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**FIRST PHASE REPORT
ON
IDENTIFICATION OF ENVIRONMENTAL ISSUES
HYBRID WOOD-GEOTHERMAL POWER PLANT
WENDEL-AMEDEE KGRA
LASSEN COUNTY, CALIFORNIA**

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INTRODUCTION

BACKGROUND

GeoProducts Corporation and the California Department of Water Resources have jointly proposed to develop a 55 MWe power plant in Lassen County, California. The proposed power plant is unique in that it will utilize geothermal heat and wood fuel to generate electrical power, the first attempt to utilize these resources together on a commercial scale.

The proposed power plant will be located approximately 19 miles east of Susanville, tentatively in the southwest quarter of Section 13, Township 29N, Range 15E.

Most of the power generated by the proposed plant would be used by the California Department of Water Resources for the operation of the State Water Resources Development System. An adequate supply of wood fuel is believed to exist within a 100 mile radius of the plant site. The United States Geological Survey has given a favorable opinion on the adequacy of the geothermal resource for this project. The hybrid power plant is viewed by the community as a possible means of reducing high power rates and stemming the long-term trend of declining employment.

GeoProducts Corporation, in a contract dated November 12, 1980, with Gennis & Associates, Engineers, a Division of George S. Nolte and Associates, has authorized preparation of a study to identify environmental issues and constraints which may impact the proposed hybrid wood-geothermal power plant. This report completes the first phase of the study which covers the following three tasks:

Task One

Identify, review and evaluate environmental requirements under Federal, state and local statutes and guidelines as they relate to the project.

Task Two

Perform a literature search of existing environmental data pertaining to the area and the project, and prepare a bibliography with abstracts of this data.

Task Three

Identify sensitive environmental issues pertaining to the project.

REPORT FORMAT

This first phase report has been organized along the following disciplines:

- Air Resources
- Land Use, Vegetation and Wildlife
- Geotechnical Environment
- Surface Water, Groundwater and Waste Disposal
- Cultural Resources
- Health and Industrial Hygiene
- Socio-Economics

A bibliography with abstracts has been prepared for each of the above disciplines. An attempt has been made to tailor the depth of the abstract to the importance or applicability of the material contained in the reference. In some cases, the same reference appears in more than one discipline because of its importance to each.

I. AIR RESOURCES

GENERAL COMMENTS

The identification, review and evaluation of air resource-related requirements under Federal, state and local statutes and guidelines involves estimating the type and magnitude of atmospheric emissions of the proposed 55 MW wood-geothermal power plant. The unique nature of the fuels for the power plant, wood (biomass) and geothermal fluids, complicates both the emissions evaluation and selection of pertinent regulations related to air quality.

In order to gain a perspective on the relative "cleanness" of fuels, Table I-1 was developed to show the atmospheric emissions level of various fuels. Wood is somewhat higher in particulate emissions compared with coal, but lower in sulfur oxides. Fuel distillate, LP gas and natural gas are very low in particulate emissions; distillate is high in sulfur oxides as is coal. All the fuels produce comparable nitrogen oxides emissions. The table shows emissions in two ways: per weight of fuel consumed, and per energy content of the fuel. The latter is perhaps a more fair basis for comparison of fuels.

The wood consumption rate of the proposed 55 MW power plant will be determined to a large extent by the mechanical design and operation of the power plant. Preliminary analysis indicates that about 1,000 dry tons of wood will be required per day to fuel the plant (Fogelman, 1981).

Estimated unabated atmosphere emissions from the proposed 55 MW power plant are tabulated in Table I-2. In general, as indicated in Tables I-1A and I-1B, a range of unabated emission rates may be anticipated. Emissions tabulated in Table I-2 are best-guess estimates derived by considering available information. Footnotes to Table I-2 indicate the bases for these estimates.

These estimates are somewhat more conservative than those given in the Sverdrup/ARO, 1980 report and are believed to be estimates considered acceptable by EPA. Use of these more conservative values in permit applications is expected to expedite permit approvals without affecting project feasibility.

Some controversy exists regarding SO₂ emissions resulting from burning wood residues. EPA resource documents give an emission factor of 0.375 lb. SO₂ /million BTU for wood-residue-fired boilers. This factor is based on an average wood-residue sulfur content of 0.1%, 86% stoichiometric conversion of sulfur to SO₂, and a heating value of 4600 BTU per lb. of wood residue (unknown moisture content). This is equivalent to an emission rate of 3.44 lbs. SO₂/ton wood-waste.

In two tests on a bark-fired boiler at the Masonite plant in Ukiah, California, SO₂ emission rates equivalent to 0.135 and 1.72 lbs. SO₂/ton hogged² fuel (dry weight) were measured. The sulfur content of the fuel is unknown (test results courtesy of Mr. Robert Swann, Deputy Director, Mendocino County Air Pollution Control District).

Field studies conducted by the National Council of the Paper Industry for Air and Stream Improvements, Inc., indicate that just over 5% of the sulfur contained in wood-residue is converted to SO₂ and released upon combustion. Combustion of bark containing between 0.01 and 0.14 percent sulfur in four dedicated bark boiler systems produced SO₂ emission rates between 0.01 and 0.17 lbs SO₂/ton bark (dry weight) (Oglesby, H.S. and R.O. Blosser, Journal of² Air Pollution Control Federation, Vol. 30, No. 7, July 1980, p. 769).

Many alternative operational schemes are possible for the proposed power plant. If geothermal waters are used in a cooling tower or are discharged to the surface rather than reinjected, potentially significant emissions of dissolved gases or salts could occur. However, although the composition of undiscovered geothermal waters is unknown, it is probable that geothermal waters encountered will be of low to moderate salinity with a low H₂S content (GeothermEx, 1980).

Wood hauling will be an important consideration in an eventual complete plant inventory. During the seven month harvest season (May 1 through November 30), a fleet of about 47 trucks will haul wood to the power plant site (Bibow, February, 1981). It is estimated that, typically, about 3 of these trucks will be operating within 2 miles (3 km) of the plant during a harvest-season day. As shown in Table I-3, truck hauling is a minor emission when compared with power plant fuel emissions.

A detailed description of air resources regulations pertinent to the proposed 55 MW power plant is presented in the following section. It is possible to determine which regulations will be "triggered" by the unabated emissions estimates given in Tables I-2, I-3 and I-4. A summary list of regulations and their "trigger points" is presented in Table I-4. These "trigger points" would be surpassed, assuming our estimated unabated emissions. Note that 250 tons of pollutant per year is 1.4 lbs. pollutant per ton of fuels (0.70 Kg/MT fuel), for a consumption rate of 1,000 tons per day.

TABLE I-1A

COMPARISON OF EXTERNAL COMBUSTION FUEL SOURCES AS TO RESULTING
AIR POLLUTANTS AND UNCONTROLLED EMISSIONS
BY ENERGY CONTENT OF FUEL

<u>Fuel Source</u>	<u>Rating*</u>	<u>Particulates</u> 1b/10 ⁷ BTU (Kg/10 ² Kcal)	<u>Sulfur Oxides</u> 1b/10 ⁷ BTU (Kg/10 ² Kcal)	<u>Carbon Monoxide</u> 1b/10 ⁷ BTU (Kg/10 ² Kcal)	<u>Hydrocarbons</u> 1b/10 ⁷ BTU (Kg/10 ² Kcal)	<u>Nitrogen Oxides</u> 1b/10 ⁷ BTU (Kg/10 ² Kcal)
Wood ¹ 8,530 BTU/lb	C	15 to 18 (260 to 310)	0 to 1.8 (0 to 31)	1.2 to 35 (21 to 600)	1.2 to 41 (21 to 700)	5.9 (100)
Municipal Refuse 12,000 BTU/lb	A	13 (220)	1.0 (17)	15 (260)	0.63 (11)	1.3 (22)
Coal Anthracite 12,650 BTU/lb	B	6.7 (120)	15 (260)	0.40 (6.9)	0.012 (0.21)	7.1 (120)
Coal Bituminous 12,250 BTU/lb	A	6.5 (110)	16 (270)	0.41 (7.0)	0.12 (2.1)	7.3 (130)
Fuel Oil Distillate 15,216 BTU/lb	A	0.76 (13)	15 (260)	0.28 (4.8)	0.19 (3.3)	9.9 (170)
Liquid Petroleum Gas 20,700 BTU/lb	C	0.19 (3.3)	0.0097 (0.17)	0.17 (2.9)	0.031 (0.53)	1.3 (22)
Natural Gas 23,300 BTU/lb @ 70°F	B	0.14 (2.4)	0.00058 (0.010)	0.16 (2.7)	0.0094 (0.16)	5.8 (100)

* Emission Factor Rating for Reliability

A=Excellent; B=Above Average; C=Average

¹Approximately 50% moisture content.

Developed from Compilation of Air Pollutant Factors
AP-42, U.S. EPA

TABLE I-1B

COMPARISON OF EXTERNAL COMBUSTION FUEL SOURCES AS TO RESULTING
AIR POLLUTANTS AND UNCONTROLLED EMISSIONS
BY WEIGHT OF FUEL CONSUMED

<u>Fuel Source</u>	<u>Rating*</u>	<u>Particulates</u> 1b/ton (Kg/MT)	<u>Sulfur Oxides</u> 1b/ton (Kg/MT)	<u>Carbon Monoxide</u> 1b/ton (Kg/MT)	<u>Hydrocarbons</u> 1b/ton (Kg/MT)	<u>Nitrogen Oxides</u> 1b/ton (Kg/MT)
Wood ¹	C	25 to 30 (13 to 15)	0 to 3 (0 to 1.5)	2 to 60 (1 to 30)	2 to 70 (1 to 35)	10 (5)
Municipal Refuse	A	30 (15)	2.5 (1.3)	35 (18)	1.5 (0.75)	3.0 (1.5)
Coal Anthracite	B	17 (8.5)	38 (19)	1.0 (0.50)	0.03 (0.015)	18 (9.0)
Coal Bituminous	A	16 (8.0)	38 (19)	1.0 (0.50)	0.30 (0.15)	18 (9.0)
Fuel Oil Distillate	A	2.3 (1.2)	45 (23)	0.85 (0.43)	0.57 (0.29)	30 (15)
Liquid Petroleum Gas	C	0.79 (0.40)	0.040 (0.020)	0.70 (0.35)	0.13 (0.065)	5.3 (2.7)
Natural Gas	B	0.67 (0.34)	0.027 (0.014)	0.75 (0.38)	0.044 (0.022)	27 (14)

* Emission Factor Rating for Reliability
A=Excellent; B=Above Average; C=Average

¹ Approximately 50% moisture content.

