# Measurement of Minimum Detectable Activity for Clearance Level

Min-Seung Ko*, Jae-Yong Lee, Kyung-Min Kim, and Yong-Soo Kim
Dept. of Nuclear Engineering, Hanyang Univ., 222 Wangsimni-ro, Seongdong-gu, Seoul, Republic of Korea
*hjgo2003@hanyang.ac.kr, chungooc@hanyang.ac.kr, nuclearphy@hanyang.ac.kr, yongskim@hanyang.ac.kr

## 1. Introduction

Many decommissioning wastes are generated during decommissioning NPP. In particular, very low level wastes occur mostly. Table 1. shows that by the year 2090, the very low level radioactive waste among the total 616,000 drums is the largest with 413,336 drums (67.1%) [1].

Table 1. Occurrence of Domestic Decommissioning Waste by 2090

| Classification | Number of Drums (rate, %) |
|---|---|
| Intermediate Level Waste | 25,872 (4.2) |
| Low Level Waste | 176,792 (28.7) |
| Very Low Level Waste | 413,336 (67.1) |
| Total | 616,000 (100) |

Therefore, if it is possible to accurately classify and dispose that are very low level wastes and general wastes, economic and environmental benefits will be gained.

In Korea NPP, clearance level for radionuclide of IAEA is followed [2]. Therefore, it is necessary to be able to measure less than the clearance level of radionuclide. Very low level waste has a wide variety of shape and characteristics. There is a need for technologies that can accurately measure the characteristics of various wastes.

In this study, we conducted to evaluate the factors that can affect the MDA (Minimum Detectable Activity) research using the standard source and designed box.

## 2. Methods and Result

### *2.1 Experiment*

To measure the change of MDA according to time and background count, the experimental equipment was configured as shown in Fig. 1.

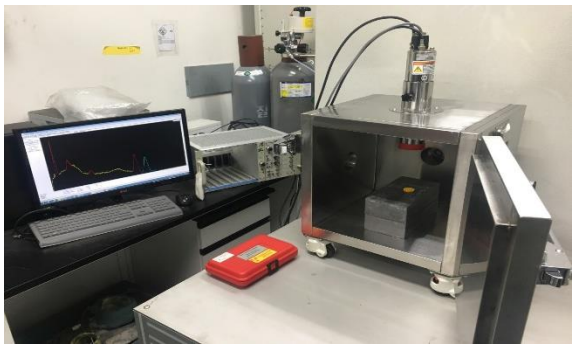

Fig. 1. Detection system composed of NaI(Tl) Scintillator and genie-2000.

As shown in Table 2., NaI(Tl) scintillation was fixed in the measurement box and the standard source was measured with Genie-2000 software. Co-57, Co-60, and Cs-137 were selected for the standard source to measure from low energy to high energy.

Table 2. NaI(Tl) Scintillation

| Model | Efficiency | Voltage | Range | Number of channel |
|---|---|---|---|---|
| Canberra 802-2*2 | 7.5% | 1100V | 2MeV | 1024 |

The measurement time and the background count were set as variables to measure changes in the MDA value.

As the thickness of the shield increases, the background count decreases. To measure the reduction of MDA due to shielding, measurements were conducted for 200s at the lead 0mm (air), lead 3mm (measurement box) and lead 50mm (lead brick). We also measured the change in MDA from 50s to 1000s.

*2.2 Result*

As a result of the experiment with lead thickness of 0mm, 3mm, and 50mm at the measurement time of 200s as shown in Fig. 2., MDA decreased during increasing the thickness of the lead and decreasing the background count.

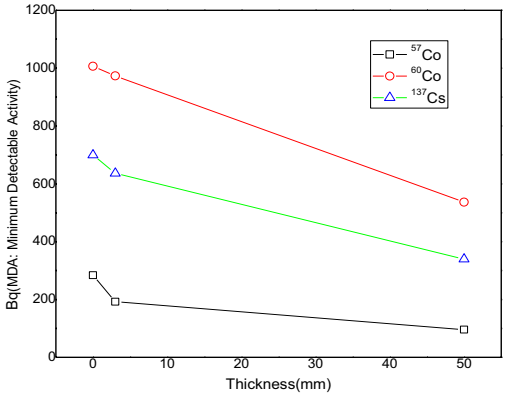


Fig. 2. MDA values varying with shield thickness at 200s.

As shown in Fig. 3., the MDA value decreased in the entire energy range as measurement time increases at the lead 50 mm.

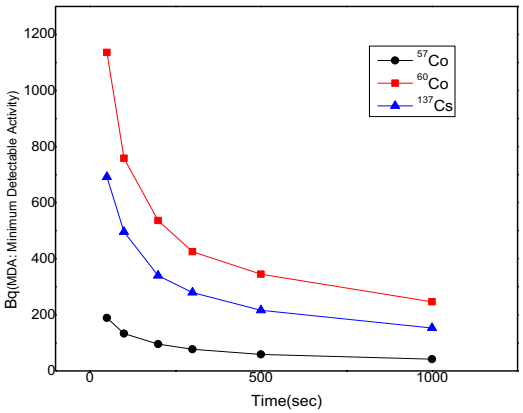


Fig. 3. MDA value that varies with measurement time at lead 50mm.

## 3. Conclusion

In this paper, we conducted a basic study to measure below clearance level in actual decommissioning wastes.

There is a need to set the appropriate measurement time and shielding thickness when measuring very low level waste after NPP decommissioning.

A measurement box was constructed to measure very low level waste of various shapes. Also, it is necessary to develop the technology for the clearance level by increasing the reliability of measured values through MCNP simulation.

## REFERENCES

[1] Korea Radioactive Waste Agency, Analysis of scenario for management of decommissioning waste, KORAD/TR/2013-24 (2013).

[2] Nuclear Safety and Security Commission, NSSC Notice No. 2014-003 (2014).