HLWYM HEmails

From: Hakan Basagaoglu
Sent: Tuesday, September 11, 2007 7:47 PM
To: Jin-Ping Gwo; Jude Mcmurry; John Bradbury; Randall Fedors; Timothy McCartin; 'Chandrika Manepally'; 'Hakan Basagaoglu'; 'James R Winterle'; 'Paul Bertetti'; 'Scott L Painter'
Cc: 'Robert J Lenhard'
Subject: few notes on the matrix diffusion

I had a chance to chat with HH. Liu at the Appendix 7 about how differently they treat the matrix diffusion process in their TSPA and in their exploratory analyses in their most recent journal articles. Apparently, there are some major differences in the conceptualization of the matrix diffusion process in their TSPA and journal articles.

Briefly,

In their TSPA, they simulate the matrix diffusion process as a Fickian process using a molecular diffusion coefficient of RNs without considering any scaling effect. They do not consider the scaling effect in TSPA, because, at this point, they do not know how to address the scaling issue at the repository scale properly. They also believe that the current treatment of the matrix diffusion process in their TSPA is conservative (the RNS will less-likely diffuse into a matrix, but they will mostly remain in fractures if they use the molecular diffusion coefficient (after modifying it using the tortuosity) to simulate the matrix diffusion process, as opposed to any other scaling "corrections" on the molecular diffusion coefficient).

In their exploratory analyses, however, -as we discussed in the matrix diffusion workshop- they conceptualized -in a nutshell- that the overall matrix diffusion process is contributed by (a) diffusion of RNs from large fracture s to a supporting matrix; (b) flow and transport from large fracture s to smaller fractures, and (c) diffusion of RNs from smaller fractures to the supporting matrix. Based on their numerical results heterogeneity in the matrix properties as well as small scale fractures (loops around large fractures) contribute to the scaling effect of the matrix diffusion coefficient. This conceptualization and the others (the effect of dry fractures in matrix, multi-site diffusion process, etc.) have no direct connection with the matrix-diffusion conceptualization in their TSPA model. Apparently, they will not modify their TSPA based on their on-going exploratory analyses at anytime soon, although they strongly emphasize the importance of dry fractures, multi-site diffusion process, and scaling issue in their independent on-going research activities.

The connection between the matrix diffusion process in their TSPA and exploratory research works was a bit blurry –at least to me- at the matrix diffusion workshop. And, I believe it is a bit clear to me after the Appendix 7 meeting, and wanted to share them with you.

PS: I have completed a simple analysis (based on temporal moment analyses and risk parameters) on a serially connected fracture-matrix system with heterogeneous properties to look at the scaling effect of the matrix diffusion that Liu et al. (2007, JCH) recently published. My preliminary results indicate that their results can be true for some particular heterogeneous domains, but not necessarily true for all sorts of heterogeneous fracture-matrix domains. So, their discussion on the scaling issue of D in their most recent article seems to be not very convincing.

Hakan

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Sent Date: 9/11/2007 7:47:01 PM
Received Date: 9/11/2007 7:47:02 PM
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