Transactions of the Korean Nuclear Society Spring Meeting
Jeju, Korea, May 22-23, 2025

Surface Dose Rate Analysis of Radioisope Transport Devices for Reducing Radiation Exposure

Sungsoo Nam*, Eunha Cho, Kihwan Park, Taegil Lee.
Radioisotope Research Division, Korea Atomic Energy Research Institute, Daejeon, Korea
**Corresponding author: ssnam@kaeri.re.kr*

Keywords : Radiation dose rate, Radiation exposure, Lead container, Hot cell

1. Introduction

Radioisotopes produced by the Korea Atomic Energy Research Institute are used in many fields, including medical, industrial and research purposes. When producing these medical, industrial and research radioisotopes, a large amount of radiation is emitted and for the safety of workers, the work is carried out in a production facility called a hot cell.

When producing radioisotopes, workers work in a production facility called a hot cell and can be directly exposed to radiation when they move lead containers containing radioisotopes by hand. Above all, the work area and hot cell emit a large amount of radiation, so workers must wear safety equipment such as full-body work clothes and aprons while working. Even if workers wear safety equipment while working, they can suffer from radiation damage due to radiation exposure.

In particular, radiation workers can suffer from leukopenia and anemia, bone marrow dysfunction, aplastic anemia and other disorders such as chronic dermatitis, skin cancer, and hair loss [1.2].

In accordance with the recommendations of the International Commission on Radiological Protection, korea has also set limits on the annual radiation exposure dose for radiation workers to ensure the safety of radiation exposure for radiation workers.

Therefore, attention and caution are necessary to reduce the possibility of radiation exposure for radiation workers and the aim is to minimize radiation exposure dose and maintain the health of radiation workers [3].

This experiment compared the difference in surface dose rate at the back of the hot cell, which is the workspace when carrying an actual radioisotope and moving it using the radioisotope transport device.

2. Manufacture and Experimental

2.1 Manufacture of RI transport devices

The radioisotope transport device was designed to hold four lead containers, reducing direct radiation exposure and ensuring safety for woikers. (Fig. 1.)

The motor and screw jack were used to adjust the height from 0 to 30 Cm, allowing the operator's position and the height of the hot cell door to be adjusted for safer work. The lead container transport cart was manufactured with gear-shaped spur gears and rack gears to allow the lead container transport cart to move more safely and easily along rail.

Most importantly, the four lead containers were manufactured with a 10-degree incline from the horizontal to reduce the operator's radiation exposure. At this time, the operator's radiation exposure was further reduced.

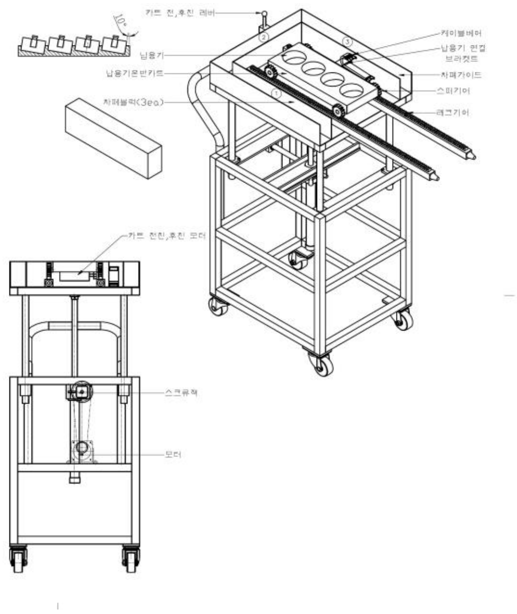

Fig. 1. Drawing of Radioisotope Transport Device

2.2 Results and Analysis

To reduce radiation exposure an radioisotope transport device was manufactured. The transport cart was made to accommodate four lead containers. The four lead containers were not placed horizontally. Instead, there were placed at a 10-degree incline. In fact, an I-131 solution with a radioactivity concentration of 10 mCi was used. When the lead container transport cart was placed horizontally and measured the surface dose rate was 14.4 uSv·hr^{-1}. When measured after placing at a 10-degree incline, the surface dose rate was measured to be 10.1 uSv·hr^{-1}. The surface dose value was reduced by 4.3 uSv·hr^{-1}.(Fig. 2.)

Horizontal(A)	10 degree incline(B)
	
Surface dose rate(uSv·hr^{-1})	
	

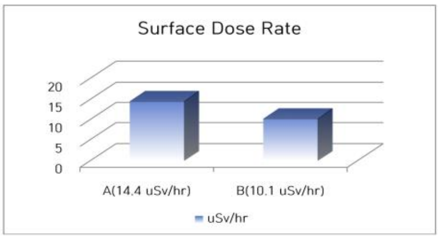

Fig. 2. Lead container transport cart surface dose rate measurement

3. Conclusions

This study was conducted to reduce radiation exposure of workers when handling in hot cell and isotope production areas using a new radioisotope transport device. The lead container in the lead container transport cart of the radioisotope transport device was manufactured by tilting it by about 10 degrees. At this time, the surface dose rate was measured to be lowered from 14.4 uSv·hr^{-1} to 10.1 uSv·hr^{-1} at a 10-degree. The surface dose value was reduced by 4.3 uSv·hr^{-1}. It is expected that the radiation exposure of workers will be reduced as a result.

REFERENCES

[1] Mun Ho Lee, Clinical Nuclear Medicine, Ryo Moon Gak. P. CO, pp.12-56, 1989.
[2] Joon Huh, Radiation Biology, Shinkwangpub, pp.14-33, 1986.
[3] Seong Min Back, Eun Sung Jang., Comparative Evaluation of Radiation Exposure in Radiation Related Works, Journal of the Korean Society of Radiology, Vol. 5, No. 4, pp.198-200, 2011.