GRO Order No. 4: General Environmental Protection Requirements

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
CONSERVATION DIVISION

GEOTHERMAL RESOURCES OPERATIONAL ORDER NO. 4

Effective August 1, 1975

GENERAL ENVIRONMENTAL PROTECTION REQUIREMENTS

This Order is established pursuant to the authority prescribed in 30 CFR 270.11 and in accordance with 30 CFR 270.2, 270.34(k), 270.37, 270.41, 270.42, 270.43, 270.44, and 270.76. Lessees shall comply with the provisions of this Order. All variances from the requirements specified in this Order shall be subject to approval pursuant to 30 CFR 270.48. References in this Order to approvals, determinations, or requirements are to those given or made by the Area Geothermal Supervisor (Supervisor) or his delegated representative.

All data submitted under this Order shall be available for inspection in accordance with the Freedom of Information Act of 1966 (P.L. 89-487), as amended in 1974 (P.L. 93-502), except information such as geological, geophysical, reservoir, trade secrets, and financial data and interpretations of such data, maps, and related files for which a lessee requests proprietary status; provided that such status is determined by the Supervisor to be warranted and is approved by appropriate officials of the Department of the Interior.

Protection of the environment includes the lessee's responsibility to: conduct exploration and development operations in a manner that provides maximum protection of the environment; rehabilitate disturbed lands; take all necessary precautions to protect the public health and safety; and conduct operations in accordance with the spirit and objectives of all applicable Federal environmental legislation and supporting executive orders.

Adverse environmental impacts from geothermal-related activity shall be prevented or mitigated through enforcement of applicable Federal, State, and local standards, and the application of existing technology. Inability to meet these environmental standards or continued violation of environmental standards due to operations of the lessee, after notification, may be construed as grounds for the Supervisor to order a suspension of operations.

The lessee shall be responsible for the monitoring of readily identifiable localized environmental impacts associated with specific activities that are under the control of the lessee. Monitoring of environmental impacts may be conducted by the use of aerial surveys, inspections, periodic samplings, continuous recordings, or by such other means or methods as required by the Supervisor. Due to the differing natural environmental conditions among geothermal areas, the extent and frequency of such monitoring activities will be determined by the Supervisor on an individual basis. In the event the Supervisor determines that the degree and adequacy of existing environmental protection regulations in certain areas are insufficient, the Supervisor may establish additional and more stringent requirements by the issuance of field orders or by modifying existing orders.

Lessees shall provide for acquisition of environmental baseline data as required in accordance with 30 CFR 270.34(k) for a period of one year prior to submission of a plan for production. Techniques and standards to be used by the lessee for meeting these requirements shall receive prior approval by the Supervisor.

1. Aesthetics. The lessee shall reduce visual impact, where feasible, by the careful selection of sites for operations and facilities on leased lands. The design and construction of facilities shall be conducted in a manner such that the facilities will blend into the natural environmental setting of the area by the appropriate use of landscaping, vegetation, compatible color schemes, and minimum profiles. Native plants or other compatible vegetation shall be used, where possible, for landscaping and revegetation.

2. Land Use and Reclamation. Operating plans shall be designed so that operations will result in the least disturbance of land, water, and vegetation. Existing roads shall be used where suitable. Entry upon certain environmentally fragile land areas, as designated by the surface management agency, may be either seasonally restricted or restricted to special vehicles or transportation methods which will minimize disturbance to the surface or other resources as specified by the Supervisor and surface management agency.

Operating plans shall provide for the reclamation and revegetation of all disturbed lands in a manner approved by the Supervisor and the appropriate surface management agency. Land

reclamation may include preparation and seeding with prescribed wildlife food and plant cover or improved and acceptable substitutes thereof which will equal or enhance the food values for indigenous wildlife species and domesticated animals. Temporary fencing for such reclaimed areas may be required to facilitate restoration thereof.

The lessee shall at all times maintain the leased lands in a safe and orderly condition and shall perform the operations in a workmanlike manner. The lessee shall remove or store all supplies, equipment, and scrap in a timely and orderly fashion.

Operations under a geothermal lease shall not unreasonably interfere with or endanger operations under any other lease, license, claim, permit, or other authorized use on the same lands.

3. Public Access. The public shall have free and unrestricted access to geothermal leased lands, excepting however, where restrictions are necessary to protect public health and safety or where such public access would unduly interfere with the lessee's operations or the security thereof. The lessee shall provide warning signs, fencing, flagmen, barricades, or other safety measures deemed necessary by the Supervisor to protect the public, wildlife, and livestock from hazardous geothermal or related activities.

