

Status of Drum Assay System for Disposal of Radioactive Waste Drums stored at KAERI

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1. Introduction

According to the construction schedule for the final repository at Kyeong-ju in the southeast of Korea, a disposal plan for the radioactive waste drums at KAERI was required. More than 95% of all radionuclides contained in radioactive waste package should be identified for final disposal. Radioactivity concentration of various radionuclides (H-3, C-14, Fe-55, Co-58, Co-60, Ni-59, Ni-63, Sr-90, Nb-94, Tc-99, I-129, Cs-137, Ce-144, Gross- α) should also be identified according to the acceptance criteria regulated by the government. In order to ensure that the waste package meets the acceptance criteria given by KORAD and the government, the radionuclide inventory of all radioactive waste drums at KAERI should be measured. To characterize the radioactive waste drums at KAERI, a radioactive waste drum assay facility equipped with a Wide-Range SGS system manufactured by ANTECH has been constructed.

2. Current Management Status of Drum Assay System

2.1 Drum Assay Building

Framework of the building was made of normal concrete and walls were built as 30cm thick for radiation shielding except ceiling. Its dimension is as follows. The area where relatively low radiation effect was predicted was built to have 20cm wall. To minimize the external radiation, the shield wall in detector zone was designed to be 30cm thick. [1]

- Area : 150 m²
 - Assay building : 144 m²
 - Passageway : 6.44 m²
- Height : 5.15 m
 - Internal height : 5 m
 - Ceiling wall thickness : 15 cm

Internal area of the radioactive waste drum assay building is divided into radiation controlled zone and non-radiation zone. Radiation controlled zone consist of a detector zone and a temporary storage zone. Non-radiation zone is comprised of a control room, a locker room and a meeting room. Equipment or handling tools installed in the each zone or room are described below. (Fig. 1)

- Temporary storage zone : Drums for assay, Calibration drums, Calibration source storage, Crane
- Detector zone : Radioactive waste drum assay equipment, Barcode system
- Maintenance zone : Forklift
- Control room, Locker room, Meeting room

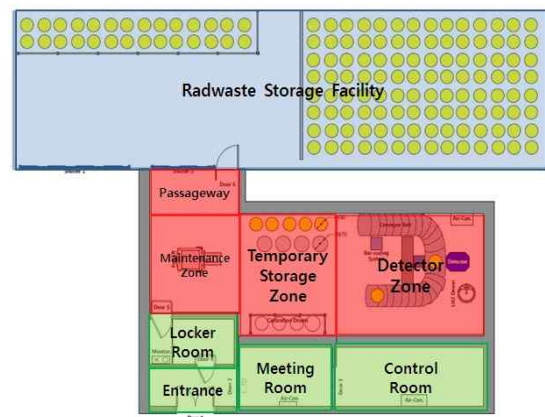


Fig. 1. Floor plan of the radioactive waste Drum assay building

2.2 Drum Assay Equipment

The radioactive waste drum assay equipment consists of conveyor (In feed and Out feed), detector plinth, rotary carriage, and a control cabinet. (Fig. 2) Specification of drum assay equipment is described below. (Table I)

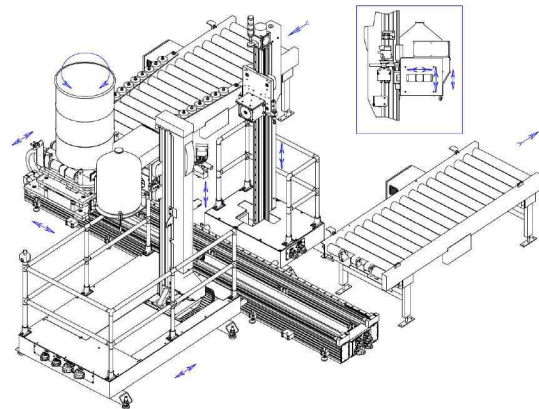


Fig. 2. WR-SGS drum assay equipment [2]

Table I: Specification of the drum assay equipment

Operating Modes	SGS (for Homogeneous waste drums)
	TGS (for Heterogeneous waste drums)
Drum size	200 liter or 320 liter drums
Variable collimator range	1 mm-70mm (Motorized & automatically)
Germanium coax Detector efficiency	40% + (typical) with LN ₂ cooling FWHM 1.85keV@1.33MeV
Transmission source	152Eu, 10mCi 2ea. (20mCi.) In Tungsten shield
Detectable activity range	Up to 10E12 Bq
Density range	Up to 2100 kg/m ³
Barcode reader	2-D reading
Surface dose measurement	GM based counter
Manufacturer	ANTECH in England

In SGS mode, operating processes are as following steps [3]:

- Step1. Loading
- Step2. Barcode reading (for identification of drum)
- Step3. Pre-scanning:
Dose-rate detector and weight scale
- Step4. Transmission scanning
- Step5. Straight-Through measurement
- Step6. Dead-time source measurement
- Step7. Emission scanning
- Step8. Unloading

2.3 The Assay results

Since the installation of the drum assay equipment on July 2013, about 400 drums have been completed gamma radionuclide assay. According to the assay results until now, major radionuclides were as Co-60 and Cs-137. Additionally, maximum radioactivity concentration of 1.37E+04 Bq/g was detected.

Table II: The Assay Results

Contents	Radioactivity concentration [Bq/g]	Weigh [kg]	Detected major gamma nuclides [Bq]	
			Co-60	Cs-137
Max.	1.37E+04	159.6	3.66E+08	4.09E+08
Min.	8.66E-03	35.5	8.08E+02	4.76E+02
Avg.	1.59E+02	92.0	4.52E+06	9.79E+06

3. Conclusions

According to the acceptance criteria of KORAD and the government, KAERI make thorough preparation of disposal plan. To characterize the radioactive waste drums at KAERI, a radioactive waste drum assay facility equipped with a Wide-Range SGS system

manufactured by ANTECH has been constructed. Since then, about 400 drums have been completed gamma radionuclide assay. Co-60 and Cs-137 were major radionuclides of the radioactive waste drums at KAERI.

We have a plan to examine radionuclides and activity of a radioactive waste drum and secure reliability of analysis results with cross analysis using drum assay equipment at institute for inspection.

REFERENCES

- [1] Young Yong Ji, Dae Seok Hong, Kyung Kil Kwak, Woo Seok Ryu, "An evaluation on the radiation shielding of the radioactive waste drum assay facility", Korea Atomic Energy Research Institute, TR-4382, 2011
- [2] A.N. Technology Ltd, "Operating and Maintenance Manual; Series G3250-3850-320, Wide Range Segmented/Tomographic Gamma Scanner", 2013
- [3] Won-Hyuk Jang, Kyung-Kil Kwak, Dae-Seok Hong, Tae-Kook Kim, Shi-up Jang, "Installation and Performance Test a LL/ILW Drum Assay System at KAERI – 14387", WM2014 Conference, Phoenix, Arizona, USA March 2 – 6, 2014