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Geothermal development and environmental protection procedures

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INTRODUCTION

National Goals

The critical nature of our national energy shortage has led to the establishment of a national goal of energy self-sufficiency. With this objective in mind, Congress passed the Geothermal Steam Act of 1970 in an effort to make public lands available for exploration and development of potential geothermal resources. Although the contribution from geothermal energy may represent a small percentage of the nation's total energy supply, it can locally be very significant.

Matching the great concern for the alleviation of the energy shortage is concern for preserving the quality of our environment. The National Environmental Policy Act (NEPA) of 1969 clearly brought into focus our national goal of environmental protection.

The purpose of this paper is to describe how NEPA is implemented in a Federal geothermal development program and to discuss major problems encountered in the process.

NEPA's Requirements

To implement the intent of NEPA, the Council on Environmental Quality (CEQ), established under NEPA, published guidelines for all Federal agencies. These guidelines require that Federal agencies develop

procedures for determining whether a proposed project or program is a major Federal action significantly affecting the quality of the human environment; if so, NEPA, Section 102(2)(C), requires preparation of an environmental impact statement (EIS). In order to make that determination, each agency requires preparation of an environmental analysis or environmental assessment for Federal action. For example, the Bureau of Land Management (BLM) prepares an environmental analysis record (EAR), the Forest Service (FS) prepares an environmental analysis report (EAR), and the U.S. Geological Survey (USGS) prepares an environmental analysis (EA).

Geothermal Development Constraints

Geothermal regulations are complex and include many general environmental protection requirements. To further implement the regulations, the Area Geothermal Supervisor (AGS) has issued geothermal resources operational (GRO) orders which detail the requirements for drilling and abandonment of wells, environmental protection, reporting, pipeline construction, royalty measurement, and so on. These regulations and orders, together with standard lease terms, cover a rather broad range of environmental protection requirements. The regulations further require that, before a lessee can begin any surface-disturbing activity, the lessee must submit a plan of operation (POO) for joint approval by the AGS and the surface management agency. The AGS also approves the Application for Permit to Drill (APD) for each well to ensure safe

drilling. Regulations, GRO orders, and standard lease terms apply to all leases, whereas the POO and APD are for a specific site to ensure an environmentally acceptable and safe operation.

Cooperative Procedures

Mineral leasing on Federal land has been administered by BLM and the USGS, both agencies in the Department of the Interior. BLM issues the lease and functions as a surface management agency; and, after a lease is issued, the USGS is responsible for lease supervision within the area of operation. The FS, in the Department of Agriculture, is the surface management agency responsible for FS lands. The BLM and the USGS have been working closely with another sister agency--the U.S. Fish and Wildlife Service (FWS)--for the purpose of protecting flora and fauna resources. The cooperative procedures for these three agencies were formally established in June 1976. A similar cooperative agreement involving FS is being developed.

In 1974, the Geothermal Environmental Advisory Panel (GEAP) was established by Secretarial Order No. 2962 of the Secretary of the Interior. The Panel's main function is to advise the AGS, the authorized officers of the BLM, or any other land-managing agencies, and to assist them in carrying out their responsibilities with respect to environmental impacts resulting from geothermal activities on Federal leases. Panel members consist of representatives from various bureaus within the Department of the Interior and appointees from several other Federal departments. The

Sierra Club, State and county agencies, and industries are also invited to participate as ex officio members of GEAP. Currently, the Panel has about thirteen members, each of whom is responsible for obtaining and contributing the views of his own agency or organization on the proposed plan of action.

PRELIMINARY ENVIRONMENTAL PROTECTION

Environmental Analysis Records (Reports)

Geothermal leasing is a Federal action. Prior to leasing, the surface management agencies (BLM, FS, and others who manage withdrawn lands) prepare an environmental analysis record or report (EAR) for the proposed area to be leased. The purpose of the EAR is (1) to determine whether or not the leasing of the area for geothermal development is a major Federal action requiring the preparation of a full-fledged environmental impact statement, and (2) to identify measures for mitigating environmental impacts.

