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Text (Partial) of E-Mail to Tom Peake Regarding Capillary Pressure Models

Capillary pressure is a measure of the pressure difference between the non-wetting phase (gas in this case) and the wetting phase (brine), which varies with the saturations of the two phases. The capillary pressure model in BRAGFLO, Version 6.0, may be turned "on" or "off" for various materials in a BRAGFLO grid. The status of the key parameters for the BRAGFLO capillary pressure model in the "on" or "off" condition is summarized in the following table:

Table 1. Key parameters for BRAGFLO capillary pressure model

Capillary Pressure Model is Turned Off	The threshold capillary pressure[1], P_t, is 0, with PCT_A = 0, defined by input, and PCT_EXP = 0, defined by input CAP_MOD = 1, defined by input. PC_MAX is defined by input[2] but not used, and P0_MIN is defined by input[2] but not used.
Capillary Pressure Model is Turned On	The threshold capillary pressure, P_t, is nonzero; PCT_A and PCT_EXP are nonzero values, defined by input. A nonzero value for P_t results in a positive capillary pressure[3], P_c, which is a function of the time-dependent brine saturation. CAP_MOD = 2, defined by input. PC_MAX is defined by input[2] and is an upper bound on the capillary pressure; P0_MIN is defined by input[2] but not used.

Footnotes:

[1] The threshold capillary pressure, P_t, is defined by $P_t = (PCT\_A)k^{PCT\_EXP}$, where k is permeability and PCT_A and PCT_EXP are input parameters for each material. The values of PCT_A and PCT_EXP for the PA for the Compliance Recertification Application of 2009 (CRA-2009) and for the PABC-2009 (Clayton et al., 2010) are documented in Table PA-3 of Appendix PA of CRA-2009 (DOE, 2009).

[2] PC_MAX is equal to 10^8 Pascals for all materials but is only used when CAP_MOD = 2. P0_MIN is equal to 1.01325×10^5 Pascals for all materials but has never been used in a performance assessment.

[3] The equation for capillary pressure, P_c, depends on the model for relative permeability for a given material. The models and equations for relative permeability and capillary pressure are documented in Section PA-4.2.1 of Appendix PA of CRA-2009 (DOE, 2009). The relative permeability model is defined by the BRAGFLO input parameter RELP_MOD, whose values are documented in Table PA-4 of Appendix PA of CRA-2009 (DOE, 2009).

References

Clayton, D.J., Camphouse, R.C., Garner, J.W., Ismail, A.E., Kirchner, T.B., Kuhlman, K.L., and M.B. Nemer. 2010. Summary Report of the CRA-2009 Performance Assessment Baseline Calculation. Sandia National Laboratories, Carlsbad, New Mexico. ERMS 553039.

DOE (U.S. Department of Energy), 2009. Title 40 CFR 191 Parts B and C Compliance Recertification Application. DOE/WIPP-09-3424. Carlsbad Field Office, Carlsbad, New Mexico.

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