4. Recreation. Recreational values shall be adequately protected through planning and designing of site development to minimize the aesthetic degradation of the particular recreation area. The lessee shall generally be restricted from surface locations for drilling and other lease operations within 61 metres (200 feet) of established recreation sites and access routes thereto. However, the lessee may relocate a recreational site and/or access routes thereto when approved by the Supervisor with the concurrence of the land management agency.

5. Slope Stability and Erosion Control. Operations shall be conducted in such a manner so as to minimize erosion and disturbance to natural drainage. The lessee shall provide adequate erosion and drainage control to prevent sediments from disturbed sites from entering water courses for soil and natural resource conservation protection.

Mitigating measures to lessen environmental damage may include reseeding of disturbed soils, chemical stabilization, and dust and erosion control on well sites, roads, and construction areas.

All operating plans shall give proper consideration to the potential hazards of slope instability. Where potentially unstable ground conditions exist, design of proposed roads, drill sites, and surface facilities shall be approved by and constructed under the supervision of a qualified engineer or engineering geologist satisfactory to the Supervisor.

6. Biota. The lessee shall conduct all operations in such a manner as to afford reasonable protection of fish, wildlife, and natural habitat. The lessee shall take such measures as are necessary for the conservation of endangered and threatened species of flora and fauna as set forth in applicable executive orders, regulations, and State or Federal legislation such as the Endangered Species Act of 1973 and the Fish and Wildlife Coordination Act. When such species would be adversely affected by the lessee's operations on the leased lands, the lessee shall implement those measures necessary to minimize or eliminate such adverse effects and to protect the flora and fauna as specified by the Supervisor in accordance with recommendations by appropriate Federal and State agencies. Such measures may be in addition to provisions set forth in the lease or accompanying stipulations.

The Supervisor may receive information from recognized experts that a delicate balance of flora and/or fauna exists in the area of operations or proposed operations. Upon receiving such notice, the Supervisor will request timely advice and assistance from appropriate Federal and State agencies regarding: (1) an assessment of the status of flora and fauna in the area which may be adversely affected by operations, and (2) advice as to reasonable mitigating measures appropriate to minimizing or preventing adverse trends in populations, growth, vegetative recovery, or repopulations in potentially affected flora and/or fauna. Based on timely receipt of advice from appropriate agencies, the Supervisor will direct the lessee to take appropriate measures to minimize significant adverse trends in flora and fauna. Such measures may include, but not be limited to, revegetation with grasses, shrubs, or other vegetation of high forage values desirable for habitat, replacement of fauna where lost, replacement of water supply, or sources where destroyed.

Where the lessee's operations have destroyed significant flora and/or fauna or their natural habitat and replacement by natural processes will not take place in a normal growth cycle, the lessee shall take reasonable measures to replace those species or their habitat with the same or other acceptable species or habitat as directed by the Supervisor. The Supervisor's requirements shall be based on recommendations and advice received from appropriate Federal and State agencies.

7. Cultural Resources Preservation. The lessee shall exercise due diligence in the conduct of his operations to protect and preserve significant archaeological, historical, cultural, paleontological, and unique geologic sites. The lessee shall not disturb any known cemetery or burial ground of any group or culture.

Previously unknown sites uncovered by the lessee shall be immediately reported to the Supervisor, and operations on the particular site shall cease until said site can be assessed for its archaeological value and preservation. Necessary controls and remedial actions for the protection and preservation of cultural resources shall be issued on an individual site basis by the Supervisor as warranted.

The preservation, restoration, maintenance, and nomination of all resources for purposes of the National Register of Historic Places shall be in accordance with the provisions of Executive Order 11593 (36 FR 8921) entitled, "Protection and Enhancement of the Cultural Environment," or any amendments thereto.

8. Subsidence and Seismicity. Surveying of the land surface prior to and during geothermal resources production will be required for determining any changes in elevation of the leased lands. Lessees shall make such resurveys as required by the Supervisor to ascertain if subsidence is occurring. Production data, pressures, reinjection rates, and volumes shall be accurately recorded and filed monthly with the Supervisor as provided in 30 CFR 270.37. In the event subsidence activity results from the production of geothermal resources, as determined by surveys by the lessee or a governmental body, the lessee shall take such mitigating actions as are required by the lease terms and by the Supervisor.

