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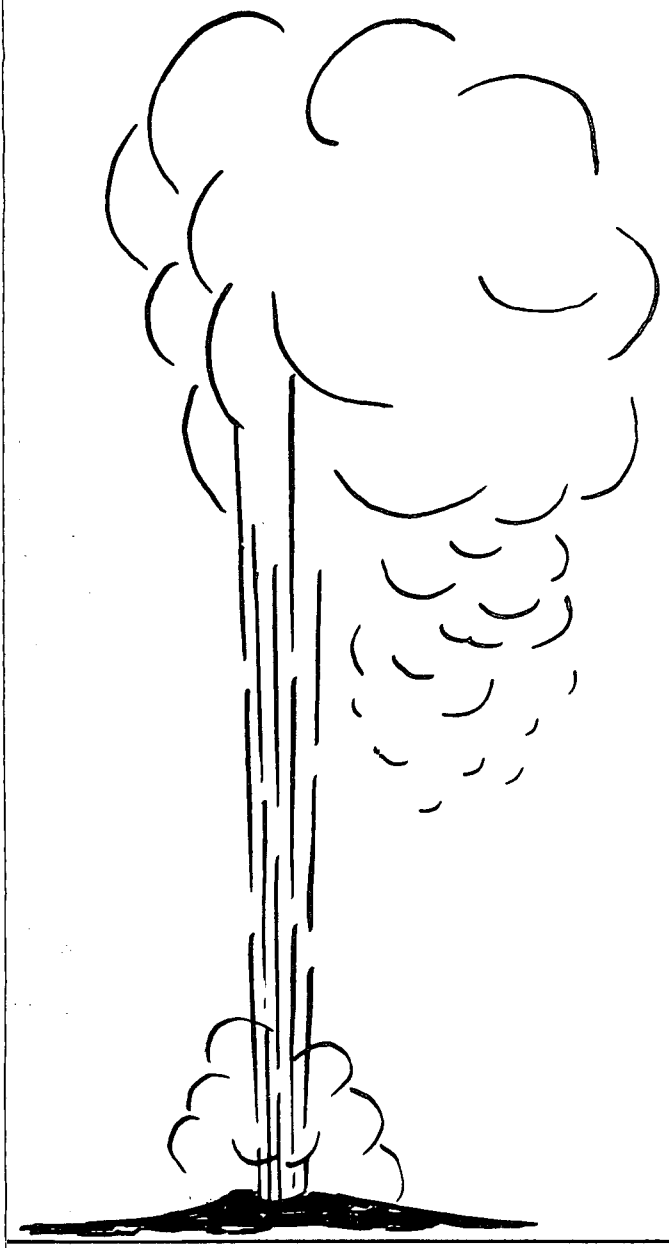

THE POTENTIAL EFFECTS OF ENVIRONMENTAL REGULATORY PROCEDURES ON GEOTHERMAL DEVELOPMENT

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SECTION I

EXECUTIVE SUMMARY

INTRODUCTION

With one major exception, all Federal environmental statutes were enacted and the implementing regulations of the Environmental Protection Agency were promulgated without consideration of their effect on the production and use of geothermal energy. It is hoped that as knowledge of this resource and the production and use technologies increases, stability and consistency in regulation will follow. In the meantime, the potential exists for difficulties in compliance with various regulatory procedures which are peculiar to geothermal operations.

Thus, a major function of this project was to assess the potential effects of several types of applicable environmental regulatory procedures on geothermal development and to identify particular problem areas. The possible impact of procedures adopted pursuant to the following Federal statutes were analyzed:

- Clean Air Act (CAA), P. L. 95-95, as amended by P. L. 95-190
- Clean Water Act (CWA), P. L. 92-500, as amended by P. L. 95-217
- Safe Drinking Water Act (SDWA), P.L. 93-523, as amended by P. L. 95-190
- Resource Conservation and Recovery Act (RCRA), P.L. 94-580, as amended by P.L. 96-482.

The Federal Noise Control Act of 1972 (P. L. 92-574) is excluded since it will have no direct effect on geothermal operations. The emphasis of this statute is on regulating the noise levels emitted by various types of products, such as construction equipment, at the point of manufacture rather than the use of such products. However, the Environmental Protection Agency has recommended limitations which are reflected by state and local statutes and regulations which restrict noise levels of construction, drilling, and utilization of geothermal resources.

State regulations applicable, or potentially applicable, to geothermal facilities were also reviewed to determine:

- permit information requirements
- pre-permit air or water quality monitoring requirements
- effect of mandated timeframes for permit approval
- potential for exemption of small facilities.

The regulations of the following states were covered in the review:

Alaska	Montana
Arizona	Nevada
California	New Mexico
Colorado	Oregon
Hawaii	Utah
Idaho	Washington

Wyoming

It can be concluded from the ensuing analysis that there are three general, pervasive environmental regulatory problems for geothermal operators, or potential operators. These include:

- o uncertainty
- o non-uniformity
- o complexity.

The uncertainty derives primarily from the fact that with the exception of the provisions of the regulations implementing the Safe Drinking Water Act dealing with underground injection of fluids, most geothermal operations are not yet subject to industry-specific requirements. This statement does not imply criticism of the Environmental Protection Agency's performance in this regard because at the current state of geothermal development, a high priority in the Agency's over-loaded standard-setting schedule cannot yet be justified.

Non-uniformity will, however, continue to exist in the absence of industry-specific standards since the absence of such requirements does not mean that air emissions and liquid effluents will not be controlled. To the contrary, it means that they will controlled on an ad hoc, site-by-site basis under limitations determined by personnel of EPA Regional Offices in some cases, state agency personnel in others, or, in some cases, both will be involved.

By contrast, more established industries are subject to, or soon will become so, specific limitations established, directly or indirectly, at the Federal level which apply nationwide. While many industries are unhappy with the limitations applied to their facilities, they at least know well in advance what the limitations will be and that they are uniform and apply across-the-board to all those competing in the same market. In addition, whole industries or segments of them have been sufficiently strong and affluent to overturn in the courts limitations which they felt to be unreasonable.

Geothermal operators do not share in the advance knowledge of what their requirements will be or in the national uniformity among competitors. And, a single operator is far less likely to succeed in winning a dispute as to the reasonableness of the limitations imposed than a collective industry, or to have the resources to attempt to do so.

Another variable in the case-by-case regulatory approach is the range of competence in industrial processes among permitting personnel--either EPA or state agency--in general and in geothermal operations in particular. It is not at all unusual for the individual responsible for regulating plants in a given industry to admit that he has no previous experience with that industry, a situation which could be particularly onerous in connection with the still-developing geothermal technologies. Perhaps this situation will improve as the environmental programs mature, but for now it can be expected to exacerbate regulation for those industries not yet subject to uniform limitations.

The matter of timing in achieving permits also becomes cloudy when decisions must be made which are applicable to only one facility. A specific effect of this phenomenon on geothermal operations is that regulatory agency personnel, with near unanimity, state that they will give such facilities "a closer look" because they are "different." Thus far, these terms have tended to translate into longer time lapse for permit approval and/or more restrictive requirements. If this practice continues, lead times and costs could severely inhibit geothermal development of all types. Tight construction schedules are needed for large new power plants and industrial uses on the scale of pulp and paper mills because of the effect of recession/boom fluctuations on the heavy capital investment required. This same effect will also be crippling to small marginal direct uses. Small users will be especially hampered if regulatory agencies and the public equate their environmental impacts with those of large operations, with multiple supporting production and reinjection wells.

This air of uncertainty is likely to continue for some years unless there is such an upsurge in geothermal activity that it achieves a higher priority in EPA's standard-setting schedule than it now has. And, at such time as development justifies uniform national limitations, the variable nature of resource will make this a difficult job indeed.

The complexity of regulations stems from several factors. First, the number of environmental programs enacted by the Congress were conceived at different times, under differing pressures, and without sufficient consideration of their interaction with the other programs, and certainly with no consideration of geothermal interests. A proliferation of different, yet similar, programmatic definitions, criteria, and regulatory missions resulted. The statutes for the most part also placed very severe time limits on EPA to develop and consolidate regulations to govern the complex and differing types of activities under the four statutes listed above and to deal with the contradictions, gaps, and overlaps in their mandated programs.

This problem--complexity--is of course a problem general to all industry. But again the newness of geothermal activity and questions of regulatory applicability to an industry which was not considered in the formulation of the regulations magnify the problem for this emerging industry.

This report can do little to solve any of these problems except to make them more comprehensible to the geothermal community. In order to achieve this objective, each program is examined separately to permit more specificity in defining their requirements as they may or may not apply to geothermal operations and in identifying particular problem areas.

A question and answer format is utilized in the detailed analyses in subsequent sections as a means of raising the most significant issues involved in each program. The "who," "why," "what," and "where" approach of the questions also provides a check-list for would-be developers.

The review of state regulations applicable to the construction of new facilities to use geothermal energy supports the following conclusions:

- o Uncertainty is the prevailing factor as to the kind and amount of information that will be required in order to obtain a permit, monitoring requirements, and timing of permit approval/denial.

- o In order to faciliate use of geothermal energy, the states should consider use of staged information requirements to meet the unique needs attendant to permitting production and use of this resource.

- o The impacts of some small geothermal operations may be so minimal that they will come under lawful exemption from state regulations, either under quantitative exemption or discretionary authority to exempt minor sources.

CONSOLIDATED PERMIT PROGRAM

This is a new program initiated by EPA to consolidate the processing of permits required under five different programs variously established by the statutes enumerated above for the control of air emissions in clean air areas, surface and underground discharge of liquid effluents, land disposal of hazardous wastes, and disposal of dredged and fill material. Its theoretical benefits to applicants include:

1) They will only have to learn one permit system.

2) The time required to obtain all permits may be accelerated.

In practice, there are built-in programmatic differences which will tend to inhibit the approach to a single permit system, and only time and performance will demonstrate whether acceleration occurs or whether industry fears that the timing of all permits will be keyed to the pace of the slowest permit are realized. The consolidated regulations do appear to limit the use of repeated requests for additional information to "complete" an application as a delaying tactic. In what is believed to be a unique provision, only one deficiency notice is allowed in any permit proceeding.

While the consolidated regulations are about 300 pages in length, they are mostly procedural in nature. The technical regulations relating to each type of permit are contained in other parts of the Code of Federal Regulations (CFR).

The consolidated approach applies only to permits issued by the EPA Regional Offices in states which elect not to operate their own permit programs as envisioned by the above statutes. The states are only encouraged to adopt a similar consolidated approach.

The permit application form to be used is consolidated only in that the very general information required is only detailed once. The other forms are program-specific.

PREVENTION OF SIGNIFICANT DETEORIORATION

This regulatory concept, commonly called PSD, is designed to protect the air quality of areas where the ambient air is cleaner than is required by the Clean Air Act. A major purpose of PSD is to prevent the degradation of air quality in pristine areas such as national parks and wilderness areas. It is thus of especial concern in the development of the geothermal resource since a large bulk of the hydrothermal resource lies in or adjacent to such areas in the far west.

While development is precluded within such statutorily protected areas by the legislation establishing them and the Geothermal Steam Act, PSD permits will be difficult to obtain for construction in their vicinity which willl adversely impact air quality values (including visibility) within them. If a Federal land manager demonstrates to a state that such values will be adversely impacted, a permit cannot be issued.

Other areas are also classified as PSD because they have attained the ambient air quality standard for one or more pollutants. However, restrictions on new construction will not be as severe as those relating to Class I, or pristine areas.

PSD permits will be required in designated PSD areas for facilities such as geothermal power plants and heating systems which will emit 250 tons or more per year of any regulated pollutant after control equipment is applied. The regulated pollutants include hydrogen sulfide, the most important contaminant known to be in the resource in some areas, sulfur dioxide, particulate matter, and others of less concern. Certain industrial applications of geothermal energy may be subject to PSD if they emit 100 tons or more per year. The use of the resource and its production will be considered two separate sources for determination of PSD applicability, a provision which may reduce the number of geothermal operations subject to PSD.

For those which must obtain a PSD permit, the requirements are much more onerous and costly than those for standard air pollution control permits. First, all permit conditions are established on a case-by-case basis which opens the door to inconsistent judgments which could be subjectively influenced by prevailing local pressures. A new source review must be conducted which includes a complex analysis of the potential air quality impact of the new facility, which in many cases will include a period of ambient air monitoring, and determination of BACT, best available control technology. BACT is more stringent than other emission limitations in several ways, especially in that it will permit the states, or EPA, to impose construction design and workplace practices on new facilities. This provision will not be welcomed in any industry, and the newness of the still-developing geothermal technologies could pose additional problems.

PSD also imposes a new type of restriction on development in limiting total future contributions to ambient levels of sulfur dioxide and particulates to established numerical increments over baseline levels. The allowable increments vary among area classifications, and are smallest in the Class I

pristine areas discussed above. Increments are currently divided among potential new sources on a first-come-first-served basis. If increments are exhausted, new development can only be permitted if existing sources reduce their emissions of sulfur dioxide or particulates, or both, as the case may be. It is not known at this writing whether EPA will extend the increment system to other pollutants.

The applicability of PSD to geothermal operations will depend on the physical and chemical nature of the resource used, on the manner in which it used, the variability of the local ad hoc interpretations of various PSD requirements, and proximity to Class I areas. On the basis of hydrogen sulfide alone, it can be calculated that power plants of commercial size utilizing a resource similar in H_2S contamination to the steam at The Geysers and the fluid in Imperial Valley will probably come under the PSD umbrella. Emissions of this gas to the atmosphere are reduced in binary plants, but escape from PSD may be offset by other environmental problems. It is also estimated that many small direct users may not be required to comply with the costly PSD requirements which will be favorable to the marginally economic uses of geothermal energy.

UNDERGROUND INJECTION CONTROL PROGRAM

This program (UIC) was established by the Safe Drinking Water Act to prevent contamination of underground drinking water sources. No permit is required for reinjection wells used in conjunction with the use of geothermal energy in "heating or aquaculture" unless it is found that they are adversely affecting drinking water or human health. EPA expressed the belief that "too little is known about the practices grouped in this class (of wells) to make them ripe for regulatory controls." It is possible that the term "heat" can be broadly interpreted to include a range of geothermal applications.

The only geothermal reinjection wells which do require a UIC permit are those used in conjunction with electric power generation. A permit may be issued only for wells which will not cause or allow movement of fluid into underground sources of drinking water.

Such sources will be designated by the states which may exempt aquifers from the designation and thus the protection required for drinking water because:

- The aquifer does not currently serve as a source of drinking water.
- It cannot now and will not in the future serve as a source of drinking water because:
  - it is mineral, hydrocarbon, or geothermal energy producing;
  - it is situated at a depth or location which makes recovery of water for drinking purposes economically or technologically impractical;
  - it is so contaminated that it would be economically or technologically impractical to render the water fit for human consumption; or

it is located over a Class III (which includes geothermal reinjection wells at power plant sites) well area subject to subsidence or catastrophic collapse.

Exemption of aquifers for any of these reasons is significant in that EPA has left the states free to ease the regulatory restrictions on wells discharging to an exempt aquifer. Particular note was made in the preamble to the regulations that the recent extension of the exemption to aquifers underlying the site of a Class III operation subject to subsidence "should make it possible to ease the burden of Class III operations in a number of cases."

The "burden" consists of a very detailed list of information requirements, monitoring wells, potential limitations on injection pressures and/or correction of deficient wells in the area although they do not belong to the permittee, and stringent construction and operating standards. EPA recognized, however, that some of the information cannot be supplied by permit applicants seeking to utilize geothermal energy until wells have been drilled and tested, and thus provided for a staged permit. The three phases include: construction, testing, and stimulation; operation; and abandonment.

These terms and the definitions of "geothermal" wells used in the regulations would tend to limit coverage of the UIC regulations to geothermal wells used for the extraction of the resource since disposal wells are not specifically included. An EPA spokesman publicly confirmed, however, that reinjection wells are intended to be covered.

In almost inviting the states to ease the regulatory burden of geothermal wells attendant to power generation, EPA has responded to the Congressional mandate "to assure that constraints on energy production activities...be kept as limited in scope as possible while still assuring the safety of present and potential sources of drinking water."

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

NPDES permits limit the quantities, rates, and concentrations of pollutant parameters, including heat, which may be discharged to surface waters. All unpermitted discharges are unlawful; there are no "small" or "minor" discharge exemptions.

While reinjection will probably be the most commonly preferred method of disposing of spent geothermal fluids, surface discharge may provide a viable alternative where conditions are favorable. Such conditions include purity of resource, successive uses or other economical means of reducing temperature, low risk of subsidense, and ample water bodies for discharge.

Obtaining an NPDES permit for surface discharge of geothermal effluents from power plant and direct heating sytems is hampered, however, by the lack of established effluent limitations and new source performance standards such as those prescribed for other industries on a nationwide, across-the-board basis, thus putting all competitors on the same footing. In the absence of such standards, the permit conditions are again established on a case-by-case basis.

Non-uniformity in this instance will not occur solely because of a variety in judgmental factors, but will be compounded by the use of state water quality standards in determining case-by-case, site-by-site permit conditions. Such standards may vary from state to state, from one water body to another within states according to the use for which they are classified, and from one reach of a stream to another. Therefore, permit conditions calculated on the basis of achieving or maintaining such standards may vary for operations only a few miles apart on the same stream. They may also be more stringent than EPA would feel necessary to apply to the whole industry.

It is not known whether the states or EPA will consider that the effluent limitations and new source performance standards already established for various industries are applicable to plants within them that use the geothermal resource for all or part of their energy needs or direct-contact process water. A ruling on this issue will be required by the permitting agency.

An advantage does paradoxically accrue to the use of geothermal energy in new facilities in the absence of new source performance standards. In NPDES parlance, they are not defined as "new sources" and are therefore not subject to the environmental impact scrutiny required for new sources under the National Environmental Policy Act.

Ocean discharge of effluents is regulated under a separate section of the Clean Water Act and separate regulations. Permits may be issued when it is determined that, after application of permit conditions, a discharge will not cause unreasonable degradation of the marine environment.

DISPOSAL OF DREDGED AND FILL MATERIAL

Permits under this program are only required where plant construction involves dredge and fill activities for water intakes and other structures and has no bearing on the use of geothermal energy.

HAZARDOUS WASTE MANAGEMENT

Pending a two-year Congressionally mandated study by EPA of the character of the muds and brines associated with exploration, development, and production of geothermal energy, these materials are not defined as hazardous. Therefore, their disposal is not subject to the rigid and costly requirements for handling of hazardous wastes. Such a study is especially needed in light of the high degree of proprietary interest on the part of drilling mud manufacturers. Otherwise, laboratory analysis would be required in almost every case to determine whether a given mud would be deemed hazardous due to the presence of toxic metals and thus subject to the hazardous waste provisions of the Resource Recovery and Conservation Act.

STATE PERMITTING REQUIREMENTS

Information Required to Obtain a Permit

While the specified information requirements for the same type of permit vary from state to state, discretionary authority to require the production of

any information needed by the permitting agency in order to reach its decision has three major effects:

- o It equalizes information requirements among states in that what one state may require specifically, another can require under the discretionary authority.

- o It provides the permitting agencies broad freedom in the types and amount of information they can require.

- o It precludes advance knowledge of specific information requirements.

The difficulty in the information requirements peculiar to geothermal development is that all types of regulations require information which a potential geothermal developer cannot supply until a well is drilled and tested. In fact, it is not even known whether permits will be needed until these activities prove a useable resource. Examples of this type of information are: estimated quantities and types of pollutants, efficiencies of control equipment, and average and maximum pressures of fluids to be injected. The problem is that drilling and testing of wells are themselves sources of pollution which generally cannot be undertaken without a permit.

As noted above, EPA solved this key problem in the underground injection control program by allowing for a staged permit. In this way, the appplicant furnishes the information he has available at three separate points and receives his permit conditions for the next step.

The PSD program also provides for staging of a sort in that test wells are considered temporary sources and, as such, are not required to have a PSD permit. Thus, the applicant has the opportunity to develop the needed information before filing his application.

Therefore, it appears that it might be well for the states to consider modeling permit programs applicable to geothermal development, in addition to UIC and PSD, after EPA's staged approach. Considerable confusion on the part of both the developer and the control agencies might be avoided.

Monitoring Requirements

Pre-permit air and water quality monitoring requirements are similarly discretionary and no specific mandatory requirements--in terms of the type of monitoring or length of period required--applicable to proposed geothermal operations were found. The effect of this is that potential developers cannot take monitoring costs, if any, and timeframes into account in their earliest feasibility studies.

Mandatory Time Limits

Many state regulations impose mandatory limits--such as 30 days, 180 days, etc.--on the length of time an agency may allow to elapse before it acts on permit applications. While the intent is commendable, the effects are diluted by the provision that the clock does not start to run until an application is "complete." Thus, applications can be hung up indefinitely by requests for more information. Violation of the mandated limits is admittedly frequent and is often considered "normal" procedure.

Potential for Exemption from Permitting Requirements

It is possible that the impacts of some small direct uses of geothermal energy may be so minimal that they may lawfully be exempt from some permit requirements, either under specified quantitative limits or discretionary authority to exempt minor sources. Potential users, particularly individuals, should investigate this possibility before being frightened away by the maze of existing regulations. If reason prevails, requirements may be more nominal than expected in some cases.

SECTION II

ANALYSIS OF FEDERALLY-MANDATED ENVIRONMENTAL CONTROL PROCEDURES

CONSOLIDATED PERMIT PROGRAM

What is this New Program?

It is a program designed by EPA to consolidate the applications for permits under five major programs and to establish procedures for processing all permits needed by a facility at the same time. These programs include:

- o Prevention of Significant Deterioration (PSD) (Clean Air Act)
- o Underground Injection Control (UIC) (Safe Drinking Water Act)
- o National Pollutant Discharge Elimination System (NPDES) (Clean Water Act)
- o Hazardous Waste Management (Resource Conservation and Recovery Act)
- o State Dredge and Fill ("404") (Clean Water Act)

Will all Permits Needed by Geothermal Operators be Applied for and Obtained Under the Consolidated Program?

No. The consolidated program applies only to permits issued by EPA and not to those issued by state agencies.

Why are Some Permits Issued by EPA and Some by State Agencies?

The Federal legislation creating the above programs envisioned that the states would implement and enforce the statutes under their own Federally-approved programs. This is clearly the preferred mechanism. However, some states elect not to develop and maintain implementing and enforcement programs, in which case EPA retains the authority to do so.

In some instances, states will qualify to administer one or more of the above programs but not others. For example, a state with approved NPDES, UIC, and dredge and fill programs may choose to leave management of the PSD and hazardous waste programs to EPA. In such a case, permits would be variously obtained from the appropriate EPA Regional Office and one or more state agencies.

EPA establishes mandatory minimum requirements for state programs, but in most cases the states may adopt more stringent requirements.

Then why was the Consolidated Permit Program Adopted?

It was EPA's intent to consolidate and unify the procedures applicable to its own permit programs and to allow greater coordination and cooperation in permit review and issuance between EPA and the states in instances where a single facility requires permits from both EPA and one or more state agencies. In addition, where appropriate, EPA will consolidate draft permits, public

notices, public hearings, and administrative records for the permits needed by an applicant. The program embodies the so-called "one-stop shopping" permitting concept.

Are States Required to Develop Consolidated Programs?