Customarily, before preparing a geothermal EAR, BLM completes the unit resource analysis and the management framework plan (MFP). In the unit resource analysis, the BLM District Manager presents data on current land use and on potential capacity of the land to fulfill the public's needs with regard to the following resource activities: lands, minerals, recreation, wildlife, watershed, timber, and forage. For each activity, the basic sources of information include a base map, a physical profile, and resource data. Each resource activity is considered independently

at this stage in formulating resource management opportunities. The environment and socio-economics are described in an ecological profile and a socio-economic profile, respectively.

In the management framework plan, the BLM District Manager seeks to reconcile conflicts between objectives and limitations for each resource. The MFP is prepared in three steps. Step 1: The Manager compares the Bureau's resource management guidelines with technically feasible resource opportunities and determines the best plan for each resource. Step 2: The Manager identifies conflicts between resources, develops multiple-use solutions, and identifies any support needed, such as road construction, trail development, or added fire protection. Step 3: After weighing all the factors and after a period of public discussion and interagency coordination, the Manager decides whether to accept, modify, or reject each recommendation and whether or not an EIS will be required. Then, more detailed plans--livestock allotment management plan, wildlife habitat management plan, recreation management plan, timber management plan, and so forth--can be drawn up to show how they are to be developed in accordance with the MFP.

The FS planning is predicated on a land use policy which is determined by Congress through enabling legislation such as the Organic Act, the Multiple Use-Sustained Yield Act, and the Environmental Policy Act. Whenever possible, the FS prepares a land management plan before making any specific resource development plan.

According to the inherent capability of the land to produce resources and meet public needs, the FS allocates national forest land to production of resources in a way that will (1) protect soil productivity, (2) produce renewable resources on a sustained yield basis, and (3) least affect the environment.

Both the USGS and the FWS provide technical data to the surface management agencies to assist in their preparation and review of EAR's. The USGS provides information on geology, geothermal resources, geological hazards, hydrology, geothermal operation problems, and associated mitigating measures. The FWS provides technical information about fish, wildlife, vegetation, and associated mitigating measures.

Each agency has its own guidelines for preparing an EAR. Generally, they follow the CEQ guidelines for the preparation of an EIS. A typical EAR includes description of the proposed action (in this instance, geothermal leasing), existing environmental information, potential environmental impacts of the proposed action, discussion of mitigating measures, unavoidable adverse environmental effects or residual impacts, alternatives to the proposed action, and their short-term and long-term effects; and, further, it documents the public involvement. On the basis of the EAR, the BLM District Manager or the FS Forest Supervisor decides whether an EIS is necessary.

At the prelease stage, both the geothermal potential and the resource characteristics are usually poorly defined, even though the area may have been designated as a Known Geothermal Resource Area (KGRA)

by the USGS. Therefore, what a lessee will do on leased land is not well defined, although obviously the lessee will explore the resources and, if they are found to be promising, the lessee will develop them and produce energy for either electrical or nonelectrical uses. Because of the uncertainty of exactly what activity will take place on a lease, the environmental effect of those activities cannot be accurately predicted.

To cope with these unknowns, the surface management agency postulates a geothermal exploration and development model. This model describes the activities involved in a typical geothermal exploration, development, and production program and assumes that these activities may occur anywhere in the area. The agency then identifies all the environmentally sensitive areas within the study boundaries: areas with land instability or erosion hazards; endangered species habitats, sensitive wildlife habitats (such as winter migration routes and sage grouse strutting grounds), established recreational areas, historical sites, cultural resource areas, scenic areas, and so on. Assuming a possibility of maximum development, the agency examines the multiple-use feasibility within the context of the MFP or a land management plan. Where conflicts with geothermal development exist, the areas may either be excluded from leasing or be leased with special stipulations which restrict occupancy to certain locations or seasons or with other requirements to protect surface and esthetic resources.

Formulation of Special Lease Stipulation

A special lease stipulation is designed to protect a certain resource value associated with the lease. The need for a special lease stipulation can be ascertained by comparing the potential impacts identified in the EAR with the mitigating measures already provided. Consequently, no stipulations are needed if protective measures are already provided in Government regulations, GRO orders, and standard lease terms or if such measures are best provided after lease-granting when the lessee submits a plan of operation (POO) and an Application for Permit to Drill.

