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LA GRANDE, OREGON GEOTHERMAL
ENVIRONMENTAL ASSESSMENT
REPORT

February 1975

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ENVIRONMENTAL ASSESSMENT REPORT

Prepared by

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LAW DEPARTMENT - WESTERN AREA

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SUMMARY

AMAX is currently conducting exploration operations for geothermal resources in Union County, Oregon near the town of La Grande. Maps of the La Grande area are attached as Appendices 1 and 2. Passive testing, in the form of telluric and electromagnetic studies, will be continued. This will be followed by the drilling of shallow thermal gradient wells. If justified by the results of exploration activities, production wells will be drilled and a surface generating facility constructed. Present plans call for a leasehold totaling 50,000 acres, about 45,000 of which have been obtained. However, several crucial leases are still pending.

Exploration and production will be subject to state geothermal and pollution control laws. A state permit will be required prior to commencement of any drilling activities. Bonds must be posted during both drilling and production stages. If, on the basis of the exploratory wells, further commercial development is undertaken, an environmental impact statement must be prepared. Notice of any transfer of a well or the land on which it is situated must be given to the State Geologist. State approval must be acquired for the suspension of production and the abandonment of any well.

Hot waters of less than 250 degrees Fahrenheit bottom hole temperature are presently excluded from the definition of geothermal resources in Oregon. The status of such water that is brought to the surface by geothermal production depends on whether it is fit, without further treatment, for domestic or agricultural use. If this water were fit for such uses and were allowed to flow onto another person's land, it probably would be subject to appropriation under the Oregon water laws. For this reason, AMAX may want to take steps to insure its right to exclusive use of such water.

The Department of Environmental Quality (DEQ) is charged with the administration and enforcement of most of the Oregon state law concerned with pollution control. General policies for the operation of the DEQ are established by the Environmental Quality Commission (EQC). The EQC also has authority to adopt any rules and standards that it considers necessary to perform the functions assigned to it by law.

Hydrogen sulfide (H_2S) and ammonia (NH_3) are the air pollutants most commonly associated with geothermal activity. Both gases fall within the statutory definition of "air contaminant," but emissions of these gases have not yet been regulated by the EQC. Registration of the geothermal well

with the DEQ, for the composition of air pollution controls, is necessary at the discretion of the Department. If the DEQ determines a thermal electric power generating plant is a significant source of air contamination, the Department may require that the plant not be constructed until it receives prior written notice. Construction may proceed after the DEQ decides that the plant will meet all applicable air quality rules and standards. The DEQ already requires the registration of thermal electric power generating plants for purposes of regulating air pollution.

Present plans do not call for any discharge of waste into surface streams. Wastewater from drilling activities must be placed into holding ponds approved by the state. If wastewater from geothermal exploration or production is re-injected through the geothermal wells, a discharge permit will probably be required. The EQC has promulgated general standards of quality and purity of state waters. In addition, special standards have been enacted for the main stem of the Grande Ronde River.

Solid waste disposal problems should be minimal. Excessive noise will be limited to short intervals, but low level noise from generating plants may be an annoyance. Oregon regulations restrict both types of noise emissions.

The Oregon Land Conservation and Development Commission has authority to recommend the designation of certain activities as activities of state-wide significance. In order to conduct an activity of state-wide significance, a planning and siting permit must be obtained from the Land Conservation and Development Commission. There is no indication that the Commission has yet classified geothermal development as such an activity.

If it is to obtain a conditional use permit in Union County for geothermal development, AMAX probably will have to do so under the classification of "mining." Requests for conditional uses may be initiated by the property owner, but before the permit is issued, it must be considered by the County Commission at a public hearing.

Assuming that the county has a building code, application for a building permit will probably be necessary. If no such code exists or if the code does not require a permit for the type of building to be constructed, notice must be provided to the Oregon Land Conservation and Development Commission prior to the construction of the building.

PERMITS, NOTICES AND BONDS

The following is a list of permits, notices, and bonds that must be obtained or filed in order to explore for and develop geothermal resources in Union County, Oregon:

State

1. Written application to the State Geologist for a permit to commence drilling, re-drilling, or deepening any well for geothermal purposes. ORS 522.110.
2. A drilling indemnity bond of \$5,000 for each well drilled, re-drilled, or deepened, or a \$25,000 blanket bond for the drilling, re-drilling, or deepening of one or more wells being conducted at any time, to be filed with the State Geologist at the time of filing for a drilling permit. Not required if drilling for purposes of geophysical tests, temperature gradient tests, or solely for informational purposes regarding geothermal resources. ORS 522.120(1); OAR Ch. 632 §20-035.
3. A production indemnity bond to be filed with the governing board of the State Department of Geology and Mineral Industries upon properly completing a well. ORS 522.120(5).
4. Preparation of an environmental impact statement if geothermal activity of commercial interest is discovered. Miscellaneous Oregon Geothermal Regulations (MOGR #1) (Appendix 3).

5. Submission, prior to drilling activities, of a contingency plan outlining measures taken to minimize the number of blowouts to the Oregon Department of Geology and Mineral Industries. [MOGR #3(a)].
6. Notice to the DEQ and the Department of Geology and Mineral Industries if a breakdown of equipment or facilities causes a violation of the conditions of the permit or results in an unauthorized discharge. MOGR #12.
7. Application to the governing board of the State Department of Geology and Mineral Resources for a "certificate of primary purpose" after drilling a well which is producing geothermal resources. ORS 522.220.
8. Statement to be filed monthly with the State Geologist with respect to production of geothermal resources. ORS 522.230.
9. Notice to the State Geologist of the transfer of a geothermal well or exchange of the land upon which the well is situated. ORS 522.240 & .250.
10. Written application to the governing board of the State Department of Geology and Mineral Industries for permission to suspend operations. ORS 522.260.
11. Written notice of intention to the State Geologist of intention to abandon a well; approval by the State

Geologist of the plan of abandonment; written report on the completion of abandonment procedures. Final approval of abandonment by the State Geologist is required.