If subsidence is determined by the Supervisor to present a significant hazard to operations or adjoining land use, then the Supervisor may require remedial action including, but not limited to, reduced production rates, increased injection of waste or other fluids, or a suspension of production.

A. Surveys. All required surveys shall be second order or better and shall be conducted under the direct supervision of a registered civil engineer or licensed land surveyor using equipment acceptable by the National Ocean Survey for second order surveys. All such work shall be coordinated with the county surveyor of the county in which the surveys and bench marks are to be established. Level lines and networks shall be tied to available regional networks.

Adjusted survey data shall be filed with the Supervisor within 60 days after leveling is completed. Any

lessee having a commercially productive geothermal well or wells shall participate in cooperative County/State subsidence detection programs. All survey data filed with the Supervisor shall be available to the public.

B. Bench Marks. One or more wellsite bench marks shall be required at each completed well prior to prolonged production and said bench marks shall be located in a manner such that there is a minimal probability of destruction or damage to said bench marks. Wellsite bench marks shall be tied to existing regional networks. Additional bench marks between the wellsites and the regional network shall be at 0.8-km (one-half mile) intervals or as otherwise specified by the Supervisor. These bench marks shall be resurveyed during well production operations on a periodic basis as determined by the Supervisor.

Acceptable bench marks include, but are not limited to, a brass rod driven to refusal or 9 metres (about 30 feet) and fitted with an acceptable brass plate or a permanent structure with an installed acceptable brass plate.

C. Reservoir Data. Initial reservoir pressure and temperature shall be reported to the Supervisor in duplicate on Well Completion or Recompletion Report (Form 9-330C) for all completed wells within 30 days after the completion of measurements or tests conducted for the purpose of obtaining such data. Initial production test data including steamwater ratio, surface pressure and temperature, quality, and quantity of well effluent shall also be filed with the Supervisor on Form 9-330C within 30 days after a well is completed.

D. Seismicity. The installation of seismographs or other like instruments in producing geothermal areas for the purpose of detecting potential seismic activity may be initiated from time to time by appropriate public agencies. Lessees shall cooperate with the appropriate public agencies in this regard. The lessee and the appropriate public agency should take care not to unreasonably interfere with or endanger each other's respective operations. The Supervisor shall coordinate such detection programs between the appropriate public agency conducting the program and the lessee.

Where induced seismicity caused by the production of geothermal fluids is determined to exist by the Supervisor, then the Supervisor may require the lessee to install such monitoring devices as necessary to adequately quantify the effects thereof. If induced seismicity is determined to represent a significant hazard, the Supervisor may require remedial

actions including, but not limited to, reduced production rates, increased injection of waste or other fluids, or suspension of production.

9. Pollution, Waste Disposal, and Fire Prevention. The lessee shall comply with all applicable Federal and State standards with respect to the control of all forms of air, land, water, and noise pollution, including the control of erosion and the disposal of liquid, solid, and gaseous wastes. The Supervisor may, at his discretion, establish additional and more stringent standards. Plans for disposal of well effluents must be approved by the Supervisor before any implementation action is undertaken. Immediate corrective action shall be taken in all cases where pollution has occurred.

The lessee shall timely remove or dispose of all waste including human waste, trash, refuse, and extraction and processing waste generated in connection with the lessee's operations in a manner acceptable to the Supervisor.

The lessee shall provide safeguards to minimize potential accidental fires and shall instruct field personnel in fire-prevention methods. The lessee shall maintain fire-fighting equipment in working order at strategic locations on the leased lands.

A. Pollution Prevention. In the conduct of all geothermal operations, the lessee shall not contaminate any natural waters and shall minimize adverse effects on the environment.

(1) Liquid Disposal. Liquid well effluent or the liquid residue thereof containing substances, including heat, which may be harmful or injurious and cannot otherwise be disposed of in conformance with Federal, State, and regional standards, shall be injected into the geothermal resources zone or such other formation as is approved by the Supervisor.

Toxic drilling fluids shall be disposed of in a manner approved by the Supervisor and in conformance with applicable Federal, State, and regional standards.

(2) Solid Waste Disposal. Drill cuttings, sand, precipitates, and other solids shall be disposed of as directed by the Supervisor either on location or at other approved disposal sites. Containers for mud additives for chemicals and other solid waste materials shall be disposed of in a manner and place approved by the Supervisor.

(3) Air Quality. Noncondensible gases such as carbon dioxide, ammonia, and hydrogen sulfide may be vented or ejected into the atmosphere, provided, however, that the volume and the measured concentration of such vented gas or gases shall not exceed applicable Federal, State, or regional air pollution standards. Copies of each permit issued by the appropriate air pollution control agency and the reports required thereunder shall be submitted to the Supervisor.