No. The regulations specifically exempt states from developing consolidated programs but encourage them to do so. However, as noted above, certain provisions of the consolidated regulations establish minimum requirements for the procedural aspects of state programs.

Spokesmen for several state agencies interviewed for other aspects of this project stated that they do not agree with the "consolidated" approach and will not adopt it. Since a consolidated form does not alter the fact that each permit must be considered by a separate program element within their agency, these spokesmen view the "coordination" as an additonal administrative "layer."

How does EPA Plan to Overcome this Problem in its Own Consolidated Program?

Centralized permit processing units comprised of representatives of the various program elements are being established in each EPA Regional Office, and files on permit applications will be consolidated.

Will the Consolidated Process Expedite Permit Issuance?

If the comparison is drawn between the time required to obtain all of the permits needed by a new facility under the consolidated approach with the time lapse involved in obtaining them separately, the new concept may result in some acceleration. EPA considers this the important consideration since four of the five types of permits are construction permits, (dredge and fill is the exception) and all of them are necessary before construction can begin. Thus, EPA believes the timing of the last, rather than the first, permit is the most critical because it completes the environmental specifications for the construction and provides the firm basis for final planning and financing.

Industry, on the other hand, fears that the consolidated procedure will tend to slow down the entire permitting process to the pace of the slowest permit. Only time and practice will indicate whether improved permitting schedules evolve from consolidation.

The "kicker" in this permit proceeding, and most others as discussed in Section III, is that most procedural steps do not start until an application is deemed "complete." However, use of this mechanism as a delaying tactic appears to be inhibited somewhat in the consolidated regulations in that the permitting agency is limited to only one deficiency notice in any given permit proceeding. There is no binding limitation on how long EPA or the states may take to issue the notice, although Section 124.3 of the regulations requires the permitting agency to set and make public a nonbinding schedule for decision making for each new project. In addition, under the consolidated approach, the completeness of one permit application does not depend on the completion of another (40 CFR, 122.4(c))--e.g., if the UIC application were deemed complete, processing on it could begin while more information is sought for the PSD application.

Are there Benefits to Geothermal Developers in the Consolidated Regulations?

Perhaps, but they are difficult to discern at this juncture. Theoretically, costs of preparing the "standard" permit application form will be reduced, and "standardized" permit processing procedures will require permittees to learn only one procedure.

In actual practice, however, more than "one" procedure will be utilized since there are inherent programmatic differences, as explained by the voluminous regulations establishing the consolidated program. In addition, the forms to be used in applying for EPA-issued permits are not "standardized" for all permits. Only a two-page form, shown in Appendix A, applies across-the-board to all permits. The subsequent forms are permit-specific and are considered by EPA as separate documents. Approved state programs are allowed to develop their own application forms but must require as a minimum the same information solicited on EPA's forms.

The supplementary form for existing industrial sources applying for an NPDES permit is shown in Appendix B. The form for new industrial dischargers has not yet been finalized as is the case with the PSD and UIC forms.

The NPDES application form is the only one which is a revision of a previously existing form since all of the other programs are relatively new. The major change in this form is distinctly inimical to the interests of geothermal developers utilizing a relatively pure resource since the old short form for "simple discharges" has been abandoned. EPA notes in its preamble to the forms that "some of the more burdensom requirements will immediately be understood not to apply to simple, non-toxic discharges and therefore may be marked "Not Applicable." Even so, the formidable appearance of the form shown in Appendix B would not immediately be discerned as a benefit.

The programmatic differences are illustrated in Figures 1, 2, and 3, taken from the regulations. It will be noted that the differences occur primarily in appeal procedures, which are perhaps the most significant procedures to geothermal developers since they provide recourse when permit conditions established on a case-by-case basis are considered unreasonable.

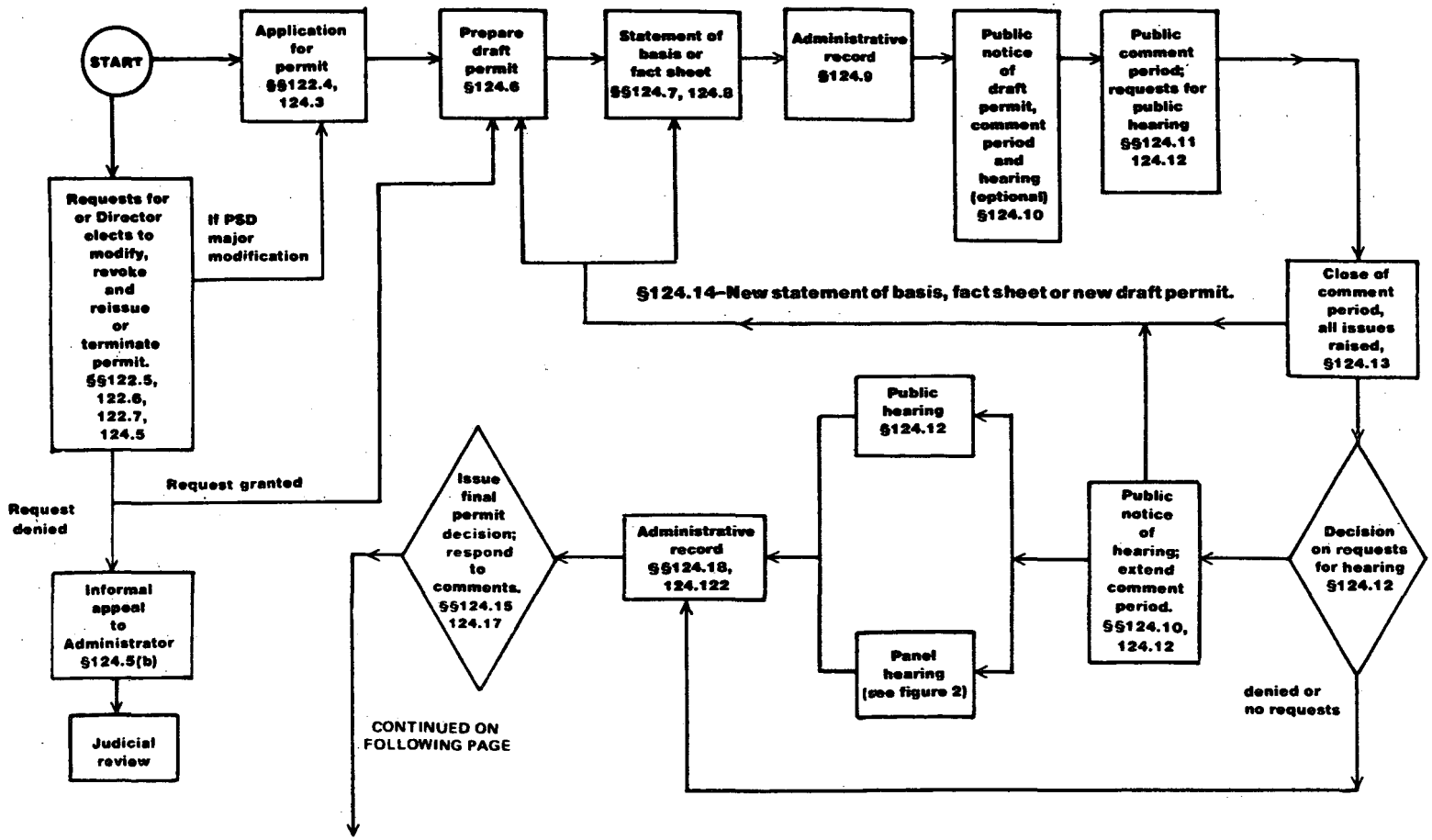
Most of the procedures outlined in Figures 1 through 3 are self-explanatory although a few terms have special meanings within the consolidated program. These include:

- o Statement of Basis - A statement must be prepared setting forth the basis for every draft permit (or notice of intent to deny the permit) for which a "fact sheet" is not prepared. It briefly describes the derivation of the draft permit conditions and the reasons for them (or reasons supporting tentative denial). Although Figure 1 does not so indicate, a notice of intent to deny a permit is processed in the same manner as draft permits.

- o Fact Sheet - A fact sheet is required for draft permits for "major" facilities, which, except in PSD, is a designation for administrative purposes only and does not relate to size of facility, and for those subject to widespread public concern or which raise major issues. The fact sheet is considerably more detailed than the statement of basis.

Figure 1

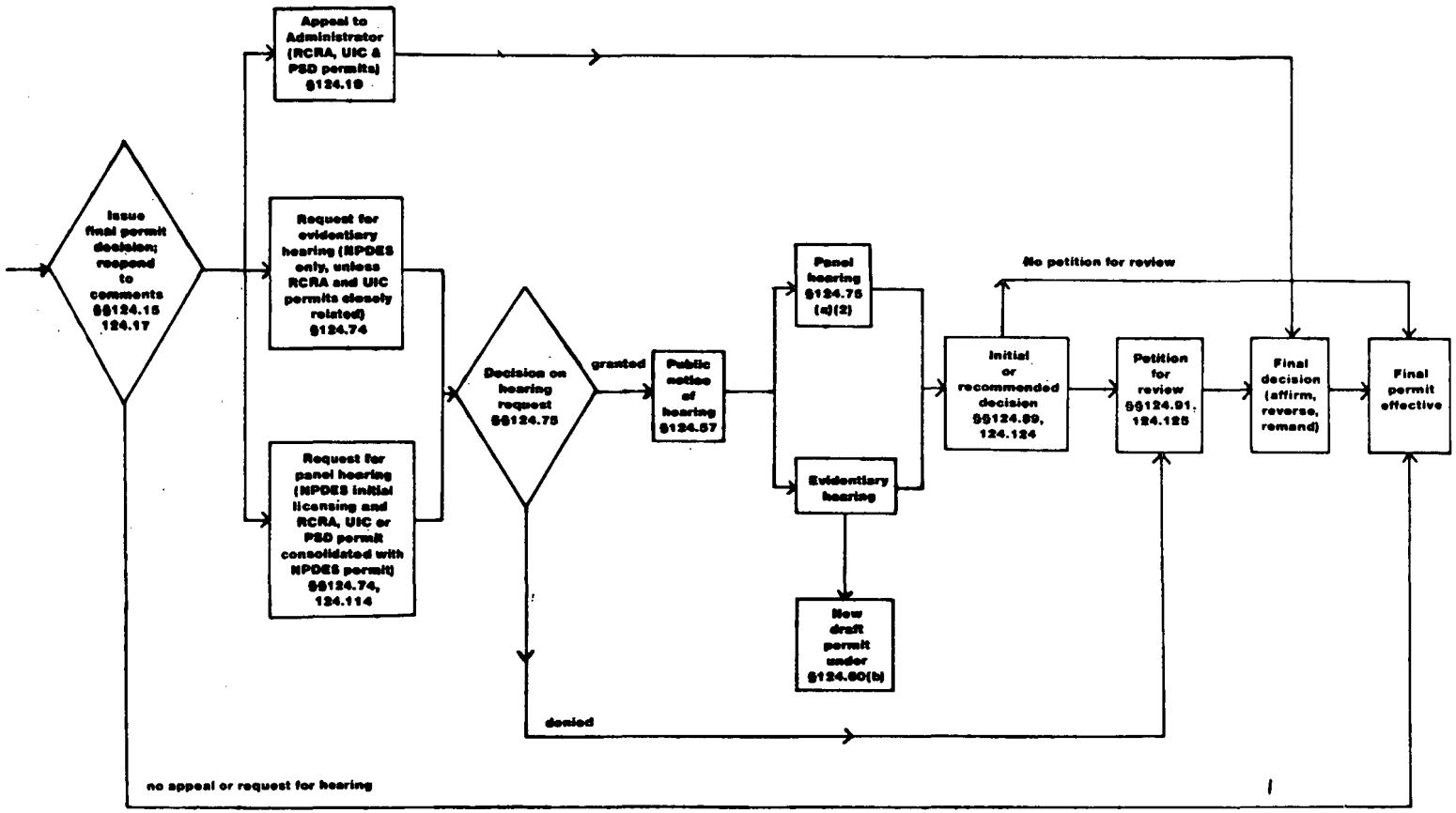
EPA CONSOLIDATED PERMIT PROCEDURE



SOURCE: Federal Register, 19 May 1980

Figure 2

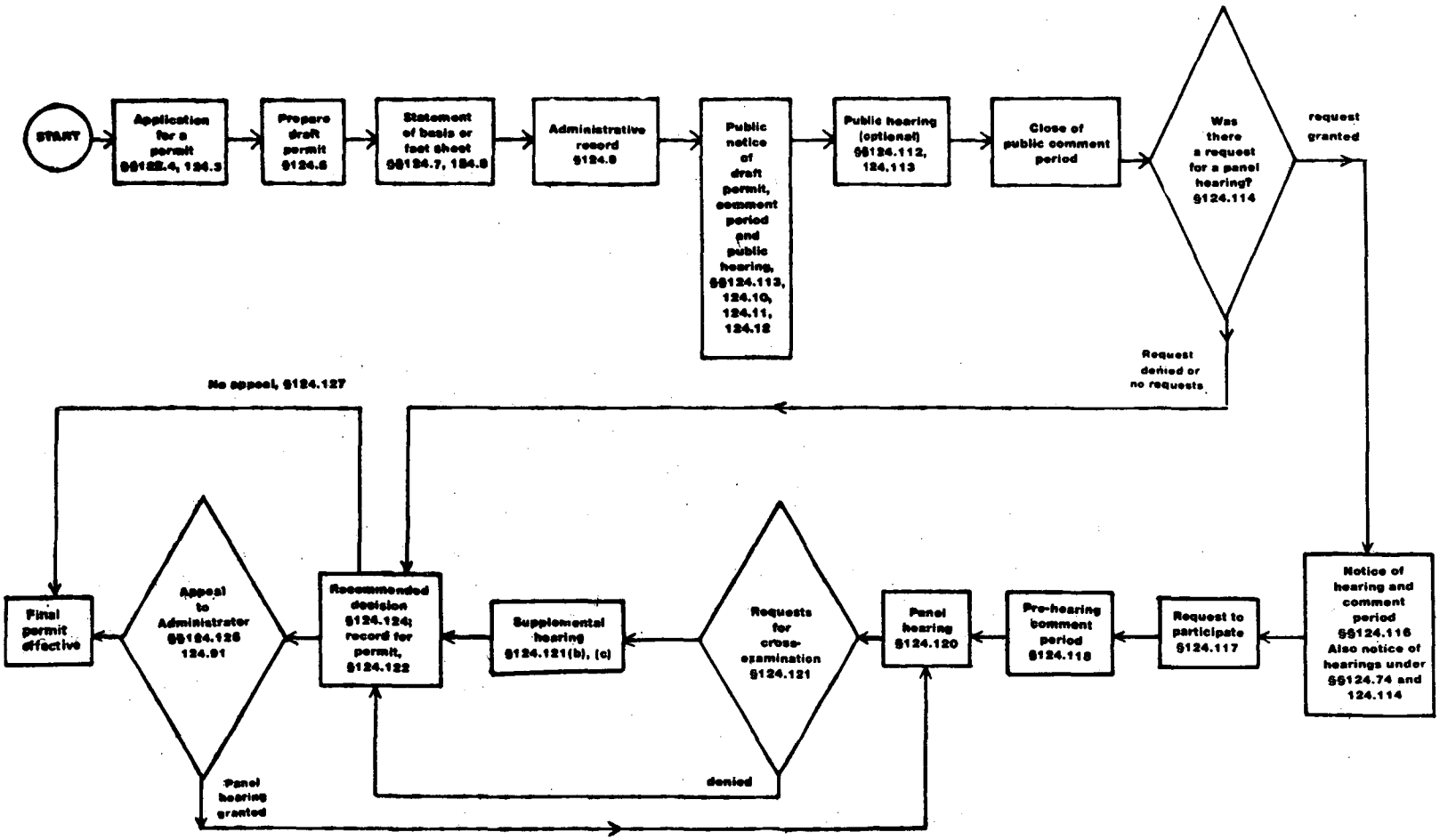
EPA PERMIT APPEAL PROCEDURE



SOURCE: Federal Register, 19 May 1980

Figure 3

EPA NON-ADVERSARY APPEAL PROCEDURE



BILLING CODE 6560-01-C

SOURCE: Federal Register, 19 May 1980

- o Evidentiary Hearing - A formal hearing under Section 554 of the Administrative Procedures Act (APA). It is available when NPDES permits are contested, and may be extended to closely related conditions of a UIC or RCRA permit. PSD permits are never subject to this type of hearing (EPA-issued UIC, RCRA, and PSD permit conditions are appealed to the EPA Administrator.)

- o Panel Hearing - This is also a formal hearing, but non-adversary, which may be used by EPA in making NPDES, RCRA, or UIC permit decisions, and parties subject to an evidentiary hearing may agree to use the panel hearing instead.

The programmatic differences become much more dramatic when the issuance of EPA-issued NPDES permits are deemed to be subject to the Environmental Policy Act of 1969 (P.L. 91-190) (NEPA). The complex procedures set in motion by this determination are illustrated in Figure 4. It is emphasized, however, that NPDES permits for the discharge of effluents from geothermal power plants and direct heating systems are not subject to NEPA, as discussed in considerable detail below, although such permits for some industrial uses may be subject to this process.

Even when permit issuance is not subject to NEPA, permits of all varieties are subject to public participation and litigation which, in controversial situations, can amount to almost the same thing. "Scare" stories on the odor of geothermal resources, for example, can engender prolonged public controversy.

Are all of the Regulations Pertaining to the Five Types of Permits Contained in the Consolidated Regulations?

No, the consolidated regulations are mostly procedural in nature. In addition to the 300 pages establishing this program published in the Federal Register of 19 May 1980 (40 CFR, Parts 122, 123, 124, and 125)--with more to come as other program elements and forms are completed--there are separate technical regulations covering each of the permit programs which aggregate to several hundred additional pages. They will be cited in the following program-specific discussions.

Whatever else might be said about the total package of regulations, it can be observed here that it discriminates against the small potential user of geothermal energy who does not have a corporate legal staff to determine the applicability of the various provisions to his proposed activities.

Will EPA Always Use the Consolidated Approach?

No, its use is discretionary, and consolidation can occur at any point in the permitting process. The applicant may request consolidation and great weight will be given to the request. He may not, however, veto consolidated action.

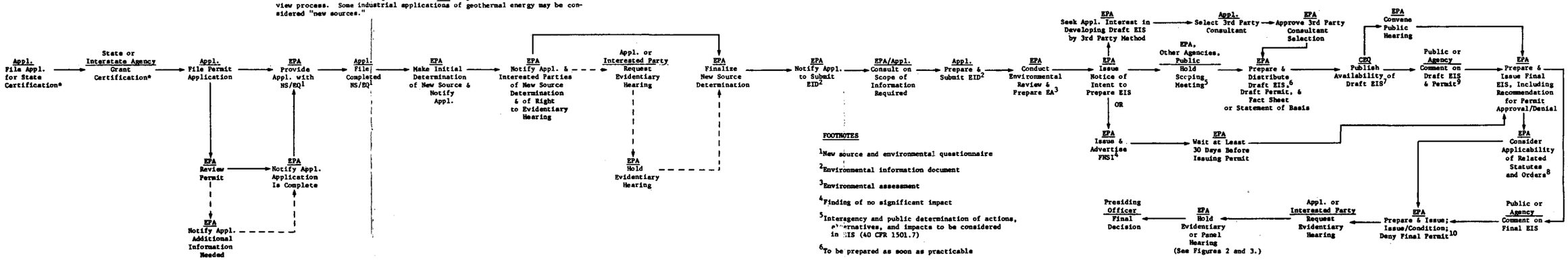
Are Application Filing Dates the Same for All Programs?

No. The deadline for NPDES applications for new facilities is 180 days prior to start-up; for RCRA, 180 days before any physical construction; for

Figure 4

PROCESS FOR OBTAINING EPA-ISSUED NPDES PERMITS FOR NEW SOURCES
(of the states subject to this report, this process is applicable only in Alaska, Arizona, Idaho, and New Mexico)

NOTE: Until new source performance standards are proposed/promulgated for geothermal power plants and direct heating systems, new facilities of these types are classified as "new dischargers" and are not subject to the environmental review process. Some industrial applications of geothermal energy may be considered "new sources."



*Under Section 401(a)(1) of the Clean Water Act, NPDES permits cannot be issued until state certification is granted, waived, or conditioned. If certification is not submitted with the application, EPA may request it at any point in the process.

FOOTNOTES

[1] New source and environmental questionnaire

[2] Environmental information document

[3] Environmental assessment

[4] Finding of no significant impact

[5] Interagency and public determination of actions, alternatives, and impacts to be considered in EIS (40 CFR 1501.7)

[6] To be prepared as soon as practicable

[7] After the release of the NOI; prior to or concurrent with publication of public notice for the issuance of a proposed permit

[8] National Historic Preservation Act of 1966, Executive Orders on Protection of Wetlands and Floodplain Management, etc.

[9] Comment period on draft may be reopened if a new draft permit is formulated

[10] Not until 90 days after the comment period on the draft EID or 30 days after the comment period on the final EIS, whichever is later

UIC, a reasonable time prior to construction of a new well; and for PSD, prior to commencement of construction.

PREVENTION OF SIGNIFICANT DETERIORATION REGULATIONS

What is PSD?

"PSD" is the common acronym for the air pollution control concept of "prevention of significant deterioration" in the air quality of areas where the ambient air is cleaner than required by the Clean Air Act. This concept grew out of the stated statutory purpose of earlier air pollution control legislation to "protect and enhance" the quality of the nation's air resources. The impetus to push the concept into the courts and finally into legislation in 1977 was provided by the fact that the Federal air pollution control program then focused solely on reducing pollutant levels in areas already in violation of ambient air quality standards, now known as nonattainment areas. The strict emission controls to be imposed in those areas, it was felt, would tend to push industry to new locations where little or no development had occurred, and where its emissions would permit the air quality to remain in compliance, but would, nonetheless, degrade pristine areas.

The effort to curb this eventuality has resulted in one of the most complex and restrictive of the environmental limitations placed on new industrial facilities--the PSD permit system. The system, to be implemented by EPA until states qualify to manage their own PSD programs, is designed to severely limit pollution emissions from new sources in clean air areas, or, at its most extreme, prevent sources of pollution from being constructed.

The PSD program is of special importance in the development of the geothermal resource since virtually all construction for the purpose of utilizing geothermal energy will be new construction as defined in Part C of Title I of the Clean Air Act Amendments of 1977 (P.L. 95-95, as amended by P.L. 95-190). In addition, it is predicted that PSD will exert its greatest impact in the pristine areas of the western "geothermal" states.

The technical PSD permit requirements are contained in 40 CFR, Parts 51 and 52 (Federal Register, 7 August 1980). These parts also set forth the minimum requirements for state administered PSD programs in issuing permits.

What Facilities Require PSD Permits?

The full burden of PSD falls only on new construction projects which qualify as major sources of a regulated pollutant or pollutants. A major stationary source is one which:

- emits, or has the potential to emit, 100 tons per year or more of any air pollutant regulated under the Clean Air Act and is one of the specified types of industrial sources

- emits, or has the potential to emit, 250 tons per year or more of any regulated air pollutant (40 CFR, 51.24(b)(i)(i)).

