

PREDICTION AND PREVENTION OF SILICA SCALING AT LOW LEVELS OF OVERSATURATION: CASE STUDIES, AND CALCULATIONS FOR UENOTAI GEOTHERMAL FIELD, AKITA PREFECTURE, JAPAN

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ABSTRACT

Production system design studies often include site-specific silica scaling field experiments, conducted because the onset and rate of scaling are believed difficult to predict, particularly at relatively low levels of oversaturation such as may exist in separators, flowlines, and injection wells. However, observed scaling occurrences (Cerro Prieto, Dixie Valley, Svartsengi, Otake, Hatchobaru, Milos, experimental work) actually conform fairly well to existing theory and rate equations. It should be possible to predict low level scaling with sufficient confidence for production and injection system design and, in cases where oversaturation is allowed, to design systems with foresight to suppress or manage the scale, which develops. A promising suppression technology is fluid pH reduction by mixing with non-condensable gases and/or condensate. Calculations for injection lines at Uenotai geothermal field indicate molecular deposition at rates of 0.1 to 1 mm/yr, and some potential for particle deposition at points of turbulence, which can be suppressed by an order of magnitude with about 500 ppm CO₂. Further improvements of predictive technique will benefit from more uniformity in designing experiments, reporting results, and reporting measurements of scaling in actual production systems.

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