ORS 522.310, .320, & .330.

12. Application to the State Engineer for a water appropriation permit. ORS 537.615.
13. Registration of the geothermal well, as a source of contamination, with the DEQ required at the discretion of the Department. OAR Ch. 340 §20-005.
14. Registration of the thermal-electric power generating plant, as a source of air contamination with the DEQ, as required by OAR Ch. 340 §20-005.
15. Approval of the DEQ and the State Geologist prior to discharge of drilling or other waste into holding ponds. OAR Ch. 632 §20-145, MOGR #6.
16. Application for a water discharge permit, prior to reinjection of wastewater through geothermal wells, or discharge of waste into surface streams. ORS 468.720 & .740; OAR Ch. 632 §20-150; MOGR #10.
17. Written permission from the Oregon Department of Transportation before construction of any approach to a state highway or county road. ORS 374.305-.315.
18. Notice to the Oregon Land Conservation and Development Commission ten (10) days prior to construction of any

building requiring materials valued at \$300.00 or more, unless the land upon which the building is to be constructed is subject to zoning regulations approved by the Land Conservation and Development Commission and is also subject to building regulations imposed by Union County that require a permit for the type of building to be constructed. ORS 215.520.

Local

1. Conditional use permit from the Union County Zoning Commission prior to removal of geothermal resources. Union County Zoning Ordinances §§2.03, 20.01 through .07. Application to include a scale drawing of a site plan.
2. Application for a building permit probably required for any on-site construction; to be obtained from the county department charged with enforcement of the building regulations.

FACT STATEMENT

AMAX Exploration, Inc. is currently exploring for geothermal resources in Union County, Oregon, near the town of La Grande. Maps of the La Grande area are attached as Appendices 1 and 2. In the last year, micro-earthquake surveys, ground noise monitoring, gravity surveys, ground magnetic surveys, geologic mapping, and water sampling have been completed. An aeromagnetic survey has been made, but the results of that test are not yet available. In the future telluric and electromagnetic testing are planned, and at some point, probably during the present year, temperature gradient measurements will be made by drilling holes of 300 to 1,000 feet in depth.

If the work described above yields favorable results, AMAX will drill an exploratory hole to a depth of 5,000 to 10,000 feet, possibly beginning as early as the summer of 1975. This would include clearing of access roads and construction of a drill site. This work could be completed in 1976. If the exploratory hole demonstrates the existence of a reservoir capable of producing geothermal resources, additional wells leading to full field development may be drilled.

Land Position

The area of exploration covers approximately 250 square miles in the Upper Grande Ronde River Valley of northeastern Oregon. This valley lies primarily in Union County and is bounded on the east by the Wallowa Mountains and on the west by the Blue Mountains. The Grande Ronde River flows in a northward direction and provides, with its tributary Ladd Creek, the principal drainage for the area.

Two hot springs in the area have been developed, one at Hot Lake on the slopes of Craig Mountain (about five miles to the southeast of the town of La Grande) and the other at Cove. Several minor warm springs and creeks are associated with the valley.

Present plans call for the establishment of a leasehold of approximately 50,000 acres, about 45,000 of which have been obtained. Several crucial leases are still pending, however, and progress in obtaining them has been slow in recent weeks. None of the leases cover federal or state lands.

Infrastructure

Little or no water will be required during the exploration stage, but large amounts of water will be needed during the drilling process. Possibly, AMAX can obtain this water

from the lessors, who have diverted it for irrigation purposes. Notice of such an assignment should be filed with the State Engineer. ORS 537.220. Before AMAX could use this water, it would have to file with the State Engineer an application to change the use of the water from agricultural to industrial purposes. This would involve a hearing to determine whether the change of use would adversely affect the rights of other water appropriators. If so, the application would be rejected. ORS 540.520 & .530.

Existing roadways will be used for access during the exploration phase. Prior to actual drilling, however, access roads and drill sites will have to be constructed. Most, if not all, of these roads should be on land leased by AMAX. The source of the power needed for construction of roads and drilling sites and for the drilling itself is still uncertain.

Environmental Considerations

No wastewater will be generated during the exploration phase. If the property is drilled, wastewater, which will contain drilling mud, small rock chips, and minor amounts of chemicals, cannot be discharged into natural bodies of water in Oregon. This water could be disposed of at the drilling

sites in retention ponds, or it could be trucked from the area and disposed of elsewhere. State law requires that such disposal be into self-contained, non-overflow holding ponds for which construction plans have been approved by the DEQ and the State Geologist (Supervisor). OAR Ch. 632 §2-145, MOGR #5. In addition, drill holes should be sealed, cemented, or cased to prevent the escape of drilling fluids into pervious rock formations.

If the property is developed to the point where electricity is generated at the drilling sites, wastewater created in the generation process may be injected into the geothermal reservoir rather than introduced into surface streams or holding ponds. This is particularly true if the wastewater is of generally the same composition as the fluids in the geothermal reservoir.

If commercially exploitable brines are recovered, salts will be produced as a byproduct of the recovery process. A method for disposing of these salts has not yet been decided upon. If brines are recovered, sufficient fluid should be injected into the reservoir to mitigate subsistence hazards.

A certain amount of fugitive dust and vehicle emissions will contribute to degradation of air quality in the vicinity of the geothermal development. At present, the La Grande area enjoys a strong prevailing wind from the west and

northwest during the entire year, which keeps the region free of smog or smoke. If a geothermal reservoir is encountered, there is a possibility of some non-condensable gases venting into the atmosphere. The major air pollutants associated with geothermal production are hydrogen sulfide (H_2S) and ammonia (NH_3). Both of these gases are readily soluble in water and can be expected rapidly to return to the earth when it rains.