(4) Pits and Sumps. Pits and sumps shall be lined with impervious material and purged of environmentally harmful chemicals and precipitates before backfilling. In no event shall the contents of a pit or sump be allowed to contaminate streams, lakes, and ground waters. Pits and sumps shall be constructed in a manner and in such locations so as to minimize damage to the natural environment and aesthetic values of the lease or adjacent property. When no longer used or useful, pits and sumps shall be backfilled and the premises restored to as near a natural state as reasonably possible. Temporary fencing of unattended pits and sumps to protect wildlife, livestock, and the public may be required by the Supervisor and the surface management agency.

(5) Production Facilities Maintenance. Production facilities shall be operated and maintained at all times in a manner necessary to prevent pollution. The lessee's field personnel shall be instructed in the proper maintenance and operations of production facilities for the prevention of pollution.

B. Inspection and Reports. Lessees shall comply with the following pollution inspection and reporting requirements.

(1) Pollution Inspections. Drilling and production facilities shall be inspected daily by the lessee. Appropriate preventative maintenance shall be performed as necessary to prevent failures and malfunctions which could lead to pollution. Wells and areas not under production shall be inspected by the lessee at intervals prescribed by the Supervisor. Necessary repairs or maintenance shall be made as required.

(2) Pollution Reports. All pollution incidents shall be reported orally within 18 hours to the appropriate Geothermal District Supervisor and shall be followed within 30 days thereof by a written report stating the cause and corrective action taken.

C. Injection. The use of any subsurface formation, including the geothermal resources zone for the disposal of well effluent, the residue thereof, or the injection of fluids

for other purposes such as subsidence prevention shall not be permitted until the lessee has submitted a plan of injection covering the proposed injection project and has subsequently received the Supervisor's written approval thereof.

(1) Plan of Injection. The plan of injection shall include the quantity, quality, and source of the proposed injection fluid; the means and method by which the fluid is to be injected; a structure map contoured on the intended injection zone; and cross-sections showing producing well locations and the proposed injection well location(s).

(2) Injection Report. The lessee shall file in duplicate with the Supervisor a Monthly Water Injection Report in a form approved by the Supervisor. The subject report shall be filed on or before the last day of the month following the month in which the injection took place.

(3) Inspection. Injection wells and facilities shall be inspected by the lessee at intervals as prescribed by the Supervisor to ascertain that all injected fluids are confined to the approved injection zone. A spinner survey, a radioactive tracer survey, and a cement bond log may be required on each injection well within 30 days after injection begins. The lessee shall furnish to the Supervisor two legible exact copies of any and all such surveys and logs. In the event of a casing failure, inadequate annular cement, or other mechanical failure, the lessee shall without unreasonable delay repair, suspend, or abandon the well. Where failure occurs in a zone which may damage surface or fresh water aquifers, injection shall immediately cease.

(4) New Wells. The drilling of new injection wells in accordance with an approved plan of injection shall be in conformance with the provisions of GRO Order No. 2. An Application for Permit to Drill, Form 9-331C, shall be filed in triplicate and approved for each injection well.

(5) Conversions. The conversion of an existing well to an injection well in accordance with or modification of an approved plan of injection shall be in conformance with the requirements of GRO Order No. 2. The lessee shall demonstrate to the satisfaction of the Supervisor by appropriate testing and logging that the well is mechanically sound and suitable for injection purposes. A Sundry Notice, Form 9-331, shall be filed in triplicate and approved for each conversion.

10. Water Quality. The primary responsibility for water quality and pollution control has been delegated to the States where such States have standards approved by the Environmental

Protection Agency. Such State standards must meet basic Federal requirements prohibiting the deterioration of waters whose existing quality is higher than established water quality standards. The lessee shall comply with the State water quality control organization's standards in such States as have federally-approved standards. The Supervisor, at his discretion, may establish additional and more stringent standards.

The lessee shall file, in duplicate, a detailed water analysis report for all completed geothermal wells within 30 days after completion and annually thereafter or as otherwise specified by the Supervisor. Unless otherwise prescribed by the Supervisor, such analyses shall include a determination of arsenic, boron, radioactive content, and radioactivity of the produced fluids. In the event that a health hazard exists, the Supervisor shall require appropriate health and safety precautions, periodic monitoring, or the suspension of production.

