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GEOTHERMAL RESEARCH AT THE PUNA FACILITY

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SILICA CONTROL AND RECOVERY

Since the last progress report submitted, Dr. E.H. De Carlo has continued chemical analyses on the flocculated silica samples obtained during previous field experiments at HGP-A on both flashed and unflashed brines. Analyses were carried out to determine the composition of the recovered silica for specific constituents of the brine which seem to often be entrapped in the silica during the flocculation process. Metals added as flocculants to the brine were also analyzed in order to evaluate the ease or difficulty with which these can be removed from the precipitated silica under varying conditions. Conditions employed included simple distilled water and acid washing (HCl of varying concentration).

The results of the analyses indicate that the precipitated silica indeed incorporates a variety of other brine constituents besides silica, such as Na and to a lesser extend Ca, but that a large portion of these are readily removed from the silica by distilled water rinses. The elements added to the brine as flocculating agents however are not removed by water rinses and require the use of dilute acids. Use of 0.15 M HCl will leach out less than half of the iron added, however, 98% of the added iron can be removed when using 2 M HCl. The leaching data indicate that flocculants must be incorporated into the silica matrix, as they are not readily desorbed with simple water rinsing. Such an argument had been previously suggested by the author in a paper dealing with the flotation recovery of silica from the spent brine ponds recently submitted for publication to Separation Science and Technology. The chemical characteristics of the silica precipitated from unflashed fluids by flocculation with aluminum and iron salts are significantly unexpected as the fluid characteristics themselves are quite different. The most noticeable differences are in the Mg and Ca content of the precipitates from the two fluid types; silica generated from the flashed brine seems to contain less magnesium and more calcium than precipitates from the unflashed brine. Trace element analyses on the silica from the unflashed brine also indicate a significant level of scavenging of copper and lead from the original fluids. Enrichments of two to three orders of magnitude in the precipitates were observed for two samples precipitated by the addition of aluminum and iron (independently).

Presently we are expanding our leaching tests as those previously carried out only gave broad indications of the lability of the various constituents of the silica. The present experiments consist of leaching the silica with a much wider range of acid concentrations in order to pinpoint the minimum leaching needed to remove a given amount of the constituents of interest. Results of these tests will be forthcoming.

Drs. Don Thomas and Bob Taylor have carried further experiments dealing with the changes in fluid composition as a function of operating conditions at the HGP-A plant. Variables investigated included pressure and temperature. Brines collected were analyzed for major constituents which have been routinely monitored in the past. The data are being evaluated in order to help determine if changes in the fluid composition reflect difference production zones in the geothermal reservoir. Additionaly, observation of the fluid from the weir box has indicated that it may be a viable source of very small particle sized silica; further experiments to investigate this possiblity are currently underway.

A preliminary design is underway for a prototype heat exchanger and silica extraction device that will be used to determine scaling rates on heat exchanges using geothermal brine. This prototype will also be used to identify the most effective reagents that can be used to alleviate scaling. This small-scale prototype could be completed by June 30, 1986, if funds are available for construction.

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