The surface resource must be adequately protected. At the same time, the lessee should be allowed to explore, extract, and utilize the geothermal resources and protect them from drainage of the resource. A particularly difficult problem in adequately protecting surface resources is establishing an appropriate buffer zone. Because of lack of scientific data, many of the buffer zone specifications are subjective. Whenever a "no surface occupancy" stipulation is contemplated, the effect of such a restriction on the lease management must be carefully considered.

POST-LEASE ENVIRONMENTAL PROTECTION

As mentioned previously, a lessee is required by regulations to submit a site-specific POO prior to any surface-disturbing activities for joint approval by both the AGS and the surface management agency. In response to each POO, the USGS writes an environmental analysis (EA). After conducting the geophysical survey, a lessee normally proceeds sequentially

with the drilling of shallow temperature gradient holes, exploratory drilling, development and, ultimately, production. Conceivably then, a series of EA's will be prepared for a given lease.

Environmental Analyses

An environmental analysis (EA) may be considered as complementary to an EAR. Whereas the EAR examines the areawide effects and provides the first-level environmental protection, the EA identifies the site-specific environmental impacts and mitigating measures to provide the second-level environmental protection.

Site-specific impacts could be those either unforeseen in the EAR stage or anticipated at that time but thought to be more appropriately handled after leasing. Recognizing that some adverse environmental effects may be unavoidable when a POO is implemented, the EA seeks to prevent or minimize them. Processing the POO is as follows:

When a POO is received from a lessee or operator, the USGS and the surface management agency arrange to jointly inspect the proposed site. The USGS's Geothermal Office notifies interested parties of the time and location of the scheduled inspection and distributes copies of the POO. All the interested parties may submit their comments within a certain time (normally 2 weeks) after the inspection. Whenever the Panel (GEAP) decides to review an EA, any interested parties also have the opportunity of review. The Geothermal Office considers all the comments before a final EA is prepared and the determination is made as to whether an EIS should be written. However, for an unusual EA, the determination is made

by the appropriate Conservation Manager of the USGS. If no EIS is deemed necessary, copies of the final EA are distributed to interested parties who are on the EA distribution list, and the POO is then approved by the AGS and an authorized officer of the appropriate surface management agency. If an EIS is deemed necessary, this recommendation is referred to USGS headquarters for concurrence and preparation.

As a result of the review of the POO and the EA, the Area Geothermal Supervisor's (AGS) office may identify additional mitigating measures. These measures are special conditions recommended as conditions of approval of the plan or permit.

To obtain environmental advice from GEAP before approving such plans, the AGS submits exploration or development plans and the EA in any new geological or geographical areas to the GEAP chairman. The GEAP chairman then calls a public meeting at a location near the project site or at areas of particular environmental concern. The AGS considers all comments before completing the EA.

In order to streamline the process, the AGS prepares a detailed EA when the first deep exploratory drilling is proposed on a lease (or unit). Environmental baseline information of the entire lease (or unit) is gathered for that EA and may be used again in the preparation of subsequent EA's.

Field Inspection of Operation and Monitoring

Subsequent to the approval of a POO, the AGS monitors field operations to ensure compliance with approved plans, regulations, GRO orders, lease terms, special lease stipulations, and conditions of approval. The objectives are (1) to protect the natural environment and the health and safety of employees; (2) to prevent waste and maximize recovery of natural resources; (3) to ensure that leasehold production is properly measured, transported, and accounted for; and (4) to protect Federal and Indian lands from drainage or loss of reserves. Monitoring these operations is an extension of prelease EAR and post-lease EA, which obviously are interrelated.

The District Supervisor is the AGS's designated field representative and is responsible for inspection of all field operations. The District Supervisor makes detailed and random inspections of approved activities at the frequency prescribed in GRO orders and as required in a specific circumstance. Detailed inspections include at least the following:

1. Compliance inspections of geophysical survey activities, including the drilling of shallow temperature gradient holes.
2. Exploratory drilling and development inspections. These may involve inspections related to: site construction, blowout prevention equipment tests, cementing and casing tests, short-term production tests, long-term production tests, pipeline tests, metering tests, plugging and abandonment, site restoration, and pollution incidents and accidents.

3. Regular annual lease inspection. Results of these inspections are recorded and filed with the lease records in the AGS's office. For a minor violation or incident of noncompliance by the lessee, the District Supervisor notifies the lessee of matters needing prompt correction. For a major event, however, the AGS may order a suspension of activity.