Developed from Compilation of Air Pollutant Factors
AP-42, U.S. EPA

TABLE I-2

ESTIMATES OF UNABATED ATMOSPHERIC EMISSIONS
FROM A 55 MW WOOD-GEOTHERMAL POWER PLANT

(wood combustion rate estimated at 1000 dry tons per day)

	<u>lb/hr</u>	<u>(Kg/hr)</u>	<u>lb/day</u>	<u>(Kg/day)</u>	<u>Ton/year</u>	<u>(MT/year)</u>
Particulates ^a	1,040	(470)	25,000	(11,000)	4,600	(4,200)
Sulfur Oxides ^b	4.2	(1.9)	100	(45)	18	(16)
Carbon Monoxide ^c	420	(190)	10,000	(4,500)	1,800	(1,600)
Hydrocarbons ^d	170	(76)	4,000	(1,810)	730	(660)
Nitrogen Oxides ^e	83	(38)	2,000	(910)	365	(320)

^a Based on 25 lb/ton (13 Kg/MT wood); this figure may range from 25 with no reinjection to 45 lb/ton (23 Kg/MT) wood with 100% reinjection. As the percentage of bark increases, particulates increase.

^b Estimated at 0.10 lbs/ton (0.051 Kg/MT), based on an assumed bark sulfur content of 0.1%, wood-fuel composed of 25% bark, and 10% stoichiometric conversion of sulfur to SO₂ (see discussion in text).

^c Estimated at 10 lb/ton (5 Kg/MT) wood from measurements by Humboldt County APCD, supported by recent studies (see references).

^d Estimated at 4 lb/ton (2 Kg/MT) wood (see c).

^e Estimated at 2 lb/ton (1 Kg/MT) wood (see c).

TABLE I-3

TRUCK HAULING EMISSIONS IN PLANT AREA *

	<u>lb/hr</u>	<u>(Kg/hr)</u>	<u>lb/day</u>	<u>(Kg/day)</u>	<u>ton/year</u>	<u>(MT/year)</u>
Particulates	0.021	(0.010)	0.5	(0.23)	0.09	0.08
Sulfur Oxides	0.43	(0.019)	1.0	(0.47)	0.19	0.17
Carbon Monoxide	(0.36)	(0.163)	8.7	(4.00)	1.57	1.43
Hydrocarbons	0.06	(0.027)	1.4	(0.67)	0.26	0.24
Nitrogen Oxide	0.60	(0.27)	14.3	(6.67)	2.63	2.37
Aldehydes	0.005	(0.0024)	0.13	(0.057)	0.023	0.021
Organic Acids	0.005	(0.0024)	0.13	(0.057)	0.023	0.021

* Plant area defined as within a radius of 2 miles (3 km) from the power plant; 3 loads per hour. Emissions from U.S. EPA, AP-42 "Heavy-Duty Diesel-Powered Vehicles," assuming 20 tons/load.

TABLE I-4

AIR QUALITY REGULATIONS "TRIGGERED" BY ESTIMATED UNABATED
ATMOSPHERIC EMISSIONS FROM THE PROPOSED 55 MW POWER PLANT

I. U.S. Environmental Protection Agency

1. Prevention of Significant Deterioration (PSD):

- a. 250 tons pollutant/year
- b. 10 tons hydrogen sulfide/year
- c. Ambient air increments

2. New Source Review (NSR):

100 tons pollutant/year

3. "Significant" emission increases of regulated air
pollutants:

Carbon Monoxide	-100 tons/year
Nitrogen Oxides	- 40 tons/year
Sulfur Oxides	- 40 tons/year
Particulates	- 25 tons/year
Mercury	- 0.01 tons/year
Hydrogen Sulfide	- 10 tons/year

II. State of California Air Resources Board and Lassen County
Air Pollution Control District.

1. New Source Review (NSR): (Stationary Sources):

250 lb pollutant/day

AIR QUALITY REGULATIONS

The Federal, state and county air agencies have promulgated standards which limit and control the emissions to air in the County of Lassen.

Prevention of Significant Deterioration (PSD), Federal EPA

On December 3, 1974, the U.S. Environmental Protection Agency (EPA) published regulations under the 1970 version of the Clean Air Act for the prevention of significant deterioration of air quality. These regulations, codified as 40 CR 52.21 (Title 40 of the Code of Federal Regulations, Section 52.21), established a program for protecting areas with air quality cleaner than the national ambient air quality standards (NAAQS). The 1970 Act was superceded by the 1977 Clean Air Act and Amendments which appear in the Federal Register for June 19, 1978, and August 7, 1980.

(U.S. Environmental Protection Agency. June 19, 1978, Part V. "1977 Clean Air Act; Prevention of Significant Air Quality Deterioration. State Implementation Plans: Requirements." Federal Register, Vol. 43, No. 118, pages 26380-26410, The National Archives of the United States.

U.S. Environmental Protection Agency. August 7, 1980. "Requirements for Preparation, Adoption, and Submittal of Implementation Plans: Approval and Promulgation of Implementation Plans." Federal Register, Vol. 45, No. 154, pages 52676 to 52748, The National Archives of the United States.)

Under the EPA's regulatory program, clean areas of the nation could be designated under any of three "classes." Specified numerical "increments" of air pollution were permitted under each class up to a level considered to be "significant" for that area. Class I increments permitted only minor air quality deterioration; Class II increments, moderate deterioration; Class III increments, deterioration up to the national ambient air quality standards, as specified below:

<u>Pollutant</u>		<u>Maximum Allowable Increase</u>		
		<u>ug/m³</u>		
		<u>Class I</u>	<u>Class II</u>	<u>Class III</u>
Particulate Matter	Annual geometric mean	5	19	37
	24-hour maximum	10	37	75
Sulfur Dioxide	Annual arithmetic mean	2	20	40
	24-hour maximum	5	91	182
	3-hour maximum,	25	512	700

Except for certain wilderness areas and national parks which are mandatory Class I areas, all clean areas of the country were initially designated as Class II.

The principle mechanism within the State Implementation Plan (SIP) to implement the objectives of the PSD program is the preconstruction review process. These provisions require that new major stationary sources and major modifications are carefully reviewed prior to construction to ensure compliance with:

- a. The National Ambient Air Quality Standards (see Table I-5),
- b. The applicable PSD air quality increments, and
- c. The requirements to apply the best available control technology on the project's pollutant emissions.

No source or modification subject to the PSD rules set out in the Federal Register, August 7, 1980, may be constructed without a permit which states that the stationary source or modification would meet all applicable PSD requirements.

The criteria used to determine the applicability of the PSD regulations are:

- a. Size (in terms of emissions): PSD applies to any "major stationary source," defined as any source type belonging to a list of 28 categories, or any other source type which has potential to emit any pollutant subject to regulation under the Clean Air Act in amounts equal to or greater than 250 tons per year.
- b. Location: A PSD area is one formally designated by the State as "attainment" or "unclassifiable" for any pollutant for which a national ambient air quality standard exists.
- c. Types of Pollutants and their emission rates: PSD review applies to all significant emissions increases of regulated air pollutants. 40 CFR 52.21 (b) Definitions (23)(i) defines "significant" in reference to a net emissions increase or the potential of a source to emit any of the following pollutants, as a rate of emissions that would equal or exceed any of the rates on the following page.

<u>Pollutant</u>	<u>Emissions Rate</u> <u>(tons per year)</u>
Carbon Monoxide	100
Nitrogen Oxides	40
Sulfur Dioxide	40
Particulate Matter	25
Ozone	40 tpy of volatile organic compounds
Lead	0.6
Asbestos	0.007
Beryllium	0.0004
Mercury	0.1
Vinyl Chloride	1
Fluorides	3
Sulfuric Acid Mist	7
Hydrogen Sulfide	10
Total Reduced Sulfur (including H ₂ S)	10
Reduced Sulfur Compounds (including H ₂ S)	10

40 CFR 52.21 (b) Definitions (23) (iii) states that notwithstanding paragraph (b)(23)(i) (above), "significant" means any emissions rate or any net emissions increase associated with a major stationary source which would construct within 10 kilometers of a Class I area³, and have an impact on such an area equal to or greater than 1 ug/m³ (24 hour average).

In order for a source to obtain a PSD permit, the following steps must be taken:

- a. It must apply the best available control technology (BACT):
An analysis must be conducted to ensure application of the best available control technology. The reviewing authority will then specify an emissions limitation for the source that reflects the maximum degree of reduction achievable for each pollutant regulated under the 1977 Clean Air Act. During the analysis, the reviewing authority will evaluate the energy, environmental, economic and other costs associated with each alternative technology, and the benefit of reduced emissions that the technology will bring. In no event can a technology be recommended which would not meet any applicable standard of performance under 40 CFR, Part 60 (New Source Performance Standards [NSPS]), and 40 CFR, Part 61 (National Emission Standards for Hazardous Air Pollutants [NESHAPS]). Also, if the reviewing authority determines that there is no economically-reasonable or technologically-feasible way to accurately measure the emissions, and hence to impose an enforceable emissions standard, it may require the source to use source design, alternative equipment, work practices or operational standards to reduce emissions of the pollutant to the maximum extent.

- b. It must conduct an ambient air quality analysis: to demonstrate that its new pollutant emissions would not violate either the applicable NAAQS or the applicable PSD increment. This analysis ensures that the existing air quality is better than that required by national standards and that baseline air quality will not be degraded beyond the applicable PSD increment.

The source must first assess the existing air quality for each regulated air pollutant that it emits in the affected area. This analysis requirement does not apply to pollutants for which the new emissions would cause insignificant ambient impacts. 40 CFR 52.21 (i)(8) states that the stationary source may be exempted from ambient air quality analysis if the emissions increase of the pollutant from the new source would cause, in any area, air quality impacts less than the following amounts:

	<u>ug/m³</u>	<u>Averaging Time</u>
Carbon Monoxide	575	8 hour average
Nitrogen Dioxide	14	annual average
Total Suspended Particulates	10	24 hour average
Sulfur Dioxide	13	24 hour average
Lead	0.1	24 hour average
Mercury	0.25	24 hour average
Beryllium	0.0005	24 hour average
Fluorides	0.25	24 hour average
Vinyl Chloride	15	24 hour average
Total Reduced Sulfur	10	1 hour average
Hydrogen Sulfide	0.04	1 hour average
Reduced Sulfur compounds	10	1 hour average

Ozone: No de minimis air quality level is provided for ozone. However, any net increase of 100 tons per year or more of volatile organic compounds subject to PSD would be required to perform an ambient impact analysis including the gathering of ambient air quality data. The source may be exempted also if the ambient concentrations of these pollutants are less than the values above.

