HLWYM HEmails

From: Osvaldo Pensado
Sent: Wednesday, April 04, 2007 6:50 PM
To: Xihua He
Cc: Luis Ibarra
Subject: Feedback for TPA code manual

Xihua, could you please check the second paragraph to be included in the TPA manual? You are welcome to suggest edits.

I use the term "waste package class" to refer to packages in a TPA category. It is just a TPA label to group waste packages.

Luis is cc for information only.

$P_{contact}$

For waste packages in any class but the localized corrosion class, $P_{contact}$ is the probability for waste packages to be contacted by water capable of mobilizing waste forms. Water could drip or flow on waste package (condensation is ignored as a source of water in the TPA code). $P_{contact}$ is only function of the capability of damaged drip shields to divert water. If drip shields are not damaged, it is assumed in the TPA code that waste forms cannot be released (e.g., a fraction of the waste packages are assumed initially defective in the nominal scenario; however, radionuclide releases can be activated only after the drip shield is damaged by mechanical or corrosion processes). Since a single value of $P_{contact}$ is used in a realization, proposed values for $P_{contact}$ should reasonably account for temporal phenomena affecting the probability of water to contact waste packages. Because it is difficult for a damaged drip shield to prevent water to contact waste packages throughout time, in the nominal case, high values of $P_{contact}$ are considered for all waste package classes but localized corrosion.

For waste packages in the localized corrosion class, the interpretation of $P_{contact}$ is different. In addition to accounting for the potential capability of damaged drip shields to divert water, the factor $P_{contact}$ is also used to recognize the existence of additional requirements for waste packages to exhibit localized corrosion. In Chapter 8 it is discussed that localized corrosion is assumed to initiate if the corrosion potential exceeds a critical potential —potentials computed as function of compositions of in-drift waters and the waste package temperature. For Alloy 22, localized corrosion is in the form of crevice corrosion. In order for crevice corrosion to initiate, it is necessary the presence of tight crevices and water of enough ionic strength to support electrochemical processes. If either of these requirements is not available, localized corrosion does not initiate. Recent experiments suggest varying degrees of susceptibility to localized corrosion depending on crevice quality (He and Dunn, 2007). In other words, crevice corrosion initiation and propagation requires the presence of "good enough" crevices. Susceptibility to localized corrosion is also a function of metallurgical state. For example, welded areas on the waste package are more susceptible than mill-annealed parts (Pensado et al., 2006; Dunn et al., 2005). Values proposed for $P_{contact}$ should account for the likelihood for crevice formation on welded areas (a small percent of the waste package surface) versus other waste package outer shell regions.

In summary, in the initially defective, mechanical, faulting, igneous, and general corrosion waste package classes, only a fraction $P_{contact}$ of the total number of <u>breached</u> waste packages may contribute to release (i.e., breached waste packages could exist that never leach radionuclides). On

the other hand, in the localized corrosion class, if additional requirements for localized corrosion are not fulfilled, then localized corrosion cannot initiate. The scale factor $P_{contact}$ is used to define the number of waste packages exhibiting localized corrosion. The $P_{contact}$ factor is specified in the input file *tpa.inp* as follows

Probability_WPWaterContact_InitialDefects — initially defective waste package class

Probability_WPWaterContact_MechFail — mechanical class

Probability_WPWaterContact_LC — localized corrosion class

Probability_WPWaterContact_GC-Flt-Ig — general corrosion, faulting, and igneous

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