HLWYM HEmails

From: Chandrika Manepally
Sent: Wednesday, March 21, 2007 4:21 PM
To: wpatrick@swri.edu; goodluck.ofoegbu@swri.org; james.winterle@swri.org; chandrika.manepally@swri.org; Amitava Ghosh; Gary Walter; Budhi Sagar; David Ferrill; sitakanta.mohanty@swri.org; david.turner@swri.org; alan.morris@swri.org; kevin.smart@swri.org; danielle.wyrick@swri.org; libarra@cnwra.org; asadul.chowdhury@swri.org
Cc: Gordon Wittmeyer; Hakan Basagaoglu; Kaushik Das; 'Robert Lenhard'; Roman Kazban; Ronald Green
Subject: RE: Rubble Characterization Meeting Held on Monday, March 12, 2007 - Summary Attached.

All
I'd like to make some points from a UZ2 perspective.

As noted by Wes, we need to know the shape and size distribution of the rubble to provide basis for thermal and hydrological properties used in our models. Process – level and abstractions have indicated that these properties play a significant role in determining the temperature and RH conditions that control the chemical and corrosion processes (Manepally et al.(2005), Fedors et al. (2003, 2004)). Goodluck's recent work related to progressive spallation of the roof area of emplacement drifts (Abaqus model to examine if degradation is a self-arresting process) points to role of rubble as a heat capacitor that stores energy and releases it at a moderated rate thereby keeping DW temperature essentially unchanged for an extended period. This, in turn, affects the temperature gradients in the host rock that control the extent of thermal spalling. This indicates that we need to have a good basis for the thermal properties of the rubble. This should address the risk-significance question. Currently, the thermal properties used in our models are based on DOE's values for invert (crushed tuff), Ron Green's experiment based on middle non-lith sample and other sources available in the literature. Note that none of these sources directly provide adequate justification by itself. Our parameter ranges are based on an ensemble of these sources and staff expert judgment. So, any work that characterizes the rubble will help us in providing additional technical basis. The results of the proposed work could either support our current estimates or provide basis for revisions. The hydrological properties (porosity, permeability etc) that determine the flow in the rubble also are based on rubble characteristics. For flow, we are in general agreement, that it will be gravity-dominated with very little capillary diversion based on the current rubble conceptualization that %fines is very small. We will revisit this aspect if the proposed work indicates that %fines form a significant portion of the rubble.

Based on my discussions with NRC and Center staff, there seems to be no consensus regarding what the rubble (range of particle size distributions) looks like. I am aware that there are numerous approaches to conceptualizing the rubble, but we don't have a strong technical basis towards any particular approach or distribution(s). The first step in this regard is the field work by Danielle, Kevin et al. It is for the geologists and rock mechanics folks to determine the important inputs (fracture characteristics, thermal stresses, etc) that will determine the shape and size distribution(s). UZ2 staff will then use that information to determine the TH properties. We are downstream users of the shape and size distribution ranges. The important thing here is that we all need a common understanding/conceptualization of the rubble as it affects TH-Mechanical-Chemical-Corrosion processes.

During our 3/12 meeting, Sitakanta suggested that there were some approaches in literature that tie the particle size distribution to the dominant heat transfer processes that is used to calculate effective thermal properties. UZ2 staff will examine this approach and see if we can determine the sensitivity of particle size on the heat transfer processes. That should address the question of how good is good enough to some extent.

In regards to Wes point in #2, the proposed approach will use the field data i.e., fracture data and rubble sample collected to see if the numerical model is able to predict rubble characteristics. Before going to that step, we talked about (on 3/12) using a simple analytical approach by Amit to see if we can correlate fracture data to rubble. A step-by-step approach using the currently available tools and resources should give us additional insight about (i) adequacy of using simple models and (ii) the sensitivity of the input parameters that control rubble characteristics.

-Chandrika

-----Original Message-----
From: Wesley Patrick [mailto:wpatrick@swri.edu]
Sent: Tuesday, March 20, 2007 4:39 PM
To: goodluck.ofoegbu@swri.org; james.winterle@swri.org; chandrika.manepally@swri.org; 'Amitava Ghosh'; 'Gary Walter'; bsagar@cnwra.swri.edu; dferrill@cnwra.swri.edu; sitakanta.mohanty@swri.org; david.turner@swri.org; alan.morris@swri.org; kevin.smart@swri.org; danielle.wyrick@swri.org; goodluck.ofoegbu@swri.org; libarra@cnwra.org; asadul.chowdhury@swri.org
Cc: 'Gordon Wittmeyer'; 'Hakan Basagaoglu'; 'Kaushik Das'; 'Robert Lenhard'; 'Roman Kazban'; 'Ronald Green'
Subject: RE: Rubble Characterization Meeting Held on Monday, March 12, 2007 - Summary Attached.

