An analysis on waste stream classification of radioactive waste generated in domestic institute and international radioactive waste tracking system

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1. Introduction

Representative domestic institutions that generate radioactive waste are nuclear power plants, Korea Atomic Energy Research Institute, Korea Institute of Nuclear Safety and KEPCO Nuclear Fuel Company. Each of these representative institutions has its own radioactive waste tracking and management system. To manage radioactive waste more efficiently and safely, it is necessary to build an integrated tracking and management system in consideration of the connectivity among different stages, i.e. generation, disposal, storage and final disposal.

2. Domestic nuclear energy agencies radioactive waste classification standards

2.1 Korea Atomic Energy Research Institute

The processes that generate radioactive waste, classified as operation waste, in Korea Atomic Energy Research Institute and Korea Atomic Energy Research Institute include the operation of Hanaro, production of radioisotopes, operation of irradiated materials examination facilities, post irradiation examination facilities and radioactive waste disposal facilities, and other laboratories. The radioactive waste, generated by each facility and laboratory, is collected according to radiation levels (Table I) and the classification standard (Table II).

2.2 KEPCO Nuclear Fuel

KEPCO Nuclear Fuel. KEPCO Nuclear Fuel produces the nuclear fuel used in nuclear power plants, and the nuclear fuel production process generates radioactive waste. Key radioactive waste includes the protective clothing, protective gloves and masks worn by workers for protection in the production processes in the radiation controlled area, and the metals generated in the equipment improvement process due to the deterioration of production equipment and facilities. The radioactive waste, generated in each facility, is classified into 8 wastes (Table III) and collected according to the solid waste management procedure of KEPCO Nuclear Fuel Company.

2.3 Korea Hydro Nuclear Power

The radioactive waste generated by Hanbit Nuclear Power Plant of Korea Hydro & Nuclear Power Co. Ltd. is classified as shown in Table 4 in consideration of physical properties, density, generation and non-disposable substances.

3. Domestic radioactive waste tracking systems

3.1 WACID (Waste Comprehensive Information Database)

It is the integrated radioactive waste safety management information system developed by Korea Institute of Nuclear Safety to totally manage safety management information about domestic radioactive waste and spent fuel, etc. WACID systematically tracks and manages the history of waste that is generated and stored, and manages separate databases for low and intermediate-level waste, spent fuel and decommissioning waste, etc [1].

3.2 MES (Material Engineering System)

KEPCO Nuclear Fuel Company implemented MES to efficiently manage nuclear fuel and safely manage radioactive waste. MES consists of gas waste emission management, liquid waste management, solid waste management, self-disposal, metal waste management [2].

4. Overseas radioactive waste tracking systems

4.1 IWTS (Integrated Waste Tracking System)

This system is an application program based on Access Point wireless network, not a general waste management system. It has wireless network equipment in the storage and uses a wireless scanner equipped with a bar-code reader to input/output the database information of the drums. IWTS has the real-time data input and retrieval, waste history data, physical/chemical component properties, and waste inventory management function, etc [1].

4.2 CID (Central Internet Database)

CID is an integrated environmental information system based on ORACLE8i DBMS (Database Management System), which includes all environment-related information, and modules like the nuclear material control database and the TRU waste database.

This web-based database system has a real-time report output system [1].

4.3 BRIMS (British Radwaste Information Management System)

It is an integrated information system based on ORACLE that manages all kinds (HLW, ILW, LLW) of radioactive waste data and records. BRIMS consists of three modules, that is, the inventory management module, the waste management module and the waste package module, and has the data provision, document provision, waste movement tracking and management function [1].

4.4 ReVK (Restoff-Verfolgung und – Kontrolle)

ISTec (Institute for Safety Technology) developed a documentation system for recording and tracking waste generated in nuclear power plants, based on ORACLE8, on behalf of EWN GbmH (Greifswald and Rheinsberg nuclear power plant operating company). ReVK is designed to simplify operations and clearly show the flow of waste. It uses the bar-code system to simplify the identification of waste packages that enter and leave waste disposal facilities, and register all waste in the ReVK Web. Also, it can show the status of the packages stored in the storages graphically (Figure 1) [3].

4.5 NEWMDB (Net-Enbaled Waste Management Database)

This system, based on the Microsoft SQL server, was implemented to integrative manage the waste of member countries according to the WIRKS guideline. If a member country enters data according to its radioactive waste classification standard, the DBMS converts and manages the data according to the classification standard of IAEA [2].

4.6 DIRATA (Database on Discharges of Radionuclides to the Atmosphere and Aquatic Environment)

It was implemented to integrated manage the liquid/gas radioactive waste emissions of member countries based on Microsoft Access. Besides NEWMDB, it integrated manages the types and quantities of liquid/gas radioactive waste discharged into the environment, and as it has the effluent tracking and management function and the linear regression analysis function, it is possible to see 5-year trends [2].

