Approaches to Release a Very Low-Level Waste (VLLW) from Regulatory Control

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1. Introduction

IAEA defines "**clearance**" as the removal of regulatory control, which is applied for radiation protection purpose, by the regulatory body from radioactive materials or radioactive objects within notified or authorized practices. Therefore, if the materials have been cleared once, they do not again become subject to requirements for notification, registration and licensing, unless otherwise specified by the regulatory body. This clearance system, usually including exemption, aims to reduce the amount of the very low-level wastes (VLLW) to be disposed as radioactive waste, thereby reducing cost. The clearance criteria are also needed to determine when decommissioning is finished (decommissioning endpoint) [1]. However, all nuclear states do not adapt this kind clearance framework. In this article, the clearance frameworks for some nuclear states have been reviewed at the point of view of waste management.

2. IAEA

IAEA describes the control of radioactive materials as an integrated concept of exclusion, exemption and clearance [2, 3], as shown in Fig. 1. The regulatory framework for control of radioactive material is very closely related with waste classification scheme [4]. The radioactive materials with an exposure that is essentially unamenable to control, such as ^{40}K in body, cosmic radiation and gaseous discharge of radon and associated daughters are excluded from regulatory control. And other radioactive materials, whose radiation risks to individuals arising from the materials are sufficiently low as to not warrant regulatory control and these materials are inherently safe, with no appreciable likelihood of scenarios that could lead to a failure to meet the exemption criteria, or regulation of the materials would provide no net benefit, in that no reasonable control measures would achieve a worthwhile return in reduction of individual doses or risks, are exempted from regulatory control [1].

Most radioactive materials except those becomes to be controlled under the legislative and regulatory framework. Once the materials enter under the regulatory control system, they have to be controlled by regulatory body and could be released from regulatory control by only authorized procedure according to relative criteria. The clearance criteria and levels are derived on the basis of trivial dose (de-minimis) concept, 10 μSv in a year, which is recommended by IAEA [1].

The detail exemption and clearance levels are listed in Table I-1 and Table I-2 in Schedule I [1], respectively. Those clearance levels are generic clearance levels for unconditional clearance, which are derived for application to all material types, management options and volumes.

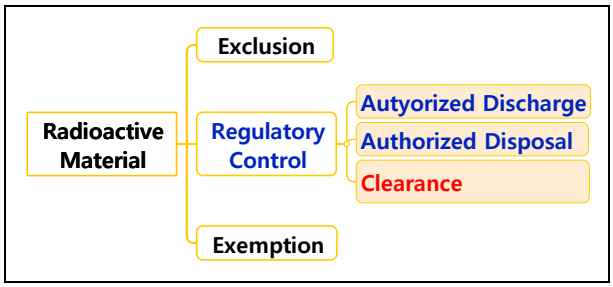

Fig. 1. Regulatory framework of radioactive materials.

3. Foreign Countries

3.1 United States of America

There are no current clearance framework system or plans to reduce the VLL radioactive materials in USA, but the pre-approved disposal options, such as transfer to an authorized recipient, disposal by release into sanitary sewage and by incineration exist. The approval allows for the disposal or transfer of VLLW at a non-nuclear licensed disposal facility according to 10 CFR 20.2002 [5, 6].

3.2 Germany

About 97 % of radioactive waste from nuclear power plant in Germany is suitable for clearance. Germany has its own regulatory framework system established by Atomic Energy Act (AtG) and Radiation Protection Ordinance (RPO). Nuclide-specific clearance levels are given in the RPO for 8 different clearing paths, 4 paths (solid material/oils/coolants, demolition waste/rubble > 1000t/yr, ground area/soil, buildings for future use) for unconditional clearance, and 4 paths (solid material for disposal on landfills, solid and liquid material for disposal in incinerators, building for demolition, metal for recycling) for conditional clearance. In order to clear

these materials, 10 μSv/yr criterion for individuals of the population need to be proved [7].

3.3 Netherland

Annual production of radioactive waste in Netherland is about 40,000 m^3/yr, which is mainly VLLW and LLW. Dose criteria for clearance of artificial nuclides are 10 μSv/yr (normal) and 1 mSv/a (low probability). For naturally occurring nuclides, the dose criteria are 0.3 mSv/yr (occupational, public on site), 10 μSv/yr (public) and 1 mSv/yr (low probability) [8].

3.4 France

France does not adapt the IAEA recommendation for clearance, but has own radioactive waste management policy with the inherent waste classification. For VLLW, there are only two waste types depending on zone. All waste from radioactive zone, or waste that is liable to be so, is considered as radioactive waste (RAW), and must follow specific management pathway including disposal in a facility dedicated to RAW. On the other hand, all waste from conventional zone is, after control of the absence of radioactivity, directed to a conventional waste facility [9].

3.5 Spain

Spain does not apply the IAEA's clearance framework system. Especially, clearance is not mandatory, but it is a decision of licensees, who have to decide the kind of clearance process, unconditional and conditional processes. For the conditional clearance, its level and measurement requirements are defined by the law, but licenses do not need authorization of regulatory body. For the conditional clearance, however, radiological criteria, instead of clearance levels, and measurements requirement are defined by the law, therefore, clearance levels have to be approved by licensees and processes require the specific authorization of regulatory body [10].

4. Conclusions

Clearance of VLLW from regulatory control, to reduce the amount of material disposed as waste, thereby reducing cost, is different depending on state's conditions such as disposal site, waste classification, regulatory framework, etc. The clearance levels are usually derived on the basis of individual dose of 10 μSv/yr and collective dose of 1 man-Sv/yr.

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