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# Development of a Sampling Method for a Radionuclide Assessment of a Spent HEPA Filter Waste

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## 1. Introduction

Spent filter wastes of about 2,160 units have been stored in the waste storage facility of the Korea Atomic Energy Research Institute since its operation. These spent filters have generally consisted of a HEPA filter after its filtering of all the contaminants in the gas stream generated during the operation of the HANARO research reactor and the nuclear fuel cycle facilities. At the moment, to secure a storage space, it is necessary to make a volume reduction of the stored radioactive wastes through a compression treatment or a regulatory clearance. These methods are considered in view of a reduction of a management cost and disposal cost and the security of a free space for a waste storage facility approaching saturation.

In order to dispose of the spent filters, it is first necessary to conduct a radionuclide assessment of them. To do that, a sampling procedure should be prepared for obtaining the representative sample in the spent filter. As for conducting a nuclide analysis for this representative sample, a corresponding spent filter can be sorted as either a regulatory clearance waste or a radioactive waste.

In this study, the spent filter wastes were classified according to their generating facilities, their generation date and their surface dose rate. After selecting several HEPA filters, they were dismantled into a frame part and a filter medium part. And then, a quantitative analysis of the nuclide existing in the filter medium was conducted. From the analysis results, it was possible to divide the filter medium into three specific regions in respect of the nuclide distribution. As a result, these three regions could be a sampling guide to take a representative sample of a spent HEPA filter waste for treating it.

## Methods and Results

The spent HEPA filter out of various filter types was selected for this experiment, and then, several HEPA filters by their generation facilities were selected throughout a classification process.

### *2.1 Classification of the spent HEPA filters*

There are spent filter wastes of about 2,160 units in the waste storage facility of KAERI and spent HEPA filters account for about 91 % of those [1]. As shown in the table and figure below, the spent filter wastes were classified according to three phases of a classificatory criterion which mean their generation facilities, their generation date and their surface dose rate by investigating the inventory of the spent filters stored in the waste storage facility.

Table 1. The amount of the spent HEPA filter waste stored by the generation facilities

| HANARO | Nuclear Fuel Cycle | | | *NFP | *RI | Others |
|---|---|---|---|---|---|---|
| | IMEF | PIEF | RWTF | | | |
| 208 | 122 | 409 | 723 | 367 | 78 | 65 |

* NFP : Nuclear Fuel Processing Facility
* RI : Radioisotope Production Facility

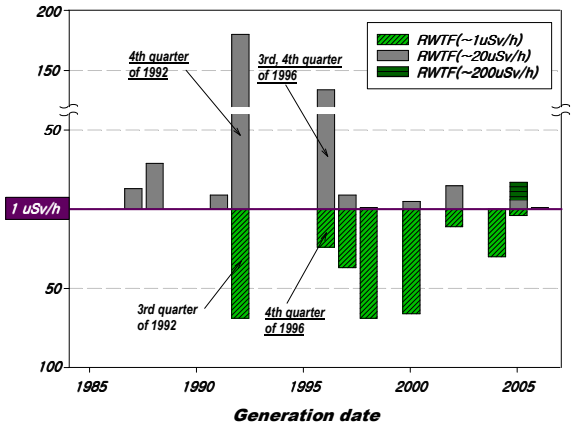


Figure 1. The distribution of the spent HEPA filter waste generated in the RWTF

### *2.2 Pre-treatment of the spent HEPA filter*

There are several types of HEPA filters, and the figure 2 shows the assembled components of an open-face, deep-pleat HEPA filter with corrugated separators that is the most widely used type [2]. It consists of two major parts which are a frame part (the filter casing and the separator) and a filter medium part.

In order to dispose of a spent HEPA filter, it is first necessary to conduct a radionuclide assessment of it. There are some researches on a radionuclide assessment by using a leach system and a waste assay system [3, 4]. In this study, to investigate the species and the distribution of the captured radionuclide in a HEPA filter, the spent HEPA filter was dismantled into a frame part and a glass fiber part.

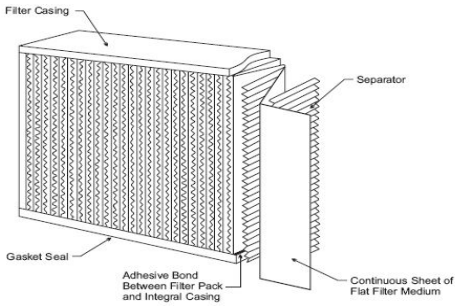


Figure 2. Open-face deep-pleat HEPA filter type A filter pack

After marking the glass fiber with the direction of the air flow, it was cut into 12 pieces in the direction from the intake to the outlet. And then, the 12 pieces of the glass fiber were individually put into Marinelli beakers which had a 1 liter volume.

*2.3 Sampling method*

In the case of conducting a quantitative analysis of the nuclide existing in the Marinelli beakers, it is possible to establish the radionuclide distribution in a glass fiber because each piece has depth information in the fiber. The result of the quantitative analysis of gamma emitters is shown in figure 3. The data points mean the ratio of the activity of the gamma emitter at each depth to the total activity of it existing in every region of the glass fiber.

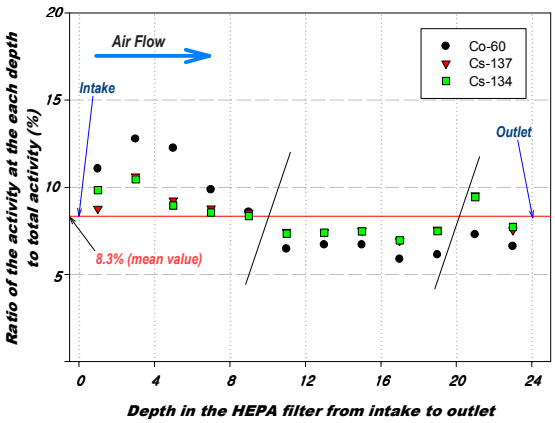


Figure 3. The activity ratio of the gamma emitter existing at the each depth to the total its activity in the glass fiber.

As shown in figure 3, it is possible to divide the glass fiber into the three parts; first, the front part which represents an above average value, and then, the middle part which represents a uniform distribution below average value, and finally, the rear part which represents a somewhat increase when compared with the middle part. In the event of taking samples at the three parts respectively, the average value of the nuclide analyses for those samples is able to be used as a representative value of a glass fiber. If taking the sample only at the front part, its data is also used as a conservative estimate for a glass fiber.

## 3. Conclusion

First, the spent HEPA filter wastes that have been stored in a storage facility were classified by their generation facility, their generation date and their surface dose rate. And then, a selected spent HEPA filter was dismantled into a frame part and a glass fiber part to investigate the species and the distribution of the captured radionuclide in it, and also the glass fiber was cut into 12 pieces in the direction from the intake to the outlet of the air flow.

From the analysis results of the nuclide existing in each glass fiber piece, it was possible to divide the fiber into three specific regions in respect of the nuclide distribution. As a result, these three regions could be a sampling guide to take a representative sample of a spent HEPA filter waste for treating it.

Finally, the results for a beta and an alpha emitter with the same sampling method have to be obtained for confirming the validity of the sampling method. And then, according to this sampling method, it is necessary to develop the equipment for taking a representative sample without dismantlement.

## REFERENCES

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