A Material Balance Method for Estimating the Radionuclide Inventory Accumulated in LILW Radioactive Waste Based Upon Operating History of a NPP

Taeman Kim and Jooho Whang

Department of Nuclear Eng. College of Advanced Technology, Kyung Hee Univ., Kiheung, Yongin, Kyunggi, South Korea

To dispose of radwaste in a repository, the safety of disposal must be ensured. To this end, the source term and accumulation inside the radwaste must be assessed, and countries around the world, which are operating or planning to have repositories, have established related laws and regulations and presented the direct/indirect estimation method with proven validity as the radionuclide accumulation estimation method. In this study a method for estimating the radionuclide accumulation of radwaste utilizing the material balance technique, one of the indirect estimation methods, was developed. This method is characterized by the utilization of the water quality(radiational) measurement data, collected during the operation of an NPP, in front and back of the purification system. To confirm the applicability of this calculation program, this study conducted an application estimate during the 9th planned preventive maintenance of Gori Unit No. 4, one of the commercial NPP in Korea. First of all, to ensure that the technique developed in this study is assessed accurately, this study utilized the data regarding the radionuclide removal in the purification system during the shutdown water chemistry control('SCALP'). The target nuclides were Co-60 and Co-58, and it turned out that the relative error was less than 1%. The estimation result was compared with the result of direct measurement of the radwaste during the corresponding period as presented by commercial power plants. The result showed that the quantity of Co-60 measured by the direct method was about 50% less than that calculated by the technique developed in this study. In addition, this study applied a foreign scaling factor to the values estimated by the technique to calculate the accumulation of important difficult-to-measure radionuclides and compared them with the values measured by the direct method. The compared values show about 40-90% or greater differences depending on which radionuclide it is. This finding leads to the conclusion that this technique can be an important estimation tool that can make up for the limitations and errors of the direct estimation method. However, Until now the radionuclides chosen for this estimation have been limited to radionuclides which are corrosion products. Furthermore, future estimations must be performed on the basis of data from commercial nuclear power plants concerning radionuclides that are fission products and ultrauranic elements, and unique scaling factors.