STATUS REPORT ON GEOTHERMAL DEVELOPMENT IN THE VALLES CALDERA, NEW MEXICO

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INTRODUCTION

The Valles Caldera is a prominent geological structure located in North Central New Mexico in the Jemez Mountains about 55 miles north of Albuquerque and 40 miles northwest of Santa Fe. Interest in the geothermal potential of the Valles Caldera began accelerating in the 1960s with the drilling of several exploratory wells in the Sulphur Creek and Redondo Creek areas in the caldera. In the early 1970s, drilling activity concentrated in the Redondo Creek area, and at the current time a total of 14 wells has been drilled in this area (Fig. 1).

The geological characteristics of the Valles Caldera geothermal system were recently summarized by Dondanville (1978), while a more detailed description of the hydrothermal system has been presented by the Union Oil Company (1978). The caldera is a subcircular volcanic collapse feature 12 to 15 miles in diameter, with its walls rising from a few hundred to more than 2,000 feet above the floor. A central resurgent structural dome, Redondo Peak, lies near the center of the caldera, has a relief of nearly 3,000 feet, and is bisected by a northeasterly-trending central graben. The Redondo Creek Development Area straddles this graben structure, and is where initial geothermal development in the Valles Caldera is planned.

The bulk of fluid production in the hydrothermal system penetrated to date is found to occur from fractures in the pumiceous basal part (1,000 ft) of the Bandelier Tuff. This unit is up to 6,300 feet thick in the Redondo Creek Area. The upper portion of the tuff is densely welded and forms the caprock of the hot water reservoir. Reserves of hydrothermal fluids are also thought to exist in rocks underlying the Bandelier Tuff.

The hydrothermal fluid encountered in the reservoir underlying Redondo Creek is a high temperature, low salinity water. The reservoir pressure at 3,000 ft ASL ($\pm$ 6,000 ft below ground level) is about 1700 psi. Thus the reservoir is underpressured and does not appear to be in communication with surface waters in Redondo Creek. Fluid temperatures in excess of 500°F are commonly encountered at the base of the tuff. The

maximum recorded temperature in the field is slightly more than 600°F. Total dissolved solids values of 6,000 ppm are typical, and the average noncondensible gas content of the flashed steam is approximately 3% by weight, corresponding to a flash of 30%.

INITIAL DEVELOPMENT PLANS

A 50 MW generating facility is planned for the initial development phase of the Redondo Creek Area. It is anticipated that about 13 additional wells will probably have to be drilled to supply this plant. This will most likely result in a total of 17 producing wells and 4 injection wells (subcommercial wells will be used for pressure observation). These numbers are based on an average total mass flowrate per well of 200,000 lbm/hr, with a 35% flash at 125 psia separator pressure.

Hot water reserves in the Redondo Creek Area have been estimated to be a minimum of 2.5×10^6 acre-ft. This is enough of a resource to produce 400 MW_e for 30 years, based only on the heat in the water. Careful reservoir management could conceivably recover even more heat from the reservoir rock, with an ultimate potential energy recovery of three times that in the water alone. These reserves figures are based on the analysis of a 6-month fieldwide interference test carried out during 1976. During the 6-month period geothermal fluid was produced from three wells, and then injected into three other wells, while four static wells were monitored for pressure interference.

The electrical power generating system will be constructed and operated by Public Service Company of New Mexico. It will consist of a single-stage turbine with a tube and shell condenser and forced draft cooling towers. The fluid production system will be constructed and operated by the Union Geothermal Company of New Mexico. Geothermal well effluent will be gathered at various satellite separator stations, from which separate vapor and liquid lines will transport the fluid to the power plant.

Unflashed well effluent and cooling tower blowdown will then be distributed to injection wells through a separate water injection system. This system will allow for flexibility in controlling where injected water is placed in the reservoir. Thus, if pressure interference or tracer monitoring studies indicate channelling of injected water in some part of the field, the control of its deleterious effects will be managed by altering water injection patterns.

GEOTHERMAL DEMONSTRATION POWER PLANT

This initial development of the Valles Caldera geothermal resource was selected by the Department of Energy (DOE) as a Geothermal Demonstration Power Plant project. Under this arrangement DOE will contribute to initial funding of the project. This will allow for a better definition of the economic and technical uncertainties involved in the development of this high temperature, low salinity reservoir, which is considered to be typical of hard rock geothermal resources in the western U.S.

Extensive monitoring of all phases of the operation will be carried out in order that other utilities and operators may learn from the experience gained here. Monitoring will include aspects relating to: economics; reservoir behavior; fluid chemistry and scaling tendencies; fluid production systems; electrical generating systems; metallurgy; institutional; and environmental matters. Technical reports on all of these topics will be issued on a regular basis and distributed to all interested parties (Maddox and Wilbur, 1979).

The current plans call for completion of the first 50 MW unit during 1982. Further development will depend on the improved definition of power generation economics, and nature of the reservoir which is gained by this initial phase.