11. Noise Abatement. The lessee shall minimize noise during exploration, development, and production activities. The method and degree of noise abatement shall be as approved by the Supervisor.

The lessee shall conduct noise level measurements during exploration, development, and production operations to determine the potential objectionability to nearby residents as well as the potential health and safety danger due to noise emissions.

Noise level measurements and accompanying data shall be filed with the Supervisor. Such data shall provide the basis for operational and noise control decisions by the Supervisor and shall be based on an assessment of the noise relative to Federal or State criteria including adjustments for the area involved, meteorological conditions, and the time of day of the noise occurence.

The lessee shall comply with Federal occupational noise exposure levels applicable to geothermal activity under the Occupational Safety and Health Act of 1970 as set forth in 29 CFR 1910.95, which are incorporated herein by reference, or with State standards for protection of personnel where such State standards are more restrictive than Federal standards.

A. Measurement Condition. Outdoor noise measurements shall be made at least 3 metres (10 feet) from structures, facilities, or other sound reflecting sources and approximately 1 metre (3 feet) above ground level. Extreme weather conditions, electrical interference, and unusual background noise levels shall be avoided or given due consideration when measuring sound levels.

(4) Sound level meter controls shall be set for as uniform a frequency response as possible when measuring sound pressure levels.

(5) Octave band noise levels shall be reported in equivalent A-weighted levels.

G. Record of Sound Measurements. The Supervisor may require sound level measurements during drilling, testing, and producing operations. Such measurements shall be filed in duplicate with the Supervisor and shall include the following data:

(1) Date, time, and location.

(2) Name of observer.

(3) Description of primary noise source emitter under test.

(4) Kind of operation and operating conditions.

(5) Description of secondary noise sources including location, type, and kind of operation.

(6) Type and serial numbers on all microphones, sound level meters, and octave band analyzers used. Length and type of microphone cables.

(7) Position of observer.

(8) Direction of arrival of sound with respect to microphone orientation.

(9) Approximate temperature of microphone.

(10) Results of maintenance and calibration tests.

(11) Weighting network and meter speed used.

(12) Measured overall response and band levels at each microphone position and extent of meter fluctuation.

(13) Background overall response and band levels at each microphone position with primary noise source not operating.

(14) Cable and microphone corrections.

(15) Any other pertinent data such as personnel

B. Measurements. The lessee shall monitor and measure noise levels using an octave band noise analyzer with an A-weighted frequency response or a standard sound level meter that conforms to the requirements set forth in USA Standard Specifications for General Purpose Sound Level Meters USASI S1.4-1961 or the latest approved revision thereof. Bandpass filters shall conform to the requirements of USASI S1.11-1966. The lessee shall measure noise level frequency distribution as required by the Supervisor. Sound levels shall be measured in conformance with the USA Standard-Method for the Physical Measurement of Sound USASI S1.2-1962.

C. Criteria. In the absence of more restrictive criteria as may be established in this paragraph, the lessee shall not exceed a noise level of 65 dB(A) for all geothermal-related activity including but not limited to, exploration, development, or production operations as measured at the lease boundary line or 0.8 km (one-half mile) from the source, whichever is greater, using the A-weighted network of a standard Sound Level Meter. However, the permissible noise level of 65 dB(A) may be exceeded under emergency conditions or with the Supervisor's approval if written permission is first obtained by the lessee from all residents within 0.8 km (one-half mile).

D. Assessment. The lessee shall be responsible for taking such noise level measurements as are deemed necessary by the Supervisor. The background noise level shall serve as the criterion for the rating and assessment, by the Supervisor, of the objectionableness of noise emission from a particular source. The background or ambient noise is defined hereby as the minimum sound level at the relevant place and time in the absence of the source noise and shall include consideration for the type of land use, the season, atmospheric conditions, and the time of day.

E. Attenuation. To attenuate objectionable noise, the lessee shall utilize properly designed muffling devices as required by the Supervisor.

F. Relationships. Reference levels and relationships for noise measurements shall be as follows:

(1) Reference sound pressure for airborne sounds shall be 20 MN/m (20 micronewtons per square metre).

(2) Reference power shall be 10-12 watts.

(3) Sound levels shall be measured using a standard Sound Level Meter with an "A" frequency response characteristic (weighting network).

exposed directly and indirectly, time pattern of the exposure, atmospheric conditions, attempts at noise control, and personnel protection.

Reid T. Stone
Area Geothermal Supervisor

APPROVED:

Russell G. Wayland
Chief, Conservation Division

☆GPO 695-811