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Civilian Radioactive Waste Management System
Management & Operating Contractor

Preclosure Criticality Analysis Process Report

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$k_C(x)$ = the value obtained from a regression of the calculated k_{eff} of benchmark critical experiments or the mean value of the data set if there is no trend

$\Delta k_C(x)$ = the uncertainty of k_C based on the statistical scatter of the k_{eff} values of the benchmark critical experiments, accounting for the confidence limit, the proportion of the population covered, and the size of the data set

Δk_m = administrative margin-to-criticality that would reduce the CL

The USL is defined as:

$$USL = k_C(x) - \Delta k_C(x) - \Delta k_m \qquad \text{(Eq. 2)}$$

Based on a given set of critical experiments, the USL is estimated as a function of a trending parameter for the experiments. Because both $\Delta k_C(x)$ and $k_C(x)$ can vary with this parameter, the USL is typically expressed as a function of this parameter within an appropriate range of applicability derived from the parameter bounds.

The preferred method for postclosure (DOE 1998a) for estimating a USL uses a tolerance band approach referred to as a single-sided, uniform-width, closed interval approach in Lichtenwalter et al. (1997, p. 160), and referred to here as a Lower Uniform Tolerance Band approach. This approach applies statistical techniques to estimate a lower tolerance band. Further, this approach deals with estimates of criticality for a population of waste material, which is the approach used here for preclosure. This is the preferred method for estimating a USL provided significant trends could be identified.

An alternative method for preclosure is to use a confidence band with administrative margin, similar to USL Method 1 in Lichtenwalter et al. (1997, p. 158). When a strategy for making a transition from preclosure to postclosure is determined, the preferred method for postclosure will have to be determined.

Part of the range of applicability (ROA) of a benchmark data set is based on the range of parameter variation in the benchmark experiments that are used for estimating the USL. The other part is based on the range of fundamental parameters of the benchmark experiments. Lichtenwalter et al. (1997, p. 163), defines three classes of fundamental characteristics from which a fundamental parameter may be defined. The three characteristics are (1) materials of construction (including fissionable materials), (2) the geometry of construction, and (3) the inherent neutron energy spectrum affecting the fissionable material(s).

Once fundamental parameters and a set of critical experiments have been established. Calculated values of k_{eff} are trended against a number of these parameters to determine the parameter that provides the best fit to the data from the benchmark critical experiments. This parameter may be used for extending the range of applicability to the waste form.