An assessment of the gaseous radioactive waste emissions from HANARO in 2008

Mun Lee, C.Y. Park, H.C. Shin, S.O, Hur, C.S. Lee, G.H. Ahn, I.C. Lim
HANARO Management Division, Korea Atomic Energy Research Institute,
1045, Daeduk-daero, Yusung-gu, Daejeon, Korea
mlee@kaeri.re.kr

1. Introduction

The typical gaseous radioactive wastes discharged from HANARO research reactor such as the RX (reactor) hall, the RCI (Reactor Concrete Island) area are noble gases, halogens and radioactive iodine. These wastes monitored by the RMS (Radiation Monitoring System) are discharged into the atmosphere through a 68 m stack via various air filtrations which consist of the combination of pre-filter/HEPA filter or pre-filter/HEPA filter/charcoal filter. Also, tritium released from the reactor hall and the RCI area is monitored by the RMS monitor. This study is to assess the annual release of the noble gases, halogens, and iodine released from the RX hall and the RCI area closely related to the reactor operation.

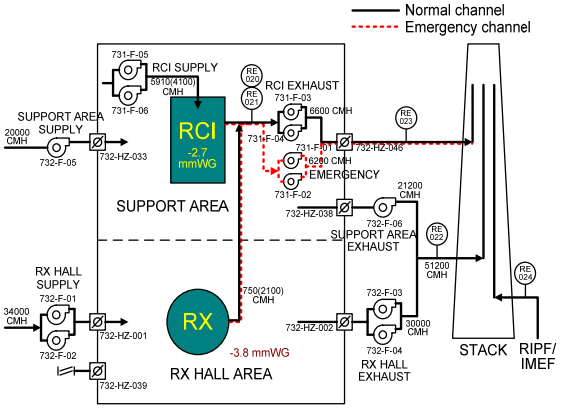

Figure 1. The ventilation system and the stack monitor in HANARO

2. The assessment of the gaseous waste emissions

2.1 Noble Gases

The gaseous radioactive wastes discharged from the HANARO contain Xe and Kr, as well as Ar-41. The annual release of the noble gases from the RX hall in 2008 was 2.11E+08 Bq, and that from the RCI area was 7.61E+08 Bq. The Ar-41 released from the RX hall was not monitored in 2008, but 8.78E+07 Bq was released from the RCI in the 1st quarter of 2008. It was 9 % of the total amount of the released noble gas and 91 % of them was the Kr-85. The annual release of the Ar-41 in 2008 decreased about one sixty-ninth of the release in 2007. The total amount of the noble gases from the RX and RCI in 2008 was 9.72E+08 Bq, whose the annual release was trivial when compared with the ADRL (Annual Derived Release Limits) as shown in Table 1.

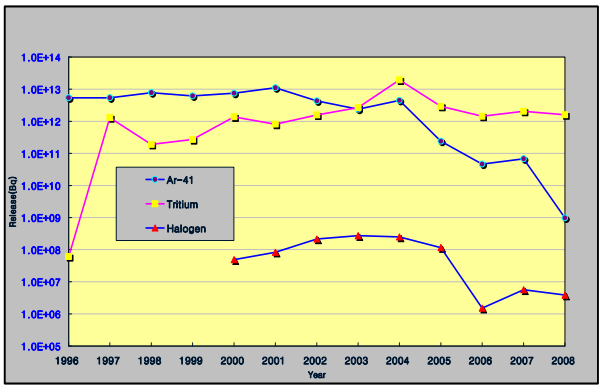

Figure 2. Status of the gaseous radio-isotopes released for the last 13 years in HAANRO.

The noble gases discharged since 2004 have been decreasing gradually as shown in Figure 2. These resulted from the efforts to reduce the gaseous radioactive wastes, decreasing the reactor operation days and changing the evaluation method of the noble gases. The decrease of the operation days were caused by the replacement work of the reactor doors in HANARO in 2005, the installation of the FTL (fuel test loop) facility from 2005 to 2007, and CNS (cold neutron source) facility installation by 2008. Figure 3 shows the status of the operation days for the last 13 years.

Table 1. The annual derived release limits in HANARO.

