Blending of Low-Level Radioactive Waste for Disposal

David S. Kessel and Chang-Lak Kim
KEPCO International Nuclear Graduate School,
658-91 Haemaji-ro, Seosaeng-myeon, Ulju-gun, Ulsan 689-882, Republic of Korea

Summary

Many countries including the Republic of Korea face a significant increase in low level radioactive waste (LLW) from nuclear power plant decommissioning in the near future. The purpose of this paper is to look at blending as a method for enhancing disposal options for low-level radioactive waste from the decommissioning of nuclear reactors. The 2007 U.S. Nuclear Regulatory Commission strategic assessment of the status of the U.S. LLW program identified the need to move to a risk-informed and performance-based regulatory approach for managing LLW. The strategic assessment identified blending waste of varying radionuclide concentrations as a potential means of enhancing options for LLW disposal.

Blending is a special case of concentration averaging that is applicable to mixtures of granular solid materials. The NRC's position is that concentration averaging or blending can be performed in a way that does not diminish the overall safety of LLW disposal. The revised regulatory requirements for blending LLW are presented in the revised NRC Branch Technical Position for Concentration Averaging and Encapsulation (CA BTP 2015). The changes to the CA BTP that are the most significant for NPP operation, maintenance and decommissioning reviewed in this paper and a potential application is identified for decommissioning waste in Korea. By far the largest volume of LLW from NPPs will come from decommissioning rather than operations. The large volumes in decommissioning present an opportunity for significant gains in disposal efficiency from blending and concentration averaging. An application of concentration averaging waste from a reactor bio-shield is presented.

The NRC's current position on blending is that large-scale LLW concentration averaging and blending may be conducted when it can be demonstrated to be safe. The NRC allows concentration averaging based on risk and performance measures for public health and safety. LLW concentration averaging and blending is an approach to waste management that can give greater flexibility for disposal options for NPP waste from the entire life cycle of the plant which includes operational wastes and most importantly large quantities of decommissioning wastes.

Concentration averaging could be applied to the concrete bio-shield to potentially facilitate disposal in a simple trench facility as opposed to the LLW disposal facility. It is assumed that disposal costs would be significantly lower for a simple trench facility for VLLW as compared to disposal as LLW. There are other potential advantages to near-surface disposal as LLW. The ability to dispose of much larger sections of the bio-shield as VLLW could reduce the final disposal volume. The exact isotopic mix in the massive components of the reactor is to a large extent dependent on the particular decommissioning strategy and the time frame chosen for implementation.

Acknowledgement

This work was supported by the Nuclear Safety Research Program through the Korea Foundation of Nuclear Safety (KOFONS), granted financial resource from the Nuclear Safety and Security Commission (NSSC), Republic of Korea (No. 1305009).