The list of specified industries, shown in Table 1, does not include geothermal production or its use in electric power generation, direct heating/

TABLE 1

INDUSTRIES SUBJECT TO PSD 100-TON PER YEAR CUTOFF POINT*
(Primary Industries)

Coal cleaning plants (with thermal dryers)

Kraft pulp mills

Portland cement plants

Primary zinc smelters

Iron and steel mills

Primary aluminum ore reduction plants

Primary copper smelters

Municipal incinerators capable of charging more than 25 tons/day of refuse

Hydrofluoric, sulfuric, and nitric acid plants

Petroleum refineries

Lime plants

Phosphate rock processing plants

Coke oven batteries

Sulfur recovery plants

Carbon black plants (furnace process)

Primary lead smelters

Fuel conversion plants

Sintering plants

Secondary metal production plants

Chemical processing plants

Petroleum storage and transfer units with a total storage capacity exceeding 300,000 barrels

Taconite ore processing plants

Glass fiber processing plants

Charcoal production plants

* The list also includes fossil fuel-fired steam electric plants and fossil fuel boilers of more than 250 million Btu/hour heat input.

cooling systems, or agriculture/aquaculture. Thus, such facilities do not need a PSD permit unless they have the potential to emit 250 tons or more annually of any regulated pollutant or pollutants. However, it is assumed that where geothermal energy is used to supply all or part of the energy needs for industrial facilities of the types listed in Table 1, such facilities would be subject to the 100-ton limitation.

The "potential to emit" is defined as the maximum capacity of a facility to emit a pollutant under its physical and operational design capacity after the application of air pollution control equipment and/or restrictions on hours of operation and types or amounts of materials consumed, stored, or processed. In order to determine applicability, the following calculations are required for all geothermal operations in PSD areas:

- the quantity of each contaminant present in the geothermal resource which will be generated as emissions, as well as total particulate emissions to be generated (excluding fugitive emissions)
- the percentage reduction achievable by the application of control equipment and operating characteristics
- the quantity of pollutants which will become airborne.

Well testing may be a necessary part of this determination. The test wells will not be considered new sources for PSD because they are defined as "temporary" sources and are exempt from PSD requirements.

If the calculated controlled emissions of facilities not on the list in Table 1 do not exceed 250 tons of a regulated pollutant, a state construction and operating permit issued under an approved implementation plan is all that is needed insofar as air emissions are concerned. If the emissions of a listed facility utilizing geothermal energy will exceed 100 tons per year, inquiry should be made to the state control agency or EPA as to PSD applicability.

To obtain credit for pollutant reductions resulting from control equipment and operating limitations, such reductions must be Federally enforceable--i.e., required by state or Federal regulations and/or included as an enforceable permit condition. While EPA included this provision, insofar as it relates to control equipment, to ensure proper operation and maintenance, it could possibly work to the advantage of the applicant in limited cases. For example, if the annual emissions of hydrogen sulfide (H_2S)--so far the most important contaminant in geothermal resources--were calculated at or slightly over 250 tons, and additional reductions were achievable through the installation of more effective control equipment than required by state or Federal regulations, its use, if covered by a correspondingly more stringent enforceable permit limitation on emissions, could result in calculated emissions below 250 tons and relief from PSD. The major consideration then would be the relative economics of escape from PSD requirements vis-a-vis the cost of installing and maintaining the extra control equipment. Similarly, an adjustment in operating hours might bring emissions to below the cutoff point in a marginal situation.

Modifications to existing sources are also subject to PSD review if they will result in a "significant net increase" in the potential emissions of any regulated pollutant. "Net" increase means an increase which is not offset by reductions in the emisssions of the same pollutant or pollutants by the existing source (40 CFR 51.24(b)(3) and 52.21(b)(3)). If the emissions of an addition or expansion are entirely offset by contemporaneous emission reductions, the new construction is not considered a modification for PSD purposes. Only an actual physical change in, or change in the method of operation, of a major source may be considered in calculating contemporaneous decreases. It will be exceedingly important to determine the prevailing interpretation of this offset policy when planning a plant expansion.

"Significant" is defined in terms of de minimis thresholds for each regulated pollutant (40 CFR 51.24(b)(21) and 52.21(b)(21)). For example, if the additional annual H_2S emissions of the plant expansion are calculated at less than 10 tons, the net increase is not significant and the expansion is not subject to PSD.

The final definition of the term "source" may benefit large applications of the geothermal resource in that a power plant or an industrial use, for example, would be considered a separate "source" from the supporting well field. As separate sources, the likelihood of PSD application is decreased since each one could emit up to 250 tons, or 100 tons as the case may be, of a regulated pollutant without being subject to its requirements.

To constitute a single source, all buildings or structures must belong to the same industrial grouping (i.e., Standard Industrial Classification (SIC) Major (2-digit) Group); must be located on one or more contiguous or adjacent properties; and be under the control of the same person (or persons under common control) (40 CFR 51.24(b)(5)(6)). Either the first or the last of these criteria, or both, may result in the separate source determination. While no SIC classification for geothermal exploration, drilling, and production was found, and it is thus assumed that these functions fall into SIC 9999, Unclassified Establishments, they are a logical extension of Major Group 13 covering these same operations connected with oil and gas. Power plants fall into Major Group 49, pulp and paper mills in Major Group 26, and frozen and canned food products, Group 20, for example. The common control factor may also dictate the same determination in that the resource may be produced by one corporate entity and used by another.

Another change in the final version of the regulations also appears favorable to geothermal operations. In earlier proposals, an aggregation of new minor sources on the site of a minor source (less than 250 or 100 tons per year of a regulated pollutant, depending on type source) which collectively reached the cutoff point, would result in the whole facility becoming "major" and subject to PSD. This is no longer the case. For example, if an initial well is a minor source, an aggregation of additional wells qualifying as minor sources will not change its classification.

For now, geothermal operators will not be required to consider fugitive emissions in the calculation of annual emissions for purposes of the "major" source determination. Fugitive emissions are defined as those which could not reasonably pass through an opening which the owner or operator uses for ventilation, such as a stack, chimney, roof vent, or roof monitor. This means that

fugitive emissions at the well head and fugitive dust, for example, will not be included in the annual tonnage for purposes of determining whether the source falls under the 250- or 100-ton cutoff. This situation will almost certainly change as EPA develops better techniques for quantifying these emissions.

How Is PSD More Onerous Than Other Permitting Programs? An Overview

If it is calculated that a new unlisted geothermal facility has the potential to emit 250 tons or more per year of any regulated pollutant (100 tons for a listed industrial source), or that a modification to an existing facility will generate a significant net increase, the burden of PSD begins with a new source review (NSR) before a permit application is filed. The requirements of this review are compared with typical requirements for obtaining construction and/or operating permits under traditional types of air pollution control regulations in Table 2.

Perhaps the most onerous provision shown in the table to industry generally is mandated best available control technology (BACT). This is a higher degree of control than is called for under other regulations and may add considerably to the cost of any new construction subject to the requirement. This is not a prospect welcomed by any industry, but it could be a more prohibitive factor in marginally economic proposed geothermal operations than in more established industries.

On the other hand, the adverse effect of the case-by-case approach of PSD may be far greater in those established industries already subject to across-the-board standards which put all competitors on the same footing, as discussed earlier. The application of unequal case-by-case requirements could have a highly detrimental effect on competitive balance and industry growth. In the absence of such standards for geothermal, permit limitations will be developed on an ad hoc basis anyway. And, in light of the stringency to be expected in some areas, there may be little difference between BACT and the limits the permitting agency would require under other regulations.

Ideally, case-by-case determinations will be knowledgeable, practicable, and reasonable within the intent of the PSD concept, and consistent to the extent possible in achieving its purpose. From a real-world standpoint, the departure from uniform standards applicable to all sources within a class of sources opens the door to a wide range of determinations, subject to a number of subjective, rather than technological, factors. For example, the direction of public or media pressures at a given time could influence the BACT determination for a specific new source.

The new power of the environmental agencies under BACT to impose construction design and workplace practices also departs from the performance standard which establishes a uniform emission limitation, and leaves it to the source to determine the most feasible and economic means to achieve it. This approach also opens a potential Pandora's box of inconsistent judgments made by control agency personnel with little or no knowledge of or experience in the processes involved in geothermal operations.

The concept of dividing among new sources an allowable amount of air pollution in a specified area (called an "increment") is also new. Similarly,

TABLE 2

COMPARISON OF PSD NEW SOURCE REVIEW WITH TYPICAL REQUIREMENTS FOR PERMITS UNDER OTHER STATE/FEDERAL AIR POLLUTION CONTROL REGULATIONS

PSD	Other
An analysis to determine the best available control technology (BACT)	
The control agency, EPA or the state, evaluates on a case-by-case basis, the energy, environmental, economic and other costs, and the benefit of emission reductions achievable with each technology. Emission limitations are then specified that reflect the maximum degree of reduction for each regulated pollutant to be emitted. In addition, if the reviewing authority determines that there is no economically reasonable or technologically feasible means to accurately measure the emissions, and hence to impose an enforceable emission standard, it may require the proposed source to use source design, alternative equipment, work practices, and operational standards to reduce emissions to the maximum extent.	Emission limitations are imposed across-the board on all sources, or all similar sources, in an industry, and the individual source complies with the most suitable and economic technology for the source. There are no plant-by-plant requirements and no interference in how individual plants are built or operated.
An analysis of ambient air quality	
This analysis must demonstrate that the emissions of a new source or modification of an existing source will not violate either applicable ambient air quality standards or the applicable PSD increment, a new mechanism for setting a maximum allowable increase in pollutant concentration in a PSD area (see page). Up to one year of monitoring may be required for pollutants subject to ambient air quality standards and dispersion modeling will be required for other pollutants. Sources which will emit sulfur dioxide or particulates will have to compute how much increment for those pollutants is available to them. If there is none, the permit cannot be approved unless an existing source reduces its emissions of these pollutants.	Monitoring can be required in all states to determine whether air quality standards will will be exceeded. If violation is indicated, additional emission reductions will be required. There is no mechanism for allotting incremental increases in pollutant concentrations among sources or to make the construction of a source dependent upon the actions of others.

TABLE 2--Continued

An analysis of impacts to soils, vegetation, and visibility	
As a part of this analysis, the applicant must also consider the associated impacts from general commercial, residential, industrial, and other growth.	An environmental analysis such as this is performed on Federal land before geothermal development can commence by the leasing agencies, not the applicant. Some states--e.g., California and Montana--impose such a procedure on new development.
Determination of no impact on a Class I area	
Pristine areas such as national parks and wilderness fall into this category (see page). If the Federal land manager demonstrates that emissions from the proposed source would impair air quality related values (including visibility), he may recommend denial of the permit even though the emission levels would not cause a violation of an allowable increment.	No related requirement.
Public participation in consideration of application	
Public notice and a public comment period are required before the PSD review agency takes final action on the permit application. A public hearing may be held if requested or at the discretion of the control agency.	Some states have similar provisions.
Time initiation of construction	
Once a PSD permit is obtained, construction must start within a reasonable period (typically 18 months) or the permit will be invalidated.	This is a typical requirement in most western states.

placing the burden on existing sources, in areas where the increment has all been used, to further reduce their emissions so that new development may occur is without precedent except for a related offset policy imposed in nonattainment, or "dirty", areas. The difficulties inherent in implementing the increment approach are discussed in detail below.

Finally, the prohibition on construction which will adversely affect the air quality related values (including visibility) of Class I areas--national parks, wilderness, etc.--could, on a site-by-site basis--constitute the most important inhibition to geothermal development embraced in the PSD concept. This is true because such a preponderance of the resource underlies very remote, pristine terrain.

All of the terms used in this brief overview are defined in the following discussions, and the inherent problems are delineated in detail.

What Are Regulated Pollutants?

The regulated pollutants are those which are subject to:

- o air quality criteria and thus ambient air quality standards
- o a standard of performance for new stationary sources (NSPS)
- o a hazardous air pollutant emission standard.

The list assembled in accordance with this definition is as follows:

Column 1	Column 2
particulate matter	asbestos
sulfur dioxide	beryllium
ozone	fluorides
hydrocarbons	mercury
carbon monoxide	vinyl chloride
oxides of nitrogen	sulfuric acid mist
lead	hydrogen sulfide
	methyl mercaptan
	dimethyl sulfide
	dimethyl disulfide
	carbon disulfide
	carbonyl sulfide

Column 1 lists the so-called "criteria" pollutants which are also the subject of ambient air quality standards; Column 2 lists the pollutants which are regulated under NSPS or hazardous pollutant standards.

Hydrogen sulfide is on the list of "regulated" pollutants by virtue of the fact that there is a new source performance standard governing the H_2S emissions of petroleum refineries. It is EPA's interpretation that this is sufficient basis to extend PSD coverage to this pollutant, and it is this interpretation, more than any other, that is likely to bring some geothermal facilities under the PSD "umbrella."

The 1977 Clean Air Act Amendments direct EPA to consider regulating several other specific pollutants. Aresenic and cadmium are probably the most important ones to geothermal development.

Where Does PSD Apply?

All areas of the country are classified as PSD (clean) or nonattainment (dirty) areas. Contrary to popular opinion, PSD areas are those in which the national ambient air quality standards for any of the pollutants listed in Column 1 above have been attained. Designation does not hinge on levels of particulate and sulfur dioxide alone. Further, if there are insufficient data available to support classification--attainment or nonattainment--an area is considered a PSD area. Conversely, a nonattainment area is one in which one or more ambient air quality standards are being violated.

Since designation is pollutant-specific, an area may be both a PSD and a nonattainment area at the same time. For example, if the air quality of an area meets the carbon monoxide standard, it is a PSD area; if it is not in compliance with the particulate standard, it is a nonattainment area; and both sets of standards apply to new construction. The significant difference in such areas is that a facility will be subject to PSD if it generates emissions exceeding 250 tons (or 100 tons for listed facilities) per year of any of the above regulated pollutants, unless the pollutant is the one for which the area was designated nonattainment. A source is subject to nonattainment review only if its emissions exceed the size cutoff for the particular pollutant exceeding a national ambient air quality standard.

Nonattainment areas are thus of less concern to potential geothermal operators--at least insofar as the nature of the resource is now known--for several reasons. First, there is no ambient air standard for hydrogen sulfide, and the standards for particulates and, possibly, sulfur dioxide are the only other standards of this type which will bear on geothermal emissions. The remaining air quality standards are related primarily to motor vehicle emissions. Second, violations of the particulate standards, and thus designation of nonattainment areas on this basis, occur mainly in heavily industrialized areas which are not the present major focus of geothermal production and use.

Further, EPA has apparently virtually abandoned the use of the ambient air quality standard to trigger state emission standards in favor of the new source performance standard route (Section III, Clean Air Act). Thus, it appears unlikely that new standards of this type will be adopted which would in turn force the creation of nonattainment areas where the pollutant of

concern would impede construction of geothermal facilities. This is not to say that nonattainment areas will never present a problem anywhere, but only to indicate that they are a relatively minor concern compared with PSD for geothermal operations.

Persons interested in developing and utilizing geothermal energy should, as a first step in their planning, determine the status of the land area to be utilized from the appropriate EPA Regional Office.

What Is Class I Area?

A Class I area is the category of area which is subject to the strictest degree of control under PSD. Class II allows for moderate industrial growth, and Class III embraces the already industrialized areas where, within limits, the greatest degree of industrial expansion will be permitted.

The Act established certain lands as mandatory permanent Class I areas. These include:

- o international parks
- o national wilderness areas of over 5,000 acres
- o national memorial parks of over 5,000 acres
- o national parks of over 6,000 acres

which were in existence on August 7, 1977. The list of areas falling into these categories were published in the Federal Register of 3 November 1977, and are shown in Appendix C.

This list supports the conclusion drawn in the earlier in this section that the greatest impact of PSD will be felt in the far west. Of the total of 39 national parks included on the list, 25 are in the "geothermal" states covered by this report and represent nearly four million of the approximately 5.5 million acres of national parks listed. These states also embrace 90 of the 121 wilderness areas listed, accounting for 11.4 million acres out of a total of 12.5 million.

In addition, the Act (Sec. 164(d)) directed the Secretary of the Interior to review "all national monuments, primitive areas, and national preserves" and to recommend any appropriate areas for redesignation as Class I where air quality related values are important attributes of the area." His recommendations were published in the Federal Register of 7 September 1979. The areas in the states to which this report is addressed recommended for redesignation as Class I are shown in Appendix D.

States may on their own volition redesignate areas as Class I, although the concurrence of the Federal land manager is required when Federal lands are involved. A survey of the air pollution control agencies of the subject states indicates that there is currently no widespread move in this direction.

How Are Areas Redesignated?

All areas, except those statutorily defined as permanent Class I areas, are inititally classified as Class II. It is then left to the state or Indian tribe to reflect its own desires for limiting or encouraging development by reclassifying areas as Class I or Class III, respectively. In both instances, what amounts to an environmental impact statement on the effects of the proposed redesignation must be prepared and a public hearing held in the affected area. Class III designation additionally requires:

- o approval by the state governor after consultation with the state legislature
- o legislation approving the change enacted by local governments representing a majority of the area's residents.

How Will Classification Affect Geothermal Development?

The stringency of the PSD limitations and, in fact, permission to locate industrial facilities at all in some locations, hinges on the classification of the area. Insofar as particulate matter and SO_2 are concerned, classification brings into play the new emission control device, called "increments," discussed above. An increment is a maximum allowable increase over baseline ambient concentrations of a pollutant, which, in effect, establishes a numerical limit on the increase of that pollutant which will be permitted through the combined contributions of all new development in a PSD area. Put another way, all future construction will have to share the established increment for PM and SO_2 in the area, and if in time the increment is used up, no new development will be possible unless an existing source or sources reduce their contribution.

The allowable increment varies according to the classes of PSD area. Table 3 illustrates the relative degree of control stringency among them. The effects of Class I on future development which will generate particulates and/or SO_2 are readily discernible.

If this stringency were applicable only within Class I areas, it would exert little or no effect on geothermal development since development of this resource is otherwise precluded in these areas. Industrial development is prohibited in national parks and soon will be precluded in wilderness areas, and the Geothermal Steam Act expressly forbids geothermal development on lands in national recreation areas, fish hatcheries, wildlife and game ranges, wildlife management or waterfowl production areas, or lands acquired or reserved for the protection and conservation of fish and wildlife that are threatened with extinction (P.L. 91-581, Sec. 15(c)).

But, issuance of a PSD permit for a new source outside a Class I area is dependent on its impact on "the air quality-related values (including visibility)" of the Class I area, and even the potential effects of de minimis pollutants must be investigated if the source or modification proposed is within 10 miles. In fact, if a Federal land manager demonstrates to the state that the impact of the source will be adverse to "air quality-related values (including visibility)," even though the source's emission will not cause an increment to be violated in the Class I area, a permit shall not be issued

TABLE 3

MAXIMUM ALLOWABLE INCREASES
UNDER PSD INCREMENT SYSTEM

Class	I $\mu g/m^3$	II $\mu g/m^3$	III $\mu g/m^3$	Primary Ambient Air Quality Standard $\mu g/m^3$
Particulate Matter				
Annual mean	5	19	37	75
24 hr max	10	37	75	260
SO_2				
Annual mean	2	20	40	80
24 hr max	5	91	182	365
3 hr max*	25	512	700	1300

* The 3 hr max figure for SO_2 represents the secondary standard rather than a primary standard.

Section 165(d)(2)(c)(ii). This provison is not limited to emissions of particulate matter and sulfur dioxide and embraces adverse effects of any regulated pollutant. Its effect will depend on how the term "demonstrate" is defined by the states and the level of proof required. This provision offers conservative land managers and those hostile to development an opportunity to seriously delay construction if not to avoid it altogether. (In the preamble to related proposed regulations, Visibility Protection for Federal Class I Areas (Federal Register, 22 May 1980), EPA stated that water vapor will not be considered visual impairment unless it is combined with other substances such as sulfur or nitrogen dioxide.)

Neither the Act nor the regulations require the Federal land manager to withhold other types of permits which he is responsible for issuing in cases where the reviewing authority (EPA or the state) does not agree that adverse effects would occur. However, EPA points out that the regulations do not prohibit this form of "affirmative" action.

The other side of this coin is a provision whereby a permit can be issued to a new source even though its emissions will cause or contribute to concentrations which exceed the allowable Class I increment. The prerequisite is demonstration by the applicant, and certification by the Federal land manager, that the emissions will have no adverse impact on the air quality-related values of the Class I lands (including visibility), the increment violation notwithstanding. If such a permit is issued, limitations must be applied to assure that emissions of PM and SO_2 do not exceed the following increments:

	MAXIMUM ALLOWABLE INCREASE (micrograms per cubic meter)
Particulate matter	
Annual mean	19
24 hr max	37
SO_2	
Annual mean	20
24 hr max	91
3 hr max	325

A further variance from maximum short-term sulfur dioxide peak levels (24 hours or less) is available when the Governor of the state and the Federal land manager concur that the variance would not adversely affect the air quality related values of the Class I area (including visibility). If the Federal land manager does not concur, the President acts as a referee between the two.

The degree of relief offered by these variances appears dependent on the importance of the specific facility whose impact is in question and how long the PSD applicant can afford to wait for resolution of these issues. It seems safe to observe that they were not designed to assist the geothermal industry as it is now constituted.

Whether the use of the increments will be expanded to other pollutants is not known. The Act only directs EPA to promulgate regulations to prevent the significant deterioration of air quality by emissions of all pollutants for which national ambient air quality standards are established. It does not specifically require the classification of areas and setting of increments for the other pollutants. In any event, the balance of those subject to existing standards (listed in Column 1) will not be of concern to geothermal operations and no new ambient standards on other pollutants are expected for the reasons stated in the discussion "Where Does PSD Apply?"

Problems of development in Class II areas, which for the foreseeable future will account for the bulk of the land, will depend on:

- o their proximity to Class I areas and the air transport between
- o availability of applicable pollutant increment
- o local sentiment toward the proposed construction.

It is uncertain at this time whether Class III designation will ever be of concern to geothermal development. First, the process for redesignation of Class II areas to Class III is subject to several procedural and political obstacles which will severely limit Class III designation. In addition, these areas are already heavily industrialized and use of geothermal in such areas could hinge on factors such as the following:

- o continued availability of conventional fuels
- o discovery of a local geothermal resource, the use of which is determined to be feasible and economic
- o sufficient delay in the development of other alternative sources of energy to make geothermal the most attractice alternative source to industry where it is available.

How Will Increments Be Allocated?

The increments of particulate matter and sulfur dioxide emissions will, for now, be allocated by EPA on a first-come, first-served basis after consultation with the states. EPA has, however, encouraged the states, in developing their PSD programs, to examine alternative approaches to the allocation of available increments in order to provide for their own development planning and individual growth objectives. These alternatives include:

- o Marketable Permits - a permit which permits the source to sell a portion of its permit proportional to the degree to which it reduces emissions below the level specified in the original permit. The theory behind this approach is that it provides an incentive to

greater emission reduction at the selling facility while permitting the buyer to utilize a means of compliance which is cheaper than its own cost of reduction.

- Emission Density Zoning - a land classification based on the quantity of pollutants which could be emitted over the land. Each acre of land would translate to a fixed quantity of allowable emissions, and sources would purchase the air rights to enough land to cover their emissions. More expensive air rights, in areas of heavy demand, would, EPA feels, lead to higher levels of control since more costly control equipment would be justified in order to buy the remaining air rights.

- Emission Fees - fees charged to a source according to the quantity of pollutants it emits. The intent is to provide the economic incentive to minimize pollution.