Blowouts, in which steam or hot water escapes uncontrolled, pose an environmental hazard in geothermal operations. Potential adverse effects include waste of the resource, noise nuisance, air and water contamination, and hazards to the health and safety of those working at the site or engaged in subsequent attempts to control the emissions. Prior to any drilling activities, a contingency plan outlining measures to minimize the number of blowouts must be submitted to the Oregon Department of Geology and Mineral Industries. MOGR #3(a).

Noise should not be a problem during the exploration phase. Production drilling may cause noise aggravation to local residents and the surrounding wildlife community. During pilot testing and commercial production, wells should

not be permitted to vent unchecked into the atmosphere for extended periods of time. Whatever venting or bypassing is necessary should be through mufflers designed to reduce the noise levels. However, if generating plants are located close to homes or recreation sites, low level noise will be an annoyance.

No surficial damage is anticipated from passive exploration activities, but during exploratory and production drilling, drill access roads and drill pads will be constructed. Oregon regulations provide that these shall be built and maintained to minimize soil disturbances, control erosion, and prevent channeling. MOGR #7. After the roads and drill pads have served their purpose, they should be closed and reseeded with natural vegetation. If the project proceeds to the pilot and production stages, reclamation efforts similar to those now in effect at The Geysers production area should be utilized. These would include painting the surficial pipes a color which will harmonize with background vegetation, when possible siting the generating facilities in areas which are not readily visible, minimizing damage to natural vegetation, minimizing noise, and reclaiming disturbed areas.

LEGAL ANALYSIS

State Geothermal Regulation

The Oregon Geothermal Resources Act, ORS 522.010 et seq., (1973 Replacement Part) declares that the people of Oregon have a direct interest in the development of geothermal resources within the state. Hence the act provides for state regulation and control of the

drilling, redrilling, and deepening of wells for the discovery and production of geothermal resources so that such wells will be constructed, operated, maintained, and abandoned in the manner necessary to safeguard the life, health, property, and welfare of the people of this state and to encourage the maximum economic recovery of geothermal resources therefrom. ORS 522.050(2).

The power to administer and enforce the act is delegated to the governing board of the State Department of Geology and Mineral Industries (Board). ORS 522.410. The Board has the power to prescribe reasonable rules in carrying out the purposes of the act. ORS 522.420.

No drilling operations, whether to commence, redrill, or deepen a well, can be undertaken until a drilling permit has been issued for each well by the Supervisor of the Department of Geology and Mineral Industries (Note: Supervisor, Director of the Department, and State Geologist are one and the same person). ORS 522.110(1). The requirements are less severe if an operator proposes to drill wells for geophysical tests,

temperature gradient tests, or solely for informational purposes. In this case, only a single application need be filed. ORS 522.110(5). Generally, no permit will be issued until the operator has filed an application, secured approval of the application, filed an indemnity bond, and named an agent within the state. The Supervisor must notify the State Wildlife Commission, the Fish Commission of the State of Oregon, the State Water Resources Board, the State Engineer, and the DEQ prior to issuing a permit. ORS 522.140. There is no express requirement that the Supervisor consider the responses of these agencies, but it is likely that any of their objections to the project would at least delay, if not prevent, the issuance of a permit.

Every person who engages in the drilling, redrilling, or deepening of any well must file with the Board an indemnity bond of \$5,000 for each well drilled, or a \$25,000 blanket bond for the drilling, redrilling, or deepening of one or more wells being conducted at any time. The bond shall be filed with the State Geologist at the time of the application for the drilling permit. ORS 522.120(1); OAR Ch. 632 §20-035. No bond need be provided if the wells are to be used for geophysical tests, temperature gradient tests, or solely for informational purposes regarding geothermal resources. ORS 522.120(4).

If these exploratory or informational wells indicate geothermal resources of commercial interest, no drilling of additional wells can begin until an environmental impact statement has been prepared for utilizing and developing the resource. MOGR #1. No indication of how to determine whether the geothermal resource is of commercial interest is available; this may be a decision made solely by the operator in concluding that the results of his informational wells merit further exploration.

Upon properly completing a well that is producing geothermal resources, the operator must file with the Board a production indemnity bond. ORS 522.120(5) & .130(1). He must also, in areas of known high pressures, equip the well with casings and other safety devices as required by the Supervisor. ORS 522.180. The operator is obliged to insure that the well casings are watertight, in order to prevent the pollution of surface and ground water. ORS 522.190. In the event a breakdown of equipment or facilities causes a violation of any of the conditions of the permit or results in an unauthorized discharge, the operator must immediately notify the DEQ and the Department of Geology and Mineral Industries. MOGR #12.

On the commencement of production, the operator must file monthly statements with the Supervisor indicating the production for the preceding month. ORS 522.230. In the event a well is transferred, both the transferor and the transferee must provide notice to the Supervisor within five (5) days of the conveyance. ORS 522.240 & .250. In addition, the Board must authorize any suspension of operations, ORS 522.260, and approval of the Supervisor must be obtained before abandoning production and on completion of abandonment procedures. ORS 522.320 & .330. One of the conditions for approval of final abandonment is that the site be restored to as near its original state as possible. OAR Ch. 632 §20-125(2)(b).

Upon determination of the Director of the DEQ or the State Geologist that any activities conducted by the operator in relation to its drilling operations may cause a hazard to the environment or may violate any of the conditions of the permits, the operator must stop its drilling operations upon oral or written notice by the Director or the State Geologist until the problem has been corrected. MOGR #4.

Having drilled a well capable of geothermal production, the operator can obtain a "certificate of primary purpose."

ORS 522.220. The grant of a certificate creates a rebuttable presumption that the holder has "absolute title," subject to royalties, etc., to the resource. This presumption can be rebutted only by proof that the water content of the resource is useful for domestic or irrigation purposes without further treatment. Proof that the recovery of such water is a byproduct of the geothermal production will not overcome the presumption. ORS 522.220.

Although spacing of geothermal wells is not presently required by statute, lessors, lessees, or operators may choose to enter into well-spacing agreements so as to conserve the geothermal resources. The governing board of the State Department of Geology and Mineral Industries may approve such agreements; approval renders the agreement binding on any successors in interest of the parties making the agreement. ORS 522.210.