REFERENCES

Dondanville, R.F.: "Geologic Characteristics of the Valles Caldera Geothermal System, New Mexico," Geothermal Resources Council Trans. (July 1978), 2, Section 1, 157.

Maddox, J.D., and Wilbur, A.C.: "Baca Geothermal Demonstration Power Plant Data Gathering, Evaluation, and Dissemination," Geothermal Resources Council, Trans. (September 1979), 3, 405.

Union Oil Company of California and Public Service Company of New Mexico, Technical and Management Proposal (II) for Geothermal Demonstration Power Plant, submitted to the Department of Energy in response to Program Opportunity Notice EG-77-N-03-1717, 1/31/79.

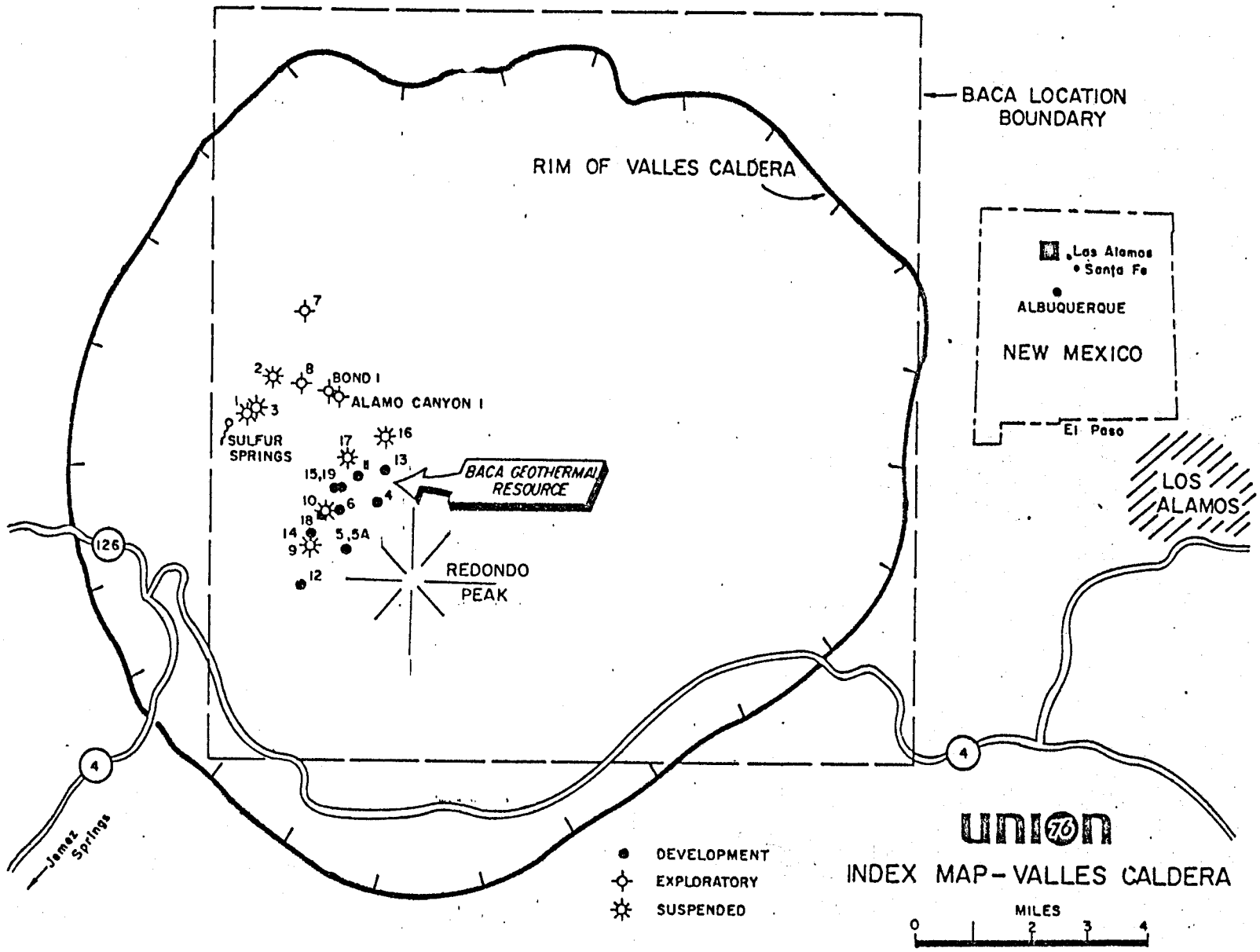
BACA LOCATION BOUNDARY
RIM OF VALLES CALDERA
Los Alamos
Santa Fe
ALBUQUERQUE
NEW MEXICO
El Paso
BOND I
ALAMO CANYON I
SULFUR SPRINGS
BACA GEOTHERMAL RESOURCE
REDONDO PEAK
LOS ALAMOS
126
4
Jemez Springs
DEVELOPMENT
EXPLORATORY
SUSPENDED
union 76
INDEX MAP - VALLES CALDERA
MILES
0 2 3 4

FIGURE 1