# Sensitivity of HANARO Stack Radiation Monitor for Iodine Measurement

Myong-Seop KIM*, Young-Chil KIM, Chang-Kyung KIM, Chang-Woo SEOL, Hyung-Sub LEE

*Korea Atomic Energy Research Institute*
*150 Dukjin-Dong, Yuseong-Gu, Daejeon, 305-353, Korea,* * mskim@kaeri.re.kr

## 1. Introduction

During a normal operation of HANARO, a 30 MW research reactor, the representative radioisotopes which can be emitted from the stack were analyzed to be Ar-41, H-3 and I-131. Therefore, tritium, particle, iodine and noble gas detectors had been installed in HANARO stack, and they are continuously being operated to monitor the emissions of the above radioisotopes.

We have been confirmed the sensitivity of the noble gas detector for Ar-41 detection[1], and we began to study the sensitivity of the iodine detector in the stack monitor for the I-131 detection.

In this research, we have analyzed the radionuclide in the charcoal filter installed in the iodine detector of the stack and measured the iodine activity in it with the HPGe detection system. The measured activity with the HPGe detector was compared with the stack monitoring value.

## 2. Experimental Methods

HANARO stack radiation monitor is composed of particle, iodine and gas detectors. The tritium monitor was installed apart from this radiation monitor. The iodine gas emitted from each area of the reactor site is passed through the ventilation pipe to the stack with air. This line branches into the radiation monitor, and a portion of the ventilating air goes through the monitor. The iodine gas in the air is captured by charcoal filter of the radiation monitor. The diameter of this filter is 5.5 cm, and its height is 2.5 cm. The NaI(Tl) scintillation detector in the monitor measures the 364 keV gamma-rays from I-131($T_{1/2}$=8.04 days), and gives the iodine concentration in the air discharged from HANARO.

We have monitored the iodine activity concentration in air from three areas of HANARO site; the reactor hall(RX), the reactor concrete island(RCI) and the radioisotope production and irradiated materials examination facility(RIPF-IMEF).

Figure 1 represents the results of the iodine concentration monitoring in air from the three areas for three months. The charcoal filter is replaced with a new one once a week. The air volume passed through the filter for a week is 570.5 $m^3$.

The radionuclides in the used filter were analyzed with the HPGe detector, and it was confirmed that there was no dominant radionuclide without I-131 in charcoal filter. The absolute activity of I-131 in the filter was measured by using the standard source calibration[2,3].

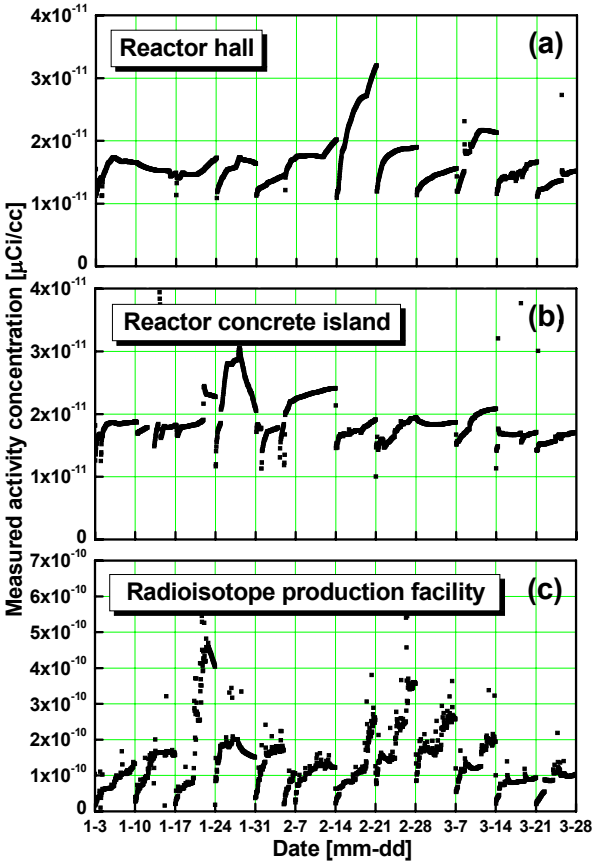


Fig. 1. The measured activity concentrations of I-131 in air from the reactor hall(a), reactor concrete island(b) and radioisotope production and irradiated materials examination facility(c).