For pollutants for which a NAAQS exists, the applicant must provide ambient monitoring data that represents air quality levels in the year's period preceding the PSD application. Where no existing data are judged representative or adequate, then the source applicant must conduct its own monitoring program. The administrator may determine that a shorter monitoring period is adequate, but not less than four months.

For any application which becomes complete, except as to air quality analysis, between June 8, 1981 and February 9, 1982, the required air quality monitoring data shall have been gathered over at least the period from February 9, 1981 to the date the application becomes complete, except that if the source would have been major for that pollutant under 40 CFR 52.21 as in effect on June 19, 1978, any monitoring data shall have been gathered over at least the period required by these regulations.

According to the EPA (telephone conversation, Matt Haber, Environmental Engineer, EPA, December 5, 1980) this means that if the application is deemed complete by June 8, 1981, one year of monitoring of the five criteria pollutants is usually required (Carbon monoxide, reactive hydrocarbons, nitrogen dioxide, sulfur dioxide and particulate matter); if the application is complete after this date, monitoring of all fifteen pollutants would be required from June 8, 1981, until such time as the application is complete, for any pollutant which the source has the potential to emit.

Typically, air quality dispersion modeling is used by applicants to support or extend the assessment made with gathered monitoring data. For pollutants for which there is no NAAQS, the required analysis will normally be based on dispersion modeling alone.

Source applicants who are subject to the ambient analysis requirement for sulfur dioxide or particulate matter must also perform an analysis to compute how much of the PSD increment remains available to them. Then the applicant must demonstrate that his proposed new emissions would not exceed the remaining PSD increment.

- c. Post Construction Monitoring: The owner of a major stationary source shall, after construction of the source, conduct such ambient monitoring as the Administrator determines is necessary to determine the effect emissions from the stationary source may have or are having on air quality in the area.
- d. Source Information: The owner of a proposed source shall submit all information necessary to perform any analysis or make any determination required under this section:
 - 1. A description of the nature, location, design capacity, and typical operating schedule of the source, including specifications and drawings showing its design and plant layout.
 - 2. A detailed schedule for construction of the source.
 - 3. A detailed description as to what system of continuous emission reduction is planned for the source, emission estimates, and any other information necessary to determine BACT.

Upon request of the Administrator, the owner shall also provide information on:

- 1. The air quality impact of the source, including meteorological and topographical data necessary to estimate such impact.
- 2. The air quality impact, and the nature and extent of any or all general commercial, residential, industrial and other growth which has occurred since the baseline date.

- e. Environmental Impact Statements: Whenever any proposed source or modification is subject to action by a Federal agency which might necessitate preparation of an environmental impact statement pursuant to the National Environmental Act (42 U.S.C. 4321), review by the Administrator conducted pursuant to this section shall be coordinated with the broad environmental reviews under that Act and under Section 309 of the Clean Air Act to the maximum extent feasible and reasonable.
- f. It must analyze impacts to soils, vegetation and visibility: Not only must the applicant look at the direct effect of source emissions on these resources, but also must consider the impacts from general commercial, residential, industrial and other growth associated with the proposed source or modification.
- g. It must not adversely impact a Class I area: The project is in a Class II area. However, the following comments from BLM should be noted:

"Plant is located in close proximity to Skedaddle and other WSA's and all public land air quality must be managed in compliance with Clean Air Act (as amended, 1977) Class II. This classification allows moderate deterioration of present air quality. If WSA is ultimately designated wilderness, the area could be reidentified as Class I. (Letter from C. Rex Cleary, District Manager, U.S.D.I., Bureau of Land Management, to Arnold Bullock, dated November 26, 1980, Ref. 3200 [C-020]). (Any change in classification is prerogative of State of California.)"
- h. Its application must undergo adequate public participation.
- i. It must start construction on time: Once a PSD permit is received, the source owner must start construction within a reasonable period of time (typically within 18 months of approval), and must stay on a continuous construction schedule. Normally, long delays will invalidate the permit.

Further information as to Application Requirements and Procedures and Time Requirements related to the prevention of significant deterioration of air quality is included in Appendix A.

New Source Review Regulations

Federal. Federal New Source Review (NSR) regulations require review if a new source has a potential to emit more than 100 tons per year of any pollutant which is regulated by a national ambient air quality standard. The required review is to determine if the proposed project will meet the applicable emission limitations and if the emissions will violate or exacerbate a violation of the national ambient air quality standards.

PROPOSED HYBRID
WOOD/GEOTHERMAL
POWER PLANT

AREAS BEING CONSIDERED FOR
REDESIGNATION TO CLASS I

1. LAVA BEDS NATIONAL MONUMENT (PORTION)
2. SALMON-TRINITY ALPS PRIMITIVE AREA
3. HUMBOLDT REDWOODS STATE PARK
4. KING RANGE CONSERVATION AREA (CHEMISE MOUNTAIN)
5. REDWOOD NATIONAL PARK (PORTION)
6. JEDDAH SMITH REDWOODS STATE PARK
7. DEL NORTE COAST REDWOODS STATE PARK
8. PRAIRIE CREEK REDWOODS STATE PARK
9. EMIGRANT BASIN-PRIMITIVE AREA
10. PINNACLES NATIONAL MONUMENT (PORTION)
11. BIG BASIN REDWOODS STATE PARK
12. HENRY COWELL REDWOODS
13. THE FOREST OF NISENE MARKS STATE PARK
14. HIGH SIERRA PRIMITIVE AREA
15. DEVIL'S POSTPILE NATIONAL MONUMENT
16. MINERAL KING (ADDITION TO SEDUONA NATIONAL PARK)
17. GOLDEN TROUT WILDERNESS
18. DEATH VALLEY NATIONAL MONUMENT
19. SANTA LUCIA WILDERNESS
20. MONTANA DE ORO STATE PARK
21. MONO LAKE WATERSHED
22. MT. TAMALPIAS STATE PARK
23. POINT REYES NATIONAL SEASHORE (PORTION)
24. MUJR WOODS NATIONAL MONUMENT
25. SAN JACINTO STATE WILDERNESS
26. JOSHUA TREE NATIONAL MONUMENT (PORTION)
27. MORONGO BASIN
28. ANZA-BORRERO STATE PARK
29. CUYAMACA RANCHO STATE PARK
30. CHANNEL ISLANDS NATIONAL PARK

MANDATORY CLASS I

31. AGUA TIBIA NATIONAL WILDERNESS
32. CARIBOU NATIONAL WILDERNESS
33. CUCAMONGA NATIONAL WILDERNESS
34. DESOLATION NATIONAL WILDERNESS
35. DOME LAND NATIONAL WILDERNESS
36. EMIGRANT NATIONAL WILDERNESS
37. MOOVED NATIONAL WILDERNESS
38. JOSHUA TREE NATIONAL MONUMENT (PORTION)
39. JOHN MUIR NATIONAL WILDERNESS
40. KAISER NATIONAL WILDERNESS
41. KINGS CANYON NATIONAL PARK
42. LASSEN VOLCANIC NATIONAL PARK
43. LAVA BEDS NATIONAL MONUMENT (PORTION)
44. MARBLE MOUNTAIN NATIONAL WILDERNESS
45. MINARETS NATIONAL WILDERNESS
46. MOKELUMNE NATIONAL WILDERNESS
47. PINNACLES NATIONAL MONUMENT (PORTION)
48. POINT REYES NATIONAL WILDERNESS
49. REDWOOD NATIONAL PARK (PORTION)
50. SAN GABRIEL NATIONAL WILDERNESS
51. SAN GORGONIO NATIONAL WILDERNESS
52. SAN JACINTO NATIONAL WILDERNESS
53. SAN RAFAEL NATIONAL WILDERNESS
54. SOUTH WARNER NATIONAL WILDERNESS
55. THOUSAND LAKES NATIONAL WILDERNESS
56. VENTANA NATIONAL WILDERNESS
57. YOLLA-BOLLY MIDDLE BEL NATIONAL WILDERNESS
58. YOSEMITE NATIONAL PARK
59. SEDUONA NATIONAL PARK

Source: California Air Resources Board

There are national ambient air quality standards for photochemical oxidants, carbon monoxide, nitrogen dioxide, sulfur dioxide, suspended particulate matter and hydrocarbons (corrected for methane).

State. The California Air Resources Board (CARB) has adopted a set of H₂S emissions regulations for geothermal activities related to power plants. The CARB has requested that local APCDs adopt these emissions regulations and adopt procedures and requirements for the review and evaluation of geothermal projects which direct that, in evaluating a geothermal project for an Authority to Construct, the project meet emission regulations. The regulations require that the H₂S emissions "will not cause a violation of the State ambient air quality standard for H₂S where and when receptors are likely to be present."

Ambient Air Quality Standard

State and Federal air quality standards limit air emissions concentrations in the ambient atmosphere. These standards ensure that public health and safety are not adversely affected. (See also California Air Resources Rule 62 and local APCD New Source Review Regulation.)

State and Local Air Quality Control

In California, air pollution control districts (APCDs) have primary responsibility for control of air pollution from stationary sources. To accomplish this, the APCDs adopt and enforce rules and regulations for the area under their jurisdiction. The body of local regulations forms the core of the State Implementation Plan (SIP) control strategy for stationary sources for each air basin. The CARB develops model rules for specific source categories to assist local districts in the development, adoption and implementation of control measures which will provide needed emission reductions.

The local regulations appear in the Rules and Regulations for Lassen County (Northeast Plateau Air Basin). The State control strategies are presented in State of California, Air Resources Board, April 1979, Chapter 4, California Air Quality Control Strategies and Maintenance of Ambient Air Quality Standards, pages 13-43 and Table 4-7, page 20. The State model rules are presented in State of California, Air Resources Board, April 1979, Chapter 4, Appendix 4-B, California Air Quality Control Strategies, Category 1, Model Rules for Stationary Sources.

