7.3 **Numerical modeling of ExxonMobil’s Electrofrac™ field experiment at Colony Mine**

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ExxonMobil’s Electrofrac™ process is an energy-efficient method for converting oil shale to producible oil and gas. Electrofrac heats oil shale in situ by creating a hydraulic fracture in the rock and filling it with an electrically conductive material to form a resistive heating element. Kerogen in the oil shale converts to oil and gas that is produced conventionally. In 2009, ExxonMobil conducted a low-temperature field experiment at the Colony Mine in northwestern Colorado. The experiment verified that an electrically conductive fracture can be constructed in the field and operated at low temperatures for a period of several months. During the experiment, a great deal of temperature, voltage, electric current, and rock motion data were acquired. These data present a unique opportunity to develop and calibrate in situ oil shale modeling capabilities. In the present study, numerical models are used to analyze and interpret the thermal and electrical data collected during the field experiment. An electrical model was developed to predict the spatial distribution of heat generated on the fracture from electrical measurements and an interpreted spatial distribution of conductive material in the fracture. The electrical model can also be used to estimate voltage and current at locations were measurements were not taken. Independently, a thermal model was developed to derive the spatial distribution of heat generated on the fracture from temperature data in the surrounding rock. The model predicts temperature at locations not measured and is used to infer the thermal diffusivity of rocks adjacent to the fracture. History-matched thermal and electrical models are in excellent agreement with experimental results. The spatial distribution of heat generated on the fracture predicted by the electrical model is in accord with that derived from the thermal model. Both the models suggest that the spatial distribution of heat generated on the fracture showed little variation during the course of the experiment. The combination of electrical and thermal models provides a powerful tool for analyzing this low-temperature field experiment and for predicting behavior of future tests.