

## A Study on Korea Experience in Regulating the Transport of Low and Intermediate-level Radioactive Wastes – 17182

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### ABSTRACT

In the Republic of Korea, the transport of Low and Intermediate-Level Radioactive Wastes (LILW) from nuclear power plants (NPP), nuclear research reactor, and radioactive isotope storage facility to Gyeongju LILW disposal facility has increased since the operation license of facility was approved in December 2014. As a result, there has been an increase in public anxiety and concerns over damage or social disorder with LILW transport. So the necessity of strengthened safety confirmation on LILW has been constantly raised. In August 2016, the Enforcement Regulations of the Nuclear Safety Act were amended in relation to the reporting and inspection of LILW transport.

The first section of this paper describes the domestic transport regulations including the recently revised contents. The second section shows that the status of domestic and inspection of LILW transport were introduced and transportation regulatory experience was shared in Korea.

### INTRODUCTION

As of September 2016, a total of 5,984 drums were transported to disposal facility; 4000 drums (2,000 drums of 320 L and 2,000 drums of 200 L) from NPP in Wolsong, Hanul and Hanbit, 800 drums (200 L) nuclear research reactor, and radioactive isotope storage facilities in Korea Radioactive Waste Agency (KORAD). In addition, 1,184 drums (200 L) of decommissioning wastes from the first nuclear research reactor and waste generated during the research in Korea Atomic Energy Research Institute (KAERI) have been transported and are waiting for the disposal suitability inspection in disposal facility. Table 1 shows the detailed status of transport in Korea. All transports of LILW were inspected for safety.

Table I. Transport performance of LILW in Korea (based on 2016 3rd quarter)

Conveyance	Institution	Site	Report of Transport	Quantity of Transport(drum)
Transport vehicles & Container	KHNP <sup>1</sup>	Wolsong	1	1,000
	KORAD	Daejeon	2	800
	KAERI	Daejeon	1	800

<sup>1</sup> Korea Hydro & Nuclear Power

	KAERI	Seoul	1	384
Ship	KHNP	Hanbit	1	1,000
	KHNP	Hanul	2	2,000
Total			8	5,984

According to the IAEA Specific Safety Requirements (No. SSR-6 "Regulations for the Safe Transport of Radioactive Material", 2012), the report and inspection for LILWs transport not subject to design approval are not required. There are no cases of carrying out individual report and inspection of transports in the world. However, it was pointed out that it is a matter of approval when it meets the regulation on technical standards for radiation safety control, etc. to pack and transport of radioactive waste from 2014. The necessity of confirming the strengthened safety of the LILW transport has been constantly raised. Accordingly, the Enforcement Regulations of the Korean Nuclear Safety Act have been revised as shown in Table II in regards to the report and inspection of LILW transport in August 2016. Even if the amount of radioactivity is small, LILW with more than 1.6 m<sup>3</sup> are subject to report and inspection of transport.

Table II. Revision of Enforcement Regulations of Nuclear Safety Act for transport

	Before	After
Enforcement Regulations of Nuclear Safety Act	<p>Article 98 (Report of Transport)</p> <p>① The "radioactive materials, etc., the quantity of which is prescribed by the Ordinance of the Prime Minister" provided in Article 71 ① of the Act mean such materials, etc. that fall under any of the followings:</p> <ol style="list-style-type: none"> <li>1. Type B(U) packages</li> <li>2. Type B(M) packages</li> <li>3. Type C packages</li> <li>4. Fissile material packages</li> <li>5. Large-sized machinery and equipment contaminated by radioactive materials that are inappropriate for packaging in a transport container.</li> </ol> <p>6. &lt; revision &gt;</p>	<p>Article 98 (Report of Transport)</p> <p>① ----- -----</p> <ol style="list-style-type: none"> <li>1. ~ 5. (same as current)</li> </ol> <p><b>6. More than 1.6 m<sup>3</sup> LILW</b></p>

	<p>Article 101 (Inspection of Packaging and Transport)</p> <p>③ "Radioactive materials, etc. as prescribed by the Ordinance of the Prime minister" in</p> <p>Article 111 ② of the Decree shall mean each of the following radioactive materials, etc. :</p> <p>1. In case of packaging or transport by a person who must undergo periodic packaging or transport inspections in accordance with the foregoing Paragraph ①:</p> <p>a. Spent nuclear fuels</p> <p>b. Radioactive materials, etc. of which special transport is approved in accordance with regulations set by the Commission; and</p> <p>c. Radioactive materials, etc. to be transported of which radioactivity exceeds a 30-fold of the relevant A1 or A2 values as in accordance with regulations set by the Commission;</p> <p>d. &lt; revision &gt;</p>	<p>Article 101 (Inspection of Packaging and Transport)</p> <p>③ ----- -----</p> <p>1. ----- -----</p> <p>a. ~ c. (same as current)</p> <p><b>d. More than 1.6 m<sup>3</sup> LILW</b></p>
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A report on more than 1.6 m<sup>3</sup> LILW transport is expected to correct the problem before the actual transport through the review of transport plan, document and safety of the operator in advance. Thus the efficiency of on-site transport inspection can be expected.