The following summarizes applicable State control strategies. Where there is a corresponding local rule for Lassen County, the APCD rule number is included.

Particulate Matter.

- State Strategy 1. Visible Emissions. State law limits the opacity of visible air contaminants of darker than "Ringelmann 2" (equivalent opacity of 40%) to no more than three minutes in any one hour. Various exceptions are provided for under state law (e.g., fires set by public officers for fire fighting and agricultural burning). Lassen County APCD Rule #4:0.
- State Strategy 2. Process Weight. These strategies restrict the emission rate of particulate matter based on the total weight of all materials introduced into any specific process in one hour. A table or formula is provided to determine allowable emissions. Solid fuel charges are usually considered as part of the process weight, but liquid and gaseous fuels and combustion air are not. Lassen County APCD Rule #4:11.
- State Strategy 3. Grain Loading. These strategies limit the discharge of particulate matter from any source to a concentration in the exhaust volume. Lassen County APCD Rule #4:3. Lassen County has emission limits of 0.3 grains per standard cubic foot of exhaust gases.
- State Strategy 6. Combustion Contaminants. These strategies limit the discharge of particulate matter from any combustion sources other than power generating equipment, to a specified concentration. Lassen County Rule #4:4(b). Lassen County has emission limits of 0.3 grains per cubic foot of gas calculated at 12 percent carbon dioxide at standard conditions.
- State Strategies 8 and 8.1. Steam and Power Generating Equipment. These strategies are similar to the fuel-burning equipment strategies (4) which limit emissions of particulate matter from equipment which burns fuel to produce electric power with heat input greater than a specified minimum. Emissions are restricted on a concentration basis and vary between 0.01 and 0.05 grains per standard cubic foot.
- State Strategy 9.1. Geothermal Well Drilling. During geothermal well drilling and existing geothermal well cleanout, particulate matter emissions are limited to a mass rate per hour that is dependent on the steam rating of the well.

Organic Compounds.

- State Strategy 20. Storage of Organic Liquids. These strategies require control equipment on organic liquid storage vessels, usually larger than 40,000 gallons capacity, in which compounds are stored which have a vapor pressure greater than specified, usually 1.5 psi. The CARB is currently working with local APCDs to implement uniform requirements for the use of secondary seals on floating roof tanks, vapor recovery systems of 95% collection efficiency on fixed roof tanks, or equivalent measures. Lassen County APCD Rule #4:15.

Sulfur Compounds.

State
Strategy 30.

Sulfur Oxide Emissions. Refinery equipment and other industrial processes - this strategy limits to a specific concentration (usually 2,000 ppm or less) emissions of sulfur compounds which exist as a liquid or gas at standard conditions. Emissions are calculated as sulfur dioxide. Lassen County APCD Rule #4:4(a).

State
Strategy 33.

Fuel Burning Equipment - Sulfur Compounds. These strategies limit to a specified amount the emissions of sulfur compounds from nonmobile fuel-burning equipment. Emissions are calculated as sulfur dioxide. Typical APCD regulations require that SO₂ emissions be limited to 200 pounds per hour.

State
Strategy 34.

Sulfur Content of Fuel. These strategies prohibit the use of liquids and solid fuels which contain more than a specified amount of sulfur, usually 0.5% by weight. In addition, the use of gaseous fuels which contain more than a specified amount of sulfur compounds (usually 10 grains of H₂S per 100 cubic feet of gas) may be prohibited. Lassen County APCD Rule 4:10.

State
Strategy 35.1.

Geothermal Operations. Sulfur compounds are limited to an emission containing no more than 1000 ppm, expressed as SO₂; and hydrogen sulfide (H₂S) is limited to 200 grams/gross megawatt hour from geothermal plants. Effective January 1, 1980, these plants must limit H₂S emissions to 100 grams/hour/GMW.

Other Pollutants.

State
Strategy 40.

Oxides of Nitrogen - Fuel Burning Equipment. These strategies limit to a specified amount the emissions of oxides of nitrogen from fuel-burning equipment. Emissions are calculated as nitrogen dioxide. There may be several rules which regulate nitrogen dioxide emissions from specific types of equipment; for example, electric power-generating equipment and steam-generating equipment. Emission limits may be based on a weight rate (e.g., 140 pounds per hour), or on concentration (e.g., 125 ppm). Different emission limits may be specified for sources using gaseous, liquid, or solid fuel, or any combination thereof.

State Strategy 42. Carbon Monoxide. Emissions of CO from any source except the internal combustion engine are limited by these strategies to 2000 ppm measured on a dry basis for 15 consecutive minutes.

General Provisions.

State Strategy 50. Definitions. These strategies define words used in the Rules and Regulations of the Lassen County Air Pollution Control District and indicate that, except where the context otherwise indicates, these strategies are used in the same sense as used in the Health and Safety Code. Lassen County APCD Rule #1:2 (a) - (w).

State Strategy 51. Nuisance. These strategies, which are also part of state law, prohibit the discharge of air contaminants or other materials which cause injury, detriment, nuisance, or annoyance to a number of persons, or which endanger the comfort, health and safety of any such persons, or cause injury or damage to business or property. This strategy is one of the few instances in which state law prohibits issuance of a variance. Lassen County Rule #4:2.

State Strategy 52. Circumvention. These strategies prohibit anyone from building, erecting, installing, or using any equipment, the use of which, without resulting in a reduction in total release of air contaminants, would reduce, dilute, or conceal air contaminants which would otherwise be in violation of the Health and Safety Code or of the district rules and regulations. Lassen County APCD Rule #4:16.

State Strategy 53. Separation/Combination of Emissions. These strategies regulate the method of calculation of emissions where emissions are either separated or combined prior to emission. Where air contaminants from a single source are separated before emission, the total emissions of such air contaminants are to be the product of the highest concentration at any emission point and the exhaust gas volume through all emission points, unless actual test data indicate otherwise. Where air contaminants from two or more source operations are combined prior to emission, the strategies are to be applied to the combined emission as if it were a single source operation, unless there is an adequate and reliable means for separating the components of the combined emissions. In such case, the strategies shall apply to each source operation separately. Lassen County APCD Rules #4:12 and 4:13.

State
Strategy 56.

Public Availability of Data. These strategies classify as public information all analyses, plans, or other specifications that disclose the nature, extent, quantity, or degree of air contaminants or other pollution from any source. All air monitoring data and other data, such as emission data, are also classified as public records. Records, with the exception of air pollution emissions data, may be protected as a trade secret if the source proponent demonstrates to the APCO's satisfaction that such protection is warranted. Lassen County APCD Rule #1:3.

State
Strategies
58 and 59.

New Source Performance Standards (NSPS) and National Emission Standards for Hazardous Air Pollutants (NESHAPS). The EPA established standards of performance (NSPS) for new, modified, and reconstructed stationary sources that may contribute significantly to air pollution which causes or contributes to endangering of public health and welfare. These standards include the categories of stationary sources and the affected facilities to which the standards apply: the pollutants which are regulated and the levels to which they must be controlled; and the requirement for monitoring emissions. NSPS may be more or less stringent than California APCD rules and regulations, depending on a variety of circumstances. On a national basis, they provide a performance (emission control) "baseline" for new sources in the categories for which standards are promulgated.

MSPS categories which are potentially applicable to this project include those contained in 40 CFR 60.4 (Fossil Fuel Fired Steam Generators) and 40 CFR 60.11 (Petroleum Liquid Storage Vessels). These standards are described below.

Standards of Performance for Fossil-Fuel-Fired Steam Generators for Which Construction is Commenced After August 17, 1971 (40 CFR 60.4).

These standards are applicable to fossil-fuel and wood-residue-fired steam generating units capable of firing fossil fuel at a heat input rate of more than 73 megawatts. The standards limit emissions of particulate matter, sulfur dioxide and nitrogen oxides. Allowable emissions are a function of the heat input derived from the fuel (fossil fuel and wood residue) and the type of fossil fuel (gas, liquid, or solid).

Standards of Performance for Storage Vessels for Petroleum Liquids Constructed After May 18, 1978 (40 CFR 60.11).

These standards are applicable to petroleum liquid storage vessels with a storage capacity greater than 40,000 gallons. Design measures are specified to limit emissions of volatile organic compounds (VOC).

The EPA also sets emission standards for hazardous pollutants (NESHAPS) to which no ambient air quality standard is applicable. The standards are to provide an adequate margin of safety to protect public health where the pollutant may cause, or contribute to, an increase in mortality or serious irreversible, or incapacitating reversible, illness. Four pollutants (asbestos, beryllium, mercury, and vinyl chlorides) are currently covered.

When these categories of NSPS or NESHAPS have been established, districts may request delegation of authority to implement and enforce any of the standards. In the absence of delegation, EPA enforces the standards. According to Table 4-8, page 39 of Chapter 4 of the California Air Quality Control Strategies, State of California, Air Resources Board, April 1979, authority to implement NSPS and NESHAPS has not been delegated to Lassen County.

Permit System. The APCD permit system is designed to assure that construction or operation of sources will comply with the district's rules and regulations, and will not interfere with attainment or maintenance of ambient air quality standards. It usually consists of requirements for Authority to Construct, Permit to Operate and procedures for New Source Review.

State
Strategy 60.

Authority to Construct. These strategies require that any person building, altering or replacing a contrivance that may cause or control the issuance of air contaminants must first obtain authorization for construction from the Air Pollution Control Officer. Lassen County APCD Rule #2:0(a).

State
Strategy 61

Permit to Operate. These strategies require that before any person may operate a contrivance that may cause or control the issuance of air contaminants, a written permit must be obtained from the Air Pollution Control Officer. Lassen County APCD Rule #2:0 (b).

State
Strategy 62.

New Source Review. New Source Review (NSR) is a general emission growth control regulation, required throughout the United States, which is superimposed on existing emission regulations. NSR is intended to prevent new or modified sources from causing or aggravating violations of ambient air quality standards. Although all APCDs have NSR rules, the Clean Air Act, as amended in 1977, requires such rules to contain provisions not in current rules. The ARB has approved a new model NSR rule which complies with these requirements. All APCDs have been requested to amend their NSR rules to be consistent with the model rule. The model NSR

rule contains a provision which requires the review of permits for construction or modification of major stationary sources. The rule, as required by the Act, specifies the minimum provisions for this permit program.