The precise nature of geothermal resources is yet to be determined. Only two cases have been litigated to date. In United States v. Union Oil, 369 F.Supp. 1289 (N.D. Cal. 1973), the court held geothermal resources to be water. This case is presently on appeal, and it is being argued strongly that the resource really is the heat of the earth and that water is merely the medium by which the resource is

conveyed to the surface. In another case, Reich v. Commissioner, 454 F.2d 1157 (9th Cir. 1972), the court stated that, for purposes of federal income tax administration, the geothermal resources exploited at the Geysers should be treated as a gas. This decision, however, turned on empirical proof that the resource was being depleted, and, for that reason, may be of little value with respect to other geothermal discoveries.

New geothermal legislation has been introduced in the Oregon legislature. The proposed revision (H.B.2040) of the Oregon Geothermal Resources Act does not classify geothermal resources as water or minerals, but adopts the definition of geothermal resources in the Federal Geothermal Act of 1970. Present Oregon law excludes oil, hot waters, and hydrocarbon substances of less than 250 degrees bottom hole temperature from the definition of geothermal resources. The proposed bill would drop this exclusion. It would also eliminate the present requirement that licensed water well contractors do any necessary drilling, and give sole authority to the State Geologist to require satisfaction of air, water, and groundwater protection standards before issuing a permit to explore, so as to minimize bureaucratic confusion over conflicting responsibilities. The Director of the DEQ would be required

to issue any other necessary permits once the permit of the State Geologist has been obtained. A second bill (H.B.2041) provides that the certificate of primary purpose would be subject to unitization between adjoining state and private lands that overlay a common reservoir of geothermal resources. This bill is designed to conform with the mandatory unitization of federal and adjacent state or private lands required by the Federal Geothermal Act.

Water Rights

The Oregon legislature has declared that no one shall attempt to develop or use ground water within the state except in compliance with normal appropriation procedures. ORS 537.535. The certificate of primary purpose seems to exclude geothermal resources from the scope of this rule. ORS 522.220. However, the present definition of geothermal resources, by excluding hot waters of less than 250 degrees Fahrenheit bottom hole temperature, creates some problems in determining the ownership of the excluded waters. ORS 522.010(4). In addition, the presumption of ownership as to other water may be rebutted by a showing that "the water content of the geothermal resources is useful for domestic or irrigation purposes without further treatment."

Ground water is defined as "any water . . . beneath the land surface or beneath the bed of any stream, lake, reservoir, or other body of surface water within the boundaries of this state, whatever may be the geological formation or structure in which such water stands, flows, percolates, or otherwise moves." ORS 527.515(3). This definition is broad enough to include those waters brought to the surface as a result of geothermal operations as to which the certificate of primary purpose does not apply or the presumption of ownership is rebutted. Hence, in the absence of clarifying legislation, which may be forthcoming in 1975, a prudent course of action would be to treat any water produced as ground water within the meaning of the Oregon statutes.

Appropriation of surface water for the purpose of recharging ground-water basins has been declared a beneficial use. ORS 537.135. Presumably this would hold true for ground-water appropriations as well. However, prior to the issuance of any ground-water right certificate, the State Engineer must determine that allowing the new appropriation will not interfere with the rights of those already entitled to draw water from the ground-water reservoir. ORS 537.620(3) & (4), and 537.665 through .700. In addition, the certificate is subject to amendment if ground-water levels decline

significantly or if the wells of two or more appropriators interfere with one another. ORS 537.730 & .735. No application for a permit is required for the use of ground water for any single industrial or commercial purpose in amounts not exceeding 5,000 gallons daily; use of water for such a purpose constitutes a right of appropriation equal to that established by a ground-water certificate issued under ORS 537.700. ORS 537.545.

The Supreme Court of Oregon has declared that where spring waters arising on a person's land do not flow from the spring in such a manner as to constitute a watercourse, the owner is entitled to exclusive use of that water as against competing claimants. However, if the waters from the spring form a watercourse and flow onto the land of another, they are subject to the doctrine of appropriation, and the owner of the land on which the spring arises has no preference over other persons. Fitzstephens v. Watson, 344 P.2d 221, 225-26 (1959).

Under this doctrine, AMAX could lose its right to appropriate water recovered from geothermal operations if that water were allowed to flow onto another person's land and was subsequently appropriated. If, however, AMAX stored any water not immediately used in holding ponds on the

leased property, this should entitle the company to exclusive use of the water, assuming that the lease establishes AMAX's right against the lessor.

For these reasons, any water recovered through the production of geothermal resources should be treated as potentially subject to appropriation. Thus, should the amount of water recovered exceed 5,000 gallons daily, an application should be filed with the State Engineer under ORS 537.615. If present Oregon law is changed so as to include this water within the definition of geothermal resources, or should the Oregon courts decide that water recovered through geothermal operations is to be treated differently than ordinary ground water, nothing has been lost by using this approach.

General Pollution Control

The Department of Environmental Quality (DEQ) is charged with the administration and enforcement of most of the Oregon state law concerned with pollution control. ORS 468.035. General policies for the operation of the DEQ are established by the Environmental Quality Commission (EQC). ORS 468.015. The EQC also has authority to adopt any rules and standards that it considers necessary to perform the functions assigned to it by law. ORS 468.020. The primary

tools of the DEQ for eliminating a source or cause of pollution are conference, conciliation, and persuasion. The Department can, however, resort to administrative sanctions should a violation not voluntarily be remedied. ORS 468.090. The DEQ has the power to inspect any premises, whether public or private, while investigating an actual or suspected violation of the environmental laws. ORS 468.095. Either the DEQ or the EQC may institute an action for an injunction or damages if it has cause to believe that any person is violating the environmental laws or regulations. ORS 468.100 & .105. Any person aggrieved by any order of the EQC is entitled to a review of the decision by the Oregon courts. ORS 468.110. At least some decisions of the DEQ are reviewable by the EQC prior to appeal to the courts. E.g., OAR Ch. 340 §14-035 (Review of DEQ decision to deny issuance of an air emission, water discharge, or water disposal permit).

