Title 40 CFR Part 191
Subparts B and C
Compliance Recertification Application 2019
for the
Waste Isolation Pilot Plant

Appendix TFIELD-2019
Hydrological Investigations

United States Department of Energy
Waste Isolation Pilot Plant

Carlsbad Field Office
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Compliance Recertification Application 2019
Appendix TFIELD-2019

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Acronyms and Abbreviations

AP	analysis plan
CRA	Compliance Recertification Application
DOE	U.S. Department of Energy
PA	performance assessment
PABC	Performance Assessment Baseline Calculation
SNL	Sandia National Laboratories
T	transmissivity
WIPP	Waste Isolation Pilot Plant

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TFIELD-1.0 Overview of the T-field Development, Calibration, and Mining Modification Process

Modeling the transport of dissolved radionuclides through the Culebra Dolomite Member of the Rustler Formation (hereafter referred to as the Culebra) is a component of the performance assessment (PA) performed for the U.S. Department of Energy (DOE) Waste Isolation Pilot Plant (WIPP) Compliance Recertification Application (CRA). Transport modeling in PA requires steady-state flow velocity output from the Culebra groundwater flow model. CRA-2014 Appendix TFIELD (U.S. DOE 2014) describes the process used to calibrate the transmissivity, anisotropy, recharge, and storativity parameter fields in the Culebra flow model to geologic and hydrologic observations in detail. This appendix provides a summary of that process. Calibrated model parameters are referred to broadly as "T-fields" (transmissivity fields), although more parameters than just transmissivity (T) were calibrated as part of the CRA-2009 Performance Assessment Baseline Calculation (PABC) model (Clayton et al. 2010). The radionuclide transport results computed for CRA-2009 PABC including the T-fields were used unchanged in CRA-2014 and CRA-2019, and a detailed description of the process is given in the CRA-2014 Appendix TFIELD.

T-fields were developed through a multi-step procedure using both geologic and hydrologic data with potential effect on Culebra T. Geologic data were correlated to point measurements of Culebra T at monitoring wells to produce a linear regression model. An indicator variography method for applying the linear regression model to predict Culebra T across the WIPP model was developed resulting in 1,000 stochastic base Culebra T-fields. The inverse modeling software PEST (Doherty 2000) was used to adjust parameter values to calibrate the T-fields. Each T-field was calibrated to both steady-state freshwater heads observed at 42 locations and transient drawdown due to 9 separate large-scale pumping tests. The final T-fields were chosen as the 100 calibrated fields that best matched observations after calibration. Modifications of the calibrated T-fields were performed to account for the effects of potash mining both within and outside the WIPP land withdrawal boundary. Potentially mining-affected areas were delineated, random transmissivity multipliers were applied to the transmissivity field in those areas, and particle tracks and travel times were computed (Kuhlman 2010).

The work described in Appendix TFIELD-2014 was performed under two Sandia National Laboratories (SNL) analysis plans (APs): AP-114 (Beauheim 2008) and AP-144 (Kuhlman 2009). AP-114 (Analysis Plan for Evaluation and Recalibration of Culebra Transmissivity Fields) dealt with the development and calibration of the T-fields, in addition to development of T-field acceptance criteria. AP-144 (Analysis Plan for the Calculation of Culebra Flow and Transport for CRA-2009 PABC) dealt with the modification of T-fields for the potential future effects of potash mining for use in the PA Culebra radionuclide transport calculations. The PA Culebra radionuclide transport calculations are not described in Appendix TFIELD, which focuses on the development and modification of the T-fields.

TFIELD-2.0 References

(*Indicates a reference that has not been previously submitted.)

Beauheim, R.L. 2008. Analysis Plan for Evaluation and Recalibration of Culebra Transmissivity Fields AP-114, Revision 1. Carlsbad, NM: Sandia National Laboratories. ERMS 548162.

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

Doherty, J. 2000. PEST Manual. Brisbane, Australia: Watermark Numerical Computing.

Kuhlman, K.L. 2009. AP-144 Analysis Plan for the Calculation of Culebra Flow and Transport for CRA-2009 PABC. Carlsbad, NM: Sandia National Laboratories. ERMS 551676.

Kuhlman, K.L. 2010. Analysis Report for the CRA-2009 PABC Culebra Flow and Transport Calculations (AP-144). Carlsbad, NM: Sandia National Laboratories. ERMS 552951.

U.S. Department of Energy (DOE). 2014. Title 40 CFR Part 191 Subparts B and C. Compliance Recertification Application 2014 for the Waste Isolation Pilot Plant Appendix TFIELD-2014 Transmissivity Fields. Carlsbad, NM: US Department of Energy Carlsbad Field Office. DOE/WIPP-2014-3503.*