Before stationary sources can be constructed or modified, a Permit to Construct (called an Authority to Construct in some districts) must be issued by the APCD in which the source will be located. All districts have rules, separate from the NSR rules, which identify those sources for which permits are required. Under the model NSR rules, large new or modified sources are required to comply with all applicable air quality rules and regulations before a permit can be issued. In addition, the model rule further requires that all other stationary sources in the state which are owned or operated by the applicant be in compliance, or on an approved schedule for compliance, with all applicable emission limitations and standards which are part of the State Implementation Plan (SIP) approved by the EPA. For all stationary sources with a net increase in emissions over a specific amount (250 pound per day) of any pollutant for which there is a national ambient air quality standard, or any precursor of such a pollutant, mitigation measures will be required. These sources must use the best available control technology which will result in the maximum degree of emission control. Offsets will also be required to fully mitigate the increase in all emissions from the new or modified source, if the source wishes to locate in an area where standards are being violated.

Fee Schedules.

State
Strategy 70.

Permit Fees. These rules state that every applicant, except certain public agencies, for an Authority to Construct or Permit to Operate shall pay a filing fee and a permit fee. These rules also state how fees will be assessed under various issuing, ownership and operational conditions. Lassen County APCD Rule #3:2.

Radon 222. Department of Health, Radiologic Health Section, Title 17, CAC Section 30355, Standards for Radon 222, for levels above natural background.

State of Nevada Standards

The California - Nevada State border is approximately 13 miles east of the proposed power plant site. To control interstate pollution, EPA will apply PSD review to construction in a clean air area that would substantially impact clean air in another state (U.S. E.P.A., Fed. Register, Vol. 45, No. 154, August 7, 1980, page 52712).

However, California or national air quality standards are generally as stringent or more stringent than Nevada Air Quality Standards, as shown in Table I-5. In addition, both the proposed power plant site and nearby areas within Nevada are Class II air quality areas. Therefore, it is unlikely that substantial impacts to air quality in Nevada would occur provided that California and national regulations are adhered to by the proposed plant (telephone conversation, Glen Gentry, Environmental Specialist, State of Nevada Division of Environmental Protection, February 24, 1981).

TABLE I-5
 AMBIENT AIR QUALITY STANDARDS

Pollutant	Averaging Time	California Standards	National Standards		Nevada
		Concentration	Primary	Secondary	Concentration
Oxidant (Ozone)	1 hour	0.10 ppm (200 ug/m ³)	160 ug/m ³ (0.08 ppm)	Same as primary	235 ug/m ³ (0.12 ppm)
Carbon Monoxide	12 hours	10 ppm (11 mg/m ³)	--	Same as primary standards	--
	8 hours	--	10 mg/m ³ (9 ppm)		10 mg/m ³ (9 ppm)
	1 hour	40 ppm (46 mg/m ³)	40 mg/m ³ (35 ppm)		40 mg/m ³ (35 ppm)
Nitrogen Dioxide	Annual Average	--	100 ug/m ³ (0.05 ppm)	Same as primary standards	100 ug/m ³ (0.05 ppm)
	1 hour	0.25 ppm (470 ug/m ³)	--		--
Sulfur Dioxide	Annual Average	--	80 ug/m ³ (0.03 ppm)	--	80 ug/m ³ (0.03 ppm)
	24 hour	0.04 ppm (105 ug/m ³)	365 ug/m ³ (0.14 ppm)	--	365 ug/m ³ (0.14 ppm)
	3 hour	--	--	1,300 ug/m ³ (0.5 ppm)	1,300 ug/m ³ (0.5 ppm)
	1 hour	0.5 ppm (1310 ug/m ³)	--	--	--
Suspended Particulate Matter	Annual Geometric Mean	60 ug/m ³	75 ug/m ³	60 ug/m ³	75 ug/m ³
	24 hour	100 ug/m ³	260 ug/m ³	150 ug/m ³	150 ug/m ³
Lead	30 Day Average	1.5 ug/m ³	--	--	--
	Quarterly Average	--	--	--	1.5 ug/m ³
Hydrogen Sulfide	1 hour	0.03 ppm (42 ug/m ³)	--	--	--
Hydrocarbons Corrected for Methane	3 hour (6.9 a.m.)	--	160 ug/m ³ (0.24 ppm)	Same as primary	160 ug/m ³ (0.24 ppm)
Ethylene	8 hour	0.1 ppm	--	--	--
	1 hour	0.5 ppm			
Visibility Reducing Particles	1 observation	In sufficient amount to reduce the prevailing visibility to less than 10 miles when the relative humidity is less than 70%		--	--

BIBLIOGRAPHY WITH ABSTRACTS

Air Quality and Meteorology Data

Evans, Fred L.

1980 Personal communication. Lassen County Air Pollution Control Officer, Susanville.

Air quality and meteorological data were discussed concerning the Wendel area. Carbon monoxide data was obtained for the Susanville area, 1973-1974.

Gibson, John

1974 Climate of the Northeast Plateau Air Basin. State of California, Air Resources Board, pages 1-21, November, 1974.

Climatological and meteorological conditions of the Northeast Plateau Air Basin are discussed with information pertinent to air pollution. Topics covered are topography, general weather types and ventilation characteristics including a discussion of temperature inversions.

Granum, Fred

1980 Personal communication. Air Quality Section, California Air Resources Board, Sacramento.

Suspended particulates data was obtained for the Susanville area, 1973-1974. Wind speed and direction data is available from the Susanville airport for such times as the airport is operating.

Keith, John

1980 Personal communication. Dispatch Officer, U.S. Forest Service, Susanville.

Fire weather data is available for April 15 through October 15, several years, including observations of wind speed, direction, dry and wet bulb temperature, minimum and maximum temperature.

National Climatic Center

1979 Index of Original Surface Weather Records for Stations in California. U.S. Department of Commerce, National Climatic Center, Asheville, N.C., page 11.62.

Synoptic weather reports are available at Susanville, 17 miles (27 km) west-northwest of Wendel. The record runs from 1937 through 1976 with all months available.

Smith, Freeman R.

1980 Personal communication. Associate Meteorologist, California Air Resources Board, Sacramento.

Meteorological data sources for the Wendel area were discussed.

U.S. Army, Sierra Ordinance Depot
1980 Personal communication. Unknown person at Sierra Ordinance Depot, Herlong, California.

Weather data and air quality measurements of Total Suspended Particulates taken 8 miles (13 km) southeast of the project area were discussed.

Emissions Data

Bergvall, J.A., et al.

1978 Wood Waste for Energy Study, Inventory Assessment and Economics Analysis. Operations Research Section, Division of Technical Services, State of Washington Department of Natural Resources, page 107, September 1, 1978.

Particulate emissions control devices are discussed, with increasing efficiency of collection related to increased cost. Cyclonic separators were rated at 50 to 90% collection efficient with a cost of \$0.40/CFM-year. Wet scrubbers were rated up to 99.5% efficient with costs ranging to \$1.50/CFM-year. Electrostatic precipitators ranged from 97 to 99.5% collection efficient with cost from \$0.55 to 1.10/CFM-year.

Bosserman, P.B.

Hydrocarbon Emissions from Wood-Fired Boilers.
DEQ/Air Quality Division, Portland, Oregon.

Results from measurements of hydrocarbons (HC) emissions for wood-fired boilers are given. A total of 9 volatile and 88 condensible HC tests were made. Emission factors averaged 1.94 lb HC/Ton fuel (1,001 lb HC/10⁶ lb steam) with a high of 8.46 lb HC/Ton fuel (1,001 lb HC/10⁶ lb steam) and a low of 0.22 lb HC/Ton fuel (31 lb HC/10⁶ lb steam).

Clark, Robert W.

1980 Personal communication. Inspector, Humboldt County Air Pollution Control District, Eureka.

Recent air pollutant emissions from wood-fired boilers were discussed. A Particulate Emissions Summary for 13 wood-fired boilers was obtained covering water-scrubber-controlled, Dutch Oven Boilers and Small Fuel Cells. Data on particulates emissions and CO₂ were found to range from 0.04 grains/SCF for water-scrubbed-controlled to a high of 0.24 grains/SCF for Dutch Oven Boilers. Carbon dioxide values ranged from 3.9% to 13%. Information on hydrocarbon emissions was included.

Fogelman, Sam
1981 Personal communication. Chief Mechanical Engineer, International
February Engineering Company.

About 1,000 dry tons of wood per day will be required to fuel the hybrid power plant.

Gilbert, L.F.
1980 "CO Control Heightens Furnace Efficiency." Chemical Engineering, July 28, 1980, pages 69-73.

A combustion control system using carbon monoxide (CO) emissions as a control parameter. The system ensures furnace firing at low excess air even when heat content, temperature and pressure of fuel fluctuate, and the temperature and distribution of the air vary. Nitrogen oxides (NO_x) were reduced 15 to 35%.

Kane, L.A.
1980 "Combustion Control and Analyzers, What's Really Needed?" Hydrocarbon Processing, June, 1980, pages 65-68.

A method of combustion control is described where carbon monoxide (CO) was used as a control parameter. Air/fuel ratio control using gas analyzers for CO oxygen was shown to hold CO emissions constant while improving combustion efficiency.

Kester, R.A., and M.J. Pilot
1980 "Nitrogen Oxide Emissions from a Pilot Plant Spreader-Stoker
February Bark-Fired Boiler." Journal of the Technical Association of the Pulp and Paper Industry, Vol. 63, No. 2, February, 1980, pages 159-161.

The nitrogen oxide concentration in the gases exhausted from a pilot plant, spreader-stoker bark-fired boiler was measured as a function of fuel feed rate, excess air, combustion temperature, fuel size, under-fire air and fuel moisture content. The average concentration, corrected to 12% CO₂ was 57 ppm. An NO_x emission factor of 1.1 lb/ton of wet bark burned was calculated for the Douglas Fir bark fuel.

Oglesby, H.S., and R.O. Blosser
1980 "Information on the Sulfur Content of Bark and Its Contribution to SO₂ Emissions When Burned as a Fuel." Air Pollution Control Association, Vol. 30, No. 7, July, 1980, pages 769 and following.