Contents	HANARO facilities		
	RX Hall	RCI Area	Total
Noble Gases	2.95E+15	4.62E+15	7.57E+15
Tritium	2.27E+15	2.27E+16	2.50E+16
Halogens	2.22E+12	2.22E+12	4.44E+12

Before 2003, the Xe-133 had been used for the efficiency calibration of detectors. However, it was confirmed that the main noble gases are the Kr-85 and the Ar-41. The Kr-85 produced from continuous decay of the spent fuels and the Ar-41 produced from air activation in the reactor pool water in operation. Their counting efficiencies are similar. So, we regarded the Kr-85 as a background. It is assumed that if the measured value is under the background, and the Ar-41

is not detected. And if the measured value is over a setting value and the Ar-41 is released [1].

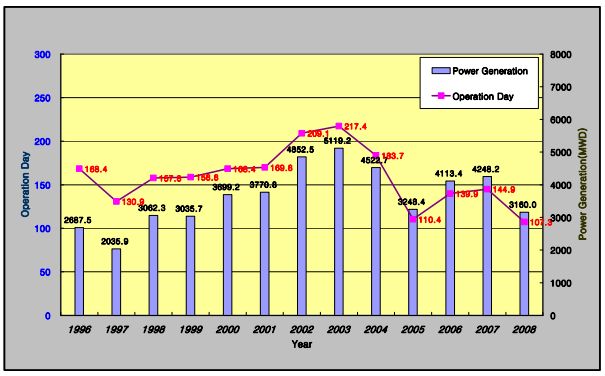

Figure 3. The status of the operation days and the power generation in HANARO

2.2 Tritium

Tritium is one of the concerned radioactive wastes in HANARO. The total amount of H-3 released from the RX hall and the RCI area in 2008 was 1.60E+12 Bq, which is 28.7 % in the previous year. The release per operation day in 2008 was similar to that in 2007. The release of the H-3 in 2008 was trivial when compared with the annual derived release limits, 2.49E+16 Bq/yr.

2.3 Halogens

They are normally produced from uranium remained on the cladding surface. The iodine gas emitted from the RX hall and the RCI area is passed through the ventilation pipe to the stack with air. The iodine gas in the air is captured by charcoal filter of the radiation monitor. The total emission of the iodine in 2008 was 3.89E+06Bq, which consists of 2.16E+06Bq from the RX hall and that from the RCI area was 1.74E+06Bq. Their emission in 2008 was smaller than that in 2007, but those figures are similar in 2007, considering the decrease of the operation days.

The iodine emission has been decreased since 2006 as shown the figure 2, and it is due to change of the evaluation method. Before 2006, calculation on the basis of the continuous measure had been used as the evaluation method, but the method was changed to a calculation by analyzing the charcoal filter installed in the ventilating system, and it has helped to evaluate the amount of the released gaseous radioactive wastes more sensitivity. The real discharged amount of iodine in 2008 was trivial in comparison with the ADRL.

3. Countermeasure for reducing of the gaseous radioactive wastes

As shown in Figure 2, the radioactive waste has been decreasing generally since 2004. That has resulted from the decrease of the operation days and the various efforts to reduce the gaseous radioactive wastes. The change of the evaluation method in the case of the noble gases and the iodine made it possible to measure the exact amount of an emission. But the amount of emission in the iodine was slightly increased in 2007 in comparison with the previous years. The reason was that I-132, I-133 and Br-82 were included in the calculation of the emission since 2007. Before 2007, the representative isotope of the iodine, the I-131 had been calculated. A task force team was established to reduce the tritium release and to manage the reflector system in 2007. The RCI hatch of the reflector system room was sealed to protect leakage. And the reflector pumps of the centrifugal type will be replaced with the can type pump which doesn't cause a heavy water leakage [2].

REFERENCES

[1] M.S. Kim et al., "Investigation into the cause of an increase in the measured values from the gaseous radionuclide monitors in HANARO" KAERI/TR-3408/2007, KAERI, 2007.

[2] W.S. Jung et al., "A management strategy for the heavy water reflector cooling system of HANARO research reactor", Technical Report, KAERI/TR-3473-2007, KAERI.