### REGULATION OF TRANSPORT

Currently, the transport regulations in Korea are classified into regulations on containers and regulations on behavior. Regulations on containers are confirmed by design approval, inspection of manufacturers, and the inspection on the use of transport containers. Regulations on transport activities are conducted by carrying out a report and inspection of transport, which intend to share experience and lessons from the safety regulations of transport in Korea.

- Regulations on container: Design approval, Inspection of manufacturers, Inspection of use
- Regulations on transport activities: Report, (Individual) inspection, (periodic) inspection

According to the Nuclear Safety Act, the document of report no later than 5 days before LILW transport should be submitted to the Nuclear Safety Commission by operators. At this time, those submitted at the time of the previous report of transport will be excluded: Statement on the transport of radioactive materials, Explanatory statement on radioactive materials, Form of a packaging and transport checking record, Containers for packaging or transporting radioactive

materials, Transport procedures, and Emergency response plan. Individual inspections are conducted by a regulatory body. An operator of a nuclear power reactor, installer of a nuclear research reactor, nuclear fuel cycle enterpriser, installer of disposal facilities, and producer/seller of radioisotopes should undergo a periodic inspection once a year. Periodic inspection is confirmed to be in compliance with related technical standards and ensures safety of transport of LILW; thus it is effective to prevent problems and repetitions. However, it is necessary to establish an independent verification system for evaluating the suitability of LILW transport activities because it is regulated to include LILW in a comprehensive range of "Packaging or Transport of Radioactive Material" according to the current regulations.

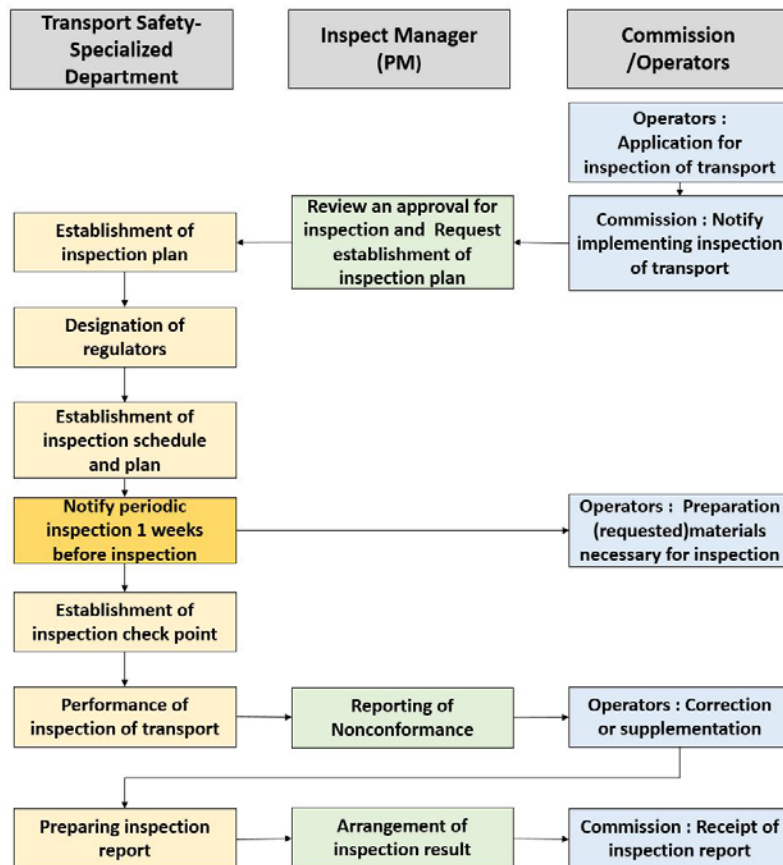


Figure I. Working procedures for (Individual/ periodic) transport inspection

### REGULATION EXPERIENCE ON LILW TRANSPORT BY SHIP

The second section shows regulation experiences on LILW transport in Korea. The regulators of Korea Institute of Nuclear Safety (KINS) have verified LILW transports through onsite inspection (classification, packaging, labeling and labeling of transported wastes, transportation documents, and transport plans including emergency response procedures) whether LILW transport satisfies the related regulations or not.