Air Pollution

The sources of potential air pollution at La Grande include engine emissions and fugitive dust from vehicular traffic, fugitive dust from drilling and construction operations, and hydrogen sulfide (H₂S) and ammonia (NH₃) gases associated with geothermal recovery. The fugitive dust and engine emission problems should be minimal, but hydrogen

sulfide and ammonia emissions may present substantial problems.

Federal air pollution laws will not immediately affect the project, but some mention of the direction of federal requirements is worthwhile. Under the Clean Air Act of 1970, national primary and secondary ambient air standards have been established for particulate matter, sulfur oxides, nitrogen dioxide, carbon monoxide, photochemical oxidants, and hydrocarbons. States were required to submit to the Environmental Protection Agency (EPA) implementation plans for bringing state programs into compliance with these standards. 40 CFR §51. New regulations were promulgated pursuant to the court order in the case of Sierra Club, et al. v. Administrator of EPA, 344 F.Supp. 253, on December 5, 1974 (39 Fed. Reg. 42510) for the prevention of significant deterioration of existing air quality.

The basic Oregon air pollution law is set forth in ORS 468.275 et seq. (1973 Replacement Part). The purpose of this statute is to develop a comprehensive, state-wide plan for the control, abatement, and prevention of air pollution. ORS 468.280 & .285. The statute charges the EQC with the duty of establishing regional air purity standards, ORS 468.295(1), regional or state-wide emission standards, ORS 468.295(3), and classification and control of air contamination sources. ORS 468.320. The EQC has authority to

require permits for air contamination sources classified by type of air contaminants, by type of air contamination source, or by area of the state. ORS 468.310. This provision also applies to increases in volume or strength of present emissions. ORS 468.315(2).

Although hydrogen sulfide and ammonia gases fall within the statutory definition of "air contaminant" and "air pollution," ORS 468.275(2) & (5), their emissions have not yet been directly regulated by the EQC. The only administrative rule that would seem to be directly applicable to a geothermal well is OAR Ch. 340 §20-001, which requires "the highest and best practicable treatment and control of air contaminant emissions for an air contamination source," notwithstanding the general and specific emission standards and regulations set by the EQC. In addition, registration with the DEQ is necessary at the Department's discretion, pursuant to OAR Ch. 340 §20-005. Should registration be required, AMAX must furnish, along with other information, a description of production processes and a related flow chart, a plot plan showing the location and height of all sources of air contamination, the amount, nature, and duration of air contaminant emissions, and the estimated efficiency

of air pollution control equipment. OAR Ch. 340 §20-010. In addition, fugitive emissions controls might be imposed pursuant to §21-055. These controls could include use of water or chemicals or the application of asphalt to control dust on roads and drill sites. OAR Ch. 340 §21-060.

If the DEQ determines that a proposed thermal-electric power plant is a "significant source of air contamination," the Department may require that the plant not be constructed unless it receives prior written notice. OAR Ch. 340 §§20-020 & -025. This notice shall include the same information as for registration of other air contaminant sources, such as geothermal wells, described above. OAR Ch. 340 §20-030(2). Construction may proceed after the DEQ decides that the plant will meet all applicable air quality rules and standards. OAR Ch. 340 §20-030(3). However, no air contaminant discharge permits are presently required for power plants.

Registration of thermal-electric power generating plants with the DEQ is required by OAR Ch. 340 §20-005. Information required here is identical to that required of other sources that need to be registered. This registration must be updated yearly. OAR Ch. 340 §20-015.

At this time, no open burning is planned which would affect the air quality in the area. The open burning of

industrial waste is prohibited by OAR Ch. 340 §23-010(1)(a). Forced-air pit incineration will be allowed as an alternative to open burning only if it is shown to the satisfaction of the DEQ that no practicable alternative exists and the installation is designed and operated in such a manner that any relevant visible emission standards will not be exceeded. OAR Ch. 340 §23-020.

Regional air quality control authorities may be formed of contiguous territory under certain conditions. ORS 468.505. When authorized to do so by the EQC, such an authority may exercise the functions relating to the control of air pollution normally delegated to the EQC and DEQ. ORS 468.535(1). These authorities lack any power to adopt any rule or standard that is less strict than any rule or standard established by the EQC and must submit to the EQC for its approval any proposed air quality standards. ORS 468.535(2). There is no indication that such an authority exists for the La Grande area.

No regulations deal with the release of odors, and no general opacity regulations have been issued, except with respect to motor vehicles.

Water Pollution

It is illegal in Oregon to cause any water pollution or discharge any wastes into waters of the state without obtaining

a permit from the DEQ. ORS 468.720 & .740 (1973 Replacement Part). Of particular importance with respect to drilling activities and the discharge of residue are the prohibitions that "no person shall . . . cause to be placed any wastes in a location where such wastes are likely to escape or be carried into the waters of the state by any means," ORS 468.720(1)(a), and that "no person shall discharge any wastes into the waters of the state if the discharge reduces the quality of such waters below the water quality standards established by rule for such waters by the Commission." ORS 468.720(2). Violation of either of these provisions is a public nuisance.

The Federal Water Pollution Control Act Amendments of 1972 were intended to enhance the quality and value of the national water resources by regulating the discharge of pollutants into these waters. Primary responsibility for enforcement of the Act, however, was left to the states, which were encouraged to develop their own statutes to prevent and control water pollution. 33 U.S.C. §§1151, 1154. Oregon is one of the states presently authorized by the EPA to issue discharge permits. Under Oregon geothermal and water pollution regulations, it is not likely that a permit will be required for disposal of wastewaters into the holding ponds. However, as was previously stated, construction

of the holding ponds must be approved by the State Geologist and the DEQ. OAR Ch. 632 §20-145; MOGR #6. A more definitive decision will be obtained when AMAX applies for a drilling permit.