What Are The Problems in Administering Increments?

There are many--both for the applicant and the administering agency. The first one is in establishing the baseline ambient concentration which is used, in an abstract sense, to establish the starting point for defining significant deterioration.

This factor is to be determined at the time after August 7, 1977 (date of the Act) of the first application for a major source in the PSD area in which the source would be constructed or on which it would have an air quality impact of one microgram per cubic meter of a pollutant or greater. It is a pollutant-specific concentration; a plant that is a "major" source because of its potential particulate emissions will not set the baseline in motion for sulfur dioxide.

The baseline concentration generally includes actual source emissions, with some exclusions, estimated from source records or other sources of information. This is the "actual emission" concept. It is not based on ambient air quality monitoring, however, even though the applicant may be required to monitor one or more pollutants for some period of time, as discussed below.

In effect, no baseline will be formally established. Instead, increment consumption will be tracked by tallying changes in the emission levels (increases or decreases) contributing to the baseline concentration and increases in emissions due to new sources. Thus, a PSD permit applicant will have to determine from a record book how much of the increment is left, if any, and EPA or the state will determine how much of the available total will be allocated to him. As noted above, this allocation will be on a first-come, first-served basis as long as EPA is administering the program. The date of application fixes the right to available PSD increment.

It is difficult to perceive a program that would be more difficult to implement in areas where more and more sources develop with a proliferation of emission additions and subtractions. In view of the deficiencies of most Federal and state recordkeeping systems, this will be a nightmarish situation. It will not be as large a problem to geothermal activity in remote areas where little other development occurs, but this advantage may be offset, in some cases, by the existence of Class I areas in those regions.

Another complexity of the increment concept is that the states have the authority to expand available PSD increments in an area by requiring emission reductions from existing sources. Assuming that this were the only way for a new source to be constructed, unless the existing sources stood to benefit from it in some way, there would be considerable protest and no doubt lengthy litigation. Meanwhile, new construction would be at a standstill.

What Are the Required Air Quality Analysis Procedures?

The required air quality analysis centers on whether pollutant emissions from a new source will cause or contribute to violation of any national ambient air quality standard or any increment. Whether or not the analysis imposes a special burden may vary widely, since the procedural requirements of this exercise will again be determined on a case-by-case basis.

On the one hand, the preamble to the final regulations (Federal Register, 7 August 1980, 52724) states that monitoring will generally be required only for the criteria pollutants--for all practical purposes in geothermal operations these are limited to particulates and sulfur dioxide--and that mathematical modeling will be used to perform the analyses for the other regulated pollutants. Conversely, it is stated 1) that the use of "existing representative air quality data" will be permitted in lieu of monitoring in some cases, and 2) that monitoring may be required for non-criteria pollutants if an acceptable monitoring method is available. Hydrogen sulfide is considered to be in that category.

Monitoring is not to be required on the pollutants to be emitted in de minimis amounts, and a new source can also be exempted from monitoring requirements if it shows either that existing air pollution in the source impact area or its projected impact in the affected area is de minimis. Yet, the exemption is not automatic, requiring special case-by-case approval, especially where there is 1) an apparent threat to an applicable PSD increment or ambient air quality standard or 2) an adverse impact on a Class I area.

EPA has established modeling as the means for determining the impact of the projected emissions. If applicants accept the assumptions and constraints of an EPA-required model, and these factors do not reflect the actual situation, serious overpredictions or underpredictions may occur. On the other hand, an applicant seeking to depart from the recommended models may do so only if EPA finds the substitute model comparable (See EPA's Workbook for the Comparison of the Air Quality Models). This alternative may lead to considerable delay and inconsistent acceptance of the substitute among EPA regions.

In the case of geothermal operations, well tests, if they have not already occurred, may be required prior to modeling in order to derive the values to be used in the models.

The length of the monitoring period, if required, is also variable-- from a minimum of four months up to one year before the application is filed.

Is Post-Construction Monitoring Required?

The requirement for post-construction monitoring is discretionary. If required, it will be used to validate and refine models, and, to some extent, to determine the effects of source emissions on consumption of allowable increments.

What Are the Procedures for Determining Impacts on Vegetation, Etc.?

No guidelines have been promulgated as yet on the scope of the analysis required on vegetation, soils, visibility, and other factors or the impact of growth anticipated to occur as a result of the proposed construction. If these requirements are decided on a case-by-case basis, severe inequities could result.

This is especially true in the case of geothermal activities due to the prevailing "closer look" attitude among regulators.

What Are De Minimis Pollutants?

De minimis pollutants are those emitted in insignificant amounts as established under a pollutant-specific de minimis exemption system that excludes or limits review of proposed construction with emissions or air quality impacts below specified values. This system may have several favorable effects. First, if the annual emission of a given pollutant on the list is calculated to be below the specified maximum level:

- a new source may avoid BACT or the air quality analysis for pollutants it imits in de minimis amounts even though it is a "major" source in terms of another pollutant

- a modification may avoid these requirements altogether if its net increase would be de minimis for all regulated pollutants; or, the pollutants for which BACT must be applied may be limited.

The pollutants on the de minimis list which may be of most concern to geothermal operations and the specific annual amounts are as follows:

Pollutants	Tons per Year
total suspended particulates	25.0
sulfur dioxide	40.0
mercury	0.1
beryllium	0.0001
fluorides	3.0
sulfuric acid mist	7.0
hydrogen sulfide	10.0

The di minimis concept also includes a list of air quality concentrations for each pollutant as criteria for exempting sources from the monitoring

requirements at the discretion of the reviewing authority, as discussed above. The levels of concern in geothermal development are as follows:

Pollutant	Air Quality Value (averaging time) ($\mu g/m^3$)
total suspended particulates	10.0 (24-hr.)
sulfur dioxide	13.0 (24-hr.)
mercury	0.25 (24-hr.)
beryllium	9.0005 (24-hr.)
fluorides	0.25 (24-hr.)
sulfuric acid mist	*
hydrogen sulfide	0.023 (1-hr.)

*No satisfactory monitoring techniques available at this time.

How Much Time Will Be Required to Obtain a PSD Permit?

The report of the Senate Committee on the Environment and Public Works (S. Rept. 95-127) is abundantly clear on congressional intent on the subject of timing. It states:

> "Inherent in any review-and-permit process is the opportunity for delay. The committee does not intend that the permit process to prevent significant deterioration should become a vehicle for inaction and delay. To the contrary, the States and Federal agencies must do all that is feasible to move quickly and responsibly on permit applications and those studies necessary to judge the impact of an application. Nothing could be more detrimental to the intent of this section and the integrity of this Act than to have the process encumbered by bureaucratic delay."

In response to this dictum, EPA's regulations require it to respond to an application (or supplement to an application) and specify any deficiencies in the information submitted within 30 days. In addition, EPA is required by the Act to make a final determination within one year after receipt of a completed application. However, a series of "deficiencies" could result in repeated delays until a "completed" application starts the clock.

EPA reports that it has been processing permits in much less than the one year allowed, and that as states take take over the PSD program it is hoped that the permit can be issued as part of the normal permitting procedure. It remains to be seen whether this optimism continues to be the case, especially if a large new geothermal power plant were proposed. Here again the "closer look," whether it is deserved or underserved, may translate into longer approval periods as well as stricter requirements.

It must be remembered that lead time also includes the ambient air quality and related environmental analyses and a period of monitoring which remains indefinite until specified on a case-by-case basis. In addition, the Act provides for a public hearing before a permit can be issued. Although EPA has interpreted this to mean providing an opportunity for public hearing, in contested cases the public has a statutory right to insist that a hearing be held.

The basic problem is that since virtually every step in the entire program is based on ad hoc decisions, and a great deal of discretion is allowed it is impossible to estimate the lead time involved in obtaining a PSD permit. What is worse, any delay which occurs as a result of PSD has to be added to the delay involved in getting Federal leases for geothermal development, rather than running concurrently with that process. This is true because the site-specific, case-by-case PSD judgments cannot be set in motion until the site of new construction is fixed.

Will PSD Apply to All Geothermal Facilities?

Almost certainly not, although prediction on the overall behavior of the resource is hampered by the fact that its chemical nature, and thus the type and quantity of emissions to be anticipated, varies from reservoir to reservoir and from site to site within reservoirs. The applicability of PSD will also depend on the manner in which the fluid or steam is used, and, finally, on the variability of the local ad hoc interpretations of various PSD requirements and terms and proximity to Class I areas.

At this time, assessment of overall applicability must be based on hydrogen sulfide since it is the only regulated pollutant of major significance known to be associated with the hydrothermal resource except particulate matter of varying composition. The problem of particulates contained in the resource becoming airborne through cooling tower drift or other routes will require site-specific determinations as to quantity. While the same is essentially true of any pollutant at the present state of the art in geothermal operations, the nature and behavior of hydrogen sulfide are well known and provide the basis for calculating the potential applicability of PSD insofar as this pollutant is concerned to certain uses of the resource.

Hydrogen sulfide is an acid gas, and becomes more soluble as the pH increases, but at commonly encountered pH values the solubility is quite low. For example, a sulfide solution at pH 8 containing 3.4 ppm of sulfide will be in equilibrium with a concentration of 10 ppm of H_2S in air. Thus, for practical purposes, it can be assumed that most of the hydrogen sulfide in a geothermal brine will escape to the atmosphere if a pathway is available. Typical pathways in power plants include venting of noncondensible gases, cooling towers, or storage ponds.

Obviously, pathways are not available, under normal operating conditions, in direct uses of the resource which employ closed systems. Thus, it can be anticipated that such systems will not themselves be subject to PSD because of H_2S even if conditions in the attendant well field or disposal area brought those sources under the umbrella.

Many open systems for direct use will also be exempt for two reasons. First, such a system would not be designed for use with a resource highly contaminated with H_2S for the obvious reasons associated with air quality restrictions. Second, if the resource is to come into direct contact with vegetation or livestock, a very pure resource will be required.

Thus, the generalization can be made that direct uses which do not require large numbers of supporting wells or utilize large surface disposal areas will usually not be subject to PSD because of H_2S emissions.

In terms of geothermal power plants and direct heating vis-a-vis PSD, it is possible to calculate the annual emissions of H_2S as a function of the amount of heat available from the geothermal brine or steam plant. The calculations on gross (uncontrolled) emissions shown in Figure 5 are based on the following assumptions:

- All hydrogen sulfide in the resource will escape to the atmosphere. (This obviously will not apply to closed systems.)
- For direct heating use, the resource is a high-temperature liquid; it is discharged at a temperature of 95°F; and there is an escape route where hydrogen sulfide will reach the atmosphere.
- For power generation, the resource is either hot liquid or steam, and the power system operates at a condensing temperature of 140°F.

The use of the figure is illustrated by consideration of the first 10 units at The Geysers, which produce 396 MW of electricity. If the efficiency is assumed as 16.7%, thermal energy is 2,371 MW. The total estimated emission of H_2S is 1,630 lb/hr or 7,130 tons/year. This indicates 83 MW thermal energy for each 250 tons/year of uncontrolled hydrogen sulfide. The value obtained by use of the figure is found by following upward from the Power-Steam arrow to the estimated average H_2S content of The Geysers steam, 2-300 ppm. The figure agrees well with the 83 MW thermal energy calculated from field data.

Another example of gross emissions is illustrated from data on the first Niland well. The well temperature is 520°F, and contains about 300 ppm H_2S. If this brine were flashed to produce steam to drive a turbine, about 6MW thermal energy is all that could be produced without exceeding a 250 ton/year limitation based on gross emissions, and the actual production of electricity would be considerably smaller because of losses in the generation step.

However, since "potential to emit" is based on controlled emissions, the amount of thermal energy which could be utilized by a plant and still stay within the 250-ton cutoff point is increased substantially. For example, if the control equipment operates at 90% efficiency, the amount of energy available within the 250-ton limit will increase by a factor of 10. It is difficult to maintain this performance level, however, as indicated by problems at The Geysers. Thus, until improved control technology is proven it must be assumed that power plants of economic size utilizing geothermal steam or fluids directly will be subject to PSD.

Consideration of H_2S emissions from binary power generating plants is complicated by several factors. In these systems there is no direct contact between the geothermal brine and the power generation working fluid, and it is possible to produce the fluid, pass it through a heat exchanger, and reinject it without H_2S escape. However, there are potential problems with such a system.

As the brine is brought to the surface, pressure is reduced, and some gases may tend to be released from solution, forming pockets of noncondensible gases in the equipment. The release of gases may also raise the pH of the brine, and result in the precipitation of insoluble materials which can interfere with reinjection. Reinjection difficulties may also be encountered

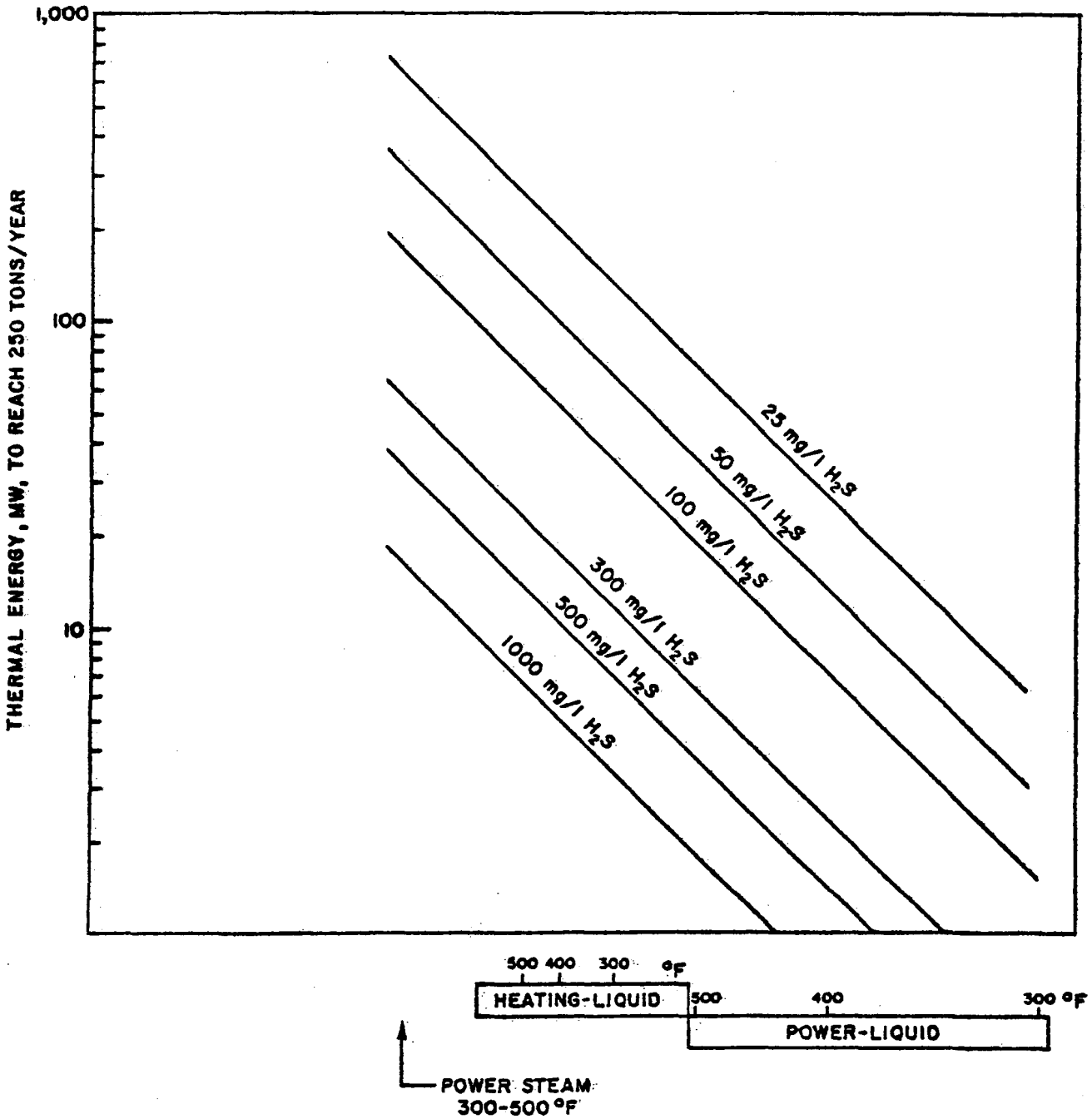


FIGURE 5. THERMAL ENERGY WHICH CAN BE PRODUCED WITH LESS THAN 250 TONS/YEAR HYDROGEN SULFIDE EMISSIONS, WITHOUT CONTROL EQUIPMENT

through air leaks into the system around pump seals and reduced solubility of silica and other materials as the temperature is reduced.

The use of down-hole pumps has been found to prevent precipitation of material in the bore of the producing well by maintaining the pressure and thus preventing the release of carbon dioxide, with the consequent deposition of calcium carbonate scale. Scale inhibitors have also been found to prevent the precipitation of scale during steam flashing, but did not appear to prevent injection-well plugging.

It is probable that a totally enclosed treatment and filtration system could be developed to prevent plugging since such systems have been used to clean up oil-well brines before reinjection by preventing iron precipitation through contact with air. The cost of such treatment will be highly dependent on the fluid composition.

Thus, it can be concluded that direct heat exchange and reinjection without gas escape may be possible in many fields, but where the fluids have scale-forming tendencies, it cannot be considered certain that currently available techniques can economically prevent equipment scaling and injection well plugging.

While Figure 5 is applicable to gross emissions when geothermal fluids are used for direct heating in a system which permits H_2S to escape, this presentation is illustrative only since such a system would not be feasible in today's environmental climate. As in other direct uses, H_2S emissions from direct heating systems will to a large extent depend on size (number of wells) vis-a-vis resource contamination, and whether properly operating reinjection is practiced. Surface disposal of an H_2S contaminated resource would be precluded by both air and water quality considerations. The definition of "source" discussed above which would consider the well field one source and the heating system another may tend to exempt most heating systems from PSD even if the well field itself is large enough and sufficiently contaminated to fall under its requirements.

It is not possible to predict the applicability of PSD to very large industrial uses, such as pulp and paper mills, due to the number of variables involved. However, a use of sufficient size to compete in an established industry is a likely candidate.

In summary, it appears that large geothermal power plants will feel the major impact of PSD and most small direct operations will escape the costly requirements of this concept. This prediction, if accurate, is in conformance with the intent of PSD and is very favorable to the marginally profitable uses of the geothermal resource.

UNDERGROUND INJECTION CONTROL (UIC) PROGRAM

What is the UIC Program?

It is the program established under the Safe Drinking Water Act and 40 CFR, Part 146 (plus the procedural consolidated regulations) to regulate wells drilled for the purpose of underground injection of fluids. Its major purpose is to prevent the contamination of underground drinking water sources. Be-

cause of the subsurface origin of geothermal fluids, the disposal of such fluids through underground injection is termed "reinjection."

Does the UIC Program Apply to Wells on Federal Lands?

Yes, the 1977 Amendments to the Drinking Water Act (P. L. 95-190) expressly gave the states jurisdiction over injection wells on Federal land. Thus, all such wells on lands leased under the Geothermal Steam Act are subject to UIC.

Do All Geothermal Reinjection Wells Require a Permit?

No. The UIC regulations as finally adopted (Federal Register, 24 June 1980) placed geothermal wells "used in heating or aquaculture" in a special category of wells (Class V) which do not require a permit. There is no indication as to whether this language can be interpreted to include geothermal wells for other direct uses, such as cooling and industrial applications, although the only other category of geothermal wells (Class III) is limited to those "which inject for extraction of minerals or energy including . . . recovery of geothermal energy to produce electric power." Many industrial applications would be embraced by the term heat, but the volume for reinjection could, in large operations, equal those of power generation.

Class V wells are generally characterized by the regulations as those which "inject non-hazardous fluids into or above formations that contain underground sources of drinking water." EPA expressed its belief in the preamble to the regulations that "too little is known about the practices grouped in this class to make them ripe for regulatory controls" and instituted a three-year assessment on:

- the construction features of Class V wells and the nature and volume of injected fluids
- the contamination of Class V wells, and
- available corrective alternatives where appropriate and their environmental consequences.

The assessment, conducted by the state or EPA in the absence of an approved state program, is to provide "recommendations both for the most appropriate regulatory approaches and for remedial actions where appropriate." Owners and operators of Class V wells must notify the appropriate UIC control program of their existence and provide the inventory information needed to support the assessment.

Injection into Class V wells may be authorized indefinitely by the state or EPA by a general rule which will require that such wells "are not to cause a violation of primary drinking water standards and they are not to affect the health of persons adversely." (Primary drinking water standards are numerical limitations on contaminants in public drinking water supplies designed to protect public health. See 40 CFR 141.)

Any wells violating these general provisions or other provisions of the rule are subject to an enforcement action. Such action may [illegible] form of

an order to institute remedial action, to obtain a permit, or to cease injection, depending on the degree of violation.

What is the Difference in Treatment for Reinjection Wells Associated with Power Production?

Class III wells, including geothermal reinjection wells at power plant sites, may be operated only with a permit, and a permit may be issued only for wells which will not cause or allow movement of fluid into underground sources of drinking water. It is to be noted that total containment is not required; only that any leak or displacement not reach an underground source of drinking water.

A single permit for a number of wells may be obtained on an area basis. The conditions for an area permit are that the wells be located in the same well field, facility site, reservoir, project, or similar unit in the same state; of similar construction; of the same class; and operated by a single owner or operator.

What Are Underground Sources of Drinking Water?

An underground source of drinking water (USDW) is an aquifer or a portion of an aquifer which (1) supplies drinking water for human consumption or (2) in which the ground water contains fewer than 10,000 mg/1 of total dissolved solids. The significance of the latter criterion is that it represents the acceptable level of salinity for water which may be processed for drinking purposes. Underground sources of drinking water are formally identified by the state (or EPA) and must be protected from contamination.

There is, however, a mechanism by which an aquifer, or portion, can be exempt from the protection required for drinking water sources. The criteria supporting such exemption are extremely important to geothermal development. They include:

- The aquifer does not currently serve as a source for drinking water.
- It cannot now and will not in the future serve as a source of drinking water because:
  - it is mineral, hydrocarbon, or geothermal energy producing;
  - it is situated at a depth or location which makes recovery of water for drinking purposes economically or technologically impractical;
  - it is so contaminated that it would be economically or technologically impractical to render the water fit for human consumption; or
  - it is located over a Class III well area subject to subsidence or catastrophic collapse.

The last criterion is new, being added to the final version of the regulations in response to comments received on the proposed regulations.

It is to be noted that the criterion for exemption based on the value of the aquifer for mineral, hydrocarbon, or geothermal resources is expressed as a "producing" aquifer. Comments on the proposed version of these regulations pointed out that this wording appeared to imply that only areas actively being worked could qualify for such an exemption, a situation which could cloud new development in some areas. These commenters recommended the use of the word "bearing" in lieu of "producing."

EPA rejected the suggestion on the basis that it did not want to open the possibility of "wholesale" exemption of aquifers, over large areas of the country, which become identified as capable of producing one or another mineral. No further definition of "producing" or clue as to how the term will be interpreted is provided.

Why Is Exemption of Aquifers from the Status of Drinking Water Source Important to Geothermal Operations?

