

# Application of Averaging Representative Sampling for a Various Surface Contaminated Wastes

MalGoBalGaeBitNaLa Yoo\*, WonHyuk Jang, and JeongGuk Kim

Korea Atomic Energy Research Institute, 111, Daedeok-daero 989beon-gil, Yuseong-gu, Daejeon, Republic of Korea

\*yoo1707@kaeri.re.kr

## 1. Introduction

According to Nuclear Safety Commission Notice No. 2017-65, a waste of clearance level can be managed by incineration, landfill or recycle. The artificial radionuclides for clearance in the Nuclear Safety Act (NSA) have 257 radionuclides with reference to IAEA RS-G-1.7, of which 138 short-lived radionuclides are included in the exemption levels of Schedule I of the Basic Safety Standards [1, 2]. In the case of fuel cycle facilities, contaminated waste may be generated by trace amounts of isotope uranium (U-234, U-235 and U-238) and their progeny; however, there is no definite clearance criterion for natural radionuclides domestically. Also, detailed guideline is needed to establish representativeness of various types of waste samples that can occur within radiation controlled area.

This paper describes in representative averaging sampling of surface contaminated waste refer to the domestic and international guidance.

## 2. Domestic clearance guidance

Clearance means the radioactive materials or items do not require any further regulatory control by the NSA. The solid wastes of very low radioactivity concentration that should be below the regulated activity concentration value of radionuclides or exposure dose level can be disposed of to landfill, incineration or recycling. The values of activity concentration should be derived from homogeneous

and averaged for representative sampling [Table 1.].

Table 1. Guideline for representative sampling of clearance level wastes

Authority	Acceptable range
Korea Institute of Nuclear Safety	- Averaged over at least 1 m <sup>3</sup> for solid wastes. - Averaged over 200 kg for solid wastes (including surface contaminated waste).

This procedure also applies to all disposal of non-contaminated items in radiation controlled area. For examples, there are a wide variety of items such as furniture, computer system, large equipment, and device control box. Surface contaminated wastes under domestic clearance regulatory guideline should be proved using direct and indirect surface contamination verification and scenario assessment; however, regulatory body ends to make a conservative approach as volumetric contaminated waste that samples 1 kg per 200 kg. Averaging is essential but very difficult to obtain representativeness for the radiological characterization of the surface contaminated items, when assuming a volumetric waste.

## 3. International clearance guidance

According to IAEA RG-S-1.7 of the concept of exclusion and ANSI/HPS N13.12 of the concept of clearance [3], the radioactivity concentration for K-40 is 10 Bq/g, and the remaining natural radionuclides are 1 Bq/g. In the event of a mixture of

radionuclides of natural and artificial origin radionuclides, the each natural radionuclides should be less than the value of activity concentration and the sum of the fraction of artificial radionuclides should be less than 1, and both conditions should be met. ANSI/HPS N13.12 refers to USNRC's mass to surface information for various surface contamination materials and provides additional typical items summary to apply volume-to-surface ratios [Table 2.].

Table 2. Mass to surface ratios for typical items

Item	Mass to surface ratio(g/cm <sup>2</sup> )
Notebook computer	0.45 – 0.66
Plywood sheet	0.21 – 0.61
Lead acid battery	12.2

It is very significant to secure the representative samples for radioactivity analysis of the clearance level wastes. For this reason, there are guidelines for securing the averaging of samples outside the country as well as ANSI/HPS N13.12 [Table 3].

Table 3. Criteria for averaging both mass and surface of contaminated wastes

Authority	Acceptable range
Nordic council of minister	-Averaged over a maximum area of 300 cm <sup>2</sup> for a metal. -Averaged over a maximum mass of 1000 kg for a metal.
European commission Radiation Protection	-Averaged over a mass of few 100 kg for a metal. (or several 100 cm <sup>2</sup> respectively). -Averaged over a surface area of 1 m <sup>2</sup> for a reuse of buildings -Averaged over a mass of 1000 kg for a building rubble.

#### 4. Conclusion

Nuclear Safety Act requires that all items used in the radiation controlled area are counted as potential radioactive wastes and treated as clearance level wastes. In fact, there are many items that do not have

directly contact with radioactive material and that are difficult to dismantle. Actually, it is necessary to develop a domestic guideline of converting the surface contamination level to the concentration per unit volumetric for the surface contaminated wastes that meet the transfer criteria from the radiation controlled area. It is appropriate to consider the development of clearance standards for surface contaminated wastes adequate for domestic circumstance, because many countries such as Belgium, UK, and France are applying case-by-case assessments of clearance wastes. In addition, additional clearance criteria are likely to be required since natural radionuclides may be included in the regulated facilities or substances.

In the near future, it is expected that large-scale clearance wastes will be generated due to the dismantling of the Kori 1 nuclear power plant and the TRIGA MARK II&III research reactors as well as an aged building or area in the radiation controlled zone. Therefore, it is necessary to subdivide and continually amend the guidelines and regulations based on international safety standards and domestic clearance regulation.

#### REFERENCES

- [1] International Atomic Energy Agency, Application of the concepts of exclusion, exemption and clearance. Vienna, Austria, IAEA Safety Standards Series No. RG-S-1.7, 2004.
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- [3] Approved American National Standard/Health Physics Society, Surface and volume radioactivity standards for clearance, ANSI/HPS N13.12, 2013.