

CHEMICAL TRANSIENTS DURING PRODUCTION OF HIGH GAS WELLS AT THE NORTHERN GEYSERS STEAM FIELD, CALIFORNIA, USA

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ABSTRACT

Non-condensable gas and stable isotope data from the extreme northwest end of The Geysers steam field indicate that this part of the reservoir consists of a deeper zone, below about -8,000 feet msl, where gas concentrations are as high as 100,000 ppm-wt, and a shallower zone with steam containing 15,000 ppm-wt gases, generally conforming to stratification of the reservoir previously reported from a production area several miles to the east. Production wells may tap the shallow zone, the deep zone, or both, depending upon the positions of their production zones with respect to the interface. In addition to high gas content, the deeper zone is characterized by anomalously high temperatures, heavy isotopes of oxygen (and perhaps hydrogen) in the steam, and high total carbon in the gases. Shifts of gas composition during production can be interpreted in terms of dilution of steam in the shallow zone by boiling of reservoir liquid, and mixing between deep and shallow steam. Reservoir steam saturation after 1-1/2 years of production is calculated to be about 0.3 in the shallow zone, and about 0.9 in the deep zone. There is some problem with saturation calculations, which involve the concentration of hydrogen, which yields deep zone saturation values as high as 2.5, which is impossible. This is discussed in relation to the possible presence of "excess" hydrogen in the steam.

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