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Model predictions for the Combustion Resources' Surface Oil Shale Process

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Combustion Resources, Inc. (CR) has developed a Clean Shale Oil Surface (C-SOS) process, described in two pending patents and in previous Oil Shale Symposium presentations. Characteristics of this process, which makes use of an innovative, patent-pending, indirect-fired rotary kiln to release oil from the shale, is described in a companion paper in this symposium. Under Department of Energy sponsorship, CR has constructed a 5 ton/day pilot plant to demonstrate this process. The process releases the oil from the shale and separates the oil into five residual, diesel and gasoline cuts. One hundred forty eight tons of oil shale ore have been acquired from the BLM White River Mine stockpile in eastern Utah, with the assistance of OSEC, Gage Geotech and BLM. The shale has been crushed to 3/8 inch and characterized. To support the pilot demonstration process development and testing, a two-component process model has been implemented. The first component describes the front (kiln) end of the process, as presented in the 28th Oil Shale Symposium. This component provides required input data, together with shale oil properties, to the back-end oil recovery and separation unit. The PRO II Process Code has been adapted for the second (oil recovery and separation) component. A process flow diagram illustrates the shale feed system, the kiln, the spent shale recovery unit, the steam generator and superheater, and the seven process vessels with pumps, heaters, compressors and product storage. The flow rates, pressures, and temperatures for fifty-seven streams are computed, with material and energy balances. A reference case has been defined based on earlier published detailed Green River Basin shale oil properties. A base case has also been defined for the oil shale from the White River Mine stockpile. Model computations have been compared with data from initial pilot plant tests. The value of process model predictions in guiding and interpreting pilot plant test data will be illustrated.