EPA at first considered exempting from the UIC regulations injection wells which do not inject into, through, or above drinking water sources. While such wells were ultimately included because of the potential for contamination of drinking water sources through lateral displacement, EPA has given the states discretion to ease the technical requirements associated with permits for such wells.

Thus, if the aquifer into which geothermal fluids are to be reinjected is declared an exempted aquifer, it is not a drinking water source subject to the most stringent regulatory controls, and the state may use its discretion on permit requirements. EPA notes in the preamble to the regulations that the extension of the exemption to aquifers overlying the site of a Class III operation subject to subsidence or catastrophic collapse "should make it possible to ease the burden of Class III operations in a number of cases."

What Are the Worst-Case Regulatory Requirements?

In order to obtain a permit for wells injecting into, through, or above drinking water sources, considerable information must be supplied. If a state agency is the permitting authority, some of the information (such as maps, tabulations of wells, etc.) which is already in the agency's files may be included in the application by reference. If EPA is handling the application, all information must be submitted. It includes:

- o a map showing known or suspected faults, the injection well(s) for which the permit is sought, and the applicable area of review. Within the area of review (calculated with a mathematical model or a determined fixed radius based on chemistry, hydrology, population, etc., according to 40CFR, 146.06) the map must show the number or name and location of:

  - all producing wells

  - dry holes

- surface bodies of water
- mines
- quarries
- public water systems
- water wells
- other pertinent surface features including residences and roads (Only information of public record is required on the map.)

o a tabulation and description of all wells within the area of review which penetrate the proposed injection zone and a plan for "corrective action" on those that are improperly sealed, completed, or abandoned

o maps and cross sections indicating the critical and lateral limits of all underground sources of drinking water within the area of review, their position relative to the injection formation, and the direction of water movement, where known, in every underground source of drinking water which may be affected by the proposed injection

o maps and cross sections detailing the geologic structure of the area

o generalized maps and cross sections illustrating the regional geologic setting

o proposed operating data:

- average and maximum daily rate and volume of fluid to be injected
- average and maximum injection pressures
- source and an analysis of the chemical, physical, biological, and radiological characteristics of the injection fluid

o proposed formation testing program to obtain an analysis of the physical, chemical, and radiological characteristics of the receiving formation

o proposed stimulation program

o proposed injection procedure

o engineering drawings of the surface and subsurface construction details of the system

o plans for monitoring

o expected changes in pressure, native fluid displacement, and direction of movement of injection fluid

- o contingency plans to cope with all shut-ins or with failures

- o certification of a performance bond or other means to assure adequate resources to close, plug, or abandon the well in accordance with required procedures.

One of the "stickier" requirements on the list is the plan for "corrective action" on wells that penetrate the injection zone within the area of review which are not under the control of the applicant. The earlier version of these regulations had the effect of requiring the applicant to go onto, or to take correction action on, the property of others, in order to meet the permit conditions. In recognition that it was inappropriate to require actions which may not be within the applicant's legal ability, the corrective action requirement has been revised to provide three options:

- o If the applicant can make arrangements with the owners or operators of deficient wells to take corrective action and does so, he may inject at his intended injection pressures.

- o The agency may issue a permit with a reduced injection pressure calculated so that the potential zone of endangering influence will be no larger than the area under the control of the applicant.

- o The permit can be issued with the requested injection pressure on condition that a lesser pressure be used until corrective action is taken.

EPA noted that it would be inappropriate to force the owner or operator of the "bad" well to repair it--i.e., to force one individual, without his agreement, to incur expenses and effort which benefit another party. In effect, however, this approach would not differ greatly from the PSD concept of forcing additional emission reductions on existing sources of air pollution before a new source can be permitted.

In reading the above list, it may appear that some of the information cannot be supplied without first injecting into the well, although the regulations prohibit injection without a permit. EPA has clarified this situation with a three-phase permit--i.e., construction, testing, and stimulation; operation; and abandonment. It is the responsibility of the owner or operator to notify the permitting agency of the completion of each phase and to obtain permission to proceed with the next one. Additional portions of the information will be supplied by the applicant at each stage and continuing conditions will be set by the agency.

The construction requirements for new reinjection wells injecting into, through, or above a drinking water source include the following:

- o casing and cementing to prevent the migration of fluids into or between underground sources of water. The casing and cement used is to be designed for the life expectancy of the well. In determining and specifying casing and cementing requirements, the following factors must be considered:

- depth of the injection zone

- injection pressure, external pressure, internal pressure, axial loading, etc.

- hole size

- size and grade of all casing strings

- corrosiveness of injected fluids

- lithology of injection and confining zones

- type and grade of cement

o appropriate logs and other tests during drilling and construction, the type to be determined on the basis of the intended functions, depth, construction, and other characteristics of the well, availability of similar data in the area of drilling site, and the need for additional information. At a minimum, the logs and tests must include deviation checks conducted on all holes where pilot holes and reaming are used, at sufficiently frequent intervals to assure that ventrial avenues for fluid migration in the form of diverging holes are not created during drilling.

o determination or calculation of the following information on water-bearing injection zones:

- fluid pressure
- temperature
- fracture pressure
- other physical and chemical characteristics of the injection zone
- physical and chemical characteristics of the formation fluids
- compatability of injected fluids with formation fluids

o monitoring wells into the injection zone and into any underground sources of drinking water above the injection zone which could be affected <u>if the water of the formation contains less than 10,000 mg/l TDS</u> (emphasis added)

o an adequate number of monitoring wells into the drinking water source <u>in an area subject to subsidence</u> to detect any movement of injected fluids (emphasis added)

o consideration of the following factors in determining the number, location, construction, and frequency of monitoring of the monitoring wells:

- the population relying on the drinking water source or potentially affected by the injection operation

- the proximity of the injection operation to points of withdrawal of drinking water

- local geology and hydrology

- operating pressures and whether a negative pressure gradient is being maintained

- toxicity and volume of the injected fluid, the formation water, and the process by-products

- injection well density.

Operating requirements include the following:

o Injection pressure at the wellhead may not exceed a maximum which must be calculated so as to assure that the pressure in the injection zone during injection does not initiate new fractures or propagate existing fractures in the injection zone, initiate fractures in the confining zone, or cause the migration of injection or formation fluids into an underground source of drinking water.

o Injection between the outermost casing protecting underground sources of drinking water and well base is prohibited.

Minimum monitoring requirements include:

o analysis of the physical and chemical characteristics of the injected fluid with sufficient frequency to yield representative data on its characteristics

o installation and use of continuous recording devices to monitor injection pressure, flow rate, and volume

o demonstration of mechanical integrity (absence of significant leaks or vertical fluid movement) once every five years during the life of the well

o weekly monitoring of fluid level and the parameters chosen to measure water quality in the injection zone

o quarterly monitoring of wells adjacent to the injection site to detect any migration from the injection zone into a drinking water source.

Monitoring may be conducted on a field or project basis rather than individual well basis by manifold monitoring in the case of facilities consisting of more than one injection well, operating with a common manifold. In order to take advantage of this provision, the owner/operator must demonstrate that manifold is comparable to individual well monitoring.

It is to be noted that a requirement for five monitoring wells in the proposed regulations has been dropped, and monitoring requirements are now stated in terms of the objectives to be achieved. For those wells subject to the full impact of the regulations, this could be a less stringent requirement, depending on the site-specific factors used to determine the number of wells required.

Will All Geothermal Reinjection Wells Associated with Electric Power Production Feel the Full Impact of the Regulations?

As suggested above, it is the apparent intent of EPA that they will not. The point is made several times in the preamble to the regulations. For example, on page 42474 of the 24 June 1980 Federal Register publication, it is stated, in reference to a new section added to the final regulations--122.43(a)--that:

> ". . . if a well does not inject into, through, or above a drinking water source, (the state or EPA) has discretion to ease the area of review, construction, mechanical integrity, monitoring, operating, and reporting requirements applicable to such wells."

This discretion thus includes all of the strict requirements enumerated above. The key to less stringency is the exempted aquifer, as noted by EPA on page 42484 of the preamble to regulations. "This provision for exempting aquifers (subsidence or catastrophic collapse) should be read together with final 122.43" which provides the authority for easing conditions for wells not injecting into, through, or above a drinking water source.

What Is the Major Significance of EPA's Final UIC Regulations?

In general, the regulations demonstrate a rather surprising sensitivity to the relative potential contribution of harm to drinking water sources by reinjection wells supporting electric power generation and those attendant to direct use for heating and aquaculture in exempting the latter from permit requirements unless they are determined to be actually impairing water quality or endangering human health. This differentiation in the treatment of the two types of wells is surprising in face of the semantic lapse in the regulatory definitions of geothermal injection wells.

As noted above, the pertinent Class III wells are defined as: "Wells which inject for extraction of minerals or energy, including . . . recovery of geothermal energy to produce electric power." The Class V wells are described as "geothermal wells used in heating and aquaculture."

Taken literally, these definitions would apply coverage of the regulations only to dry hot rock technology, some types of well stimulation, and related drilling practices, and would not embrace disposal wells. When confronted with this discrepancy, however, an EPA spokesman (Public Briefing, 8 May 1980) stated that the regulations cover all wells attendant to geothermal operations.

In spite of this deficiency in definition, in virtually inviting the states to ease the regulatory burden on Class III wells (those at power plants), EPA has, in effect, extended to geothermal energy the intent of the Safe Drinking Water Act in limiting interference with oil and gas production. The Act states that UIC programs:

> ". . . may not include requirements which interfere with or impede the underground injection of brine or other fluids which are brought to the surface in connection with oil or natural gas production, or any underground injection for the secondary or tertiary recovery of oil or natural

gas, unless such requirements are essential to assure that underground sources of drinking water will not be endangered by such injection."

EPA did not accept this instruction, nor was it so intended by Congress (H. Rept. 93-1185), as a mandate not to regulate injection wells attendant to oil and gas production, although the regulations for new oil and gas injection wells are somewhat less stringent than those for geothermal. The Agency did, however, carry out the broader congressional intent "to assure that constraints on energy production activities would be kept as limited in scope as possible while still assuring the safety of present and potential sources of drinking water."

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

What Is NPDES?

The permit issued under the National Pollutant Discharge Elimination System, established by Section 402 of the Clean Water Act, is the major tool in controlling the discharge of liquid effluents into the nation's surface waters. Permits issued under this system, commonly called NPDES or discharge permits, limit the quantities, rates, and concentrations of pollutant parameters, including heat, which may be discharged. Portions of the technical regulations for the NPDES program have been absorbed into the consolidated regulations (40 CFR, Parts 122, 123, and 124). Other applicable regulations appear in 40 CFR, Parts 125, 129, and 133, and Subchapter N.

Who Must Apply for an NPDES Permit?

The owner or operator of any facility desiring to discharge liquid effluents to surface waters. Any unpermitted discharge is unlawful; there are no built-in "small" or "minor" discharge exemptions based on size or nature of effluents. All information supplied on NPDES permit applications and required attachments becomes public knowledge; none may be claimed as confidential.

Will Geothermal Operations Ever Need an NPDES Permit?

Yes, in the instances where conditions--purity of resource, successive uses or other economical means for reducing temperature, low risk of subsidence, and ample water bodies for discharge, for example--indicate that surface discharge may be preferable to reinjection. While the use of this disposal technology will undoubtedly be limited in comparison with the reinjection of effluents, it is currently practiced in this country and will be considered as an alternative where conditions appear favorable.

Are There Disadvantages for Geothermal Operations in the NPDES System?

Yes, in the method used to calculate permit conditions.

Usually, the restrictions on the various pollutant parameters are based on industry-specific technology-based effluent limitations guidelines for existing sources adopted by EPA under Sections 301 and 304 of the Clean Water Act and new source performance standards (effluent NSPS) established under Section 307. However, guidelines and NSPS have not been promulgated applicable to geothermal power plants or to direct heating systems. (EPA ruled,

unofficially, during an earlier study* that those governing the effluents of fossil-fuel and nuclear power plants do not apply to geothermal generating units, and no guidelines or standards have been promulgated which could conceivably apply to direct heating systems.) The effect is that the limitations on pollutant parameters will be imposed on a case-by-case basis. As discussed previously in this report, such an ad hoc approach, especially to operations as novel as those incorporating the use of geothermal energy, opens the door to wide variations in limitations imposed and provides no prior insight as to what the limitations will be.

Permit writers are to use any available guidance, specifically including state water quality standards, and their own best judgment to apply to specific operations the same relevant factors that the Effluent Guidelines Division of EPA applies in determining limitations for whole discrete categories of sources (40 CFR, Part 25).

In this case, the element of non-uniformity does not rest solely on variety in judgmental factors. It is compounded by the fact that state water quality standards vary not only from state to state but within most states according to the use for which various waters are classified. They range in stringency according to the degree of purity required to support the designated use or uses. Since the same standards frequently do not apply to entire water bodies, and may vary from reach to reach of the same stream, the discharge permit limitations calculated on the basis of achieving or maintaining such standards may vary for operations even a few miles apart on the same stream.

In addition to variation, another possible result is that the limitations will, in some cases, be stricter than EPA would find necessary to apply to the whole industry through uniform effluent limitations and standards. This could occur because the Act leaves the states the option to set more stringent water quality standards than called for by the Federal Quality Criteria for Water. Many do so for bodies of water where extra protection is desired.

The situation with respect to industrial uses of geothermal energy is not as clear-cut. Effluent limitations guidelines and new source performance standards have been promulgated applicable to canning and preserving of fruits, vegetables, and seafood; sugar processing; pulp and paper mills; and many other industries in which geothermal energy could be employed (40 CFR, Subchapter N).

No consideration was given in the development of these industry-specific limitations and standards, so far as is known, to the use of geothermal energy for all or part of plants' energy requirements or direct-contact process use. This fact could rule out applicability of the guidelines and standards altogether since they are required to be based on similar factors across the industrial segment to which they are applicable. On the other hand, there is a variance procedure provided in 40 CFR, Subpart D, 125.30, which can be called into play when a discharger's facilities, equipment, processes, and other factors are "fundamentally different" from the factors used in establishing the guidelines and standards for the segment to which a particular plant would otherwise belong.

*Environmental Protection Agency. 1979. Survey of Environmental Regulations Applying to Geothermal Exploration, Development, and Use.

It is not known how EPA or the states would rule on this issue. Thus, anyone considering using the resource in industrial applications other than power production, and also weighing the advantages/disadvantages of surface discharge, should obtain an early ruling on the applicability of existing guidelines and standards, and, if applicable, any benefits which may derive from the variance procedure.

Surface discharges from "concentrated" animal feeding operations and con-concentrated aquatic animal production facilities also require an NPDES permit. The term "concentrated" is keyed to the size (numbers of animals, quantities of feed, etc.) and other criteria (40 CFR, 122.54 and 122.55). However, EPA and the states are empowered to make case-by-case determinations that such operations are "concentrated," and thus require a permit, on the basis of their contributions to stream pollution and other factors. It is unclear whether or how the use of low temperature geothermal waters for these purposes would affect their permit requirements.

In addition, an NPDES permit would be required if the effluents of one use of the resource are discharged to an aquacultural use (40 CFR 122.56).

Are There Advantages for Geothermal in NPDES?

Yes, there are two, and one, paradoxically, accrues to those new operations for which there are no new source performance standards. Since they do not qualify as "new sources," they are classified instead as "new dischargers," and their permits are not subject to NEPA, as discussed previously in connection with the consolidated permit program.

The difference is that the term "new source" has a specialized meaning in NPDES parlance and applies only to plants on which construction is started after NSPS are promulgated, or proposed if they are promulgated within 120 days. Issuance of NPDES permits to "new sources" is declared by the Clean Water Act to constitute a potential "major Federal action significantly affecting the quality of the human environment" and thus subject to NEPA.

This means that the applicant for a new source permit must prepare an Environmental Impact Document in order to supply sufficient information on the anticipated effects of the facility for EPA to determine whether it is necessary to prepare an environmental impact statement (EIS) on the permit issuance. This can be a very lengthy and involved process as shown in Figure 4.

These provisions apply only to new source NPDES permits issued by EPA, and not to those issued by approved state programs (Section 402, Clean Water Act). This being the case, they are only applicable in a few of the 13 western states which are the subject of this report--Alaska, Arizona, Idaho, and New Mexico--since all of the others have qualified to manage their own NPDES programs. This information is provided here only to point out that even when, or if, geothermal operations become subject to new source performance standards and thus qualify as new sources, the Federal NEPA process will not prevail in all states. However, some states have their own NEPA-type regulations, and they may apply to state-issued NPDES permits.

The second expensive and time-consuming pre-application NPDES requirement which does not currently apply to non-manufacturing applications of geothermal energy is the necessity of analyzing effluents for a number of toxic pollu-

tants, including a list of organic compounds for which the costly gas chromatography/mass spectrometry (GC/MS) laboratory equipment is required, 13 metals, cyanide, and total phenols. These requirements apply only to "primary" industries, those listed in Table 1; and "secondary" industries, which include all others, are only required to analyze for the toxic pollutants they know or have reason to believe will be discharged in the waste stream. Depending on the character of the resource utilized, these would be limited primarily to ammonia, heavy metals, and radon; toxic organics would not be expected to occur in the hydrothermal resource.

There is an additional exemption which is highly interesting from the geothermal standpoint, but which was obviously written without geothermal in mind. This is a provision which specifies that "applicants need not test for pollutants expected to be present solely as a result of their presence in intake waters, but need only indicate that they are expected to be present."

Are Mobile Sources Such as Drilling Rigs Subjects to NPDES?

Yes, if any portion of the produced brines is discharged to surface waters. While it is anticipated that virtually all effluents generated by geothermal well drilling, testing, and production will be reinjected, it should be remembered that a new permit is required each time the equipment moves if full reinjection is not practiced (40 CFR, 122.10, 122.53, and 122.6).

Does Discharge of Effluents to the Ocean Require an NPDES Permit?

Yes, under Section 403 of the Clean Water Act and final ocean discharge criteria (40 CFR Part 125) published in the Federal Register of 3 October 1980. The purpose of the program is to prevent "unreasonable degradation of the marine environment." If the state (or EPA) determines that a discharge, after application of permit conditions, will not cause such degradation, a permit may be issued. If it is determined that, after application of all possible permit conditions, unreasonable degradation may occur, a permit may not be issued. Where available information is insufficient to make this judgment, discharges may be permitted subject to several itemized conditions (40 CFR, 125, 123(c)).

Will Ocean Discharge Permits Be of Concern to Geothermal Operations?

They could be in areas where ocean discharge is geographically available and otherwise feasible. This technology could provide a disposal alternative for geothermal fluids containing higher levels of total dissolved solids than would be permitted to be discharged under water quality standards for inland waters.

In addition, while permitting authorities can require chemical analyses and other difficult and expensive-to-assemble information, the intent appears to be to reduce the difficulties of application for small discharges. Specifically, the permit writer is allowed to request only that information needed to make the judgments required by the criteria--primarily the determination of unreasonable degradation. And the preamble specifically addresses the costs of monitoring for small dischargers stating that although any monitoring that may be necessary will depend on the nature and location of the discharge in

question, "small discharges generally are not expected to incur significant economic costs as a result of this regulation.

DISPOSAL OF DREDGED AND FILL MATERIAL

What Is the Dredged and Fill Program?

It is the program implementing Section 404 of the Clean Water Act which requires a permit for any discharge of dredged and fill material into navigable waters incidental to any activity having as its purpose bringing an area of the navigable waters into a use to which it was not previously subject where the flow or circulation of the waters may be impaired or the reach of such waters reduced. This type of permit will only be required where plant construction involves dredge and fill activities for water intakes or other structures and has no bearing on the use of geothermal energy. If such a permit should be needed, it should be noted that the Act exempts from Section 404 coverage several land-related activities including construction or maintenance of temporary roads for moving "mining equipment."

HAZARDOUS WASTE MANAGEMENT

What Is the Hazardous Waste Management Program?

It is the program developed to implement Subtitle C of the Resource Conservation and Recovery Act to provide "cradle to the grave"--i.e., point of generation to disposal--regulation of hazardous wastes. The hazardous waste program--commonly called RCRA after the Act--is oriented primarily toward land disposal of solid wastes. However, "solid" wastes are defined to include liquids, semi-solids, or contained gaseous materials. Wastes are deemed hazardous if they exhibit any of the defined hazardous characteristics-- i.e., toxicity, ignitability, corrosivity, or reactivity (40 CFR Part 261, Federal Register, 19 May 1980). A waste is also defined as hazardous if it is a listed hazardous waste (Subpart D) or contains any of the listed wastes. The listed wastes are for the most part process-specific wastes.

Hazardous wastes may only be disposed of in "secured" landfills. Secured landfills incorporate leachate monitoring and treatment, adequate diversion and control of surface water, and impervious containment of wastes. Construction and maintenance is considerably more costly then common sanitary landfills, the sumps utilized in connection with geothermal or oil and gas drilling to contain spent drilling muds, rock cuttings, and associated debris, or conventional impoundments for holding an accumulation of liquid wastes or wastes containing free liquids.

Does the "RCRA" Program Apply to Geothermal Operations?

No, not for the present. A recent amendment to RCRA (P.L. 96-482) suspended EPA's authority to regulate several high-volume wastes as hazardous waste streams pending further study. The for-now exempted wastes include the muds and brines associated with the exploration, development, and production of geothermal energy. State hazardous waste programs must be "consistent" with this exemption.

This exemption came about through an amendment attached to the original provision exempting oil and gas field muds and brines during a two-year EPA study of their characteristics. At this writing, the decision has not been reached as to whether one study will cover the wastes of both industries or whether separate studies will be conducted.

Regardless of approach, the outcome of the study is unpredictable and will be particularly interesting in light of the high degree of proprietary interest on the part of mud manufacturers. As described by the most definitive reference on the subject,* the chemistry of the various individual components has traditionally been "clouded in secrecy."

No information has been developed during this study or the related EPA environmental survey cited previously to suggest that muds will require handling as hazardous wastes because they are ignitable, corrosive, or reactive. However, it is known that at least some muds used for geothermal drilling contain, or have contained in the past, toxic heavy metals which could classify them as hazardous.

The relevant California State disposal regulations (California Administrative Code, Title 23, Chapter 3, Subchapter 15) require the level of disposal more recently embraced for hazardous wastes on a national level by RCRA for "rotary drilling muds containing toxic materials." In order to enforce this provision, in light of the lack of published information on mud constituents, California authorities found it necessary to chemically analyze spent muds to determine their properties and impose the disposal method on a case-by-case basis. This process disclosed, for example, that one geothermal drilling fluid contained a chromium salt, used because of its ability to withstand the temperatures encountered. This compound is considered by toxicological experts as at least moderately toxic, and it thus triggered an order to build an impermeable pit.

As a result of such circumstances and other factors, Congress elected to mandate the study of muds rather than to exempt them outright from the definition of hazardous wastes as called for by other legislation related to P.L. 96-482.

*Roger, W. F., Composition and Properties of Oil Well Drilling Fluids, 3rd Ed., Gulf Publishing Co., Houston. 1976.