All,

Risk significance aside, which Goodluck addressed, the fundamental questions Jim raised deal with uncertainty, spatial variability, and the degree of accuracy/precision needed in estimates of bulking factor, thermal conductivity, and the like. These were not addressed in responses to Jim yet. These are (or at least should be) the starting point in developing any "work plan," such as that mentioned in the summary Chandrika forwarded earlier today. Following are a few thoughts along these lines, aimed at stimulating broader thinking about the problem.

1. The literature is replete with relevant information, which can give at least a good sense and probably a reasonable bound on the uncertainty in pertinent parameters. Although Goodluck noted that he/they received some criticism about using literature information, it is a sound basis for starting. Depending on the ranges of properties from the literature, you may find that the conclusions are not materially affected. If that is true, then the variability is not a concern or, in our vernacular, it is not "risk significant." Conversely, if conclusions are materially affected, we can be confident in proceeding to (and defending) the next level of analysis because the variability is potentially significant and, therefore, needs to be better known.

2. A second point should also be made. In contrast to the availability of data from the literature on relevant bulking factors and other properties, the proposed approach is not well established. The suggest method would require using detailed fracture characterization data as input to a model that would then calculate degree of fracturing, rubble sizes, and shapes, etc. from which one would then make assumptions about packing densities and the like before intrinsic properties could be estimated. That is one long "trip" with lots of assumptions along the way. It would be a first- or at best second-case attempt using such a method for tuffs. Having done the work, there would be no confidence in it until/unless it is replicated, checked against real data (we're back to the literature here), and otherwise validated.

3. I strongly encourage all involved to take more pragmatic, engineering approaches in addressing these matters. These are regulatory, not dissertation topics.

Food for thought.

Wes.

Hearing Identifier: HLW_YuccaMountain_Hold_EX
Email Number: 389

Mail Envelope Properties (cmanepally@cnwra.swri.edu20070321162100)

Subject: RE: Rubble Characterization Meeting Held on Monday, March 12, 2007 - Summary Attached.
Sent Date: 3/21/2007 4:21:26 PM
Received Date: 3/21/2007 4:21:00 PM
From: Chandrika Manepally

Created By: cmanepally@cnwra.swri.edu

Recipients:
"Gordon Wittmeyer" <gwitt@cnwra.swri.edu>
Tracking Status: None
"Hakan Basagaoglu" <hbasagaoglu@cnwra.swri.edu>
Tracking Status: None
"Kaushik Das" <kdas@cnwra.swri.edu>
Tracking Status: None
"'Robert Lenhard'" <rlenhard@cnwra.swri.edu>
Tracking Status: None
"Roman Kazban" <rkazban@cnwra.swri.edu>
Tracking Status: None
"Ronald Green" <rgreen@cnwra.swri.edu>
Tracking Status: None
"wpatrick@swri.edu" <wpatrick@swri.edu>
Tracking Status: None
"goodluck.ofoegbu@swri.org" <goodluck.ofoegbu@swri.org>
Tracking Status: None
"james.winterle@swri.org" <james.winterle@swri.org>
Tracking Status: None
"chandrika.manepally@swri.org" <chandrika.manepally@swri.org>
Tracking Status: None
"Amitava Ghosh" <aghosh@cnwra.swri.edu>
Tracking Status: None
"Gary Walter" <gwalter@cnwra.swri.edu>
Tracking Status: None
"Budhi Sagar" <bsagar@cnwra.swri.edu>
Tracking Status: None
"David Ferrill" <dferrill@cnwra.swri.edu>
Tracking Status: None
"sitakanta.mohanty@swri.org" <sitakanta.mohanty@swri.org>
Tracking Status: None
"david.turner@swri.org" <david.turner@swri.org>
Tracking Status: None
"alan.morris@swri.org" <alan.morris@swri.org>
Tracking Status: None
"kevin.smart@swri.org" <kevin.smart@swri.org>
Tracking Status: None
"danielle.wyrick@swri.org" <danielle.wyrick@swri.org>
Tracking Status: None
"libarra@cnwra.org" <libarra@cnwra.org>
Tracking Status: None

"asadul.chowdhury@swri.org" <asadul.chowdhury@swri.org>
Tracking Status: None

Post Office:

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