## 3. Results

Figure 2 shows the measured I-131 activity concentrations in air from the reactor hall and the reactor concrete island with the stack monitor and with the MCA technique using the HPGe detector. Absolute values of the concentrations obtained by two kinds of detection

methods are meaningless up to the present because various factors such as the calibration of the detector, the capturing efficiency of the iodine atom and the data reduction method are not established at present. From the figure, we can see that the I-131 concentrations in the air from RX and RCI obtained by the stack monitors are approximately constant, and they are independent of the concentration obtained by the HPGe detector.

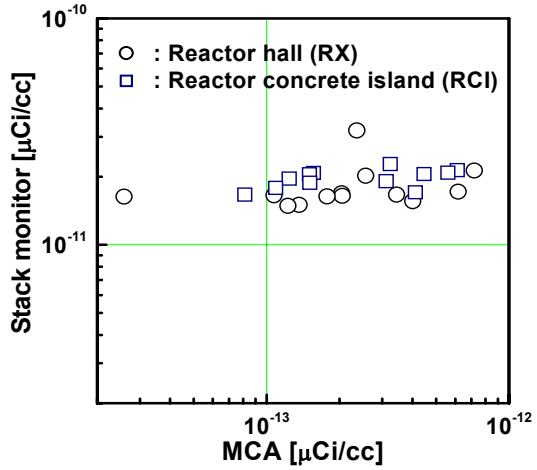


Fig. 2. Measured I-131 activity concentrations in air from the reactor hall and the reactor concrete island with the stack monitor and with the MCA technique using the HPGe detector.

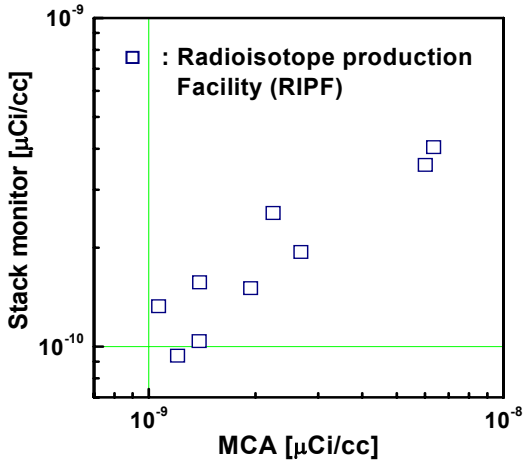


Fig. 3. Measured I-131 activity concentrations in air from the radioisotope production and irradiated materials examination facility with the stack monitor and with the MCA technique using HPGe detector.

Figure 3 shows the measured I-131 activity concentrations in air from the radioisotope production and irradiated materials examination facility with the stack monitor and with the MCA technique using the HPGe detector. In this case, the absolute activity values are higher than those in the RX or RCI cases. From the figure, it can be shown that the I-131 concentrations in the air from RIPF obtained by the stack monitors are proportional to the concentration obtained by the HPGe detector.

Conclusively, so far, we can see that the I-131 concentration levels in air from RX and RCI are less than the sensitive range of the stack monitor. More precise study to confirm the sensitivity of the stack monitor is now being planned, and the detection of the absolute activity concentration with the HPGe detector will be continued once a week.

## REFERENCES

[1] M. S. Kim, et al., Sensitivity Analysis for Gaseous Radiation Monitor of HANARO, Autumn Meeting of the Korean Association for Radiation Protection, Jeju, Korea, 2004.
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[3] G. F. Knoll, "Radiation Detection and Measurement", John Wiley & Sons, 1989.