### CHECK POINTS FOR TRANSPORT BY SHIP

Check points according to the Regulations on technical standards were made for the transport of LILW, and some key check points and recommendations are as

follows:

1. Confirmation on Package Categories  
Packages and over packs should be classified into Category I-white, Category II-yellow and Category III-yellow according to transport index and surface radiation dose rate
2. Confirmation on the satisfaction of radiation dose of transportation vessel  
Shipping vessels should be maintained to meet the radiation dose limit for workers' zone (0.0075 mSv/hr), the public zone (0.0018 mSv/hr) and the surface of vessel (2 mSv/hr).
3. Confirmation of Radiation safety-related facilities  
Shipping vessels should be maintained to meet the requirements of the radiation measuring instrument, radioactive contamination measuring instrument, radioactivity concentration measuring instrument, personal dosimeter, etc. required by the Nuclear Safety and Security Commission Notice.
4. Confirmation of cargo zone temperature  
Shipping vessels should be maintained at an average temperature of 55 °C below the cargo space in accordance with the Nuclear Safety and Security Commission Notice.
5. Confirmation of filter pressure  
There are Pre-filter, HEPA filter and activated carbon installed in the gas exhaust system in a radiation control room. The filter pressure must be checked.
6. Confirmation on loading limit, marking, and labels of carrying container  
Carriages should be marked and labeled in accordance with Article "Regulations on Technical Standards for Radiation Safety control, etc.", and other critical safety transport label, transport placards for vehicles, and UN No. must be attached appropriately.
7. Others (education for workers, etc.)

## RESULT for the inspection of transport by ship



Figure II. Examples for LILW transport by transport vehicles and ship in KOREA  
The regulatory results of transport in Hanbit site on the basis of check points (radiation dose rate, radiation safety-related facilities, temperature, loading Limit, marking and labels, etc.) are summarized in Table III. An in-depth review of documents such as transportation specifications can be confirmed through periodic inspection

Table III. Results of inspection of transport by ship

Item	Category	Standards	Result of Inspection
Radiation dose rate	Workers' zone	0.0075 mSv/hr	0.0026 mSv/h
	Public zone	0.0018 mSv/hr	0.0001 mSv/h
	Surface of vessel	2 mSv/hr	0.0005 mSv/h
Radiation safety-related facilities	Radiation survey meter	5 or more	Suitable
	Radial Dosimeter	5 or more	Suitable
	(Gas) Radial Dosimeter	1 or more	Suitable
	(Liquid) Radial Dosimeter	1 or more	Suitable
	TLD	Above number of boarding passengers	Suitable
	ADR	Above number of boarding passengers	Suitable
Temperature of cargo zone	No.1	Below 55°C	9 °C
	No.2		10 °C
	No.3		6 °C
	No.4		10 °C
Filter pressure	Pre-filter	0.6 mmAq	0.3 mmAq
	HEPA filter	8 mmAq	4.5 mmAq
	Activated carbon	10 mmAq	6.3 mmAq
Loading Limit	Weight of LILW	950 ton	almost 750 ton
Marking and labels	<ul style="list-style-type: none"> <li>- Consignor or consignee</li> <li>- UN No., shipping names</li> <li>- Total weigh of package</li> <li>- Label of package classification</li> </ul>		Suitable
Education	Emergency procedures		Suitable
Others	Emergency response facilities		Suitable

## CONCLUSION

In the Republic of Korea, LILW transportation from NPP, nuclear research reactor, and radioactive isotope storage facility to Gyeongju LILW disposal facility has started since December 2014.

As a result, there has been an increase in public anxiety and concerns over damage or social disorder with LILW transportation. In order to eliminate social risks and ensure the safety of LILW transport, the Enforcement Regulations of the Nuclear Safety Act were amended in relation to the reporting and inspection of LILW in August 2016.

However, there are still no specific regulatory guidance and procedure for LILW transport. Through the various domestic cases of LILW transport, the regulatory body intends to establish detailed regulatory guideline.

## **REFERENCES**

- [1] IAEA Specific Safety Requirements No. SSR-6, "Regulations for the Safe Transport of Radioactive Material", 2012
- [2] NRC Inspection manual "Inspection of transportation activities", 2008

## **ACKNOWLEDGEMENTS**

This work was supported by the Nuclear Safety Research Program through the Korea Foundation of Nuclear Safety (KoFONS), granted financial resource from the Nuclear Safety and Security Commission (NSSC), Republic of Korea (No. 1305004).