Disposal of the Radioactive Waste in HANARO for 11 Years

H.Y. Choi, M. Lee, S.J. Kim, H.C. shin, H.W. Kim, T.H. Kim
Korea Atomic Energy Research Institute 150 Deokjin-Dong, Yuseong, Daejeon 305-353, Korea
choihy@kaeri.re.kr

1. Introduction

HANARO has been operated for twelve years since 1995. During this period, the amount of the radioactive waste disposed in HANARO was 660 drums (200 liter per drum) of solid waste except for the ones related to the FTL construction in 2006, and the 365.4 m^3 liquid ones. In the case of a gaseous radioactive waste, the activity of Ar-41 as a representative noble gas, and the tritium and I-131 released from the reactor building to the environment were 5.45E+13, 3.17E+13 and 9.86E+8 Bq, respectively.

This report describes how to deal with the radioactive waste depending on its type, how much there is, and how to reduce it in HANARO.

2. Classification of the Radioactive Waste and Methods of Disposal

Solid radioactive wastes in HANARO are categorized into flammable, nonflammable, used resins and used filters. These solid ones of a low and medium level are disposed according to IAEA criteria for a disposal when the heat generation rate is under 2 kw/m^3, or the concentration of nuclides emitting alpha ray with a half life of more than 20 years are under 4 kBq/g[1]. Solid wastes are collected separately and packed into drums at the temporary waste storage in HANARO, and then they are moved to the temporary reservation facility in KAERI.

Liquid radioactive waste is collected in a hot shower sump or a reactor sump separately. The hot shower sump is a pit for gathering the water used for washing hands and the body after working. Whereas, the reactor sump is a pit for collecting the liquid waste produced by a leakage and maintenance work of pumps, resins and filters, and decontamination work. If the amount of liquid waste in the sumps reaches 80 % of its capacity, the radioactive concentration in the waste is measured [2]. And then if it satisfies the value of the disposal management criteria, 3.7×10^9 Bq/m^3(low level), 1.85×10^5 Bq/m^3(extremely low level), the waste is transferred to the liquid waste each storage tank in the RIPF(Radio-isotope Production Facility) and finally is vaporized in the natural vaporization facility in KAERI.

Gaseous radioactive wastesare produced by an activation of dissolved air in the coolant, and that escaping fromgaseous fission products in the primary coolant. The air from the reactor hall or the RCI (Reactor Concrete Island) containing the gaseous radioactive materials is released into the environment through the stack via an air filtration system. The main radioactive materials released into the atmosphere are Ar-41, 1-131 and H-3. The filtration system is composed of four types of filters, which are a charcoal filter to eliminate the radio-isotope iodine, a HEPA filter as a high effective particulate air filter via a pre-filter and a MOD filter. These gaseous wastes are managed and monitored by a stack monitoring system for detecting the activity of a particle, radio-isotope, noble gas and tritium.

3. The Status of Radioactive Waste Disposal in Accordance of Types

3.1 Solid-type radioactive waste

The total quantity of the solid wastes from 1996 to 2006 was 660 drums constituting of flammable ones of 338 drums, nonflammable ones of 101 drums, the used resin of 107 drums and 112 drums of the used filters. The solid wastes per year were 59 drums on average from 1996 to 2006, whereas, 155 drums only for 2005. That was over 3 times that of the average from 1996 to 2006. Especially, the flammable and nonflammable wastes were increased a lot. Increase of the nonflammable waste was originated from exchanging the doors connecting the reactor hall and the control room to security doors as a part of the physical protection activities in 2005. Crushed wall pieces of a large volume were produced from these works.

3.2 Liquid-type radioactive waste

The amount of liquid waste collected in the hot shower sump from 1996 to 2003 (the liquid waste in the hot shower sump after 2003 was transferred to the reactor sump) was 37 m^3 and that for the reactor sump from 1996 to 2006 was 328 m^3 which is 90 % of the total liquid waste originating from

HANARO. The most liquid waste of 61.58 m^3 was generated in 1997. It was caused by a decontamination of the heat exchanger in the primary cooling system. The liquid waste of 54.34 m^3, generated in 2003, was caused by a decontamination of the irradiated silicon ingots for starting the commercial service of the NTD(Neutron Transmutation Doping) and many flow tests for EWS(Emergency Water Supply) systems to confirm its characteristics.

