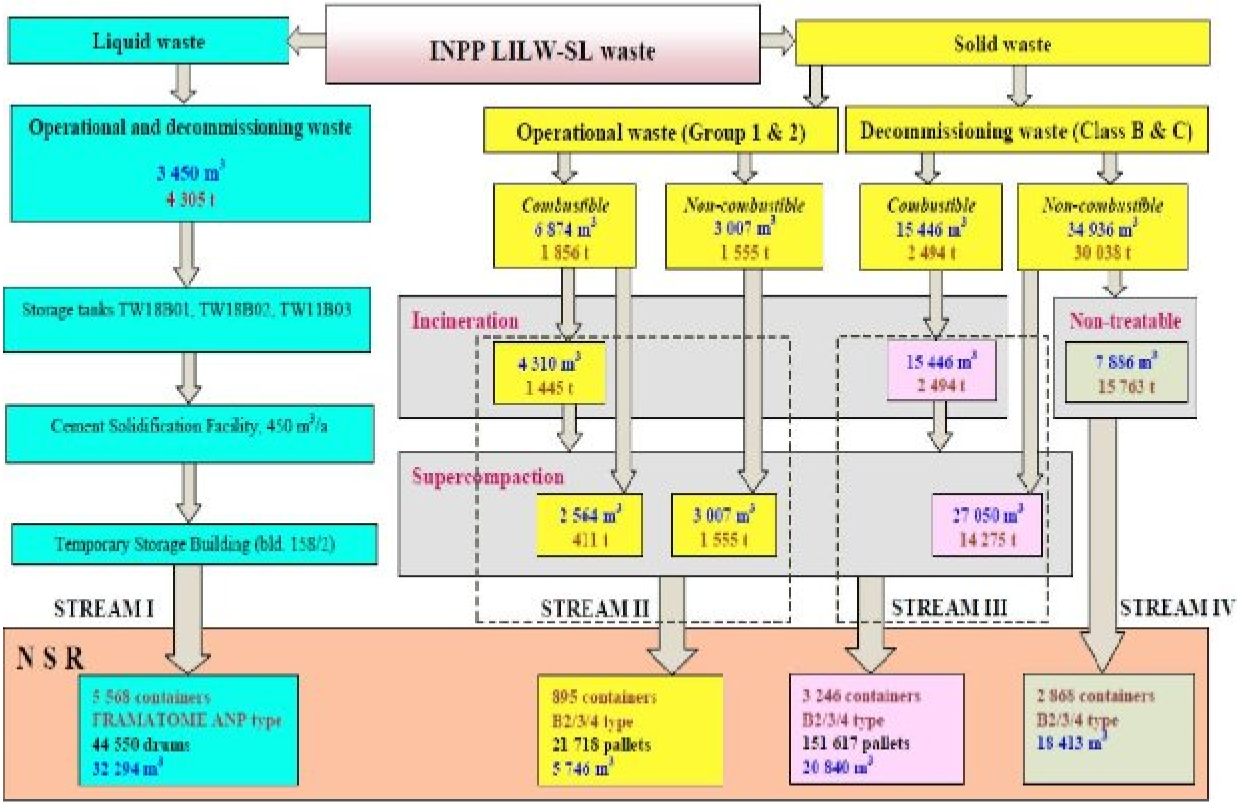
Final comment/delivery rate

For designing the NSR, certain assumptions are considered as to the rate of waste package delivery for packaging (grouting of F-ANP) or disposal, with sufficient margin to allow for increased rate and anticipated change in the inventory, additional operations required for WP's, non acceptance of WP's, etc.

The assumptions are as follows:

- Quantity of containers: 5568 F-ANP, 7009 KTZ-3.6
- Operation over 20-30 years, 20 years is considered for the dimensioning
- Increased rate of delivery at the beginning of the operational life of the NSR: 2
- Working days in a year: 100
- Grouting rate: 5568/20*2/100 = 5.57 **->** 6 F-ANP per day
- Disposal rate: (5568+7009)/20*2/100 = 12.58 **->** 13 WP's per day
- For the design of the NSR, a rate of **6** F-ANP's (or equivalent) to be grouted per day and **13** WP's (F-ANP or KTZ-3.6 or equivalent) to be disposed, will be considered.

Schematic view for waste streams future statement



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