A field study of sulfur dioxide (SO₂) emissions of representative bark is described. A sulfur balance around the combustion device was performed for solid and gaseous forms namely ash, fly ash and SO₂. The study showed that just over 5% of the sulfur contained in the bark was emitted as SO₂, which amounted to 0.001 to 0.02 lb SO₂/10⁶ BTU in bark fuel. The remainder was contained in the ash, supporting the conclusion that the sulfur content of wood is not stoichiometrically converted to SO₂.

Sverdrup/ARO and R.M.S., Inc.

1980 Wood Fuel Technical Information and Properties. Sverdrup/ARO, Inc., Tullahoma, Tennessee. Resource Management Services, Inc., Birmingham, Alabama, November, 1980.

Pages 25-32:

Emission characteristics of the proposed wood fired power plant are discussed. Particles are estimated to be 0.5 to 4.0 grams/SCF. Wood species with the higher ash content will have higher particulate emissions. Low sulfur and nitrogen content of the wood species studied will result in low sulfur oxides (SO_x) and nitrogen oxides (NO_x) emissions. The highest NO_x value obtained was found to be 0.005 moles/lb dry wood (1.0 lb/ton dry wood). NO_x was found to be below 0.001 moles/lb dry wood (0.20 lb/ton dry wood) for flame temperatures below 3000°F. Carbon monoxide (CO) was found to have high emission values up to 0.0252 moles/lb dry wood (3.1 lb/ton dry wood).

Pages 11-12:

Climatological data is presented for Susanville, 17 miles (27km) west-northwest of Wendel.

U.S. Environmental Protection Agency

1973* Compilation of Air Pollutant Emission Factors. AP-42, 2nd edition, pages 1.6.1 to 1.6.2.

*Information updated by personal contact with D. Harvey, Engineer, U.S. EPA, San Francisco, AP-42 10th edition, Section 1.6, "Wood Waste Combustion in Boilers."

This report discusses firing practices and emissions factors. Particulate emissions were lower for wood and higher for bark. Sulfur oxides were attributed to bark burning only. Carbon monoxide and hydrocarbon values ranged widely depending upon combustion efficiencies.

U.S. Environmental Protection Agency

1979 NO_x Emission Factors For Wood-Fired Boilers. Interagency Energy/Environment Research and Development Program Report. EPA-600/7-79-219.

NO_x emission data was measured from 14 wood-fired boilers for fuels including sawdust, chips, shavings, edgings, bark and process residues. NO_x emissions were considerably less than with fossil fuel boilers of comparable size. Average NO_x emission factors were 0.3 grams/Kgram for boilers less than 10 MW and 1.6 grams/Kgram of fuel for boilers larger than 10 MW.

Rules and Regulations

California Air Resources Board

1979 Chapter 4. California Air Quality Control Strategies. Revision to State of California Implementation Plan for the Attainment and Maintenance of Ambient Air Quality Standards, April, 1979.

This outlines the control strategies currently being implemented in California, including Non-Vehicular (Stationary Source) Controls, Rules Presently in Effect, and Model Rules, including New Source Review.

California Air Resources Board
1979 Chapter 4, Appendix 4-B. California Air Quality Control Strategies, Category 1, Model Rules for Stationary Sources.

This contains model rules including Model New Source Review Rules.

Evans, Fred L.

1980 Personal communication. Lassen County Air Pollution Control Officer, Susanville.

Mr. Evans is the director of applicable Air Quality Control Rules, Northeast Plateau Air Basin, Lassen County. Rules were discussed and a copy of APCD Rules and Regulations was requested.

Haber, Matt

1980 Personal communication. Environmental Engineer, Permits Branch, Region IX, U.S. Environmental Protection Agency, San Francisco.

Discussions included 1) PSD (Prevention of Significant Deterioration) requirements for air quality monitoring; 2) NSPS (New Source Performance Standards) and NESHAPS (National Emission Standards for Hazardous Air Pollutants) requirements; and 3) delegation of authority to regulate the NSR (New Source Review) requirements.

Kremer, Thomas A.

1980 Personal communication. Chief, Permits Development Section, Permits Branch, Region IX, U.S. Environmental Protection Agency, San Francisco.

Mr. Kremer supplied the EPA's Prevention of Significant Deterioration information package, including application requirements, review procedures and time requirements, as well as Prevention of Significant Deterioration regulations.

Rowland, Ralph T.

1980 Personal communication. Director, West Coast Office of Petroleum Operations, U.S. Department of Energy, San Francisco.

Mr. Rowland provided a "decision tree" to see whether the Powerplant and Industrial Fuel Use Act of 1978 (FUA) is applicable. Since the project does not contain units which would burn natural gas, petroleum or any petroleum product as a primary energy source, it would appear that no further action is required.

Sugarek, Rick

1980 Personal communication. Region IX, U.S. Environmental Protection Agency, San Francisco.

Mr. Sugarek established the status of the project area as an "attainment" or "unclassified" area for five pollutants (Total Suspended Particulates, Sulfur Dioxide, Nitrogen dioxide, Carbon monoxide and Ozone), and as Class II.

U.S. Department of Energy

1979

Environmental Readiness Document: Wood Combustion.
Report No. DOE/ERD-0026, August 1979.

This report is a brief overview of the environmental acceptability of wood combustion technology. The technological status is discussed first, including harvesting, transportation, handling, combustion and disposal. Subjects covered under "Environmental Analysis and Assessment" include:

- Industrial (Boilers, Transportation, and Handling Systems)
- Erosion/Sedimentation
- Solid Waste Disposal
- Erosion/Sediment Transport
- Water Yield Increase
- Nutrient Depletion
- Aquatic Ecosystems
- Terrestrial Ecosystems and Wildlife
- Occupational Health and Safety
- General Population Health
- Land Use Changes and Aesthetics
- Economic Impacts

The report includes several helpful tables, the current status of environmental resource requirements, and a thorough bibliography.

U.S. Environmental Protection Agency

1978

Ambient Monitoring Guidelines for Prevention of Significant Deterioration (PSD), EPA-450/2-78-019

These guidelines define the requirements concerning collection of air quality and meteorologic data in support of PSD applications.

U.S. Environmental Protection Agency

1978

Guidelines for Determining Best Available Control Technology (BACT), Office of Air, Noise and Radiation, Office of Air Quality Planning and Standards, December, 1978.

This provides the framework for a consistent approach in determining the best available control technology required by Prevention of Significant Deterioration regulations.

U. S. Environmental Protection Agency

1978

Guideline on Air Quality Models. OAQPS1.2-080, Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina, April, 1978.

This specifies the applicable air quality models, data bases and other modelling requirements on which all estimates of ambient concentrations should be based for the air quality analysis required by the Prevention of Significant Deterioration (PSD) regulations.

U.S. Environmental Protection Agency

1978 "1977 Clean Air Act; Prevention of Significant Air Quality Deterioration. State Implementation Plans; Requirements." Federal Register Vol. 43, No. 118, Part V, pages 26380-26410. June 19, 1978.

This legislation sets out the requirements for prevention of significant deterioration of air quality as determined by the Clean Air Act Amendments of 1977.

U.S. Environmental Protection Agency

1978 Workbook for Comparison of Air Quality Models. OAQPS Guideline Series #1.2-097, EPA-450/2-78-028a, May, 1978.

A wide variety of air quality dispersion models are used by regulatory agencies, consulting firms and industry to estimate the air quality impacts of pollutant sources. It is often desired to compare two or more models to determine which is the most acceptable for a given application, or to compare a given model with those which, by virtue of their extensive use, are familiar to most of the modelling community. This workshop describes a technique for qualitative comparison of modelling approaches on technical grounds.

U.S. Environmental Protection Agency

1979 "Appendix B. Quality Assurance Requirements for Prevention of Significant Deterioration (PSD) Air Monitoring." Federal Register Vol 44, No. 92, May 10, 1979, pages 27582-27584.

This specifies the minimum quality-assurance requirements of an organization operating a network of PSD stations. Quality assurance consists of 1) assessing the quality of the monitoring data by estimating their precision and accuracy, and 2) controlling and improving the quality of monitoring data.

U.S. Environmental Protection Agency

1980 "Comprehensive Version of 40 CFR 52.21, Prevention of Significant Deterioration of Air Quality," 15 pages.

This comprehensive version of 40 CFR 52.21 incorporates the changes made on August 7, 1980, into those paragraphs promulgated on June 19, 1978, which were unaffected by the August 7, 1980, rulemaking. This copy was supplied by the EPA, Region IX Permits Office, and does not bear any other title or identification.

U.S. Environmental Protection Agency

1980

Prevention of Significant Deterioration, Application Requirements
Sent from the Region IX Permits Branch, San Francisco, on
November 26, 1980.

This presents a summary of Prevention of Significant Deterioration (PSD) application requirements, including the need for information in the following categories:

- A. Applicant Information
- B. Project Location
- C. Project Description
- D. Best Available Control Technology (BACT)
- E. Air Quality Data
- F. Air Quality Analysis
- G. Additional Impact Analysis
- H. Environmental Documents
- I. Compliance with Other Regulations
- J. Business Confidentiality Claims
- K. Additional Information

U.S. Environmental Protection Agency

1980

Prevention of Significant Deterioration, Procedures and Time Requirements. Sent from the Region IX Permits Branch, San Francisco, on November 26, 1980.

U.S. Environmental Protection Agency

1980

"Requirments for Preparation, Adoption, and Submittal of Implementation Plans; Approval and Promulgation of Implementation Plans." Federal Register Vol. 45, No. 154, August 7, 1980, pages 52676 to 52748.

Sets out amendments to regulations for the prevention of significant deterioration of air quality, in response to the decision of the U.S. Court of Appeals in Alabama Power v. Costle.

Wood, Norma, and Heidi West

1980

Personal communications. Office of Permit Assistance, State of California, Sacramento.

The California legislature has passed a law that directs State and local agencies to coordinate their permit activities and to help people identify permits essential to a project. The Office of Permit Assistance was established to carry out the new law and can help in the areas of Identification of Permits, Preliminary Meetings, Monitoring Time Limits, Mediating Disputes, Coordinating Joint Environmental Documents and Consolidated Hearings.

Adams, T.N.

1980

"Predictions of Intrinsic Ash Emissions from Wood-Waste Boilers" in the Air Pollution Control Association Journal, February 1980, Vol. 30, p. 147.

