***An In Situ Process for Sorption and Stripping of REEs From a Simulated Geothermal Brine***

The purpose of this document is to describe a process to load a sorptive media with REEs from a simulated geothermal brine, strip the REEs from the loaded media and regenerate the media to be ready for another load cycle. The individual operations that were developed through this project stand alone as Unit Operations and are interdependent. The four operations are:

* Sorption Column Initiation – Media and column preparation for initial startup
* LOAD - REE sorption onto Media
* STRIP - REE recovery from Media
* REGENERATION – Prepare Media/Column to repeat the Load cycle

The process is simply described in the following outline.

* The geothermal process water or brine that originally flows directly to the re-injection point after energy extraction is diverted to the REE extraction unit.
* At the extraction unit the brine is put across a column containing a packed bed of sorptive media, the LOAD step.
* This flow is maintained until real time online effluent chemical analysis indicates that the media is fully loaded.
* The brine flow is transferred to a second identical packed column, the new LOAD column, and the first LOAD column is taken offline.
* The offline LOAD column, becomes the STRIP column.
* The STRIP column is washed with acidic water until all available REEs are removed, producing the product stream.
* The product stream is removed and stored in clean tanks. It is reused several times to build higher REE concentrations until it is ultimately removed from the site for sale or further processing at another site.
* The STRIP column becomes the REGENERATION column.
* Caustic water containing fresh ligand is pumped through the REGENERATION column until a target pH is reached and lost ligand is restored to the media.
* When completed the REGENERATION column becomes a new LOAD column.
* At the extraction unit, brine is put across a new LOAD column and the process is repeated.

Once the column is initially loaded with media and equilibrated as the REE Extraction Unit, it is ready for the repetitive Load/Strip/Regenerate cycle. Conceptually and supported by experimental data, once a column is brought online it can be reused many times. A slow loss of ligand, the active component in the media for REE sorption, occurs. After a series of experimental investigations it was determined that this slow “bleed” of ligand could create an unexpected waste stream, would reduce the cycle life of the media, increase the costs of the process and create a degree of uncertainty.