7.1 **Impact of geothermic well temperatures and residence time on the in-situ production of oil and hydrocarbon gases from Green River Formation oil shale**

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Oil and hydrocarbon gas production yields and ratios from Green River Formation oil shale using an in-situ thermal stimulation process depend on geothermic well temperatures and spacing. In this investigation, chemical reaction kinetics and stoichiometry for the thermal pyrolysis of a Type I kerogen were implemented in a new multiphase subsurface flow and transport simulator for modeling oil shale production processes. The developed simulator solves component mass and thermal energy conservation equations for a porous media system comprising two mobile phases: 1) non-aqueous phase liquid, and 2) gas; and two immobile phases: 1) host shale, and solid organics (e.g., kerogen, char, coke). The governing equation set is overspecified, yielding a primary-variable-switching-free solution scheme for handling phase appearances and disappearances. Phase equilibria are solved using fugacity based component equilibrium factors computed from the Peng-Robinson cubic equation of state using a modified Michelsen stability analysis and iterative scheme, involving five unknowns. A series of numerical simulations were conducted that investigated in-situ production, using geothermic well temperature ranges from 350° to 650°C, and geothermic well spacing ranges from 5 to 15 m. Numerically, geothermic wells were treated as thermal power sources with specified peak powers and upper temperature limits. Simulation results demonstrate that 1) increasing geothermic well density yields decreasing production time; 2) increasing geothermic well temperatures yield decreasing production times, but increasing hydrocarbon gas to oil ratios; 3) temperature limited geothermic wells require power reductions over time; 4) production volume is related to total energy for temperature controlled geothermic wells; and 5) char and coke formation occurs around geothermic wells via capillary draw and oil cracking. Principal assumptions included pressure equilibrium between matrix and fracture components, homogeneous induced fracturing, and four-component mobile fluids. Future modifications to the simulator are planned to include water, carbon dioxide and hydrogen components, anisotropic induced fracturing; and to improve geomechanical coupling and robustness of the phase equilibria algorithms.