A computer model of a spreader-stoker, wood-waste boiler to determine the influence of operating and fuel parameters on stack particulate emissions has been developed. The model has been used to examine the completeness of combustion of entrained wood particles, to identify the sources of stack emissions and to predict both the intrinsic ash and total particulate emissions from a wood-waste boiler under various conditions. Results indicate that the amount of intrinsic ash in the stack flow increases with increased combustion rate of particles. Particle combustion rate increases with either increased fuel firing rate or decreased fuel moisture (5 graphs, 7 references).

Millikeh, John O.

1979

"Environmental Assessment of Wood Combustion Processes - Current EPA Programs" presented at Wood Energy Institute, Wood Heating Seminar 5, St. Louis, Mo., September 12, 1979, p. 47.

Existing data on airborne emissions from wood combustion indicate that emission rates are highly variable and are dependent on many factors. EPA is currently conducting several wood combustion-related environmental assessment projects that address both industrial and residential wood combustion. These projects will attempt to characterize the quantity and quality of emissions from industrial and residential wood combustion processes; determine the impact on air quality from these sources; and determine how these emissions can be minimized through modification of combustion parameters.

Tuttle, Kenneth L., and D.C. Junge

1978

"Combustion Mechanisms in Wood Fired Boilers" in Air Pollution Control Association Journal, July 1978, Vol. 28, p. 677.

Data needed on wood-fired boiler design and information needed to improve combustion efficiency and particulate emissions were obtained in a test facility at Oregon State University. In the experimental spreader-stoker boiler, stack gases were monitored to determine levels of excess air, particulate loading, and opacity. Particulate emissions were measured to determine the effects of underfire air flow rate and fuel bed depth on particulate carryover rate. Four energy release rates and two fuel bed depths were tested; increased bed depth appeared to reduce particulate emissions. The effect of the deeper bed was more pronounced at higher combustion rates. Increasing the energy release rate significantly increased the particulate emissions (2 diagrams, 3 graphs, 4 references, 1 table).

U.S. Environmental Protection Agency

1974

Compilation of Air Pollutant Emission Factors: Second Edition, Supplement 3, EPA Office of Air Quality Planning and Standards, NTIS Report PB-235 736/6WP, May 1974.

Average emission factors are presented for natural gas combustion, LPG combustion, wood/bark waste combustion in boilers, sewage sludge incineration, lead smelting, secondary lead smelting, chemical wood pulping, pulp-board production, and plywood veneer and layout operations.

SENSITIVE ISSUES

Previous sections of this chapter have outlined the various rules and regulations applicable to air quality. Many of the regulations will have to await further plant design decisions before abatement methods and efficiencies can be assessed.

Beneficial offsets in air emissions may be argued for plant-controlled burning of dried wood slash, which would normally be burned, uncontrolled, in the forest without drying, causing considerably more emissions. However, forest burning is not recognized as a "source" in the regulations, so that the offset will probably not be recognized.

The U.S. EPA designates the Northeast Plateau Air Basin as an attainment area which merits special consideration to ensure that future emissions do not reduce this air quality status. Since only spotty air quality data is available for the area, it will be necessary to initiate air quality monitoring including meteorological measurements. This data would be necessary to define clearly the air quality baseline and to provide information for required future air quality modelling to meet EPA requirements. There is a possibility that the Reagan Administration may modify some of these requirements (according to newspaper stories), but we have received no such information at the time of this writing.

II. LAND USE, VEGETATION AND WILDLIFE

GENERAL COMMENTS

Privately-Owned Lands

The responsibility for land use planning and establishing zones of use on privately-owned lands to implement the County General Plan is a function of the County Planning Commission, assisted by the County Planning Department staff. The County Planning Commission holds public hearings and receives comments and recommendations from individuals, private organizations, and other county, state, and Federal agencies for new elements or for changes in the County General Plan. The updated plan is then submitted to the County Board of Supervisors for review. The County Board of Supervisors holds public hearings on the updated General Plan and incorporates such changes or modifications as they deem desirable prior to adopting the plan. Environmental protection objectives are included in the General Plan.

A similar procedure is followed by the county for developing zoning ordinances and standards for various land uses on privately-owned lands.

Table II-1 diagrams the functions and authorities of county, state and Federal planning, resource management and regulatory agencies with respect to a hybrid wood-geothermal power plant on privately-owned lands.

The State of California, Department of Forestry, has responsibility and authority for fire suppression and timber harvest plans on privately-owned forest lands in the State of California. The timber harvest plans are subject to the review of other State resource management departments of the Resources Agency (see Table 1, Item IIB) (Authority: Z'Berg-Nejedly Forest Practice Act of 1973).

The proposed power plant and its associated geothermal wells will be located on privately-owned land in the southwest quarter of Section 13, Township 29 North, Range 15 East, Mount Diablo Base and Meridian. The site is zoned A-1; an agricultural zone in which a special permit is usually required for industrial-type land uses. The County Planning Director has indicated that no specific information on County use permits will be given until a specific project application is filed.

Federal Lands

Geothermal developments on Federal lands are under the jurisdiction of the Federal Government. For a power plant or for geothermal leases located on National Resource lands, the Bureau of Land Management has responsibility for land use planning (Management Framework Plans), designating land use for the various areas within a District. The Bureau of Land Management also develops activity plans for each of the principal land uses, including mineral and geothermal resources. These activity plans specify resource management objectives practices to be followed to achieve these objectives.

Environmental Assessment Records (EARs) for certain kinds of land use, and for all types of projects on National Resource Lands, are prepared by the Bureau of Land Management (generally the District Manager and staff).

All land use plans, activity plans, and project environmental assessment records for National Resource Lands are subject to review by individuals, private organizations, county and state agencies, and other Federal agencies. This public review of projects that are large enough to have a significant impact on the environment or local economy, is accomplished through public hearings and written comments.

The State Director of the U.S. Bureau of Land Management has authority to process land leases for geothermal developments.

The U.S. Geological Survey (through a memorandum of understanding with the Bureau of Land Management) is authorized to issue geothermal drilling permits and project construction permits on National Resource Lands.

The Geological Survey, Conservation Division, District Conservation Manager, is authorized to issue permits and supervise construction and operation of a power plant on Federal lands.

The State Director of the U.S. Bureau of Land Management may authorize rights-of-way or easements for roads, pipelines, transmission lines and other surface facilitating structures. The State Director may also authorize leases or non-competitive sales of National Resource Lands when the proposed use is considered to be in the public interest.

Table II-2 diagrams the functions and authorities of Federal agencies for geothermal developments on National Resource Lands.

The U.S. Forest Service has responsibility and authority for land use planning, resource management, and timber and other product sales on National Forest lands. The Forest Service also prepares the environmental statements of the impact of timber harvest on National Forest lands (Authority: 36 CFR 223.1 U.S.F.S., Part 2400, Timber Management).

TABLE II-1

LAND USE PLANNING, ENVIRONMENTAL REVIEW, AND PERMITTING
AUTHORITY APPLICABLE TO A HYBRID WOOD-GEOTHERMAL POWER
PLANT ON PRIVATELY-OWNED LANDS

LASSEN COUNTY

I. Permit Processing:

County usually requires a Special Permit for industrial-type land uses such as exploratory geothermal well-drilling and power plant construction in Lassen County Zone "A" districts.

II. Land Use Planning and Environmental Protection:

A. Lead Agency - County Planning Commission assisted by the County Planning Department.

B. County Board of Supervisors - Review and Approval

C. Procedure:

1. Develop County General Plan with public review and consultation - County Planning Commission.

2. Adopt and implement, or modify the General Plan after public review - County Board of Supervisors.

3. Develop county ordinances to implement the County General Plan after public review and consultation - County Planning Commission.

4. Adopt and implement, or reject county ordinances - County Board of Supervisors.

*5. Preparation of Environmental Impact Reports and public review of proposed projects - Power plants under 100 MWe - County Planning Commission (if lead agency).

(a) Review and public hearings prior to making recommendations - County Planning Commission.

(b) Approve, reject, or modify project plans after public hearings and review - County Board of Supervisors.

* Lead agency designation depends upon power plant capacity and upon decision of Energy Commission whether to assume lead agency status.

TABLE II-1
(Continued)

III. Project Construction:

- A. County monitors for compliance with special use permit and county ordinances for construction projects (such as erosion control).
- B. State Division of Oil and Gas supervises well-drilling.

STATE OF CALIFORNIA

IV. Permit Processing:

- A. Office of Planning and Research - Office of Permit Assistance.
- B. The Resources Agency - Division of Oil and Gas.
- C. Energy Resources Conservation and Development Commission (Energy Commission).
 - 1. Lead Agency for certification and for preparation of an Environmental Impact Report for power plants with a capacity in excess of 50 MWe. Power plants with a capacity less than 100 MWe can apply for a Small Power Plant Exemption (from certification).
 - 2. Notice of E.I.R. filed with State Resources Agency Authority - California Environmental Quality Act, Section 21161.

V. Land Use Planning and Environmental Protection.

- A. No direct authority for land use planning.
- B. The Resources Agency participates in the public review process for planning, zoning ordinances, and project E.I.R.'s through representatives from its various departments:
 - 1. Department of Fish and Game
 - 2. Department of Forestry
 - 3. Department of Water Resources
 - 4. State Water Resources Control Board - Lahontan Region
 - 5. Air Resources Control Board
 - 6. Department of Conservation - Division of Oil and Gas
- C. Procedure for Thermal Power Plant with a capacity between 50 and 100 MWe (Energy Commission-Lead Agency).
 - 1. County Planning Commission may recommend for or against the issuance of a Special Use Permit.
 - 2. County Board of supervisors may authorize or deny the issuance of a Special Use Permit.

TABLE II-1
(Continued)

3. The project must be in compliance with the County General Plan unless the county grants a variance.
4. Energy Commission may issue Small Power Plant Exemption from its site-certification process if it finds:
 - (a) No substantial adverse environmental impacts
 - (b) Generating capacity added not substantially in excess of adopted demand forecast.
5. Energy Commission may issue Negative Declaration on site if Small Power Plant Exemption is granted.

VI. Project Construction Supervision

- A. The Resources Agency - Division of Oil and Gas supervises geothermal well drilling.

FEDERAL GOVERNMENT

VII. Permit Processing:

The Federal government is not involved with permits for geothermal developments on privately-owned lands where mineral rights have not been reserved by the Federal government.

