

A Review of Applicability of the Specific Clearance Concept to the Decommissioning Radioactive Waste

Gangwoo Ryu*, Kwangho Jo, Youngil Na, Hyungwoo Seo, Minseong Kim

Korea Hydro & Nuclear Power (KHNP) Central Research Institute, 70, 1312-gil, Yuseong-daero, Yuseong-gu, Daejeon, 34101, Republic of Korea

*gangwoo.ryu@khnp.co.kr

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1. Introduction

Following the approval of the decommissioning plan for Kori Unit 1 in June 2025, decommissioning of nuclear power plants (NPPs) in Korea is now proceeding in earnest, and how safely and efficiently the resulting large volumes of radioactive waste can be released from regulatory control through clearance has become a key issue in decommissioning projects. In 2023, the IAEA issued GSG-17 and GSG-18 to supersede RS-G-1.7 (2004), clarifying the concept of specific (conditional) clearance, under which materials are released from regulatory control for a restricted pathway, as distinct from generic clearance, which does not restrict the future use or disposal pathway. Germany has operated such a pathway-specific clearance system since 2001 and is introduced in the literature as a well-developed system in Europe. This study analyzes the IAEA's revised safety guides together with Germany's operational experience to examine the applicability of specific clearance to the large volumes of decommissioning waste generated in Korea.

2. IAEA Concept of Specific (Conditional) Clearance

2.1 Background and Framework of the Revision

The IAEA's 2004 Safety Guide RS-G-1.7, Application of the Concepts of Exclusion, Exemption and Clearance, was revised in 2023 into two separate guides: GSG-17, Application of the Concept of, and GSG-18, Application of the Concept of Clearance. Reflecting nearly two decades of Member State implementation experience, the revised guides provide detailed guidance for implementing GSR Part 3 and address, among other topics, the distinction between generic and specific exemption in planned exposure situations and screening-value-based decision-making in existing exposure situations.

2.2 Distinction between Generic Clearance and Specific (Conditional) Clearance

In addition to generic clearance, which applies uniform radionuclide-specific concentration values, Schedule I of GSR Part 3 (para. I.13) establishes the concept of deriving separate clearance levels for a defined pathway; a footnote to this paragraph (footnote 65) cites metals, building rubble, and waste for disposal

in landfill sites as examples. GSG-18 formally terms this concept specific clearance, noting that some Member States use the equivalent term conditional clearance.

Generic clearance levels are derived from the most conservative scenario bounding all exposure pathways, whereas specific clearance restricts the intended use or pathway in advance—for example, to metal recycling or landfill disposal—so that only the exposures realistically possible along that pathway need be considered. Because the same dose criteria can thereby be met with less restrictive clearance levels, conditional clearance offers a potential means of managing large volumes of decommissioning waste more economically and efficiently.

3. German Implementation of Conditional Clearance

3.1 Legal Framework

Germany first codified its clearance system in 2001 under Section 29 of the former Radiation Protection Ordinance (StrlSchV), replacing a practice that had previously relied on recommendations of the German Radiation Protection Commission (SSK). The StrlSchV was subsequently amended in its entirety, entering into force on 31 December 2018, to implement EU Council Directive 2013/59/Euratom. The current StrlSchV regulates clearance (Freigabe) in Part 2, Chapter 3 (Sections 31–42), with unconditional clearance under Section 35 and conditional clearance (Spezifische Freigabe) under Section 36; clearances granted under former Section 29 continue in effect under the current Section 36 or 37. Germany's system thus reflects an extended period of practical experience with conditional (specific) clearance.

3.2 Pathway-Specific Operation and Characteristics

Section 31(2) of the current StrlSchV sets the dose criterion for clearance at an individual effective dose of 10 μ Sv per year. Because unconditional clearance under Section 35 places no restriction on future use, compliance must be demonstrated for all possible future uses and disposal pathways. Conditional clearance under Section 36, by contrast, restricts use to a specified pathway—metal scrap recycling, building rubble, landfill disposal, or release of sites—so that only the exposure scenario for that pathway need be considered,

allowing the same dose criterion to be met with less restrictive clearance levels and thereby enabling more economical and efficient management of large decommissioning waste volumes. License holders must also record and report the mass, clearance type (Section 35, 36, or 37), and disposal pathway of cleared material (Sections 42 and 86), a requirement that also guards against cleared material being diverted from its designated pathway.

4. Applicability to the Decommissioning radioactive waste of Korea

4.1 Legal Basis of the Korean Clearance System

The Korean clearance system is based on Article 107 of the Enforcement Decree of the Nuclear Safety Act and NSSC Notice No. 2025-11 (Regulation on Classification of Radioactive Waste and Criteria for Clearance), applying uniform radionuclide-specific permissible concentration and dose criteria. This basic framework is similar to the IAEA's generic clearance system; however, the concept of conditional (specific) clearance—under which separate clearance levels are established according to pathway, such as metal scrap, building rubble, or landfill disposal—does not appear to have been explicitly introduced into the Korean system.

4.2 Considerations and Implications for Introduction

The German case demonstrates that large volumes of decommissioning waste can be safely managed by developing separate radiological models and clearance levels for each pathway. If the concept of conditional clearance is to be introduced in Korea, the following measures warrant consideration: (1) selecting high-priority pathways, such as metal scrap and concrete rubble, for the phased development of clearance levels; (2) establishing radiological assessment models based on pathway-specific exposure scenarios; and (3) establishing a system for managing the collective dose from nationwide clearance activities, separate from the individual dose criterion. In addition, because conditional clearance presupposes that the use of released material is restricted to a specified pathway, (4) a tracking and verification system should also be established—as in Germany's requirement that clearance

holders record and report the mass and pathway of cleared material—to prevent cleared material from being diverted from its designated pathway into the general market. Because such an introduction would presuppose amendment of the relevant regulatory notice and domestic validation of the assessment models, further quantitative examination through follow-up research is needed.

5. Conclusions

This study analyzed the concept of specific clearance (GSG-18), together with Germany's experience in implementing this concept, and examined its applicability to the Korean clearance system. Because the Korean system has not yet explicitly introduced the concept of pathway-specific clearance, regulatory improvement through amendment of the relevant notice and the development of assessment models will likely be necessary. Given the high level of social sensitivity to radioactive waste in Korea, however, establishing the legal and regulatory basis should be accompanied by transparent communication with local residents and industry regarding how released material will be managed, together with a process for building social acceptance. Follow-up research should further specify the selection of priority pathways and quantitative methods for deriving radionuclide-specific clearance levels.

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Table 1. Comparison of the IAEA Specific Clearance Concept, the German Implementation, and the Status in Korea

Category	IAEA (GSG-18)	Germany (StrlSchV)	Status in Korea
Clearance system	Generic clearance + conditional (specific) clearance (GSR Part 3, I.13)	Unconditional clearance + pathway-specific conditional clearance	Uniform permissible concentration/dose criteria (NSSC Notice); generic in nature
Pathway classification	Metals, building rubble, landfill disposal (GSR Part 3 footnote example)	Metal scrap, building rubble, landfill, release of sites	No pathway distinction; a single criterion applies to all waste
Derivation of clearance levels	Specific values may be derived from pathway-specific exposure scenarios	Individual dose 10 $\mu\text{Sv/y}$ + collective dose 1 person-Sv/y (pathway-specific models)	Radionuclide-specific permissible concentration/dose (single criterion)
Legal/regulatory basis	GSR Part 3, GSG-18 (2023)	StrlSchV (2018 revision), Sec. 35 and Sec. 36	Enforcement Decree of the Nuclear Safety Act Art. 107, NSSC Notice