The AGS's office also investigates, analyzes, and reports on incidents of environmental pollution and accidents. The AGS's office prepares and issues an environmental or safety alert for any serious event which is likely to recur. An "alert" generally describes briefly the event of concern, its effects and causes, and preventive and corrective measures. Alerts are distributed to all geothermal operators in the nation.

MAJOR PROBLEMS

Several major problems have arisen in the implementation of the Geothermal Steam Act and NEPA. These problems have various possible solutions.

Problems Arising from Unknown Character of the Resource

Geothermal leases are issued before the resource has been proven. The designated KGRA simply has a relatively higher resource potential than areas not so designated, and there is not always a method to accurately predict the type (power or nonpower) of geothermal resources

in a given area, nor the intensity of future development, until exploratory wells are drilled and tested. This creates two major problems:

1. The chicken and the egg.

The paradox can be stated thus. The impacts of geothermal development cannot be fully evaluated in the prelease stage because no exploration has taken place. Those who oppose leasing before its effects are reasonably predictable argue that, in proving the resource through exploration, the lessee would have spent so much money that full-scale development could not logically be restrained. Yet, the tremendous costs of exploration make impractical the proposal that the Federal Government define the resource by means of prelease exploration. In the face of this, the surface management agency generally acts conservatively. Identified in the EAR are environmentally sensitive areas which then are either excluded from leasing or leased with stipulations.

2. Trade-offs.

In nearly all instances, the unknown geothermal resource is compared with other relatively well-known surface resources within the context of multiple-use consideration. Under such circumstances, the potential geothermal resources are seldom given equal consideration with other resources (for example, recreation). A fair judgment is possible only when all the values are presented on a comparable basis. The surface management agency can improve the situation by strengthening its own mineral expertise or by more intensively utilizing USGS expertise.

Cultural Resources and Endangered Species Clearance

Some of the most vexing problems about areas to be disturbed arise from the requirement for clearance regarding cultural resources and endangered species. Theoretically, surface management agencies are responsible for a complete inventory of both cultural resources and the endangered species of an area prior to the decision to issue the leases. Unfortunately, a complete inventory of these two subjects could take so much time, money, and personnel as to be prohibitive. To meet the intent of Section 18 of the lease terms, the BLM now stipulates that the archeological clearance shall be carried out by a qualified archeologist acceptable to the authorized officer. A similar approach might be used for endangered species clearance, or the FWS could assume responsibility.

Time Delay

Industries have expressed discontent with the time delay in processing and issuing the leases and permits. The delay in issuing the leases is attributable to (1) lack of funds and personnel available to prepare the EAR or EIS, (2) the agency's desire to complete an MFP or land management plan prior to the preparation of geothermal EAR's for relatively sensitive areas, and (3) necessary steps taken to coordinate with other agencies and to involve the general public. Major causes for the delay in issuing permits to perform work on a lease are: (1) Lack of personnel and the time required to coordinate with all the interested parties, (2) the time required to comment on the POO, and (3) the time required to review draft EA's. The

various steps in processing lease or permit applications are viewed as essential in carrying out the spirit of NEPA. Therefore, only a streamlining of procedures can shorten the time required. On the other hand, by recognizing the time lag, industries may incorporate it into their project schedules.

Discussion of Alternatives

The environmental matter of the geothermal development program is presented in a sequence of documents. A programmatic EIS was prepared for the whole geothermal leasing program and the proposed regulations. An EAR (or EIS) is prepared before each area is leased. Later, for each site-specific proposal within a lease, an EA is prepared before a plan of operation is approved. The question is whether alternative energy sources should even be discussed in the prelease EAR and in the post-lease EA. As the environmental assessments cover a range from the broad program to numerous site-specific proposals, alternative energy sources logically should be, and were, discussed in the programmatic EIS. In the prelease EAR, alternatives should consist of no leasing and leasing with various degrees of control; and, in the post-lease EA, alternatives should consist of no approval and conditional approval of the proposed P00.

EAR-EA Relationship

The prelease EAR is designed to address broad-scale environmental problems, whereas the post-lease EA considers site-specific effects and, therefore, complements the EAR. Problems that were not completely recognized and evaluated in the prelease EAR certainly can be considered the post-lease EA.