SECTION III

STATE PERMITTING REQUIREMENTS

INTRODUCTION

A great deal of information has been assembled on the types of permits required in the western states before a new facility utilizing geothermal energy can be constructed or operated and regulatory scenarios on the responsibilities of the permitting agencies have been developed. Among the more recent publications on these subjects is the series of Institutional Handbooks prepared by state geothermal utilization planning groups under the aegis of state energy offices and DOE funding. These publications are completed, or soon will be, for all of the states covered by this report. The sponsoring offices are as follows:

Alaska	- Division of Energy and Power Development
Arizona	- Arizona Solar Energy Commission
California	- Energy Commission
Colorado	- Colorado Geological Survey
Hawaii	- Department of Planning and Economic Development
Idaho	- Office of Energy
Montana	- Department of Natural Resources and Conservation
Nevada	- Department of Energy
New Mexico	- Energy and Minerals Department
Oregon	- Department of Energy
Utah	- Department of Natural Resources
Washington	- State Energy Office
Wyoming	- Geothermal Commercialization Office

As a follow-up to these documents, a review was undertaken of the regulations administered by the identified state agencies from the standpoint of the pre-permit actions they require of applicants to construct and operate various types of facilities utilizing geothermal energy. The review focused particularly on:

- the information required before a permit can be obtained
- pre-permit monitoring requirements for environmental permits

- effect of mandated timeframes for permit approval
- potential for exemption of small facilities.

The types and quantity of information required are especially important to the geothermal developer because of variations in the physical and chemical nature of the resource from site to site and the unknowns of the relatively new technologies. First of all, he does not know whether he will need construction and operating permits until he has identified a useable resource. Second, if the information requirements create a "catch 22" situation--e.g., information is required which can only he supplied by drilling and testing a well but a permit is needed for this activity itself--they may limit an applicant's ability to obtain a permit or adversely affect the economics and timing of construction. Extensive requirements for ambient air or water quality monitoring would also impose an economic burden, especially on small direct users, possibly ruling out marginally feasible applications. The benefits of exemption from permit requirements could mean the difference in whether many small uses become a reality.

The length of time required to obtain the series of permits can also affect the economics of construction, as discussed in Section II, as well as the motivation to use the resource at all. Thus, the effect of state regulations imposing mandatory time limits on final action on permit applications was also investigated.

The review covered regulations governing:

- certification of the siting of new energy facilities
- public utility certificates of convenience and necessity
- drilling permits
- air pollution control construction and operating permits
- reinjection permits
- surface discharge permits

PERMIT INFORMATION REQUIREMENTS

It must be observed at the outset of this discussion that it will be useful only in a general way, and the requirements of each permitting situation will be determined on a case-by-case basis. There are several reasons for this.

One is that even though the language of the various state information requirements for the same types of permit may be somewhat dissimilar, virtually all regulations contain discretionary provisions. In terms of the kinds or amount of information required, a paragraph from the Arizona air pollution control regulations is a case in point. Following one of the most lengthy and detailed lists of specific information required, shown in Table 4, is this statement:

TABLE 4

PERMIT INFORMATION REQUIREMENTS OF ARIZONA
RULES AND REGULATIONS FOR AIR POLLUTION CONTROL
(Arizona Code, Title 9 - Health Services; Chapter 3)

- each article, machine, equipment item, or other contrivance to be covered by the permit
- type of organization applying for the permit and reason for application
- brief description of organization's activities
- brief description of all equipment for which permits are required (e.g., serial numbers, model numbers, etc.)
- operating schedule stating the percent of annual production by season, the days of the week normally in operation, the shifts or hours of the day normally in operation, and the numbers of days per year in operation
- equipment location drawings showing building outlines, property lines, adjoining streets, directional arrow, and identifying basic operating or control equipment installations with respect to buildings and property lines
- description of all basic operating and control equipment for which permits are required including name, make, and type. Engineering drawings, plans, specifications, and elevation views of equipment showing the following must be included:
  - exterior and interior dimensions
  - size and location of all emission points
  - height and inside dimensions of all stacks
  - location of all cleanouts, grates, doors, controls, fans, motors, ducts, hoods, and all parts or other equipment which may influence the production, collection, or control of air contaminants
  - dimensions and operating characteristics of all pumps, fans, compressors, or other fluid moving devices giving flow rate, temperature, barometric pressure, total net discharge head or static pressure, revolutions per minute, and rated horsepower
  - heat transfer capacities and operating characteristics of all heat exchange devices which may influence the production, collection, or control of air contaminants

TABLE 4--Continued

- the rated and operating efficiency of air pollution control equipment. The total quality of gases exhausted to the atmosphere, temperature, barometric pressure, and the emissions of air pollutants to the atmosphere from each unit of basic operating and control equipment should be stated. The method used to calculate the emissions should be described. Where water sprays are utilized as a control or cooling device, pressure drop, water requirements in gallons per minute per nozzle, location, and direction of spray shall be shown.

- description of the process to be carried out in each unit of equipment. All materials used must be stated and the maximum hourly and average annual quantities used must be given. The particle size distribution of all bulk solids must be listed. Flow diagrams and material balances for all process and waste materials must be clearly shown.

- description of fuel use, including the type used, the quantity used per year, the maximum and average quantity used per hour, the percent used for space heating and percent used for process heat, and higher heating value of the fuel. For solid fuels and fuel oils, state the sulfur and ash content. Furnish description of fuel-burning equipment.

- information demonstrating that the proposed equipment or facility will not cause a violation of the ambient air standards.

"The Director may require the applicant to provide additional information or to provide and maintain such facilities or perform such air impact modeling procedures as are necessary to secure information that will disclose the natue, extent, quantity, or effects of air contaminants discharged into the atmosphere from the facility described in the application."

A provision of the Arizona Oil and Gas Conservation Commission governing permits for injection provides another example:

"The application for a permit to inject any substance into any geothermal reservoir shall contain all information required by the Commission, including but not limited to" a list of specific requirements.

Such discretionary language has several effects. First, it allows the permitting agency broad freedom in requiring the production of information beyond that specifically prescribed. No qualifying requirement that the information must be germane was found. Thus, it is not possible here to itemize with any certainty what the total requirements will be for any type of permit in any state.

A second effect of the almost universal discretionary authority is to remove variation among information requirements from state to state. Information specifically required in one regulation but not in another can still be required in the latter case through the discretionary authority. In other words, this authority tends to equalize the requirements of all states. Thus, it is more useful to examine them generally as they may affect geothermal utilization rather than to compare specific requirements of the several states.

Many of the items on the lists of information required were obviously developed for application to complex heavy industrial processes utilizing many raw materials and having many potential sources of pollution on the premises with great pollution loadings. Such requirements become increasingly less reasonable when related to smaller and smaller and less and less complex sources such as small geothermal district heating systems.

Even more important is the fact that the regulations are replete with requirements for information which an applicant for a permit to use geothermal energy cannot supply until the resource to be used is brought to the surface and tested. It is not possible to transfer knowledge of the character of the resource from site to site.

Table 4 provides several examples of this type of information such as the following:

- estimated quantities and types of pollutants
- rated and operating efficiencies of air pollution control equipment
- total quantity of gases exhausted to the atmosphere, temperature, barometric pressure, and the emissions from each unit of operating and control equipment

- o heat transfer capabilities and operating characteristics of heat exchange devices

- o evaluation of effect of emissions on surrounding ambient air

These requirements are difficult even for conventional operations where the chemical properties of raw materials are understood, the products of reactions which may take place during industrial processes can be calculated, fuel can be purchased with guarantees on its sulfur and ash content, and pollution control equipment suppliers can provide estimated efficiencies under varying conditions. For the potential geothermal user, such requirements are impossible of compliance without resource tests to determine pollutants present, if any, their concentrations, types of equipment needed to control them, efficiencies required to meet applicable emission limits, temperature, and other factors.

The same is true of information requirements for permits to reinject geothermal fluids. As itemized in Section II, they include:

- o average and maximum daily rate and volumes of fluid to be injected

- o average and maximum pressures

- o analysis of the chemical, physical, biological, and radiological characteristics of the injection fluid

The NPDES permit application shown in Appendix B also calls for advance characterization of effluents to be discharged and efficiencies of treatment processes. The approval of the siting of large electric generating plants also hinges on similar information as shown in Appendix E. This listing is discussed below.

The problem in supplying this kind of information is that the drillling of a well and subsequent testing are in themselves sources of pollution and subject to regulation. One state air pollution control official, for example, estimated that a well being fully tested in a particular area of his state would constitute a 100-ton source of hydrogen sulfide in two months.

On the Federal level, EPA has approached this problem in two major regulatory areas and appears to have provided a model solution worthy of consideration by the states. Specifically, insofar as the use of geothermal energy is concerned, EPA recognized that information such as the above required for a permit to inject geothermal fluids cannot be supplied without drilling a well, as discussed in Section II. Thus, in finalizing the underground injection control regulations, EPA provided for a staged permit for geothermal reinjection wells. The states include:

- o construction, testing, and stimulation

- o operation

- o abandonment

In this way, only such information as can reasonably be provided will be required to obtain the permit for the first phase, but the character of the fluids to be injected, pressures, and other factors must be identified before the operating permit is issued.

Similar staging is possible in the PSD program in that "temporary" sources are exempt from the need for a PSD permit, and wells drilled for the testing of a geothermal resource are considered by state control officials to be temporary sources. Thus, the information needed to determine best available control technology can be developed prior to applying for a PSD permit for the power plant, or other large use, subject to PSD.

Although state PSD and injection control regulations must conform with the above provisions for these types of permits, other state environmental control regulations do not directly incorporate a staged approach. And the control officials interviewed expressed few firm opinions as to how geothermal applicants can develop the information needed under existing regulations.

One state agency spokesman stated that a permit might not be required for drilling a well, but might be required for testing. He added, though, that if a permit were required for the well, a new permit could be required for testing as a modification to the existing source--i.e., the well.

When asked how an applicant could supply information as called for in the regulations unless there had been other wells drilled and tested in the immediate area of his proposed operation, the spokesman state: "This is not an unusual situation with a new technology." He proposed no remedy, however.

New Mexico, on the other hand, has in effect implemented a staged approach in its key water rights permit program. While the state is very strict in its management of water appropriation, a geothermal developer can obtain a permit to drill and test wells upon application only. It is only after he has identified the resource and knows that he wants to use it that his total appropriation right will be determined and a permit to appropriate underground water for a beneficial use issued.

This facet of the total permitting process in New Mexico is shown in Figure 6. Examination of this flow sheet also illustrates the benefit of staging information requirements in that siting approval and certification of a utility, as well as applications for UIC and PSD operating permits, are not required until a commercial resource has been found and tested.

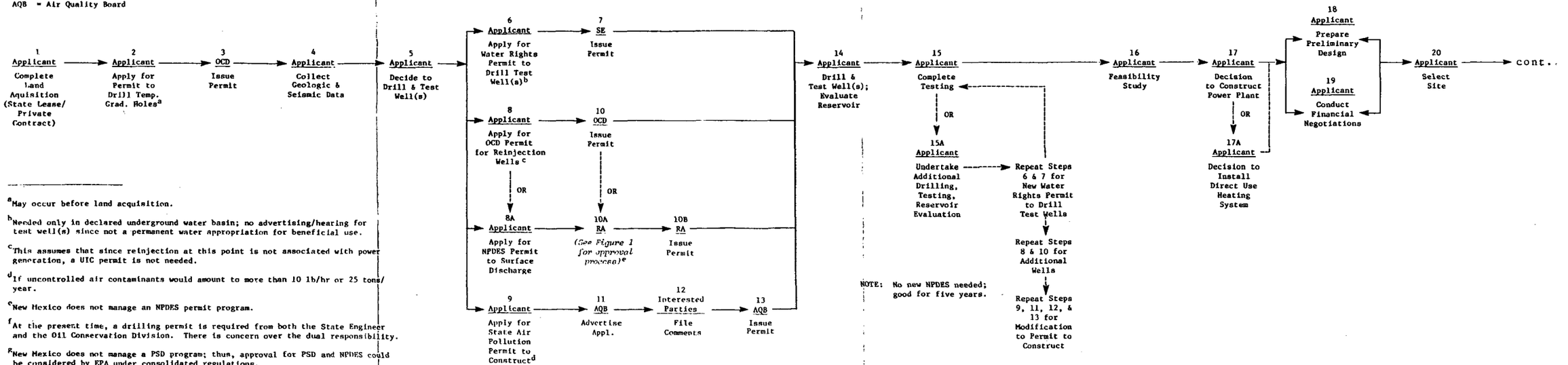
It thus appears that states where geothermal development is a possibility should consider adopting direct regulatory provisions for staging all types of permits involving the use of geothermal energy. This would remove considerable uncertainty from the permitting process--both on the part of the developer and the agency--and provide for an orderly progression. One precedent for this approach was found in the Utah Air Conservation Regulations which permit the Bureau of Air Quality to accommodate staged construction of a large source by issuing an order authorizing construction of an initial stage prior to receipt of detailed plans for the entire project.

Figure 6

PROCESS FOR OBTAINING PERMITS REQUIRED IN NEW MEXICO FOR CONSTRUCTION/OPERATION OF GEOTHERMAL POWER PLANTS AND DISTRICT HEATING SYSTEMS
(Process flow assumes permit approval and thus forward movement; permit denial could stop the process at any point.)

NOTE: Since New Mexico does not currently operate NPDES or PSD programs, Figure 1 should be consulted, as noted in the appropriate places in italics, for EPA's approval process for those permits.

OCD = Oil Conservation Division
SE = State Engineer
RA = EPA Regional Administrator
AQB = Air Quality Board
EID = Environmental Improvement Division
CPCN = Certificate of Public Convenience and Necessity
PSC = Public Service Commission



[a] May occur before land acquisition.

[b] Needed only in declared underground water basin; no advertising/hearing for test well(s) since not a permanent water appropriation for beneficial use.

[c] This assumes that since reinjection at this point is not associated with power generation, a UIC permit is not needed.

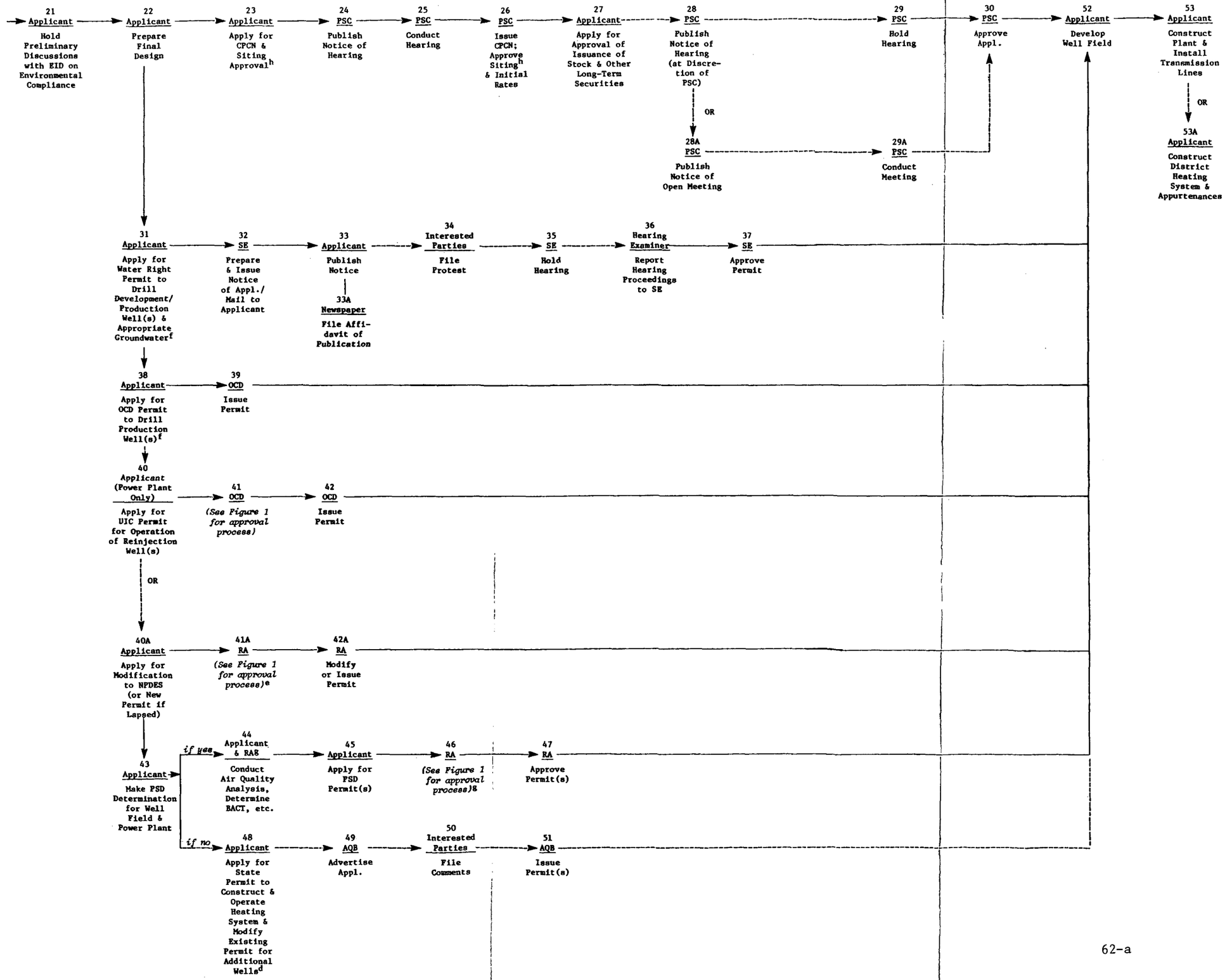
[d] If uncontrolled air contaminants would amount to more than 10 lb/hr or 25 tons/year.

[e] New Mexico does not manage an NPDES permit program.

[f] At the present time, a drilling permit is required from both the State Engineer and the Oil Conservation Division. There is concern over the dual responsibility.

[g] New Mexico does not manage a PSD program; thus, approval for PSD and NPDES could be considered by EPA under consolidated regulations.

[h] Siting approval is required for electric power plants of 350 MW or more; it is not required for district heating systems. However, the PSC appears to have utility authority over the latter; anyone proposing such a system should check with the PSC.


21 Applicant
Hold Preliminary Discussions with EID on Environmental Compliance
22 Applicant
Prepare Final Design
23 Applicant
Apply for CPCN & Siting Approval[h]
24 PSC
Publish Notice of Hearing
25 PSC
Conduct Hearing
26 PSC
Issue CPCN; Approve Siting[h] & Initial Rates
27 Applicant
Apply for Approval of Issuance of Stock & Other Long-Term Securities
28 PSC
Publish Notice of Hearing (at Discretion of PSC)
OR
28A PSC
Publish Notice of Open Meeting
29 PSC
Hold Hearing
29A PSC
Conduct Meeting
30 PSC
Approve Appl.
52 Applicant
Develop Well Field
53 Applicant
Construct Plant & Install Transmission Lines
OR
53A Applicant
Construct District Heating System & Appurtenances
31 Applicant
Apply for Water Right Permit to Drill Development/ Production Well(s) & Appropriate Groundwater[f]
32 SE
Prepare & Issue Notice of Appl./ Mail to Applicant
33 Applicant
Publish Notice
33A Newspaper
File Affidavit of Publication
34 Interested Parties
File Protest
35 SE
Hold Hearing
36 Hearing Examiner
Report Hearing Proceedings to SE
37 SE
Approve Permit
38 Applicant
Apply for OCD Permit to Drill Production Well(s)[f]
39 OCD
Issue Permit
40 Applicant (Power Plant Only)
Apply for UIC Permit for Operation of Reinjection Well(s)
OR
41 OCD
(See Figure 1 for approval process)
42 OCD
Issue Permit
40A Applicant
Apply for Modification to NPDES (or New Permit if Lapsed)
41A RA
(See Figure 1 for approval process)[e]
42A RA
Modify or Issue Permit
43 Applicant
Make PSD Determination for Well Field & Power Plant
if yes
44 Applicant & RA[g]
Conduct Air Quality Analysis, Determine BACT, etc.
45 Applicant
Apply for PSD Permit(s)
46 RA
(See Figure 1 for approval process)[g]
47 RA
Approve Permit(s)
if no
48 Applicant
Apply for State Permit to Construct & Operate Heating System & Modify Existing Permit for Additional Wells[d]
49 AQB
Advertise Appl.
50 Interested Parties
File Comments
51 AQB
Issue Permit(s)

MONITORING REQUIREMENTS

No mandatory requirements for pre-permit monitoring which would apply to geothermal operations were found in state regulations. Although all states confer on the air pollution control agency authority to require monitoring by air pollution sources at any point--from the pre-permit stage as a condition for permit approval or post-permit as a check for compliance--the type of monitoring (air quality, meteorological, or emission) and thus the type of monitoring equipment required, the timeframes involved, whether continuous or periodic, and all other factors are discretionary on the part of the agency. Even the monitoring requirements which approved state PSD programs must include in their state PSD regulations are inconclusive on this point, as discussed in Section II.

The US Geological Survey regulations (Title 30 CFR, Part 270) governing geothermal operations on Federal lands are also discretionary in that they call for provisions for monitoring "deemed necessary by the Supervisor to ensure compliance with the regulations." While the "collection of data" concerning existing air quality is requried for a period of at least a year prior to submitting a plan for production, this provision does not necessarily include monitoring. And, in fact, monitoring could be required much earlier in the development process than the production stage if the supervisor feels it is needed to determine whether any given plan of operation will meet environmental standards.

Currently, state pre-permit requirements applicable to geothermal reinjection wells are scattered among drilling regulations variously implemented by oil and gas conservation commissions, other resource or water rights agencies, or environmental control agencies. None of them appear to impose specific pre-permit monitoring requirements, although they could be imposed through broad interpretation of information requirements. If the requirements of these programs are equal to or more stringent than the minimum UIC regulations adopted by EPA and applicable to the states, they may remain essentially the same. If the Federal UIC program is adopted, monitoring does not appear to be a condition for obtaining the initial construction, testing, and stimulation permit for injection wells at power plant sites. However, monitoring wells into the injection zone and into underground sources of drinking water above the injection zone, as itemized in Section II, will be required during those phases in order to supply the informtion required for an operating permit. The number of wells, length of monitoring periods, and other details are not spelled out.

Pre-permit surface water quality monitoring is not expected to be required to obtain an NPDES permit even though estimates of the impact of the proposed effluents on existing water quality may be required. It is anticipated that sufficient background data on water bodies large enough to receive effluents will be obtainable from the US Geological Survey or state/local sources. However, it can only be said again that as new non-conventional sources of pollution are proposed, non-conventional requirements may be imposed.

The result of this uncertainty about monitoring is that potential geothermal developers cannot take monitoring costs, if any, and timeframes into account in their earliest consideration of the economic feasibility of using a

specific resource for a given use. Resource tests and analysis may be needed to provide the control agency with sufficient information to support its decision on monitoring requirements. This could mean considerable monetary outlay in potentially marginal situations before the cost of monitoring can be accounted for.

MANDATORY TIME LIMITS

The regulatory review disclosed that little credence should be given to time limits on final action on permit applications by state agencies mandated by statute or regulation. Taken at face value, the time limitations imposed--ranging, for example, from 30 to 180 days--would appear to limit the time lapse for permit approval (or denial) to an insignificant period.

These limits are in fact, and in practice, virtually meaningless in that the time clock does not start to run until the application is deemed "complete." This interpretation of state regulations was formalized in an opinion of the Arizona Attorney General and is common practice in other states. Violation of the mandated limits is admittedly frequent and is considered "normal" procedure in some states.