If wastewater from geothermal exploration or production is reinjected through the geothermal wells, a discharge permit will probably be required, since the Oregon statute specifically states that underground waters are protected under the Oregon Water Pollution Control Act. ORS 468.700(8) & .740. The duration of any permit issued cannot exceed five years. OAR Ch. 340 §14-015. A permittee is liable for the cost of restocking or replacing any fish or wildlife contaminated or destroyed by pollution or by any violation of the conditions set forth in its permit. ORS 468.745. Literally interpreted, the statute is broad enough to render AMAX liable even though all conditions of the permit have been satisfied. There have not yet been any cases in the Oregon courts to indicate whether that broad reading will be sustained.

Willful or negligent violations of the requirement to obtain a permit is a misdemeanor punishable by maximum fines of \$25,000 or imprisonment for one year or both. Each day of the violation is a separate offense. ORS 468.990.

The EQC is authorized to establish standards of quality and purity of state waters. ORS 468.735 & .710. These

standards have been promulgated (OAR Ch. 340 §§41-005 et seq.) and cover, among other items: liberation of dissolved gases, including hydrogen sulfide; discoloration and turbidity; development of fungi or other growths having a deleterious effect on stream bottoms; temperature; and degradation of aesthetic standards. OAR Ch. 340 §41-025. In addition, special water quality standards have been promulgated for the main stem of the Grande Ronde River. OAR Ch. 340 §41-055. These are in addition to the general provisions of OAR Ch. 340 §41-025 and cover, among other items, temperature and dissolved chemical substances.

Solid Waste

Solid waste disposal problems should be minimal. Oregon's solid waste disposal statute provides that sites requiring a water discharge permit need not apply for a solid waste disposal permit. ORS 459.005(4) & .215. The regulations exclude from permit requirements a landfill site used only by the owner or person in control of the premises to dispose of soil, rock, concrete, or other non-decomposable materials. OAR Ch. 340 §61-020(3)(b). However, exclusion from the permit requirements does not relieve anyone from compliance with other applicable laws and regulations relating to the disposal of solid wastes.

A special waste disposal permit must be obtained from the DEQ for the establishment of a disposal site for materials not discharged into waters of the state. ORS 459.205. The EQC has promulgated rules governing the accumulation, storage, collection, and disposal of solid wastes and the location of disposal sites (ORS 459.045), but primary responsibility for adequate solid waste management is left with local government units. ORS 459.015(1). The Union County Board of Commissioners is authorized to enact ordinances regulating disposal of solid waste on private property. ORS 459.120. The board may declare a disposal site to be a public nuisance. ORS 459.140.

Noise

Oregon statutes provide that the EQC may adopt reasonable state-wide standards for noise emissions of different kinds, for the specifications of the equipment to be used in monitoring the emissions, and procedures of data collection. ORS 467.010 & .030. Geothermal wells are subject to these standards and regulations. OAR Ch. 632 §20-090. The regulations [OAR Ch. 340 §35-035(1)(b)] now provide that "no person owning or controlling a NEW INDUSTRIAL OR COMMERCIAL NOISE SOURCE shall cause or permit the operation of that

noise source if the noise levels generated by that new source and measured at the appropriate point exceed [the following figures]:

Allowable Statistical Noise Levels in Any One Hour

7 a.m. - 10 p.m.
L50 - 55 dBA
L10 - 60 dBA
L1 - 75 dBA

10 p.m. - 7 a.m.
L50 - 50 dBA
L55 - 55 dBA
L1 - 60 dBA

The appropriate point for purposes of measurement is that point on the noise-sensitive property (e.g., homes, schools, or public libraries) that is 25 feet toward the noise source from the nearest part of the noise-sensitive building closest to the noise source or that point on the noise-sensitive property line that is nearest the noise source, whichever is further from the noise source. OAR Ch. 340 §35-035(3)(b).

However, notwithstanding those permissible levels of noise, no person may cause or permit the operation of a new industrial or commercial noise source on property previously unoccupied by an industrial or commercial source if the new source increases the statistical noise levels, L10 or L50, in any one hour by more than 10 dBA as measured at the appropriate point. OAR Ch. 340 §35-035(1)(b). Noise levels for designated quiet areas are somewhat lower. A quiet area

is any area such as a wilderness area, state park, or any other area designated by the EQC as an area where the qualities of serenity, tranquility, and quiet are of extraordinary significance. OAR Ch. 340 §35-035(1)(d), 35-005(27).

The Oregon regulations also cover impulse sounds (bursts of sound lasting for less than one second) and, when necessary to protect the public welfare, octave band sound pressure levels. OAR Ch. 340 §35-035(1)(e) & (f). Generally speaking, impulse sounds may not exceed at their peaks a pressure in excess of 100 dB from 7:00 a.m. to 10:00 p.m. and 80 dB from 10:00 p.m. to 7:00 a.m.

Land Position

The Oregon Land Use Act of 1973 charges the Land Conservation and Development Commission to prepare inventories of land uses in Oregon, state-wide land use guidelines, and comprehensive plans for conformance with state-wide planning goals. ORS 197.040(2). The Commission has authority to recommend to legislative committees the designation of certain activities of state-wide significance. ORS 197.400. There is no indication that it has yet classified geothermal development as such an activity. If geothermal development is later designated an activity of state-wide significance, no proposed geothermal project may be initiated by

anyone without a planning and siting permit issued by the Commission. ORS 187.410. If there is doubt as to whether a particular project is an activity of state-wide significance, it is possible to obtain a determination from the Commission on the question. If this question is directed to the Commission, it must issue a binding letter of interpretation with respect to the proposed project. ORS 197.425. Violation of the Act may be enjoined in a civil suit brought in the courts of Oregon. ORS 197.410(2).

