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Preliminary Study of RFID System for the LILW Transportation

Dohyung Kim†, Unjang Lee, and Kyu-Sup Choi

Korea Nuclear Engineering and Service Corporation
210-2 Hapdong Bldg., Yangjae-Dong, Seocho-Gu, SEOUL 137-130, KOREA
† Corresponding author: dhkim@kones21.com

1. Introduction

Radio-Frequency Identification (RFID) is an automatic identification method, relying on storing and remotely retrieving data using devices called RFID tags or transponders.

In Korea, Low-to-Intermediate Level Radioactive Wastes (LILW) are planed to be disposed at Kyeonju disposal repository, and 100,000 LILW drums will be disposed for the first 10 years of disposal. Tracking of these LILW drums is one of the important parts for safe transportation. To track the LILW drums during the transport as well as storage and disposal, RFID can be the prospective method for tracking the LILW drums.

In this report, RFID system is introduced to the LILW transport from the generation site to disposal site, and one possible RFID system is suggested as a preliminary study.

2. RFID

2.1 RFID

Radio-Frequency Identification (RFID) is an automatic identification method, relying on storing and remotely retrieving data using devices called RFID tags or transponders. An RFID tag is an object that can be applied to or incorporated into a product, animal, or person for the purpose of identification using radio-waves. Some tags can be read from several meters away and beyond the line of sight of the reader.

Most RFID tags contain at least two parts. One is an integrated circuit for storing and processing information, modulating and demodulating a radio-frequency (RF) signal, and other specialized functions. The second is an antenna for receiving and transmitting the signal. A technology called chipless RFID allows for discrete identification of tags without an integrated circuit, thereby allowing tags to be printed directly onto assets at a lower cost than traditional tags.

2.1 Types of RFID

There are two kinds of RFID tags which are passive and active ones. Passive RFID tags have no internal power supply. The minute electrical current induced in the antenna by the incoming RF signal provides just enough power for the CMOS integrated circuit in the tag to power up and transmit a response. Passive tags have practical read distances ranging from about 10 cm up to a few meters.

Active RFID tags have their own internal power source, which is used to power the integrated circuits and broadcast the signal to the reader. Active tags also transmit at higher power levels than passive tags, allowing them to be more effective in "RF challenged" environments like water, metal (shipping containers, vehicles), or at longer distances, generating strong responses from weak requests. In turn, they are generally bigger and more expensive to manufacture, and their potential shelf life is much shorter, however many active tags today have practical ranges of hundreds of meters, and a battery life of up to 10 years.

3. RFID system for LILW transportation

3.1 RFID system elements

Figure 1 shows the basic RFID system elements which are consisted of tag, reader and host computer. RFID tag sends radiofrequency to reader, and reader receives the radio from the tag as well as sends it to host computer through the wire or wireless.

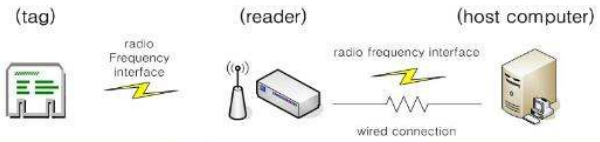

Figure 1. RFID system elements

3.2 RFID system for LILW transportation

Figure 2 shows the RFID system proposed by Korea Nuclear Engineering & Services Corporation (KONES) for LILW transportation from nuclear power plants to the disposal repository. Three types of RFID elements are used in this system and they are as follows:

(1) Type-P : Passive RFID tag
(2) Type-A : Passive RFID reader +Active RFID tag
(3) Type-B : Active RFID reader

Type-P is passive RFID tag and it is attached on each LILW drum. Type-A is a combination of passive and active RFID tags, and this type-A is attached on each LILW transport package. Passive RFID reader of type-A has a role to receive the RF transmitted from the type-P on LILW drums. Active RFID tag of type-A has a role to receive the information from passive RFID reader of type-A, and also transmit the RF to type-B, active RFID reader.

Type-B is a active RFID reader receiving the information from type-A and also transmit the information to the host computer through the GPS satellite.

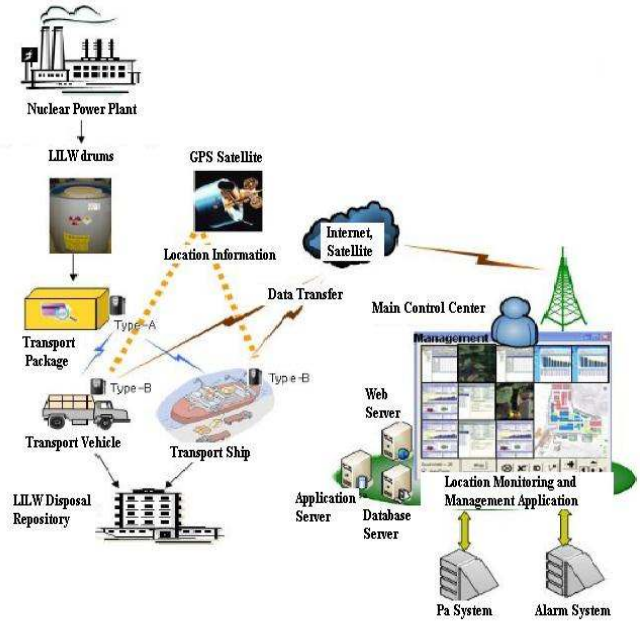

Figure 2. RFID system for LILW transportation

3.3 Procedure of tracking LILW with RFID system

For tracking individual LILW drums, passive RFID tag is useful since it does not require the power in it and is cheaper than other tags. So, the passive RFID tag, Type-P is used for LILW drum. However, passive RFID tag has short range of RF transmit (10cm ~ few meters), so it requires the passive RFID reader near itself.

When LILW drums are transported, they should be contained in the approved transport package. For example, IP-2 type LILW package developed by KHNP with KONES contains eight drums per package. So the passive RFID reader in the transport package is useful to receive the RF from type-P on LILW drums.

Type-A has active RFID tag and it functions to transmit the information from the passive RFID reader of type-A to type-B which is active RFID reader. RF from the type-A is transmitted from active RFID tag, so effective range is long (~hundreds of meters). Type-B, active RFID reader equipped in the transport vehicle or ship receives the RF from type-A on each transport package. Type-B reader sends information of each package through the GPS satellite to host computer which controls all transportation.

3.2 Other issues on RFID system

Related to RFID system, Main Control Center (MCC) effectively controls the whole system which consists of information managements of transport, delivery, loading/unloading, storage, and etc.

4. Conclusion

With RFID system for LILW transportation, touch or scan by human is not required to obtain the information from the LILW drums. Introducing RFID system into the tracking LILW transportation will make management of LILW information effectively, safely, quickly and inexpensively.

REFERENCES

[1] Everything about transportation of radioactive materials, 2nd edition, KINS/ER-064, 2003