Although state officials will reluctantly "guess" at their "average" permitting timeframes for conventional new sources, they all quickly point out exceptions. In view of the "geothermal-is-different" syndrome, it appears that all bets would be off on the timeframe for a major source utilizing geothermal energy, and even facilities with a lesser potential impact will receive closer than usual scrutiny. In spite of the mandated time limits, applications could be hung up indefinitely on the basis that they are not complete and repeated requests for more information could ensue. This is not to suggest that this will always be the case, but the possibility is there.

An example was provided in Colorado where the Oil and Gas Commission, with the advice and consent of the Division of Water Rights, issues drilling permits on temperature gradient holes in two weeks. However, when an individual applied for a permit for a deeper well to heat only his own residence, the only such application in the state so far, the Water Rights people held it up for months with repeated requests for additional data.

The timeframes which might be ascribed to various environmental permitting procedures are further complexed by the fact that geothermal operations are not yet governed by Federally-imposed industry-specific air or water standards. As a result, the limits to be imposed on emission and effluent parameters will be determined on a case-by-case basis, as discussed in Section II.

The state offices are frequently understaffed, or claim to be, and more manpower will logically be required to determine limitations "from scratch" without the guidance of an applicable air or water new source performance standard. Thus, any timeframes estimated for sources already subject to such standards will be a shaky frame of reference for non-conventional sources with which they have no experience.

POTENTIAL FOR EXEMPTION FROM PERMITTING REQUIREMENTS

Since there is a strong emphasis today on the use of geothermal energy in very small direct uses, as well as in other more extensive applications, permitting requirements were examined from the standpoint of potential exemption from those requirements. This is not to suggest that geothermal energy should be utilized in any but an environmentally acceptable manner, but to point out that the impacts of some operations would be so minimal that they would fall within lawful exemptions. It is possible that in the effort to help the potential small developer through the maze of regulations he might confront, some have been needlessly frightened away.

For example, as described in Section II, direct users for heating and aquaculture purposes are not required under the Federal UIC regulations to obtain a permit for reinjection unless it is shown that such practice is impairing the quality of an underground drinking water source or endangering human health. Many such applications would be able to discharge into an aquifer not classified as a drinking water source because it is: (1) more valuable for geothermal energy, or (2) because it is not fit for human consumption. Thus, it would be unlikely that their discharges would be proved harmful under either criterion, and no reinjection permit would ever be needed.

States qualified to manage their own UIC programs are allowed to make this provision more stringent, but as long as the discharge is to an exempt aquifer, there seems little need to do so. This feature can be determined in advance since the states must formally designate drinking water sources and exempt aquifers.

Direct uses of geothermal energy and all but the larger power plants will also be exempt from coverage of the relatively new energy facility siting procedures established in Alaska, Arizona, California, Colorado, Montana, Oregon, and Washington. Some of these require approval for generating units with a rating of 100 MW or more, some limit jurisdiction to units of 250 MW or more, and at least one, New Mexico, picks up at 300 MW or more.

While the siting procedures are designed to facilitate the construction of large new energy facilities through providing "a single forum for the expeditious resolution of all matters concerning the location of electric generating plants" (Arizona Revised Statutes, Title 40, Article 6.2), it appears that less public concern will be drawn to those operations small enough not to require this kind of attention.

The information requirements for site certification, or a "certificate of environmental compatibility," as it is sometimes called, may, in fact, add a layer onto those of individual permits. In Washington State, which has gone to the ultimate in substituting certification by the Energy Facility Site Evaluation Council for all permits required by other agencies (RCW Chapter 80.50), the information required is simply a composite of that required for the individual permits as shown in Appendix E. Thus, small geothermal facilities would stand to gain little from coverage of this type of regulation, and may benefit from avoiding it.

In terms of the permit to operate a public utility, a certificate of public convenience and necessity, the State of Hawaii has attempted to encourage the use of geothermal energy by declaring that producers of geothermal steam or electricity are not utilities (Hawaii Statutes 269.27.1). Such an action could possibly be advantageous in states such as Arizona where utilities are monopolies in their service area. In such a case, where all populated areas are covered by utility jurisdiction, a geothermal utility (electricity or direct heating/cooling) can only be introduced by existing utilities or non-regulated municipalities. Whether such an approach would be helpful and further the development of geothermal use would depend to the largest extent on whether the public would agree to utilize services not covered by regulation of rates.

It is possible that some small direct uses of geothermal energy--especially those where hydrogen sulfide is not a problem--may be exempt from the need for a state air pollution permit, either through a general quantitative exemption (e.g., sources in New Mexico which, uncontrolled, would result in emissions of 10 pounds per hour or 25 tons per year or less) or discretionary authority for the control agency to exempt minor sources. As discussed in Section II, small sources will generally be exempt from the PSD air pollution regulations unless they are very close proximity to Class I areas.

While discharges to surface waters cannot be entirely exempt from the necessity for an NPDES permit, permit conditions and pollution control measures will be tailored to the size and nature of the effluents, and the permit will in no case require an environmental impact statement.

SUMMARY

State permitting programs are designed for regulating more common industrial situations, so that normal permitting procedures may be difficult or impossible to apply directly to a new technology such as use of geothermal energy. The expected result of this situation is that permitting may often need to be done under broad discretionary powers rather than standardized procedures. This can be expected to require more discussion and interchange of information and ideas than for conventional permitting, and hence often a longer timeframe for permit issuance. It is anticipated that as the state agencies become familiar with the special problems associated with use of geothermal energy, procedures can be developed, such as the staged permits discussed earlier, which would allow for rapid and uncomplicated permitting comparable to that enjoyed in many states by conventional operations.

Thus, it is hoped that those who are contemplating the use of geothermal energy will not write it off out-of-hand because of anticipated permitting difficulties and costs. The first step is to determine the applicability of the various requirements and to assess their potential impact on the proposed use. If reason prevails, it may be that the impact will be more nominal than expected in many cases.

Please print or type in the unshaded areas only
(fill-in areas are spaced for elite type, i.e., 12 characters/inch).

Form Approved OMB No. 158-R0175

FORM 1 GENERAL

EPA

U.S. ENVIRONMENTAL PROTECTION AGENCY

GENERAL INFORMATION

Consolidated Permits Program

(Read the "General Instructions" before starting.)

I. EPA I.D. NUMBER

F | D

LABEL ITEMS

I. EPA I.D. NUMBER

III. FACILITY NAME

V. FACILITY MAILING ADDRESS

VI. FACILITY LOCATION

PLEASE PLACE LABEL IN THIS SPACE

GENERAL INSTRUCTIONS

If a preprinted label has been provided, affix it in the designated space. Review the information carefully; if any of it is incorrect, cross through it and enter the correct data in the appropriate fill-in area below. Also, if any of the preprinted data is absent *(the area to the left of the label space lists the information that should appear)*, please provide it in the proper fill-in area(s) below. If the label is complete and correct, you need not complete Items I, III, V, and VI *(except VI-E which must be completed regardless)*. Complete all items if no label has been provided. Refer to the instructions for detailed item descriptions and for the legal authorizations under which this data is collected.

II. POLLUTANT CHARACTERISTICS

INSTRUCTIONS: Complete A through J to determine whether you need to submit any permit application forms to the EPA. If you answer "yes" to any questions, you must submit this form and the supplemental form listed in the parenthesis following the question. Mark "X" in the box in the third column if the supplemental form is attached. If you answer "no" to each question, you need not submit any of these forms. You may answer "no" if your activity is excluded from permit requirements; see Section C of the instructions. See also, Section D of the instructions for definitions of bold-faced terms.

SPECIFIC QUESTIONS	MARK "X" YES	NO	FORM ATTACHED
A. Is this facility a **publicly owned treatment works** which results in a **discharge** to waters of the U.S.? (FORM 2A)			
B. Does or will this facility *(either existing or proposed)* include a **concentrated animal feeding operation** or **aquatic animal production facility** which results in a **discharge to waters of the U.S.**? (FORM 2B)			
C. Is this a facility which currently results in discharges to **waters of the U.S.** other than those described in A or B above? (FORM 2C)			
D. Is this a proposed facility *(other than those described in A or B above)* which will result in a **discharge** to **waters of the U.S.**? (FORM 2D)			
E. Does or will this facility treat, store, or dispose of **hazardous wastes**? (FORM 3)			
F. Do you or will you inject at this facility industrial or municipal effluent below the lowermost stratum containing, within one quarter mile of the well bore, underground sources of drinking water? (FORM 4)			
G. Do you or will you inject at this facility any produced water or other fluids which are brought to the surface in connection with conventional oil or natural gas production, inject fluids used for enhanced recovery of oil or natural gas, or inject fluids for storage of liquid hydrocarbons? (FORM 4)			
H. Do you or will you inject at this facility fluids for special processes such as mining of sulfur by the Frasch process, solution mining of minerals, in situ combustion of fossil fuel, or recovery of geothermal energy? (FORM 4)			
I. Is this facility a proposed **stationary source** which is one of the 28 industrial categories listed in the instructions and which will potentially emit 100 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an attainment area? (FORM 5)			
J. Is this facility a proposed **stationary source** which is NOT one of the 28 industrial categories listed in the instructions and which will potentially emit 250 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an attainment area? (FORM 5)			

III. NAME OF FACILITY

1 SKIP

IV. FACILITY CONTACT

A. NAME & TITLE *(last, first, & title)*

B. PHONE *(area code & no.)*

2

V. FACILITY MAILING ADDRESS

A. STREET OR P.O. BOX

3

B. CITY OR TOWN

C. STATE

D. ZIP CODE

4

VI. FACILITY LOCATION

A. STREET, ROUTE NO. OR OTHER SPECIFIC IDENTIFIER

5

B. COUNTY NAME

C. CITY OR TOWN

D. STATE

E. ZIP CODE

F. COUNTY CODE *(if known)*

6

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CONTINUE ON REVERSE

CONTINUED FROM THE FRONT

VII. SIC CODES *(4-digit, in order of priority)*

A. FIRST	B. SECOND
7 *(specify)*	7 *(specify)*
C. THIRD	**D. FOURTH**
7 *(specify)*	7 *(specify)*

VIII. OPERATOR INFORMATION

A. NAME

8

B. Is the name listed in Item VIII-A also the owner? ☐ YES ☐ NO

C. STATUS OF OPERATOR *(Enter the appropriate letter into the answer box; if "Other", specify.)*

F = FEDERAL
S = STATE
P = PRIVATE
M = PUBLIC *(other than federal or state)*
O = OTHER *(specify)*

(specify)

D. PHONE *(area code & no.)*

A

E. STREET OR P.O. BOX

F. CITY OR TOWN

B

G. STATE

H. ZIP CODE

IX. INDIAN LAND

Is the facility located on Indian lands? ☐ YES ☐ NO

X. EXISTING ENVIRONMENTAL PERMITS

A. NPDES *(Discharges to Surface Water)*

9 N

D. PSD *(Air Emissions from Proposed Sources)*

9 P

B. UIC *(Underground Injection of Fluids)*

9 U

E. OTHER *(specify)*

(specify)

C. RCRA *(Hazardous Wastes)*

9 R

E. OTHER *(specify)*

9

XI. MAP

Attach to this application a topographic map of the area extending to at least one mile beyond property bounderies. The map must show the outline of the facility, the location of each of its existing and proposed intake and discharge structures, each of its hazardous waste treatment, storage, or disposal facilities, and each well where it injects fluids underground. Include all springs, rivers and other surface water bodies in the map area. See instructions for precise requirements.

XII. NATURE OF BUSINESS *(provide a brief description)*

XIII. CERTIFICATION *(see instructions)*

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this application and all attachments and that, based on my inquiry of those persons immediately responsible for obtaining the information contained in the application, I believe that the information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME & OFFICIAL TITLE *(type or print)*	B. SIGNATURE	C. DATE SIGNED

COMMENTS FOR OFFICIAL USE ONLY

C

EPA Form 3510-1 (5-80) REVERSE

BILLING CODE 6560-01-C

EPA I.D. NUMBER (copy from Item 1 of Form 1)

Please print or type in the unshaded areas only.

Form Approved OMB No. 158-R0173

FORM 2C NPDES

EPA

U.S. ENVIRONMENTAL PROTECTION AGENCY
APPLICATION FOR PERMIT TO DISCHARGE WASTEWATER
EXISTING MANUFACTURING, COMMERCIAL, MINING AND SILVICULTURAL OPERATIONS
Consolidated Permits Program

I. OUTFALL LOCATION

For each outfall, list the latitude and longitude of its location to the nearest 15 seconds and the name of the receiving water.

A. OUTFALL NUMBER (list)	B. LATITUDE			C. LONGITUDE			D. RECEIVING WATER (name)
	1. DEG.	2. MIN.	3. SEC.	1. DEG.	2. MIN.	3. SEC.	

II. FLOWS, SOURCES OF POLLUTION, AND TREATMENT TECHNOLOGIES

A. Attach a line drawing showing the water flow through the facility. Indicate sources of intake water, operations contributing wastewater to the effluent, and treatment units labeled to correspond to the more detailed descriptions in Item B. Construct a water balance on the line drawing by showing average flows between intakes, operations, treatment units, and outfalls. If a water balance cannot be determined *(e.g., for certain mining activities)*, provide a pictorial description of the nature and amount of any sources of water and any collection or treatment measures.

B. For each outfall, provide a description of: (1) All operations contributing wastewater to the effluent, including process wastewater, sanitary wastewater, cooling water, and storm water runoff; (2) The average flow contributed by each operation; and (3) The treatment received by the wastewater. Continue on additional sheets if necessary.

1. OUTFALL NO. (list)	2. OPERATION(S) CONTRIBUTING FLOW		3. TREATMENT		
	a. OPERATION (list)	b. AVERAGE FLOW (include units)	a. DESCRIPTION	b. LIST CODES FROM TABLE 2C-1	

FACSIMILE

OFFICIAL USE ONLY *(effluent guidelines sub-categories)*

CONTINUED FROM THE FRONT

C. Except for storm runoff, leaks, or spills, are any of the discharges described in Items II-A or B intermittent or seasonal?

☐ YES *(complete the following table)* ☐ NO *(go to Section III)*

1. OUTFALL NUMBER *(list)*	2. OPERATION(s) CONTRIBUTING FLOW *(list)*	3. FREQUENCY		4. FLOW				
		a. DAYS PER WEEK *(specify average)*	b. MONTHS PER YEAR *(specify average)*	a. FLOW RATE *(in mgd)*		b. TOTAL VOLUME *(specify with units)*		c. DURATION *(in days)*
				1. LONG TERM AVERAGE	2. MAXIMUM DAILY	1. LONG TERM AVERAGE	2. MAXIMUM DAILY	

III. MAXIMUM PRODUCTION

A. Does an effluent guideline limitation promulgated by EPA under Section 304 of the Clean Water Act apply to your facility?

☐ YES *(complete Item III-B)* ☐ NO *(to to Section IV)*

B. Are the limitations in the applicable effluent guideline expressed in terms of production *(or other measure of operation)*?

☐ YES *(complete Item III-C)* ☐ NO *(go to Section IV)*

C. If you answered "Yes" to Item III-B, list the quantity which represents an actual measurement of your maximum level of production, expressed in the terms and units used in the applicable effluent guideline, and indicate the affected outfalls.

1. MAXIMUM QUANTITY			2. AFFECTED OUTFALLS *(list outfall numbers)*
a. QUANTITY PER DAY	b. UNITS OF MEASURE	c. OPERATION, PRODUCT, MATERIAL, ETC. *(specify)*	

IV. IMPROVEMENTS

A. Are you now required by any Federal, State or local authority to meet any implementation schedule for the construction, upgrading or operation of wastewater treatment equipment or practices or any other environmental programs which may affect the discharges described in this application? This includes, but is not limited to, permit conditions, administrative or enforcement orders, enforcement compliance schedule letters, stipulations, court orders, and grant or loan conditions.

☐ YES *(complete the following table)* ☐ NO *(go to Item IV-B)*

1. IDENTIFICATION OF CONDITION, AGREEMENT, ETC.	2. AFFECTED OUTFALLS		3. BRIEF DESCRIPTION OF PROJECT	4. FINAL COMPLIANCE DATE	
	a. NO.	b. SOURCE OF DISCHARGE		a. REQUIRED	b. PROJECTED

B. OPTIONAL: You may attach additional sheets describing any additional water pollution control programs *(or other environmental projects which may affect your discharges)* you now have underway or which you plan. Indicate whether each program is now underway or planned, and indicate your actual or planned schedules for construction. ☐ MARK "X" IF DESCRIPTION OF ADDITIONAL CONTROL PROGRAMS IS ATTACHED

EPA I.D. NUMBER (copy from Item 1 of Form 1)

CONTINUED FROM PAGE 2

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V. INTAKE AND EFFLUENT CHARACTERISTICS

A, B, & C: See instructions before proceeding – Complete one set of tables for each outfall – Annotate the outfall number in the space provided. NOTE: Tables V-A, V-B, and V-C are included on separate sheets numbered V-1 through V-9.

D. Use the space below to list any of the pollutants listed in Table 2c-3 of the instructions, which you know or have reason to believe is discharged or may be discharged from any outfall. For every pollutant you list, briefly describe the reasons you believe it to be present and report any analytical data in your possession.

1. POLLUTANT	2. SOURCE	1. POLLUTANT	2. SOURCE

VI. POTENTIAL DISCHARGES NOT COVERED BY ANALYSIS

A. Is any pollutant listed in Item V-C a substance or a component of a substance which you do or expect that you will over the next 5 years use or manufacture as an intermediate or final product or byproduct?

☐ YES (list all such pollutants below) ☐ NO (go to Item VI-B)

B. Are your operations such that your raw materials, processes, or products can reasonably be expected to vary so that your discharges of pollutants may during the next 5 years exceed two times the maximum values reported in Item V?

☐ YES (complete Item VI-C below) ☐ NO (go to Section VII)

C. If you answered "Yes" to Item VI-B, explain below and describe in detail the sources and expected levels of such pollutants which you anticipate will be discharged from each outfall over the next 5 years, to the best of your ability at this time. Continue on additional sheets if you need more space.

EPA Form 3510-2C (8-80) PAGE 3 OF 4 CONTINUE ON REVERSE

CONTINUED FROM THE FRONT

VII. BIOLOGICAL TOXICITY TESTING DATA

Do you have any knowledge or reason to believe that any biological test for acute or chronic toxicity has been made on any of your discharges or on a receiving water in relation to your discharge within the last 3 years?

☐ YES *(identify the test(s) and describe their purposes below)* ☐ NO *(go to Section VIII)*

VIII. CONTRACT ANALYSIS INFORMATION

Were any of the analyses reported in Item V performed by a contract laboratory or consulting firm?

☐ YES *(list the name, address, and telephone number of, and pollutants analyzed by, each such laboratory or firm below)* ☐ NO *(go to Section IX)*

A. NAME	B. ADDRESS	C. TELEPHONE *(area code & no.)*	D. POLLUTANTS ANALYZED *(list)*

IX. CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this application and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME & OFFICIAL TITLE *(type or print)*	B. PHONE NO. *(area code & no.)*
C. SIGNATURE	D. DATE SIGNED

PLEASE PRINT OR TYPE IN THE UNSHADED AREAS ONLY. You may report some or all of this information on separate sheets *(use the same format)* instead of completing these pages. SEE INSTRUCTIONS.

EPA I.D. NUMBER *(copy from Item 1 of Form 1)*

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V. INTAKE AND EFFLUENT CHARACTERISTICS *(continued from page 3 of Form 2-C)*

OUTFALL NO.

PART A - You must provide the results of at least one analysis for every pollutant in this table. Complete one table for each outfall. See instructions for additional details.

1. POLLUTANT	2. EFFLUENT							3. UNITS *(specify if blank)*		4. INTAKE *(optional)*		
	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a. Biochemical Oxygen Demand *(BOD)*												
b. Chemical Oxygen Demand *(COD)*												
c. Total Organic Carbon *(TOC)*												
d. Total Suspended Solids *(TSS)*												
e. Ammonia *(as N)*												
f. Flow	VALUE		VALUE		VALUE					VALUE		
g. Temperature *(winter)*	VALUE		VALUE		VALUE			°C		VALUE		
h. Temperature *(summer)*	VALUE		VALUE		VALUE			°C		VALUE		
i. pH	MINIMUM	MAXIMUM	MINIMUM	MAXIMUM				STANDARD UNITS				

PART B - Mark "X" in column 2-a for each pollutant you know or have reason to believe is present. Mark "X" in column 2-b for each pollutant you believe to be absent. If you mark column 2-a for any pollutant, you must provide the results of at least one analysis for that pollutant. Complete one table for each outfall. See the instructions for additional details and requirements.

1. POLLUTANT AND CAS NO. *(if available)*	2. MARK 'X'		3. EFFLUENT							4. UNITS		5. INTAKE *(optional)*		
	a. BELIEVED PRESENT	b. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE *(if available)*		c. LONG TERM AVRG. VALUE *(if available)*		d. NO. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
a. Bromide (24959-67-9)														
b. Chlorine, Total Residual														
c. Color														
d. Fecal Coliform														
e. Fluoride (16984-48-8)														
f. Nitrate–Nitrite *(as N)*														

1. POLLUTANT AND CAS NO. (If available)	2. MARK 'X'		3. EFFLUENT							4. UNITS		5. INTAKE (optional)		
	a. BELIEVED PRESENT	b. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (If available)		c. LONG TERM AVRG. VALUE (If available)		d. NO. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
			(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
g. Nitrogen, Total Organic (as N)														
h. Oil and Grease														
i. Phosphorus (as P), Total (7723-14-0)														
j. Radioactivity														
(1) Alpha, Total														
(2) Beta, Total														
(3) Radium, Total														
(4) Radium 226, Total														
k. Sulfate (as SO_4) (14808-79-8)														
l. Sulfide (as S)														
m. Sulfite (as SO_3) (14265-45-3,														
n. Surfactants														
o. Aluminum, Total (7429-90-5)														
p. Barium, Total (7440-39-3)														
q. Boron, Total (7440-42-8)														
r. Cobalt, Total (7440-48-4)														
s. Iron, Total (7439-89-6)														
t. Magnesium, Total (7439-95-4)														
u. Molybdenum, Total (7439-98-7)														
v. Manganese, Total (7439-96-5)														
w. Tin, Total (7440-31-5)														
x. Titanium, Total (7440-32-6)														

EPA I.D. NUMBER (copy from Item 1 of Form 1)	OUTFALL NUMBER

CONTINUED FROM PAGE 3 OF FORM 2-C

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PART C - If you are a primary industry and this outfall contains process wastewater, refer to Table 2c-2 in the instructions to determine which of the GC/MS fractions you must test for. Mark "X" in column 2-a for all such GC/MS fractions that apply to your industry and for ALL toxic metals, cyanides, and total phenols. If you are not required to mark column 2-a *(secondary industries, non-process wastewater outfalls, and non-required GC/MS fractions)*, mark "X" in column 2-b for each pollutant you know or have reason to believe is present. Mark "X" in column 2-c for each pollutant you believe to be absent. If you mark either columns 2-a or 2-b for any pollutant, you must provide the results of at least one analysis for that pollutant. Note that there are seven pages to this part; please review each carefully. Complete one table *(all seven pages)* for each outfall. See instructions for additional details and requirements.

