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THE APPLICATION OF NATURAL AND EXOTIC CHEMICAL TRACERS TO GEOTHERMAL INJECTION STUDIES, RAFT RIVER THERMAL AREA, IDAHO

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Tracer injection studies are frequently used to gain information on the hydrologic character of a geothermal reservoir. A series of injection tests conducted at the Raft River geothermal fields, located in south eastern Idaho, have provided new insight into the behavior of commonly used tracers at elevated temperatures and into the application of naturally occurring constituents as tracers in geothermal waters.

Two hydrologically and chemically distinct geothermal waters are found at Raft River. One is a moderately saline water (TDS up to 6700 ppm) present in the basin fill sediments and the other a dilute water (TDS < 2000 ppm) present in the fractured crystalline basement rocks. Both of these waters are sodium chloride in character, with measured temperatures up to 150°C.

During the tracer injection tests, saline water tapped by the deep geothermal well RRGE3 was injected into well RRGP5, which taps dilute thermal water. Enrichment of Na, Ca, Mg, Cl, SO_4, Sr and Li In RRGE3 water, relative to that of RRGP5, allows these elements to be used as tracers. In addition to these natural tracers, exotic tracers were also used, these include NaI, NaBr, $Na_2B_4O_7 \cdot 10H_2O$ (Borax), $MgCl_2$, and the organic dyes, fluoresceine and rhodamine B.

Chemical monitoring during the injection test included on site analysis of exotic tracers by wet chemical methods, continuous monitoring of organic dyes through the use of an on-line fluorometer, and, because of the distinctly different salinities of the two fluids involved, conductivity was also monitored continuously. NaI paired with a dye proved to be the most promising of the tracers used. Other tracers were deemed less favorable because of analytical difficulties and interactions with the reservoir rock.

Preliminary evaluation of the results indicates that monitoring of the tracer and major and minor element composition of the injected and backflowed solutions is needed to accurately determine the percent dilution of injected fluids by formation water and the effects of water-rock interactions. This information will utlimately prove useful in evaluating tracer responses and their relationship to the physical and hydrologic characteristics of the geothermal reservoir.