Comparing Simulation with Field Data to Enhance Modelling Accuracy

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Background/Objectives. A remediation project is designed and engineered using information and data collected from a specific site. The available data do not always include all the necessary information to complete a simulation study. Therefore, assumptions about sub-surface data and relevant information are made. These data are used in an advanced finite difference time domain simulation model to determine remediation design parameters. The results of a simulation study can be greatly affected by the incomplete information from the client or poor assumptions based on a lack of data. The focus of this paper will assess and compare an electro-thermal simulation study, where limited site conditions were provided by the client, and the field data from a completed project. The simulated and field data will be analyzed, and the simulation model will be ran again using field data and operating conditions obtained during the project. The simulation results will be compared and analyzed against the field data. Discrepancies will provide a basis for calibrating the assumed input parameters to match actual field data.

Approach/Activities. A 3-D electro-thermal finite difference time domain simulation program was used in this study. The simulation study done for the design of an actual project is compared to its operational performance. Operating data consisting of input power to the electrodes, current, electrode resistance, water injection, vapour and liquid extraction, heat losses, and up-time where used to update the input parameters to the model. The injection rate and pressure of water injection into the electrodes was helpful in estimating the hydraulic conductivity of the soil. The electrical resistance of the electrodes was used to calculate the actual resistivity of the soil as a function of temperature. The assumptions used in the dataset for the initial study are updated with the new information. The results are compared and analyzed to quantity the temperature distribution of the soil and other performance metrics such as energy usage, heat losses, and operating efficiency.

Results/Lessons Learned. This project is unique in that a minimum dataset was available at the onset. As operations of the project ramped up it became immediately evident that the assumptions used in the model study were not providing a realistic estimate of performance. The updated calculations, based on calibrating the model with actual data, provided an impressive and consistent match to the temperature data measured in the field. The lessons learned are:

1. the quality of the output calculations is only as good as the input data,
2. there must be an emphasis on collecting accurate site-specific data, especially the electrical resistivity when an electro-thermal technology is used as the remediation process, and
3. it is always a good exercise to follow up an initial simulation study with a study calibrated with actual operating and temperature data.