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A GENERAL OVERVIEW AND LITERATURE REVIEW ON CLEARANCE CRITERIA

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Exemption and clearance levels are important criteria for the release of radioactive material from regulatory control. The quantity of very low level activity steel arising from the dismantling of nuclear power plants in the EU is estimated to be a total of 10,000 tones per year [1]. Many international organizations (NEA, EU, IAEA) have worked on the determination of exemption and clearance levels. There are tremendous amount of literature available on the exemption and clearance. Different scenarios are used for the determination of clearance levels; on the other hand, surface contamination levels differ from country to country and the related data are given in Table I.

Table I. Surface Contamination Limits for Beta/Gamma Emitters [2]

Contamination Limit	Country	Additional Information
0.37 Bq/cm^2	Germany	Over 100 cm^2 for fixed or removable contamination and for each single item
0.40 Bq/cm^2	Finland	Removable surface contamination over 0.1 m^2 for accessible surfaces
0.40 Bq/cm^2	Belgium	Mean value for removable surface contamination over 300 cm^2, for beta-gamma emitters and alpha emitters with low radiotoxicity
0.83 Bq/cm^2	USA	Surface contamination above background over no more than 1 m^2, with a maximum of 2.5 Bq/cm^2 above background if the contaminated area does not exceed 100 cm^2
4.00 Bq/cm^2	Sweden	Mean value for removable surface contamination over 100 cm^2, with a maximum of 40 Bq/cm^2 if the contaminated area does not exceed 10 cm^2

During the reuse of scrap metal from the dismantling of nuclear installations, the general and widely accepted radiation safety requirements are as follows;

a) The effective dose expected to be incurred by any member of the public due to the exempted practice or source is of the order of 10 ∝Sv or less in a year,

b) Either the collective effective dose committed by one year of performance of the practice is no more than about 1 manSv, or an assessment for the optimization of protection shows that exemption is the optimum option [3].

Accordingly, IAEA has identified two basic radiation protection criteria for determining when a source or practice may be a candidate for exemption from regulatory control:

1. Individual risk must be sufficiently low as to warrant regulatory concern;
2. Radiation protection, including the cost of regulatory control must be optimized [4].

On the other hand, the expert group of NEA [5] feels that the concept of clearance, which has also been the source of much discussion, is no longer necessary in a modern system of radiological protection. It was stated by the expert group that the concept of exemption becomes a sub-case of authorization from some or all-regulatory requirements and the term "exemption" as currently used in the system of radiological protection is "somewhat overly and needlessly complicated".

Different scenarios were chosen to enable calculation of the dose received by an individual in the critical group from the waste steel upon leaving the nuclear installation. As an example, six categories of scenarios were considered in the Radiation Protection 117 are as follows:

- Exposure in scrap yard
- Exposure in foundry
- Atmospheric emission
- Exposure during post refining process
- Exposure related to use of products
- Exposure related to the disposal or use of by-products [1].

IAEA has issued publications dealing with the problems involved in applying exemption principles to the recycling and reuse of materials from the nuclear industry.

In recent years, studies have been conducted both at national and international levels concerned with the derivation of clearance levels. These studies have been directed towards the low activity streams of material generally considered to be the most likely candidates for clearance from regulatory control. These are:

- Low-level solid wastes from nuclear fuel cycle, for example, the lightly contaminated paper, plastics and clothing that arise in work with radioactive materials,
- The slightly contaminated ferrous and non-ferrous metals and concrete which arise mainly in the decommissioning and refurbishing work at nuclear facilities,

- The low level wastes generated during the application of radioisotopes in, industry, hospitals and research laboratories [6].

Many countries have already set maximum levels of individual exposure that effectively constrain the optimization of the protection for various sources. Table II gives the values of dose constraints in some Member States of the IAEA.

Table II. Dose constraints and the sources to which they apply for several member states [7]

Country	Dose Constraint ($mSv.a^{-1}$)	Source
Belgium	0.3	Nuclear fuel cycle facilities
Italy	0.1	Pressurized water reactor
Luxembourg	0.3	Nuclear fuel cycle facilities
Spain	0.3	Nuclear fuel cycle facilities
Sweden	0.1	Nuclear power reactors

In this paper, it was intended to give a general overview and literature review for the exemption and clearance concepts and also including the reuse and recycle of scrap materials in different countries.

REFERENCES

1- **EUROPEAN COMMISSION**, Methodology and models used to calculate collective doses from the recycling of metals form dismantling of nuclear installations, Radiation Protection 117, Luxembourg, 2000

2- **NUCLEAR ENERGY AGENCY**, Recycle and Reuse of Scrap Metals, OECD, Paris, 1996

3- **INTERNATIONAL ATOMIC ENERGY AGENCY**, "Principles for the Exemption of Radiation Sources and Practices from Regulatory Control", Safety Series No. 89, pp. 5, IAEA, Vienna, 1988

4- **INTERNATIONAL ATOMIC ENERGY AGENCY**, "Application of Exemption Principle to the Recycle and Reuse of the Materials from Nuclear Facilities", Safety Series No. 111-P1.1, pp. 3, IAEA, Vienna, 1992

5- **NUCLEAR ENERGY AGENCY,** The Way Forward: Modernisation of the System of Radiological Protection (Version 3, August 2001) A report for the OECD Nuclear Energy Agency's Committee on Radiation Protection and Public Health (CRPPH) by the Expert Group on the Evolution of the System of Radiation Protection (EGRP), 2001

6- **INTERNATIONAL ATOMIC ENERGY AGENCY**, "Clearance Levels for Radionuclides in Solid Materials", TECDOC 855, IAEA, Vienna, 1996

7- **INTERNATIONAL ATOMIC ENERGY AGENCY**, "Regulatory Control of Radioactive Discharges to the Environment ", Safety Standards Series No. WS-G-2.3, IAEA, Vienna, 2000