# Distribution Characteristics of Radionuclide Activity in Spent Resin Storage Tank

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*In this study, we investigated the distribution characteristics activity of C-14, Co-60, Cs-137 and H-3 in spent resin storage tank in Wolsung nuclear power plant for evaluation of disposability. Samples of analysis were taken at depths of 0.1, 1.5, 2.7, and 3.3 meters in inspection port of spent resin storage tank. The activity of H-3, C-14 and Co-60 increased with decreasing of depth, while that of Cs-137 showed minimum value at the surface of a storage tank.*

## I. INTRODUCTION

Ion-exchange resins are widely used for purification of coolant in nuclear power plant to remove cation and anion elements. Spent ion-exchange resins are classified into low and intermediate level radioactive waste. As the important characteristics of spent resins are the relatively high specific activity for interim storage and permanent disposal, it is necessary to take special precautions when handling, treating and conditioning [1-2].

Radioactive waste in nuclear power plant of Wolsung had been stored without classification of spent resin, zeolite and activated carbon generated from various purification systems such as the moderator and coolant system. As spent resins adsorbed neutron activation of stainless steel and fission product nuclides, especially the possibility of tritium contamination should be taken into account [3]. Because the spent resin in the storage tank had been stored since the commercial operation of the nuclear power plant in 1983, the species and activity of radionuclides can be changed depending on depth of storage tank.

In this study, the distribution characteristic of radionuclide activity was investigated using mixed ion-exchange resins used in the spent resin storage tank for the evaluation of interim storage and permanent disposal.

## II. EXPERIMENTAL

Samples for analysis were taken at depth of 0.3, 1.5, 2.7, and 3.3 meters in the inspection port of spent resin storage tank in Wolsung nuclear power plant. The samples obtained for this work were mixed with spent resin, zeolite and activated carbon. Also spent resin was a mixed anion/cation type, and shaped as small plastic beads. For separation of samples as the spent resin, activated carbon and zeolite, respectively, samples were sieved with 750 and 850 micrometers (Fig. 1) after drying at 60℃ for 10 hr for prevention of H-3 loss.

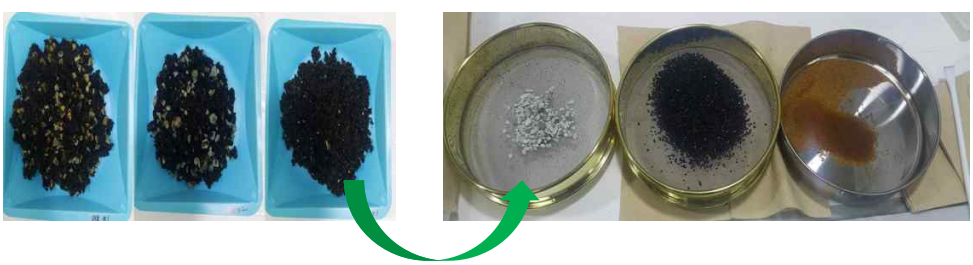

Fig.1. Separated samples using sieves

For gamma analysis, about 5 g of the separated spent resin was used to extract the radionuclides using a microwave digestion system including mixed acid ($HNO_3$-HCl-HF). After separation of insoluble residue using a filter paper, the solution was transferred to a 20 mL of volumetric flask and filled with 1 M $HNO_3$. Determination of gamma radionuclides activity was carried out using a gamma spectrometer with a high purity germanium detector. Distillation method was used for determination of volatile nuclide such as C-14 and H-3 using a liquid scintillation counter.

## III. RESULTS

Figure 2 shows the activity of Co-60, Cs-137, H-3 and C-14 in spent ion-exchange resins. The activity of Co-60, C-14 and H-3 decreased with increasing depth of a storage tank, respectively, and the ratio of C-14/H-3 observed was similar in various sample points. However, the activity of Cs-137 as one of the more common fission products showed minimum value at the surface of the storage tank.

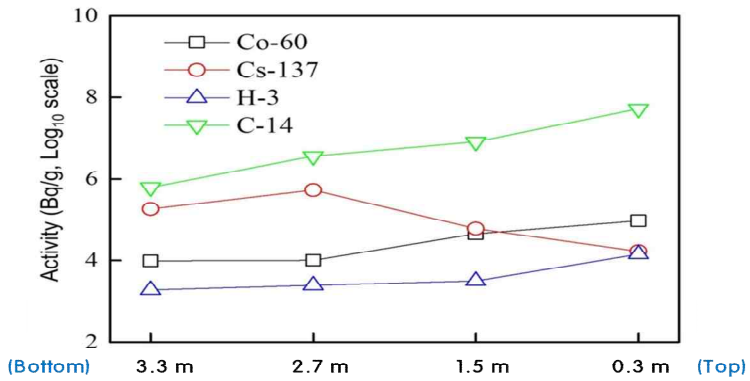


Fig.1. Distribution of radionuclides activity according to depth from the inspection port

## II. CONCLUSIONS

We measured the distribution of radionuclides activity depending on depth in spent resin storage tank. As time passed, namely, increase of depth in storage tank, the activity of H-3 and C-14 caused by operation of heavy water reactor decreased, and Co-60 produced by process of neutron activation of stainless steel also decreased. While, the activity of Cs -137 showed minimum value at the surface of the storage tank

## ACKNOWLEDGMENTS

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