5. Tables & Figures

Table I: Radioactive Concentration and Surface radiation dose rate waste classification standards

Classification	Liquid Radwaste	Solid
	Radioactive concentration	Radwaste Surface radiation dose rate
VL	A<1.85x10-4	-
LL	1.85 x 10^{-4}≤A<3.7	D<2
ML	3.7≤A<3.7x10^2	2≤D,20
HL	3.7x10^2≤A	20≤D, Heat rates<2kW/m2
α	-	α-Activity(kBq/m^3)
O A	Organic solution Inorganic Solution	C, IC, NC, SR, SF, L

Table II: Korea Atomic Energy Research Institute Radioactive waste classification standards

Categorize	Type
Combustibility	Waste Paper, Blot Paper, Hose, Vinyl Sheet
Non-combustible compressibility	Beaker, Reagent bottle, Container,
Incompressibility	Tool, Timber, Silt, Concrete
Air conditioning Spent Filter	HEPA Filter, Charocal Medium Filter
Spent Resin	Ion Exchange Resin
Laundry Waste	Smock, Protective Clothing, Experiment Gown
Disuse Source	Sealed source, Source Built-In Device
Organic solution	Alcohol, Acetone
Inorganic solution	Water in which various salts are dissolved
Solidified waste	Cement solidification, Asphalt solidification
Intermediate Level Waste	Decontamination Paper, Steel
Demolition Wastes	Soil, Concrete

Table III: KEPCO Nuclear Fuel Radioactive waste classification standards

Categorize	Type

Dry Active Waste	Glove, Mask, Decontamination Paper
Composite	Plastic, Rubber, cable sheath
Metallic materials	Pipe, Duct, Vessel
Calcific Deposit	Calcific Deposit in the form of sludge during liquid waste
Concrete	Sinter furnace, Concrete waste
Timbers	Wood, Plywood, Equipment packaging
Glass	Reagent bottle , fluorescent lamp, A variety of light bulbs
Sodium fluoride	By-product waste generated after disposal of waste liquid

Table IV: Hanbit Nuclear Power Plant Radioactive waste classification standards

Categorize	Large category	Type
Combustibility	Cotton	Experiment Gown, Glove, Socks
	Paper	Decontamination Paper, Other Papers
	Vinyl	Tape, vinyl
	Plastic	PVC, Bottle
	Timbers	walk plate, paving, Wood
	Other combustibles	Rubber, nylon, other combustibles
Non-Combustibility	Iron	Metal plate, Pipe, Grating, Wire, H-beam, S/S
	Activated carbon	HVAC Internal Filter
	HVAC waste filter	HVAC Pre-filter, HEPA-filter
	Other Non-combustibility	sludge, asbestos , plaster, glass

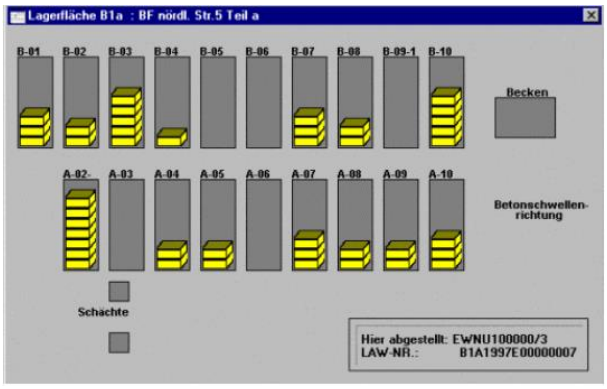

Fig 1. Graphize ReVK storages

3. Conclusions

This paper investigated the classification standards by the characteristics of the radioactive substances generated by domestic institutions. These classification standards can be applied to important databases if integrated radioactive waste tracking and management systems are implemented in Korea. This paper also investigated the radioactive waste tracking and management systems that are currently being implemented in Korea and overseas radioactive waste tracking and management systems. Except for the regulatory agency, IAEA, most foreign systems are based on ORACLE DBMS. ORACLE is highly complementary, and it can manage large databases. Also, US CID and German ReVK can use the Web to track and manage waste in real time, and have a function that makes it possible to graphicalize the storage status and create and output reports with simple operations. Also, the US IWTS and German ReVK system can use the bar-code system to track and manage the data on all waste generated during decommissioning or transportation.

Currently domestic representative institutions have separate radioactivity tracking and management systems. If an integrated radioactive waste tracking and management system, based on the representative functions of overseas radioactive waste tracking and management systems, is implemented in Korea, more efficient and safe management of waste will be possible.

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