fluids introduced to the characterization borehole.

Test packages will have a function that is unique to geologic disposal applications: containment with external pressure and corrosion at down-hole conditions (pressure, temperature, salinity). Staging of shielded casks over a borehole is a new requirement, especially if heavy shielding is used. Lowering of waste packages presents challenges in controlling pressure surge in the borehole and in predicting package behavior in the event of a drop.

Postclosure Performance of DBD

The basis for waste isolation performance in deep boreholes was summarized by Brady et al. [12]: "...physical transport of radionuclides away from HLW and SNF at multi-kilometer depths would be limited by: low water content, low porosity and low permeability of crystalline basement rock, high overburden pressures that contribute to the sealing of transport pathways; and the presence of convectively stable saline fluids." Crystalline rock has low intact porosity and low matrix permeability, because previous metamorphic or igneous processes have determined the rock fabric. Hydraulic permeability is dominated by fractures that form due to injection or tectonics, but which are at least partially closed by *in situ* stresses acting at depth. The presence of ancient saline groundwater is evidence for static hydrology over geologic time, and it resists convective circulation that might be caused by changes in the hydraulic head gradient (vertical or lateral), surface loading, or localized heating. Such stable conditions have been represented in idealized, generic (non-site-specific) projections of waste isolation performance [16, 17]. More advanced mechanistic studies of potential perturbations are under way, supported by systematic development and screening of features, events, and processes (FEPs) specific to borehole disposal [12]. Some of these processes are discussed further below.

Thermally driven convective circulation is included in thermal-hydrology simulations [18], which show that the magnitude and duration are likely to be insignificant. Thermal convection is sensitive to changes in permeability, but only if assigned much greater values of permeability than are expected to be present along potential transport pathways. Permeability is an important parameter to be investigated by the DBFT characterization borehole.

Corrosion of metals, cement, and other engineered materials is potentially significant during disposal operations (e.g., the first few years) when it is important that packages provide containment and that disposal zone geometry is preserved. However, after permanent closure (i.e., after sealing and plugging of a disposal borehole) such containment may not be as important, and it is not included in current predictive models of waste isolation performance. The disposal zone will eventually be filled with corrosion products (e.g., magnetite) and residues from degradation of cements and waste forms. Consolidation of this mixture may occur to the extent that any significant voids remain. Long-term degradation behavior of engineered materials in the disposal zone, and other sealing and plugging materials, is being addressed by laboratory studies associated with the DBFT.

Corrosion of metals in water at reducing conditions in the disposal zone will produce hydrogen [3]. Some H_2 will dissolve in water at *in situ* pressure, but mass balance arguments show that the total H_2 production will exceed solubility in the borehole, and that the rate of production might exceed the rate that H_2 can diffuse away from the borehole (see [19]). Expulsion of contaminated fluid into the overburden has been proposed as the endpoint for an H_2-generation scenario [3]. However, this may essentially be a material selection problem, and there are slowly corroding materials available (e.g., stainless steel casing). Also, experience with oil and