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Project Summary

Geothermal Environmental Assessment Baseline Study: Vegetation and Soils of the Roosevelt Hot Springs Geothermal Resource Area

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Identification and elemental concentrations of indigenous soil and plant systems found on the Roosevelt Hot Springs Known Geothermal Resource Area (KGRA) are described. Twenty-three different soils and five separate plant communities are geographically mapped and identified. Of 147 plant species identified, 58 are forbs; 53, shrubs; and 36, grasses.

Three sites, each measuring 25 hectares, were selected for long-term vegetative assessment. A permanent enclosure measuring 24.4 by 24.4 meters was constructed at each of these sites to assess undisturbed vegetation *versus* long-term effects of livestock grazing and geothermal development. Biomass, plant species, percentage composition, ground cover, and livestock-carrying capacities were determined at each site.

Surface soils and *Artemisia tridentata* leaf tissue were collected for elemental analysis. Elemental concentrations were found to be similar in distribution and magnitude to those found in soils and plants of similar areas.

Lithium, due to its low environmental levels, 1.1 ± 0.3 ppm and 2.0 ± 1.8 ppm in soil and plant tissues, respectively, when compared to the relatively high concentration in the geothermal fluid, 25.3 ppm, was identified as the key element for the detection of geothermal contamination.

This Project Summary was developed by EPA's Environmental Monitoring Systems Laboratory, Las Vegas, NV, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).

Introduction

Exploration and development of geothermal resources has expanded rapidly in recent years. A number of locations under consideration or in various stages of development include the Imperial Valley, Klamath Falls, Rio Grand Rift Zone, and a relatively new site, Roosevelt Hot Springs. These areas are also important as farming and recreational sites, wildlife habitats, and livestock rangeland. Since geothermal energy may supply a significant portion of our nation's future energy needs, it is important that an evaluation of the environmental impact of geothermal development on these lands be made.

In December 1975, Roosevelt Hot Springs was recognized as a potential

KGRA when the Phillips Petroleum Company filed a plan of operation for geothermal exploration with the U.S. Geological Survey (USGS). As a result, in 1976 the USGS prepared and distributed an Environmental Analysis (EA) statement concerning the proposed Roosevelt Hot Springs geothermal operations, as is required by the U.S. Geothermal Steam Act of 1970 and by Section 102 (2) (C) of the National Environmental Policy Act of 1969

In addition to the parameters listed in the EA, the Geothermal Steam Act of 1970 (Title 30 CFR 270.34K) requires that existing environmental baseline data be collected on air and water quality, noise, and land subsidence activities and that both biological and ecological parameters be identified on the leased lands.

Collection of baseline data was initiated by the Phillips Petroleum Company and the U.S. Environmental Protection Agency. In addition, the EPA's Environmental Monitoring Systems Laboratory in Las Vegas (EMSL—LV) developed a monitoring strategy and also conducted laboratory studies to identify the behavior and movement of selected geothermal brine contaminants in plants and soils: Identification of potential biological indicators of geothermal contamination and the establishment of permanent ecological assessment study areas at three undisturbed sites on the Roosevelt Hot Springs KGRA were accomplished.

Results from the field and laboratory studies will be used to provide a data base for a kinetic model and a pollutant exposure commitment analysis for the development of an integrated monitoring system at the Roosevelt Hot Springs KGRA.

Descriptions and elemental concentrations of the soils and vegetation and the assessment of these lands for grazing and wildlife habitats are presented in this report.

Conclusions and Recommendations

The results of this investigation have identified and geographically defined a wide diversity of soil types and plant communities found on the Roosevelt Hot Springs KGRA. Its proximity to the northern transition zone of the major southwest deserts may account for this KGRA exhibiting characteristics of both the hot desert formations to the south and the cold desert formations to the north

The dominant plant species, occurring in nearly every plant community on the KGRA, was big sagebrush, *Artemisia tridentata*. This species, common throughout the northwestern United States, accounted for more than 44 percent of the total vegetative composition. Other important species included rabbitbrush (*Chrysothamnus stenophyllus*), pinyon pine (*Pinus edulis*), juniper (*Juniperus osteosperma*), and the grasses, cheatgrass (*Bromus tectorum*) and squirreltail (*Sitanion hystrix*).

The concentrations of 26 elements found in 289 soil and plant samples will serve as baseline levels for assessing changes associated with the development of geothermal resources at the Roosevelt Hot Springs KGRA. In addition, trend studies on vegetative composition and condition can be conducted within the three permanent enclosures free from disturbance and grazing by livestock. At present, the vegetative composition in these enclosures consists primarily of sagebrush, *A. tridentata* (68 percent), seven species of grasses (24 percent), and forbs (nearly 2 percent).

The above-ground vegetation or biomass, as determined at each study site, varied from 3032 to 5222 kg/ha in 1977 and from 5224 to 5883 kg/ha in 1978. These measurements provide the bases for assessing vegetative change associated with geothermal resource development.

The authors propose that periodic sampling of soils and vegetation be conducted in this area to verify pollutant containment as geothermal exploration and development continue, with lithium being the key element for detecting geothermal leakage.

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The complete report, entitled "Geothermal Environmental Assessment Baseline Study: Vegetation and Soils of the Roosevelt Hot Springs Geothermal Resource Area," (Order No. PB 81-223 299; Cost: $11.00, subject to change) will be available only from:

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