Pursuant to the Oregon Land Use Act, the counties of Oregon must establish zoning regulations in conformity with state-wide planning goals. ORS 197.250. Union County ordinances provide that the major portion of the county should be retained for agricultural use, but that provision should be made for uses of land necessarily located within the farming area. Union County Zoning Ordinances (UCZO) §1.02. In an agricultural zone, mining, defined as removal of minerals from mines, is a conditional use. UCZO §2.03. Since none of the other conditional uses comes this close to including geothermal resource development, AMAX, if it is to obtain a conditional use permit, will probably have to do so under this classification. Requests for conditional uses may be initiated by a property owner and must include a drawing of a site plan. Before the conditional use permit

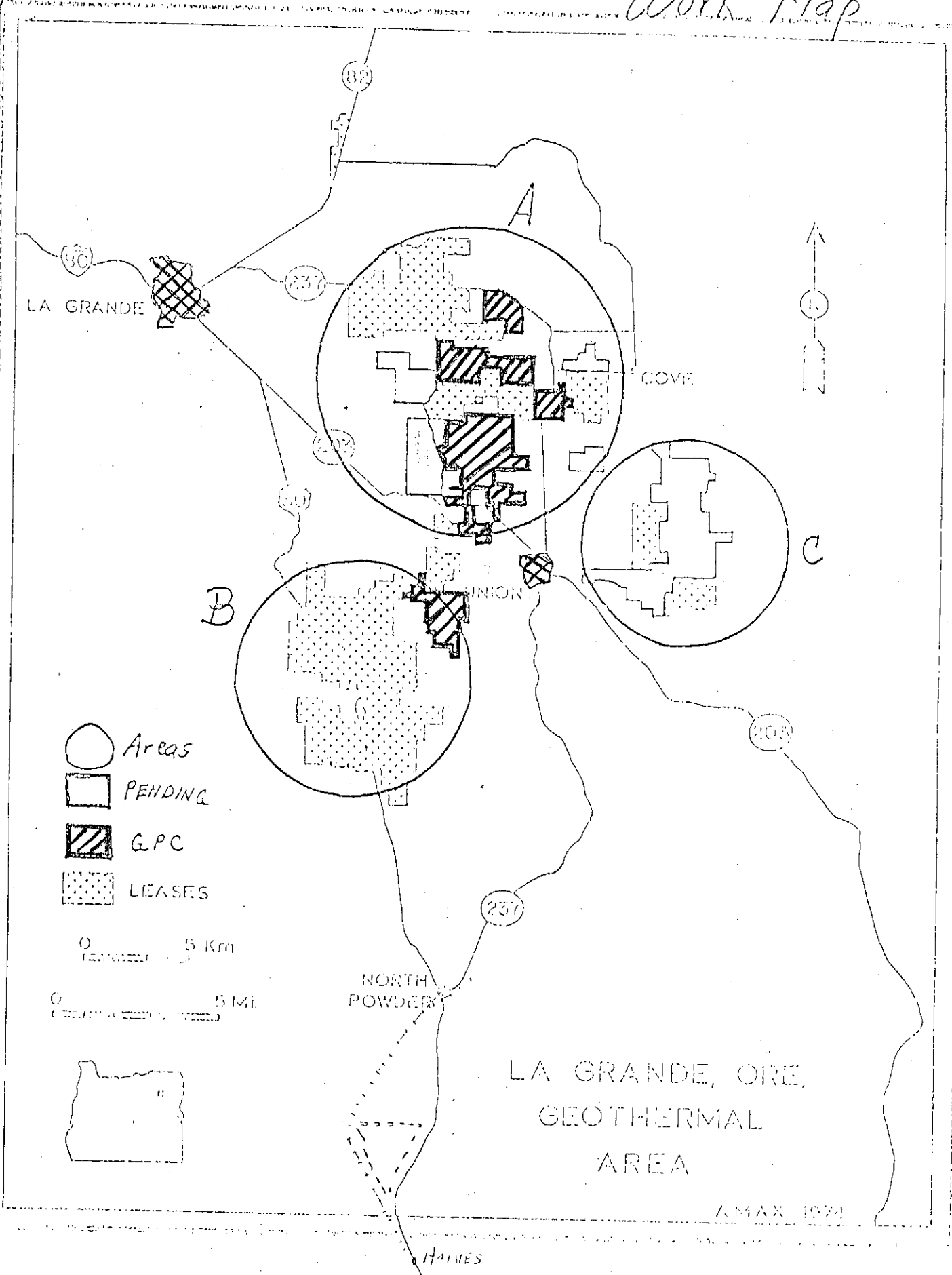
is issued, it shall be considered by the County Commission at a public hearing. The Commission may attach whatever conditions it deems necessary to carry out the purposes of the ordinance. UCZO §20.01 through .07.

The grant of a conditional use permit carries with it permission for any buildings necessary to the main use of the property. UCZO §2.03. Hence, it may be unnecessary to obtain a separate building permit. There is no indication that building regulations have been promulgated by the county. However, in the absence of such county regulations, it is necessary to provide notice to the Oregon Land Conservation and Development Commission ten (10) days prior to construction of any building requiring materials valued at \$300.00 or more. This notice is to describe the location and size of the building, an estimate of the value of materials to be used, and a brief description of the intended use of the building. ORS 215.520.

Private corporations are given a limited power of condemnation under Oregon law in two broad areas: for pollution control in areas around ore reduction plants and for the removal of ore from the operations sites. ORS 772.405 through .420. It is not clear whether this right would be extended to geothermal operations.

Public utilities have been granted authority to condemn rights-of-way across private or public lands. ORS 772.205-.215. Prior to the exercise of this power, however, the utility must obtain a certificate of public convenience for the particular project that is issued after a public hearing. ORS 758.015.

No person can construct an approach to any state highway or county road without obtaining written permission from the Oregon Department of Transportation. Such construction will be under the supervision of that department. ORS 374.305-.315.

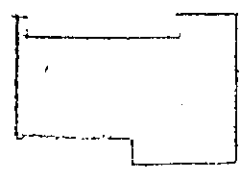


New lease that just came in.

