REGULATORY ACTIVITIES AND LESSONS LEARNED IN KOREA FOR A LILW REPOSITORY

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Abstract. Korea's programs to develop a low and intermediate level radioactive waste (LILW) repository were first launched in 1986, and about twenty-year effort, a site in Gyeongju was chosen in November 2005. The operator of disposal facility, KORAD (KOrea RAdioactive waste agency) submitted an application to the national nuclear regulatory authority for the 1st stage license, underground cavern disposal type in January 2007 and the combined construction and operating license was issued in July 2008. After the review of follow-up actions and implementation of pre-operational inspection during construction phase, the operation of the 1st stage facility with a capacity of 100,000 drums is approved in December 2014. During operation phase of the facility, as the regulatory activities, the periodic inspection and the disposal inspection are implemented to confirm whether the structure, equipment and performance of disposal facility and operational activities are in conformity with technical standards.

Key Words: LILW repository, Safety Review, Pre-operational, Periodic and Disposal Inspection.

1. Introduction

Korea's programs to develop a low and intermediate level radioactive waste repository were first launched in 1986, and about twenty-year effort, a site in Gyeongju was chosen in November 2005. The operator of disposal facility, KORAD (KOrea RAdioactive waste agency) is responsible for construction and operation of the LILW repository (Wolsong LILW Disposal Center, WLDC), which will have a final capacity of 800,000 drums in an area of about 2,060,000 m² after stepwise expansion.

In January 2007, KORAD submitted an application to the national nuclear regulatory authority for the 1st stage license, underground cavern disposal type. The professional regulatory agency (Korea Institute of Nuclear Safety, KINS) reviewed the license documents and the national nuclear regulatory authority issued the combined construction and operating license in July 2008. Based on the review results, it was recommended that the applicant, after issuance of the license, implement follow-up actions (26 items) to address issues that require safety demonstration or further confirmation to reduce uncertainty to be identified. After the review of follow-up actions and implementation of pre-operational inspection during construction phase, the operation of the 1st stage facility with a capacity of 100,000 drums is approved in December 2014.

2. Stepwise development of LILW repository

The 1st stage facility is in the operational phase through a stepwise development of the repository from site selection to construction as shown in Figure 1.
FIG. 1. Development of the 1st stage disposal facility in Korea.

The regulatory process for LILW repository in Korea is stepwise development as described in Figure 2.

FIG. 2. Regulatory Process for LILW repository in Korea.

2.1. License application

The KORAD conducted site surveys and environment surveys on the finally selected site and submitted application for Construction Permit (CP) and Operation License (OL) of a LILW disposal facility to the Nuclear Safety and Security Commission (NSSC) based on the survey results in January 2007. The KINS conducted a safety review of the application attached with
10 documents including Radiological Environmental Report (RER), Safety Analysis Report (SAR), and Quality Assurance Program (QAP). As a result of the review, it was concluded that the application was in compliance with the standards for permit specified in the Nuclear Safety Act (NSA), as technical standards for location, structure, component and performance were complied with as well as the radiological impact resulting from operation and closure of a disposal facility was in conformity with the standards for protection of public health and the environment as specified by Enforcement Decree of the NSA. After deliberation and resolution, the NSSC granted the permit to the KORAD on July 2008.

Based on the review results, it was recommended that the applicant, after issuance of CP and OL, implement follow-up actions to address issues that require safety demonstration or further confirmation to reduce uncertainty to be identified during the period of construction and operation, and the KINS conduct a review of the results of implementation. The implementation and review of follow-up actions is to reduce uncertainty over safety in the long-term and to secure the objectiveness and transparency of safety of the disposal facility based on the safety review reflecting site characteristics obtained in the process of construction and operation of the disposal facility. By doing so, it is ultimately possible to develop the Safety Case for the construction stage of the disposal facility which is in line with international requirements including the IAEA SSR-5 [1] that stipulate establishment of Safety Case for each development stage of a disposal facility.

2.2. Construction

The construction of the disposal facility started in August 2008 and as of June 2014, most of the construction works including excavation for construction tunnel, operation tunnel, access shaft, unloading tunnel and disposal storage (silo) and concrete lining have been completed. The LILW disposal facility is divided into surface and underground facilities as shown in Figure 1. Surface facilities consist of a receipt and storage building, radioactive waste processing buildings, service buildings and other supporting buildings. Here, radioactive waste is received from waste generators such as NPPs and verified to be consistent with the waste acceptance criteria. On-site treatment or conditioning is done, if necessary. Underground facilities include construction tunnel, operation tunnel, access shaft, unloading tunnel, and disposal silos. At first, 6 silos will be constructed approximately 80-130 meters below sea level to dispose of approximately 100,000 waste drums.

The KORAD should undergo pre-operational inspection in accordance with the NSA during construction phase. The purpose of the pre-operational inspection is to check prior to operation whether the construction of a disposal facility satisfies the related design and safety requirements. The disposal facility, etc. should be deemed to have passed the inspection when the construction work has been progressed according to the content of a permit given under the NSA and when the structure, equipment and performance of the disposal facility, etc. is in conformity with the technical standard set by the NSA. The pre-operational inspection by the KINS started in September 2008. The pre-operational inspection of the LILW disposal facility is conducted for the purpose of confirming the appropriateness of construction and performance and operational readiness, which is composed of 4 steps: (1) inspection on structure, (2) inspection on system installation, (3) inspection on system performance and (4) inspection before operation.

After the review of follow-up actions and implementation of pre-operational inspection, the operation of the 1st stage facility is approved in December 2014.
2.3. Operation

The 1st disposal facility is in the operational phase and about 4,900 drums were disposed of in the facility in September 2016. During operation phase, as the regulatory activities, the periodic inspection and the disposal inspection are implemented.

The periodic inspection is implemented annually to confirm whether the structure, equipment and performance of disposal facility during operational phase and whether storage, treatment and disposal of radioactive waste are in conformity with technical standards which is composed of 27 items including structures, radioactive waste management system. And the disposal inspection is implemented to confirm whether the disposal of radioactive waste is in conformity with technical standards, which is composed of 3 items: radioactive waste management environment, radioactive waste packages and disposal environment. As a result of the disposal inspection, when the disposal of radioactive waste is found to be in conformity with the standards, the disposal shall be deemed to be passed.

Also, the operator of disposal facility should re-evaluate and complement, if necessary, safety conditions of a disposal facility based on experience and data obtained from operation of a disposal facility and results of safety assessment.

3. Concluding remarks

The 1st stage facility of the LILW repository in Korea is in the operational phase through a stepwise development. Additionally, there are still challenges caused by the 2nd stage development with a capacity of 125,000 drums as a combined disposal facility: development of underground cavern disposal (the 1st stage facility) and engineered shallow land disposal (the 2nd stage facility) in the same site. Especially, there will be interference of pathways, complex radiation exposure etc. The KORAD submitted application for CP and OL of the 2nd facility in December 2015 and the safety review is underway by KINS.

The establishment of Safety Case at any step in the development of disposal system including the 2nd stage facility shall be improved reflecting the experiences from the 1st stage development.

REFERENCES