Clearance Procedures at JRC-ISPRA

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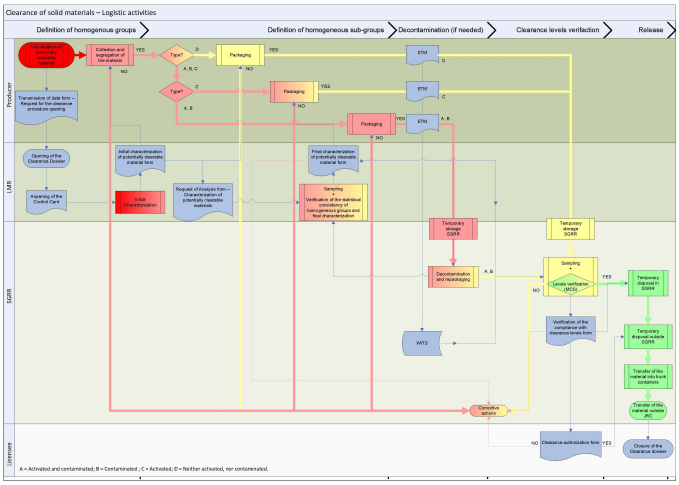
1. Introduction

The Joint Research Centre of Ispra is one of the research centres belonging to the European Commission, and was created in the late '50s, in order to steer European research on nuclear industry.
The JRC- Ispra manages:
•the Radioactive Waste Management Station (*SGRR Stazione Gestione Rifiuti Radioattivi*), a centralised storage for all historical and post operational waste generated from the past nuclear activities done on site
•the site Laboratory for Radioactivity Measurements (*LMR Laboratorio Misure di Radioattività*) an accredited Laboratory (EN ISO/IEC 17025:2005) in charge of the analysis for the JRC nuclear decommissioning programme.
The authorisation to operate for SGRR facility is referenced within the Italian law and includes clearance of solid materials therein transferred from the six shutdown nuclear facilities. In general, very low level radioactive materials aimed to be recycled, reused or disposed of can be released from regulatory control under the condition that the radionuclide concentrations content are below the specific clearance levels provided in the license by the Italian Nuclear Safety Authority. Therefore, it is necessary to:

- sort the material into **homogeneous groups**,
- assign to each one of them a well **known nuclide vector** W and,
- **verify** that their activity concentrations are below the mentioned clearance level.

2. Phases of the clearance process



Classification of the materials
All materials must be classified taking into account their **function**, their **origin** and historical **use**.
Type A – contaminated and activated material
Type B – contaminated but not activated material
Type C – not contaminated but activated material
Type D – not contaminated and not activated material

3. Initial radiometric characterisation

It consists in the determination of the initial nuclide vector for the **potential homogeneous groups** by plant characterisation reports, preliminary historical data from direct/indirect measurements and mathematical approach based on models.

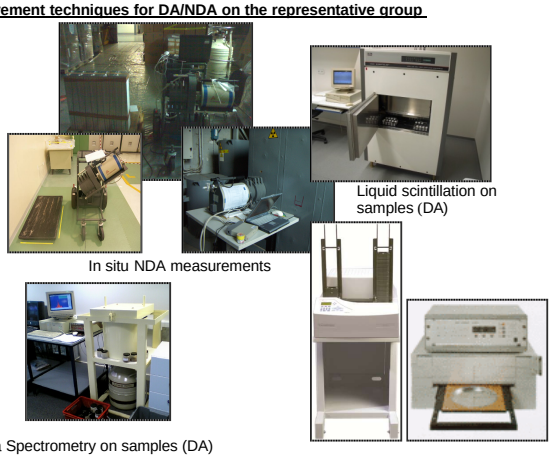
For the statistical approach the group must be divided in homogeneous (in density and disposition) "material units" with the following characteristics:

•Metals: about 0.7 m^3 volume, 400 kg weight
•Other materials: about 0.7 m^3 volume, 1000 kg weight

4. Radiometric characterisation

It consists in the verification of the consistency of the homogeneous groups and the consequent assignment of the **final nuclide vector** by statistical approach based on DA/NDA measurements on a representative number of "material units" of the potential homogeneous group.

Measurement techniques for DA/NDA on the representative group



In situ NDA measurements

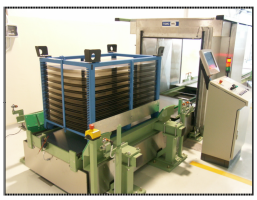
Liquid scintillation on samples (DA)

Gamma Spectrometry on samples (DA)

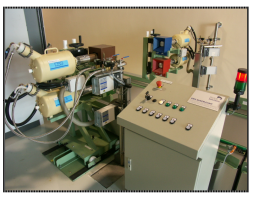
Alpha/Beta counting on samples (DA)

5. Clearance levels verification (TGMC)

It consists in the **verification of the clearance levels** by statistical approach based on the measurements of a representative number of "material units" packed in suitable containers.
The container measurements are performed by a commercial Total Gamma Counting Chain (TGMC) knowing the final nuclide vector.



TGMC measurement station



Additional checking station

For every representative container the parameter X_n is calculated. When it is less than the unit it confirms the respect of the clearance level for the whole homogeneous group:

$$X_n = \sum_i \frac{a_{i,n}}{a_i^L}$$

where a_i is the specific activity (for both mass and surface concentrations) of the nuclide i, a_i^L is the corresponding clearance level and n the dimension of the representative container group.

For the released metal intended to be processed in a foundry, the foundry Licensee will assure the 1/10 proportion mixture with metals originated elsewhere.

NUCLIDE	Metal Material		Building Rubble		Other Material
	$Bq{\cdot}g^{-1}$	$Bq{\cdot}cm^{-2}$	$Bq{\cdot}g^{-1}$	$Bq{\cdot}cm^{-2}$	$Bq{\cdot}g^{-1}$
^{3}H	1	10000	1	10000	1
^{14}C	1	1000	1	1000	1
^{22}Na	1	1	0.1	10	0.1
^{36}Cl	1	100	1	100	1
^{54}Mn	1	10	0.1	1	0.1
^{55}Fe	1	1000	1	10000	1
^{59}Ni	1	1	1	10000	1
^{60}Co	1	1	0.1	1	0.1
^{63}Ni	1	1000	1	10000	1
α- emitters	0.1	0.1	0.1	0.1	0.01

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	$Bq{\cdot}g^{-1}$	$Bq{\cdot}cm^{-2}$	$Bq{\cdot}g^{-1}$	$Bq{\cdot}cm^{-2}$	$Bq{\cdot}g^{-1}$
^{90}Sr	1	1	1	100	1
^{125}Sb	1	10	1	1	1
^{134}Cs	0.1	1	0.1	1	0.1
^{137}Cs	1	10	1	1	1
^{152}Eu	1	1	0.1	1	0.1
^{154}Eu	1	1	0.1	1	0.1
^{235}U	1	1	1	1	1
^{238}U	1	1	1	1	1
^{241}Pu	1	1	1	10	1

SGRR clearance levels assigned by Italian Authority as part of SGRR License

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