Topographic map of the Grande Ronde Valley, showing minor thermal anomalies, location of Hot Lake and Medical Hot Springs.

APPENDIX 2

Area recommended for land position and detailed exploration



Oregon:

GEOHERMAL AND PETROLEUM DRILLING REGULATIONS EXPANDED

In an effort to accelerate exploration for geothermal and petroleum resources and, at the same time, minimize hazards to the environment, an agreement between the Department of Geology and Mineral Industries and the Department of Environmental Quality is published below. In essence, the agreement spells out the DEQ restrictions on the drilling of wells; these regulations now become part of the permit-to-drill issued by the Department of Geology and Mineral Industries. It is hoped that the agreement will simplify procedures and avoid duplication for those applying for permits.

1. If geothermal activity of commercial interest is discovered, no drilling of additional wells or operations in connection therewith shall commence until an Environmental Impact Statement has been prepared for utilizing and developing the resource.
2. Prior to commencement of any construction or drilling activities, detailed plans and specifications shall be submitted to and approved by the Department of Environmental Quality for collection and disposal of drill cuttings and mud, and other potential waste materials.
3. A contingency plan shall be submitted to the Department of Geology and Mineral Industries prior to any drilling activities outlining the following information and procedures:
 - a. Measures taken to prevent emergency conditions or unplanned discharges, such as blowouts.
 - b. A description of preventive facilities to contain or treat unplanned discharges.
 - c. The reporting system to be used to alert facility management and appropriate legal authorities.
 - d. A list of personnel and equipment available to respond to emergency conditions.
4. Upon determination of the Director of the Department of Environmental Quality or the Director of the Department of Geology and Mineral Industries that any activities conducted by the permittee in relation to its drilling operations or activities may tend to or will cause damage, hazards, pollution or risk to the environment of Oregon or may violate any conditions of permits issued by the aforementioned departments, the permittee shall when notified either orally or in writing by the Director of either department immediately cease and desist its drilling operations or activities until the problem has been corrected.
5. All drilling processes and all waste mud and waste waters collection, treatment and disposal facilities shall be operated and maintained at

discharge of any waste mud and waste waters to the waters of the state.

All waste mud and waste waters are to be discharged into self-contained, non-overflow holding ponds for which construction plans have been approved by the Department of Environmental Quality.

7. All access roads, trails, drainage systems and the drilling site shall be constructed and maintained to minimize soil disturbances, control erosion and prevent channeling.
8. All refuse shall be disposed of at a refuse site which has a valid permit from the Department of Environmental Quality except as permitted in Condition 9.
9. Nonputrescible combustible wastes such as paper bags and brush may be burned. All open burning must be carried out in compliance with Oregon Administrative Rules Chapter 340, Subdivision 3, OPEN BURNING, Sections 23.005 through 23.020 and all other applicable Federal, state, and local burning regulations.
10. No geothermal waters or other waters or substances which might cause the Water Quality Standards of the State of Oregon to be violated shall be discharged or otherwise allowed to reach any of the waters of the state unless a permit for the discharge has been issued by the Department of Environmental Quality.
1. Sanitary wastes shall be disposed of in chemical or gas-fired toilet facilities which have been installed in accordance with the recommendations of the Oregon State Health Division and the local county health department or by other approved means.
2. In the event a breakdown of equipment or facilities causes a violation of any of the conditions of this permit or results in any unauthorized discharge, the permittee shall:
 - a. Immediately take action to stop, contain and clean up the unauthorized discharges and correct the problem.
 - b. Immediately notify the Department of Environmental Quality and the Department of Geology and Mineral Industries so that an investigation can be made to evaluate the impact and the corrective actions taken and determine additional action that must be taken.
 - c. Submit a detailed written report describing the breakdown, the actual quantity and quality of resulting waste discharges, corrective action taken, steps taken to prevent a recurrence and any other pertinent information.

13. Compliance with these requirements does not relieve the permittee of responsibility to maintain continuous compliance with the conditions of this permit or the resulting liability for failure to comply.

14. Authorized representatives of the Department of Environmental Quality or the Department of Geology and Mineral Industries shall be permitted access to the premises of all facilities owned and operated by the permittee at all reasonable times for the purpose of making inspections, surveys, collecting samples, obtaining data and carrying out other necessary functions related to this permit.

* * * * *

GEOHERMAL ENERGY POTENTIAL OF DEEP SEDIMENTARY BASINS

As a part of its research to identify energy resources of the United States, the U.S. Geological Survey has undertaken a study of geothermal resources. To date nearly all of these studies have been concentrated in areas of visible thermal manifestations such as volcanoes, hot springs, and fumaroles--the type of areas of the world where geothermal power is currently being utilized. A new dimension has been added to the understanding of geothermal resources by the work of Paul H. Jones, U.S.G.S. hydrologist, who studied the potential for geothermal development of the northern Gulf of Mexico basin. Jones' report, given at the Pisa Symposium on the Development and Utilization of Geothermal Resources in 1970, shows that large areas of the Gulf Coast are underlain by water at temperatures as high as 500°F at pressures as great as 15,000 pounds per square inch. Jones' paper has stimulated more study of geothermal resources in sedimentary basins, and a preliminary report (U.S.G.S. 1972) discussing the geothermal energy potential from this source follows:

The geothermal energy potential of deep sedimentary basins has been examined by B. F. Grossling (1971). In appraising the long-range prospect of geothermal energy, it is necessary to consider these deep basins because of their large masses of stored water and heat. The total amount of energy that can be recovered without regard to costs can surpass, by way of comparison, the heat of combustion of the oil and gas resources of those basins. The bulk of the waters, however, are low in enthalpy (temperature <150°C), and only a fraction are high in enthalpy (temperature >150°C). The latter may be the more important for electric power generation, depending on costs of drilling, power-generation technology, and other factors.

The size of these high-enthalpy hydrothermal resources in sedimentary basins of the United States hinges on a number of