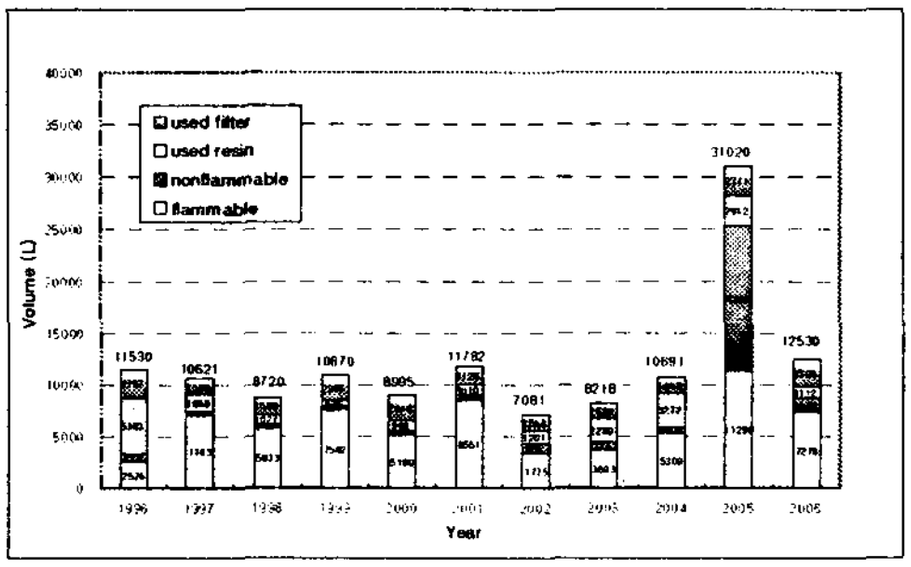

Figure 3.1 Status of the solid radioactive waste

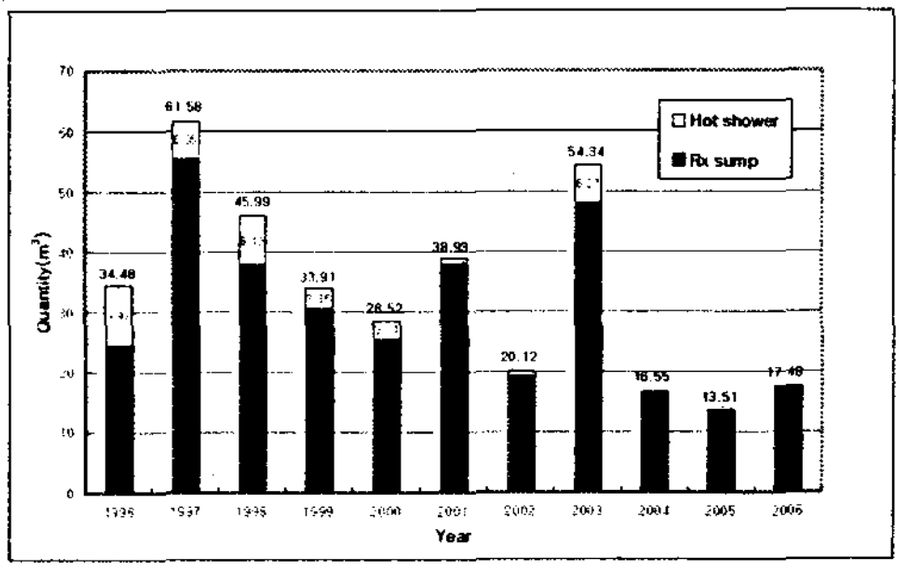

Figure 3.2 Status of the liquid radioactive wastes

3.3 Gaseous-type Radioactive Waste

The total amount of Ar-41 released from the reactor building was 5.45E+13 Bq, since HANARO started its operation, and the annual average was 4.95E+12 Bq. To reduce the generation of Ar-41, a supply device for N_2 gas to the NAA(Neutron Activation Analysis) was installed in 2002 and thereafter the waste was decreased to 4.63E+10 Bq in 2006.

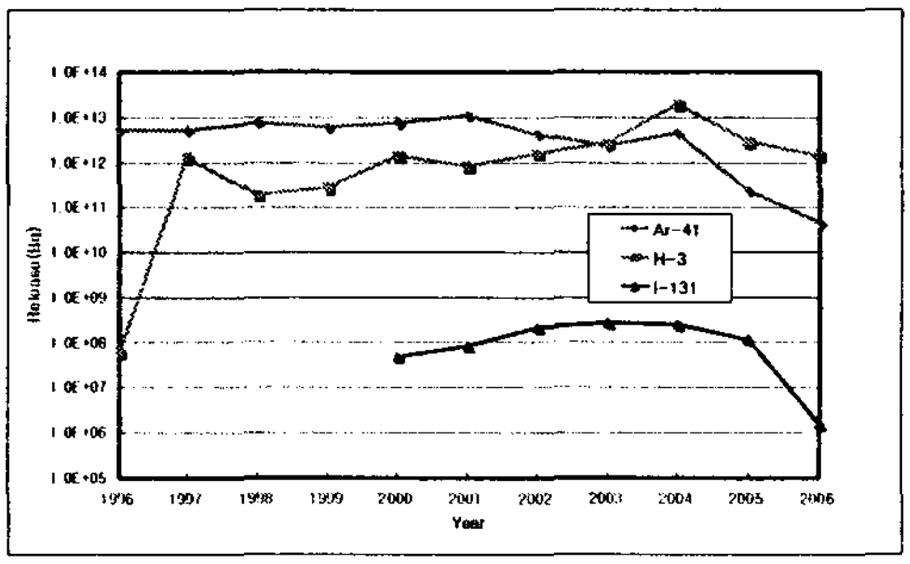

Figure 3.3Status of the gaseous radioactive wastes

The total released amount of H-3 was 3.17E+13 Bq, and the annual average was 2.88E+12 Bq. The tritium was increased gradually until 2004, but it started to decrease gradually after installing the shield room for keeping the H-3 in the reflector equipment room of the RCI in 2005 [3]. 1.43E+12 Bq of tritium was released in 2006, which was decreased to one half of the annual amount of 2005. The total amount of released iodine I-131 was 9.86E+08 Bq, and the annual average was 1.40E+08 Bq. The measuring method for the released I-131 was changed, and now analyzes the charcoal filter as collected I-131 instead of a direct detection of air in the HANARO stack.

4. Remarks

The estimated cost to dispose of low and medium level solid waste at the disposal facility of KAERI was about 5,000 USD (a drum) in 2006. A permanent disposal site for low and mediumlevel waste was selected in November, 2005 in Gyeongju, Gyeongsangbuk-do province. The solid waste stored in the KAERI site will be transferred to that site which will have a capacity of 400 drums annually after 3 years. In that case, the expense will be needed more than now. That's why we should reduce the solid waste in HANARO.

REFERENCES

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