From: Chandrika Manepally
Sent: Wednesday, August 29, 2007 12:48 PM
To: Randall Fedors
Subject: RE: Action: Drift degradation Appendix 7 questions

Randy
I need your help in rewriting Item#1 (the general feedback I got that it was a very minor issue unless we can quantify that the seepage for a degraded drift was significantly greater than intact case). So, should we include it?

I looked at the supplemental point and talked to Bob about it. He said it will not matter (based on his experimental and numerical models). Having a higher value for alpha will only delay the breakthrough (not very significant) in this case. But eventually the water will make it through.

About Q#4, I remember Ernie Hardin stating that they don't have any diversions in flow paths in rubble in TSPA (MSTHM App 7 meeting).

-Chandrika

-----Original Message-----
From: Randall Fedors [mailto:RWF@nrc.gov]
Sent: Tuesday, August 28, 2007 3:14 PM
To: Chandrika Manepally
Subject: Re: Action: Drift degradation Appendix 7 questions

1. Consider supplemental point for question 1: Basis for using capillary strength of 100 Pa for rubble, thus getting some (unknown) amount of capillary diversion around an irregularly shaped and rough-surfaced ceiling for a degraded drift. See the Drift-Scale Coupled Processes (DST abnd TH) Models, Rev 01, page 5-3, assumption 6.
2. I agree, rock bolts aren't an issue with a degraded drift.
3. I'm still not sure about the delta approach. What more could we ask?
4. What does the water do when it enters the rubble in the DOE model abstraction?

--Randy

>>> Chandrika Manepally <cmanepally@cnwra.swri.edu> 08/28/2007 3:28 PM >>>
Randy
As I mentioned earlier today, we need to write-up our questions for DOE. I need to provide this to Luis tomorrow (just got to know about this deadline!).
I'm not sure if we should include Item #1.
Regarding Item #2, the issue of rock bolts is important only for the intact drift case. In case of a completely degraded drift, it should not matter as that portion of the rock is part of the rubble. So, is it relevant to bring this up during the Appendix 7?

I will work on Item#3 and send you a draft tomorrow.

-Chandrika

Effect of Drift Degradation on Seepage

1. Assumption of perfectly circular drifts for a degraded drift case
   The DOE seepage model for degraded drifts assumes perfectly circular but larger openings compared to the nondegraded drift seepage model (Bechtel SAIC Company LLC, 2004k). Given the potential shapes for degraded drifts discussed in Section 4.2.4.1, a circular opening for a degraded drift does not appear realistic. To support the use of a circular, but larger, degraded drift opening, DOE presented results in Bechtel SAIC Company, LLC (2004l) from another model that showed seepage for noncircular openings was, on average, the same as for the original circular openings. In this second model, the drift radius remained constant, but the numerical mesh was modified to reflect chunks or blocks of fallen rock from the drift ceiling. The DOE model used stochastic realizations of fracture heterogeneity in the host rock. With blocks removed from the drift ceiling, many of the realizations led to smaller estimates of seepage for degraded drifts as compared to nondegraded drifts. On average, seepage was about the same for degraded and nondegraded drifts (Bechtel SAIC Company, LLC, 2004l). Theoretically, uneven topology of drift ceilings should lead to similar or more seepage as compared to smooth circular openings.

2. Rock bolts
   Staff may seek clarification during the license application review process regarding the effect of rock bolts on flow above the drift and on dripping from the drift wall (Kokajko, 2005). Rock bolts were modeled as open boreholes. Although the rock bolts will not be grouted, NRC believes they will directly contact the host rock. Therefore, the capillary barrier effect assumed for the rock bolt opening in the DOE rock bolt seepage model may lead to underestimates of seepage along rock bolts. Furthermore, the rock bolts will protrude from the drift wall and may serve as focal points for seepage water and condensate water dripping onto the engineered barrier system and invert. Under ambient conditions, enhanced seepage due to rock bolts would be less than during the thermally perturbed period (Kokajko, 2005). The rock bolts may serve as preferential flow pathways during this period. Water buildup in the reflux zone may preferentially flow down openings along rock bolts and drip onto the engineered barrier system and invert.

3. Effect of Degradation Rate and Timing on Multiscale Thermohydrological (TH) Model Results (In-drift TH conditions) and in TSPA Abstractions
   The Multi-scale Thermohydrological Models (MSTHM) model the degraded drift case as a Low-Probability-Seismic Collapsed-Drift Scenario. The low-probability-seismic scenario causes collapse of the drift opening, which is represented by a circular profile with a diameter of 11 m. The resulting host-rock rubble completely fills the modified drift opening, from the outer surface of the drip shield out to the modified "drift wall". This model does not account for the gradual accumulation of the rubble. The temperature difference ("deltas") are estimated as the differences between the thermal-hydrologic results for the case with drift collapse and those for the intact (nominal) case with no drift collapse. This "delta" is used to modify the temperatures (and other relevant parameters) in TSPA when a seismic event occurs. This approach does not link the degradation rate or timing to the evolution of in-drift TH conditions.
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