BSC

Scientific Analysis Administrative Change Notice

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6. Approvals:

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7. Affected Pages	8. Description of Change:
6-18	Citation update (Correct DIRS as appropriate) Section 6.1.3.3 "Effects of Several Factors on Fracture-Porosity Estimation, Based on Gas-Tracer Testing Data", 1st paragraph of page 6-18, last line, change: *(BSC 2004 [DIRS 169854], p. 81, Table 7-10).* To ***(BSC 2004 [DIRS 169854], Section 6.2.1, Table 6-6).*** This error was identified in CR 5345 and is associated with TBV 6780.

Not enough data exist to evaluate the effect of cavities on porosity estimation in detail. However, appropriateness of the estimates can be partially demonstrated by comparing them with those from the other sites without cavities, which will be discussed later on. A discussion of cavity porosities and their estimates for geological units corresponding to the repository horizon is given in *Thermal Conductivity of the Potential Repository Horizon Model Report* (BSC 2004 [DIRS 169854], Section 6.2.1, Table 6-6).

While the dispersion process is not expected to significantly affect the average tracer travel time used to calculate fracture porosity (Equation 6-13), Moench (1989 [DIRS 101146], Figure 2) implies that considering dispersion may result in larger porosity estimates than those determined from Equation 6-13 (Wang 2003 [DIRS 161654], SN-LBNL-SCI-215-V1, p. 53). Therefore, ignoring dispersion may partially compensate for the effects of cavities.

The determination of fracture porosity depends on the tracer travel times. Diffusion of tracer into the matrix delays the breakthrough and causes overestimation of fracture porosity. The effects of matrix diffusion on fracture porosity estimation can be quantified by an analytical solution. Based on mass balance, radial tracer transport in a system (with matrix diffusion) like that shown in Figure 6-3 can be described by the following differential equation (Wang 2003 [DIRS 161654], SN-LBNL-SCI-215-V1, pp. 44 to 45):

$$\frac{\partial c}{\partial t} + \frac{q_{fw}}{\phi_f}\frac{\partial c}{\partial r_s} = \frac{A_{fm}\phi_m S_{mg} D_m}{\phi_f}\left.\frac{\partial c_m}{\partial x}\right|_{x=0} \qquad \text{(Eq. 6-14)}$$

with:

$$q_{fw} = \frac{Q}{2\pi r_w L} \qquad \text{(Eq. 6-15)}$$

$$r_s = \frac{1}{2}\frac{r_L{}^2 - r^2}{r_w} \qquad \text{(Eq. 6-16)}$$

and:

$$D_m = D_0 \tau \qquad \text{(Eq. 6-17)}$$

where c is the tracer concentration in fractures at a location with a distance r from the withdrawal borehole and at time t, r_w is the radius of withdrawal borehole, ϕ_f is fracture porosity (considering matrix diffusion), A_{fm} is the fracture-matrix interface area per unit volume of bulk rock, ϕ_m is the matrix porosity, S_{mg} is the gas saturation in the matrix, D_0 is the molecular-diffusion coefficient for gas in air, τ is the tortuosity factor, c_m is the tracer concentration in the matrix, and x is the distance from the fracture-matrix interface.

Equation 6-14 can be transformed, by defining the lumped parameters (i.e., A^0 and T^0) as Equations 6-18 and 6-19, into the same mathematic form as Equation 4 of Starr et al. (1985