1. POLLUTANT AND CAS NUMBER (if available)	2. MARK 'X'			3. EFFLUENT							4. UNITS		5. INTAKE (optional)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (if available)		c. LONG TERM AVRG. VALUE (if available)		d. NO. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
METALS, CYANIDE, AND TOTAL PHENOLS															
1M. Antimony, Total (7440-36-0)															
2M. Arsenic, Total (7440-38-2)															
3M. Beryllium, Total, 7440-41-7)															
4M. Cadmium, Total (7440-43-9)															
5M. Chromium, Total (7440-47-3)															
6M. Copper, Total (7550-50-8)															
7M. Lead, Total (7439-97-6)															
8M. Mercury, Total (7439-97-6)															
9M. Nickel, Total (7440-02-0)															
10M. Selenium, Total (7782-49-2)															
11M. Silver, Total (7440-22-4)															
12M. Thallium, Total (7440-28-0)															
13M. Zinc, Total (7440-66-6)															
14M. Cyanide, Total (57-12-5)															
15M. Phenols, Total															
DIOXIN															
2,3,7,8-Tetrachlorodibenzo-P-Dioxin (1764-01-6)				DESCRIBE RESULTS											

1. POLLUTANT AND CAS NUMBER (if available)	2. MARK 'X' a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	3. EFFLUENT a. MAXIMUM DAILY VALUE (1) CONCENTRATION	(2) MASS	b. MAXIMUM 30 DAY VALUE (if available) (1) CONCENTRATION	(2) MASS	c. LONG TERM AVRG. VALUE (if available) (1) CONCENTRATION	(2) MASS	d. NO. OF ANALYSES	4. UNITS a. CONCENTRATION	b. MASS	5. INTAKE (optional) a. LONG TERM AVERAGE VALUE (1) CONCENTRATION	(2) MASS	b. NO. OF ANALYSES
GC/MS FRACTION -- VOLATILE COMPOUNDS															
1V. Acrolein (107-02-8)															
2V. Acrylonitrile (107-13-1)															
3V. Benzene (71-43-2)															
4V. Bis (*Chloromethyl*) Ether (542-88-1)															
5V. Bromoform (75-25-2)															
6V. Carbon Tetrachloride (56-23-5)															
7V. Chlorobenzene (108-90-7)															
8V. Chlorodibromomethane (124-48-1)															
9V. Chloroethane (75-00-3)															
10V. 2-Chloroethylvinyl Ether (110-75-8)															
11V. Chloroform (67-66-3)															
12V. Dichlorobromomethane (75-27-4)															
13V. Dichlorodifluoromethane (75-71-8)															
14V. 1,1-Dichloroethane (75-34-3)															
15V. 1,2-Dichloroethane (107-06-2)															
16V. 1,1-Dichloroethylene (75-35-4)															
17V. 1,2-Dichloropropane (78-87-5)															
18V. 1,2-Dichloropropylene (542-75-6)															
19V. Ethylbenzene (100-41-4)															
20V. Methyl Bromide (74-83-9)															
21V. Methyl Chloride (74-87-3)															

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1. POLLUTANT AND CAS NUMBER (if available)	2. MARK 'X'			3. EFFLUENT							4. UNITS		5. INTAKE (optional)		
	a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (if available)		c. LONG TERM AVRG. VALUE (if available)		d. NO. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION – VOLATILE COMPOUNDS (continued)															
22V. Methylene Chloride (75-09-2)															
23V. 1,1,2,2-Tetrachloroethane (79-34-5)															
24V. Tetrachloroethylene (127-18-4)															
25V. Toluene (108-88-3)															
26V. 1,2-Trans-Dichloroethylene (156-60-5)															
27V. 1,1,1-Trichloroethane (71-55-6)															
28V. 1,1,2-Trichloroethane (79-00-5)															
29V. Trichloroethylene (79-01-6)															
30V. Trichlorofluoromethane (75-69-4)															
31V. Vinyl Chloride (75-01-4)															
GC/MS FRACTION – ACID COMPOUNDS															
1A. 2-Chlorophenol (95-57-8)															
2A. 2,4-Dichlorophenol (120-83-2)															
3A. 2,4-Dimethylphenol (105-67-9)															
4A. 4,6-Dinitro-O-Cresol (534-52-1)															
5A. 2,4-Dinitrophenol (51-28-5)															
6A. 2-Nitrophenol (88-75-5)															
7A. 4-Nitrophenol (100-02-7)															
8A. P-Chloro-M-Cresol (59-50-7)															
9A. Pentachlorophenol (87-86-5)															
10A. Phenol (108-95-2)															
11A. 2,4,6-Trichlorophenol (88-06-2)															

1. POLLUTANT AND CAS NUMBER (if available)	2. MARK "X"			3. EFFLUENT						4. UNITS		5. INTAKE (optional)		
	a. testing required	b. believed present	c. believed absent	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (if available)		c. LONG TERM AVRG. VALUE (if available)		d. NO OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION -- BASE/NEUTRAL COMPOUNDS															
1B. Acenaphthene (83-32-9)															
2B. Acenaphtylene (208-96-8)															
3B. Anthracene (120-12-7)															
4B. Benzidine (92-87-5)															
5B. Benzo (a) Anthracene (56-55-3)															
6B. Benzo (a) Pyrene (50-32-8)															
7B. 3,4-Benzo-fluoranthene (205-99-2)															
8B. Benzo (ghi) Perylene (191-24-2)															
9B. Benzo (k) Fluoranthene (207-08-9)															
10B. Bis (2-Chloro-ethoxy) Methane (111-91-1)															
11B. Bis (2-Chloro-ethyl) Ether (111-44-4)															
12B. Bis (2-Chloro-isopropyl) Ether (39638-32-9)															
13B. Bis (2-Ethyl-hexyl) Phthalate (117-81-7)															
14B. 4-Bromo-phenyl Phenyl Ether (101-55-3)															
15B. Butyl Benzyl Phthalate (85-68-7)															
16B. 2-Chloro-naphthalene (91-58-7)															
17B. 4-Chloro-phenyl Phenyl Ether (7005-72-3)															
18B. Chrysene (218-01-9)															
19B. Dibenzo (a,h) Anthracene (53-70-3)															
20B. 1,2-Dichloro-benzene (95-50-1)															
21B. 1,3-Dichloro-benzene (541-73-1)															

EPA I.D. NUMBER (copy from Item 1 of Form 1) | OUTFALL NUMBER

CONTINUED FROM PAGE V-6

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1. POLLUTANT AND CAS NUMBER (if available)	2. MARK 'X'			3. EFFLUENT							4. UNITS		5. INTAKE (optional)		
	a. TEST-ING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (if available)		c. LONG TERM AVRG. VALUE (if available)		d. NO. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION – BASE/NEUTRAL COMPOUNDS *(continued)*															
22B. 1,4-Dichlorobenzene (106-46-7)															
23B. 3,3'-Dichlorobenzidine (91-94-1)															
24B. Diethyl Phthalate (84-66-2)															
25B. Dimethyl Phthalate (131-11-3)															
26B. Di-N-Butyl Phthalate (84-74-2)															
27B. 2,4-Dinitrotoluene (121-14-2)															
28B. 2,6-Dinitrotoluene (606-20-2)															
29B. Di-N-Octyl Phthalate (117-84-0)															
30B. 1,2-Diphenylhydrazine *(as Azobenzene)* (122-66-7)															
31B. Fluoranthene (206-44-0)															
32B. Fluorene (86-73-7)															
33B. Hexachlorobenzene (118-71-1)															
34B. Hexachlorobutadiene (87-68-3)															
35B. Hexachlorocyclopentadiene (77-47-4)															
36B. Hexachloroethane (67-72-1)															
37B. Indeno *(1,2,3-cd)* Pyrene (193-39-5)															
38B. Isophorone (78-59-1)															
39B. Naphthalene (91-20-3)															
40B. Nitrobenzene (98-95-3)															
41B. N-Nitrosodimethylamine (62-75-9)															
42B. N-Nitrosodi-N-Propylamine (621-64-7)															

AND CAS NUMBER (If available)	3. EFFLUENT									4. UNITS		5. INTAKE (optional)		
	a. Testing required	b. Believed present	c. Believed absent	a. MAXIMUM DAILY VALUE		b. MAXIMUM 30 DAY VALUE (if available)		c. LONG TERM AVG. VALUE (if available)		d. NO. OF ANALYSES	a. CONCENTRATION	b. MASS	a. LONG TERM AVERAGE VALUE		b. NO. OF ANALYSES
				(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS	(1) CONCENTRATION	(2) MASS				(1) CONCENTRATION	(2) MASS	
GC/MS FRACTION – BASE/NEUTRAL COMPOUNDS *(continued)*															
43B. N-Nitrosodiphenylamine (86-30-6)															
44B. Phenanthrene (85-01-8)															
45B. Pyrene (129-00-0)															
46B. 1,2,4-Trichlorobenzene (120-82-1)															
GC/MS FRACTION – PESTICIDES															
1P. Aldrin (309-00-2)															
2P. α-BHC (319-84-6)															
3P. β-BHC (319-85-7)															
4P. γ-BHC (58-89-9)															
5P. δ-BHC (319-86-8)															
6P. Chlordane (57-74-9)															
7P. 4,4'-DDT (50-29-3)															
8P. 4,4'-DDE (72-55-9)															
9P. 4,4'-DDD (72-54-8)															
10P. Dieldrin (60-57-1)															
11P. α-Endosulfan (115-29-7)															
12P. β-Endosulfan (115-29-7)															
13P. Endosulfan Sulfate (1031-07-8)															
14P. Endrin (72-20-8)															
15P. Endrin Aldehyde (7421-93-4)															
16P. Heptachlor (76-44-8)															

EPA I.D. NUMBER (copy from Item 1 of Form 1) | OUTFALL NUMBER

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1. POLLUTANT AND CAS NUMBER (if available)	2. MARK 'X' a. TESTING REQUIRED	b. BELIEVED PRESENT	c. BELIEVED ABSENT	3. EFFLUENT a. MAXIMUM DAILY VALUE (1) CONCENTRATION	(2) MASS	b. MAXIMUM 30 DAY VALUE (if available) (1) CONCENTRATION	(2) MASS	c. LONG TERM AVRG. VALUE (if available) (1) CONCENTRATION	(2) MASS	d. NO. OF ANALYSES	4. UNITS a. CONCENTRATION	b. MASS	5. INTAKE (optional) a. LONG TERM AVERAGE VALUE (1) CONCENTRATION	(2) MASS	b. NO. OF ANALYSES
GC/MS FRACTION — PESTICIDES (continued)															
17P. Heptachlor Epoxide (1024-57-3)															
18P. PCB-1242 (53469-21-9)															
19P. PCB-1254 (11097-69-1)															
20P. PCB-1221 (11104-28-2)															
21P. PCB-1232 (11141-16-5)															
22P. PCB-1248 (12672-29-6)															
23P. PCB-1260 (11096-82-5)															
24P. PCB-1016 (12674-11-2)															
25P. Toxaphene (8001-35-2)															

BILLING CODE 6560-01-C

APPENDIX C

List of Mandatory Class I PSD Areas
(Federal Register, November 3, 1977)

National Parks Over 6,000 Acres

State	Park
Alaska	Mount Mckinley
Arizona	Grand Canyon Petrified Forest
California	Kings Canyon Lassen Volcanic Redwood Sequoia Yosemite
Colorado	Mesa Verde Rocky Mountain
Florida	Everglades
Hawaii	Haleakala Hawaii Volcanoes
Idaho	Yellowstone (Wyoming)
Kentucky	Mammouth Cave
Maine	Acadia
Michigan	Isle Royale
Minnesota	Voyageurs
Montana	Glacier Yellowstone (Wyoming)
New Mexico	Carlsbad Caverns
North Carolina	Great Smoky Mountains
Oregon	Crater Lake
South Dakota	Wind Cave
Tennessee	Great Smoky Mountains

State	Park
Texas	Big Bend
	Guadaloupe Mountains
Utah	Arches
	Bryce Canyon
	Canyonlands
	Capitol Reef
	Zion
Virgin Islands	Virgin Islands
Virginia	Shenandoah
Washington	Mount Ranier
	North Cascades
	Olympic
Wyoming	Grand Teton
	Yellowstone

National Wilderness Areas Over 5,000 Acres

Alabama	Sipsey
Alaska	Bering Sea
	Simenof
	Tuxedni
Arizona	Chiricahua National Monument
	Chiricahua
	Galiuro
	Mazatzal
	Mt. Baldy
	Pine Mountain
	Saguaro
	Sierra Ancha
	Superstition
	Sycamore Canyon
Arkansas	Caney Creek
	Upper Buffalo
California	Aqua Tibia
	Caribou
	Cucamonga
	Desolation
	Dome Land
	Emigrant
	Hoover
	Joshua Tree

State	Park
California (cont'd.)	John Muir
	Kaiser
	Lava Beds
	Marble Mountain
	Minarets
	Monkelumne
	Pinnacles
	Point Reyes
	San Gabriel
	San Gorgonio
	San Jacinto
	San Rafael
	South Warner
	Thousand Lakes
	Ventana
	Yolla-Bolly-Middle Eel
Colorado	Black Canyon of the Gunnison
	Eagles Nest
	Flat Tops
	Great Sand Dunes
	La Garita
	Maroon Bells - Snowmass
	Mt. Zirkel
	Rawah
	Weminuche
	West Elk
Florida	Bradwell Bay
	Chassahowitzka
	Saint Marks
Georgia	Cohutta
	Okefenokee
	Wolf Island
Idaho	Craters of the Moon
	Hells Canyon (Oregon)
	Sawtooth
	Selway- Bitterroot (Montana)
Louisiana	Breton
Maine	Moosehorn
Michigan	Seney
Minnesota	Boundary Waters - Canoe Area
Missouri	Hercules - Glades
	Mingo

APPENDIX C --Continued

State	Park
Montana	Anaconda - Pintlar
	Bob Marshall
	Cabinet Mountains
	Gates of the Mountain
	Medicine Lake
	Mission Mountains
	Red Rock Lakes
	Scapegoat
	Selway-Bitterrost - U.L. Bend
Nevada	Jarbridge
New Hampshire	Great Gult
	Presidential Range - Dry River
New Jersey	Briganteen
New Mexico	Bandelier
	Basque del Apache
	Gila
	Pecos
	Salt Creek
	San Pedro Parks
	Wheeler Peak
	White Mountain
North Carolina	Joyce Kilmer - Slickrock
	Linville Gorge
	Shining Rock
	Swanquarter
North Dakota	Lostwood
Oklahoma	Wichita Mountains
Oregon	Diamond Peak
	Eagle Cap
	Gearhart Mountain
	Kalmiopsis
	Mountain Lakes
	Mount Hood
	Mount Jefferson
	Mount Washington
	Strawberry Mountain
	Three Sisters
South Carolina	Cape Romain
South Dakota	Badlands

State	Park
Tennessee	Joyce Kilmer - Slickrock (N.C.)
Vermont	Lye Brook
Virginia	James River Face
Washington	Alpine Lakes Glacier Peak Goat Rocks Mount Adams Pasayten
West Virginia	Dolly Sods Otter Creek
Wisconsin	Rainbow Lake
Wyoming	Bridges Fitzpatrick North Absoroka Teton Washaki

International Parks

New Brunswick, Canada	Roosevelt-Campobello

National Memorial Parks

North Dakota	Theodore Roosevelt

APPENDIX D

National Monuments (NM), National Preserves, and Primitive Areas (PA)
Recommended for Redesignation to Class I PSD Areas

State	Area	Federal	Gross
AZ	Canyon de Chelly NM	0	83,840.00
AZ	Chiricahua NM	10,645.90	10,648.25
AZ	Organ Pipe Cactus MD	329,199.10	330,688.86
AZ	Paiute PA	35,092.00	35,092.00
AZ	Paria Canyon PA	27,515.00	26,515.00
AZ	Saguaro NM	79,863.46	83,576.07
AZ	Sunset Crater NM	3,040.00	3,040.00
AZ	Wupatki NM	35,353.24	35,253.24
CA	Channel Islands NM	18,384.97	18,388.07
CA	Chemise Mountain PA	3,941.00	3,941.00
CA	Joshua Tree NM	547,789.59	559,959.79
CA	Lava Beds NM	46,821.33	46,821.33
CA	Muir Woods NM	514.32	553.55
CA	Pinnacles NM	14,177.77	16,215.67
CA,NV	Death Valley NM	2,048.948.10	1,067,795.06
CO	Black Canyon of the Gunnison NM	13,363.14	13,672.13
CO	Colorado NM	19,744.67	20,444.67
CO	Great Sand Dunes NM	36,426.16	36,826.50
CO	Powderhorn PA	40,400.00	40,400.00
CO, UT	Dinosaur NM	203,629.17	211,053.45
ID	Craters of the Moon NM	53,535.05	53,545.05
MT	Beartrap Canyon PA	2,861.00	2,861.00
MT	Centennial PA	24,166.00	24,168.00
MT	Humbug Spires PA	7,041.00	7,041.00
NM	Bandolier NM	29,661.20	36,971.20
NM	Capulin Mountain NM	775.38	775.38
NM	Chaco Canyon NM	20,990.27	21,510.32
NM	El Morro NM	1,039.92	1,278.72
NM	Gila Cliffs Dwelling NM	533.13	533.13
NM	White Sands NM	144,751.77	145,334.76
OR	John Day Fossil Beds NM	2,035.00	14,402.00
UT	Cedar Breaks NM	6,154.60	6,154.60
UT	Dark Canyon PA	57,248.00	57,248.00
UT	Grand Gulch PA	24,080.00	24,080.00
UT	Natural Bridges NM	160.00	160.00
WY	Devils Tower NM	1,345.91	1,346.91
WY	Fossil Butte NM	7,417.64	8,178.00
WY	Scab Creek PA	6,680.00	6,680.00

APPENDIX E

INFORMATION REQUIRED ON MAJOR PROPOSED ENERGY FACILITIES IN APPLYING FOR WASHINGTON STATE SITING CERTIFICATION (Title 463 WAC)

- graphic illustrations and narrative description of systems, processes, and spacial relationships
- sources of all information including all pre-application studies bearing on the site
- construction schedules and schedules and scope of environmental studies necessary to complete the application
- potential for any future additions, expansions, or further activities which might be undertaken on or contiguous to the site
- analysis of alternatives for site, route, and other elements of the proposal
- identification of applicable safety standards and methods of compliance
- descriptions of the applicant's organization and affiliations
- description of the proposed site indicating its location, prominent geographic features, typical geological and climatological characteristics, and other information necessary to provide a general understanding of all sites involved, including county or regional land use plans and zoning ordinances
- legal description of the site and identification of all non-private ownership
- copies of adopted land use plans and zoning ordinances and survey of present land uses within a 25-mile radius of thermal power plants
- description of the characteristics of the proposed facility: type, size, costs, and significant features
- contour maps showing original topography and changes expected as result of proposed construction
- description of existing roads, railroads, and other transportation facilities and of additional access needed, if any, during construction and operation

- description of the routing, conceptual design, and construction schedule of all proposed associated facilities
- Federal, state, and industry criteria used in the energy transmission route selection and construction factors considered in developing the proposed design and description of how such criteria are satisfied
- consideration of multipurpose utilization of rights of way and description of measure to be employed to utilize, restore, rehabilitate disturbed areas
- description of means to insure safe utilization of those areas of the site to which public access will be granted
- detailed information on any anticipated release of radionuclides and projected radiation doses to human populations
- descriptions of measures to be employed for protection of the facility from earthquake, flood, landslides, and other natural disruptive occurrences
- description of means to be employed to prevent sabotage, vandalism, or other security threats
- emergency plans to assume responsibility for public safety and environmental protection on and off the site in the event of a natural disaster
- procedures to be utilized to prevent soil erosion and surface water runoff
- procedures to be utilized to restore or enhance the landscape disturbed during construction
- impact of construction and operation of facility on all permanent transportation facilities and methods to mitigate impact (vehicle and transmission)
- manner in which fuels and waste products are to be transported to and from the facility
- results of a comprehensive hydrologic and geologic survey showing potential seismic activities
- source and amount of water required during construction and operation of the plant and indication that it is available for this use; description of all existing water rights, withdrawal authorizations, or restrictions which relate to the proposed source

- description of the location and type of water intakes and their impact on ground and surface waters

- demonstration that facility construction and/or operational discharges will be compatible with and meet state water quality standards

- description of
  regarding accidental and/or unauthorized discharges or emissions, relating such information to specific facilities, including but not limited to locations, amounts, storage duration, mode of handling, and transport

- description of both the proposed and alternative systems for heat dissipation from the proposed facility

- where discharges into surface water are involved, identification of outfall configurations and proposed locations; full description of effluent characteristics under all discharge conditions

- background water quality data pertinent to the site, and hydrographic study data and analysis of the receiving waters within one-half mile of any proposed discharge location with regard to: bottom configuration; minimum, average, and maximum water depths and velocities, water temperature and salinity profiles; and other relevant characteristics which could influence the impact of any wastes

- description of any changes in groundwater activity or quality which might result from project construction or operation

- description of each wastewater source accociated with the facility and for each source, the applicability of all known, available, and reasonable methods of wastewater control and treatment. Where wastewater control involves collection and retention for recycling and/or resource recovery, details of the methods selected, including at least the following information shall be provided: waste source(s), average and maximum daily amounts and composition of wastes, storage capacity and duration, and any bypass or overflow facilities to the wastewater treatment system(s) or the receiving waters. Where wastewaters are discharged into receiving waters, a detailed description of the proposed treatment system(s), including appropriate flow diagrams and tables showing the sources of all tributary waste streams,their average and maximum daily amounts and composition, individual treatment units and their design criteria, major piping (including bypasses), and average and maximum daily amounts and composition of effluent(s) must be provided.

- a completed National Pollutant Discharge Elimination System application

- description of the disposition of all solid or semisolid construction and operation wastes including spent fuel, ash, sludge, and bottoms, and show compliance with applicable state and local comprehensive solid waste disposal plans

- identification of all pertinent air pollution control standards; adequate data showing air quality and meteorological conditions at the site; meteorological data shall include, at least, adequate information about wind direction patterns, air stability, wind velocity patterns, precipitation, humidity, and temperature; description of the means to be utilized to assure compliance with air quality and emission standards

- description of the extent to which operations will cause visible plumes, fogging, misting, icing, or impairment of visibility, and changes in ambient levels caused by all emitted pollutants

- demonstration that the highest and best practicable treatment for control of emissions will be utilized in facility construction and operation

- description of all dust caused by construction or operation of the facility and how these are to be minimized or eliminated

- description of all vegetation, animal life, and aquatic life which might reasonably be affected by construction and/or operation of the facility, with particular attention to any endangered species or noteworthy species or habitat, including density and distribution information

- full description of each measure to be taken by the applicant to protect vegetation, animal life, and aquatic life from the effects of facility operation and construction, specifying insurance, bonding, or other arrangements made in order to replace or compensate for damage or loss to vegetation, animal life, or aquatic life

- description of the aesthetic impact of the proposed energy facility and associated facilities and any alteration of surrounding terrain, presenting the location and design of the facilities relative to the physical features of the site in a way that will show how the installation will appear relative to its surroundings

- description of energy consumption during both construction and operation at the facility as to sources of supply, location, use, types, amounts, and new delivery facilities

- list of all historical, archaeological, and recreational sites within the area affected by construction and operation of the facility and a description of how each will be impacted

- detailed socioeconomic impact study which identifies primary and secondary impacts

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