VIII. Land Use

Planning and Environmental Protection

- A. The Federal government has no direct authority for land use planning and environmental protection on private lands. However, the availability of Federal funds from the Department of Energy or other Federal agencies is contingent upon compliance with Federal guidelines and standards for protection of natural resources.
 1. Authority - The Endangered Species Act of 1973, Section 7(a).
- B. Federal resource management agencies participate in public hearings and the review process with county and state agencies involved in county land use planning and project environmental documents. Federal agencies that may be involved in Lassen County are:
 1. Forest Service
 2. Bureau of Land Management
 3. Fish and Wildlife Service
 4. Geological Survey
 5. Soil Conservation Service
 6. Department of Defense, Herlong Army Depot, and Army Corps of Engineers
 7. Water and Power Resources Service

TABLE II-2

LAND USE PLANNING, ENVIRONMENTAL PROTECTION, AND
PERMITTING AUTHORITY FOR GEOTHERMAL DEVELOPMENTS ON
NATIONAL RESOURCE LANDS

I. Permit Processing and Leasing:

- A. U.S. Bureau of Land Management issues permits for surface exploratory activities on lands leased to other than the applicant.
- B. Leases are processed by the State Office of the BLM.
- C. U.S. Geological Survey, District Conservation Manager, Reno, Nevada issues permits for exploratory drilling in the Honey Lake Valley and other areas on the east side of Lassen County.
 - 1. Authority - Geothermal Steam Act of 1970: Rules and Regulations, Title 30, Chapter II; Title 43, Chapter II CFR, U.S. Geological Survey, Resource Order No. 5.

II. Land Use Planning and Environmental Protection

- A. Bureau of Land Management develops Management Framework Plans for principal land uses. Public review hearings are held at which comments and recommendations are received from:
 - 1. General public
 - 2. Other Federal resource management agencies
 - 3. State resource management agencies
 - 4. County Planning Commission and County Board of Supervisors.

Authority - Federal Land Policy and Management Act of 1976.
- B. Bureau of Land Management develops activity plans with specific goals and specific management practices for each major land use on National Resource Lands. Public hearings are held primarily for persons, organizations, and other governmental agencies interested in the specific land use under consideration, e.g., minerals. Comments and recommendations are received and considered in any revision of the activity plan.
- C. Preparation of Environmental Assessment Records for specific land uses and for specific projects is a function of the District Manager and his staff, for geothermal developments. Public hearings are held to receive comments and recommendations.

Authority - Federal Land Policy and Management Act.

ORDINANCES, STATUTES AND GUIDELINES

The following lists the statutes, ordinances, orders and guidelines that regulate land use and protect vegetation and wildlife for a project such as the proposed hybrid wood fuel-geothermal power plant.

Lassen County Ordinances

Ordinances 293, 293D, 293I, 293L, 293A-9, 293A-11, 203A-14, 203A-16, and 293A-17. (1), These ordinances are combined into a booklet pertaining to land zoning in Lassen County. Zoning includes agricultural districts, "A-", industrial districts, "M", and hydroelectric districts, "H-R", but no specific designation for geothermal power plants.

Defines geothermal well: Any well for the discovery of geothermal resources, or any well on lands producing geothermal resources or reasonably presumed to contain geothermal resources; or any special well, converted producing well or reactivated or converted well for reinjecting geothermal resources or the residue thereof.

Defines land use regulations for "A-" Districts. Permits "All uses not otherwise prohibited by law are permitted, except that the establishment of any of the following shall not be permitted unless and until a special permit shall first have been secured in each case."

Proposed power plant may require special permit.

Resolution No.
78-79-102

Resolution establishing procedure for review of environmental impact.

Purpose: To establish guidelines for the general public and private developers. To implement the California Environmental Quality Act of 1970, Public Resources Code Sections 21000, et seq.

Environmental Document: Draft and Final EIRs, Initial Studies, Negative Declarations, Notices of Completion, and Notices of Determination.

Lassen County,
California, General
Plan: 1990

See Abstracts of Literature.

State of California Statutes

California Environmental Quality Act of 1970, as amended 1972, AB 889, Chapter 1154.

21011 (c). It is the policy of the state to "prevent elimination of fish or wildlife species due to man's activities, insure that fish and wildlife populations do not drop below self-perpetuating levels, and preserve for future generations representations of all plant and animal communities and examples of the major periods of California history."

21065 (c). Project means "Activities involving the issuance to a person of a lease, permit, license, certificate, or other entitlement for use by one or more public agencies."

21151. "All local agencies shall prepare, or cause to be prepared by contract, and certify completion of an environmental impact report on any project they intend to carry out or approve which would have a significant effect on the environment."

21161. Notice of completion of an EIR to be filed with Secretary of the Resources Agency.

Public Resources Code 800-801

Power plant siting. Directs Resources Agency to conduct studies relating to power plant siting.

Public Resources Code. Water pollution from oil, gas and geothermal wells.

3106-3228. Among the various specifically-mentioned objectives which the State Oil and Gas Supervisor is required to attain when supervising drilling, operation and abandonment of wells, is prevention of damage to life, health, property and natural resources.

Public Utilities Code. Power plant siting.

2851-2855. "Directs the Resources Agency, in cooperation with affected public utilities and the Public Utilities Commission, to draw up a 20-year plan governing the location of new electric power plants and additions to old plants. The plan shall contain recommendations pertaining to environmental considerations and types of fuel to be used. Requires the plan to be submitted to the Legislature by January 1973."

Fish and Game
Code. Water
Pollution Harmful
to Wildlife.
California.

5650-5655. "It is unlawful to deposit, permit to pass into, or place where it can pass into the waters of the state any of the following:...

(3) any sawdust, shavings, slabs, edgings...

(6) any substance or material deleterious to fish, plant life or bird life."

Sec. 1601. Provides that any construction project that affects the natural flow of a stream or a lake bed shall be reviewed by Fish and Game Dept. for possible adverse effects upon aquatic habitat.

Health and Safety
Code. Air San-
itation.

Sec. 24224, Amended in 1972. Requires air pollution control officer to enforce additional prescribed provisions relating to nonvehicular sources of air contaminants. AB2122, Chapter 577.

24241-24254. "No person shall discharge into the atmosphere from any single source of emission any air contaminant for a period or periods aggregating more than three minutes in any one hour which is:

(a) as dark or darker in shade as that designated as Number 2 on the Ringelmann Chart published by the U.S. Bureau of Mines.

(b) of such opacity as to obscure an observer's view to a degree equal to or greater than does smoke described in (a)."

24291-24302. Provides procedures for granting variances.

39057. Local and regional districts may adopt additional standards not specified in the law or by the State Board (A.R.B.) for all sources of air pollution other than motor vehicles.

39077. Extends the Ringelmann Number 2 opacity rule throughout the state for sources of non-vehicular air pollution, including aircraft and fires.

39260-39264. Provides a penalty of up to \$6,000 a day for violation of a cease and desist order obtained by a local or regional district or the state.

Z'Berg-Nejedly
Forest Practice
Act of 1973 and
Amendments.
(Public Resources
Code 4511, et seq.)

936.1. Stream and Lake Protection Zone -
Timber Operations.

"During timber operations, keep all lakes and streams below the stream or lake transition line, free of slash, debris, and other material which is in such quantities that it will be deleterious to fish, wildlife, or other beneficial uses of water." "Nonmerchantable riparian vegetation shall be protected from unreasonable damage."

Within the stream or lake protection zone, enough trees or shrubs of any species shall be left so that 50% or more of the shade-producing canopy before timber operations shall remain after timber operations are completed.

Sec. 4581. A timber harvesting plan is required prior to any timber harvest and must be prepared by a registered professional forester (RPF).

4584. No timber harvesting plan is required for harvesting dead trees.

4582.7. A multidisciplinary team from the different departments of the Resources Agency reviews each timber harvest plant.

Federal Government Statutes

The National
Environmental
Policy Act of
1969 (P.L. 91-
190; 42 U.S.C.
4321-4347).

Sec. 101 (a). The purpose of the Act is "to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony."

(b)(4) "preserve important historic, cultural, and natural aspects of our national heritage, and maintain, wherever possible, an environment which supports diversity and variety of individual choice."

Sec. 1.2.(A). "Utilize a systematic, interdisciplinary approach which will insure the integrated use of natural and social sciences and the environmental design arts in planning and decisionmaking which may have an impact on man's environment."

Federal Water
Pollution Control
Act (33 U.S.C.
466 et seq.),
1972 P.L. 92-500,
86 Stat. 816.

Sec. 6 (b). The Secretary is authorized to make grants to persons for research and demonstration projects for prevention of pollution of waters by industry including, but not limited to, treatment of industrial waste.

Clean Air Act
of 1970 (P.L.
91-6-4).

Sec. 112 (d)(1). Each state may develop and submit to the Administrator a procedure for implementing and enforcing emission standards for hazardous air pollutants for stationary sources located in such State. If the Administrator finds the State procedure is adequate, he shall delegate to such State any authority he has under this Act to implement and enforce such standards (except with respect to stationary sources owned or operated by the United States).

Geothermal Steam
Act of 1970,
(P.L. 91-581,
S.368; 84 Stat.
1566).

Sec. 2. As used in this Act, the term (b) "geothermal steam and associated geothermal resources" means (i) all products of geothermal processes embracing indigenous steam, hot water and hot brines; (ii) steam and other gases, hot water and hot brines resulting from water, gas, or other fluids artificially introduced into geothermal formations; (iii) heat or other associated energy found in geothermal formations; and (iv) any by-product derived from them; (e) "known geothermal resources area" means an area in which the geology, nearby discoveries, competitive interests, or other indicia would, in the opinion of the Secretary (Dept. of Interior), engender a belief in men who are experienced in the subject matter that the prospects for extraction of geothermal steam or associated geothermal resources are good enough to warrant expenditures of money for that purpose.

Sec. 3. Subject to the provisions of Sec. 15 of this Act, the Secretary of the Interior may issue leases for the development and utilization of geothermal steam and associated geothermal resources (1) in lands administered by him, including public, withdrawn, and acquired lands, (2) in any national forest or other lands administered by the Department of Agriculture through the Forest Service, including public, withdrawn, and acquired lands, and (3) in lands which have been conveyed by the United States of the geothermal steam and associated geothermal resources therein.

The Endangered
Species Act of
1973 (P.L. 93-205,
87 Stat. 884)
Including amend-
ments of:
1976-P.L.94-325
1976-P.L.94-359
1977-P.L.95-212
1978-P.L.95-632

Sec. 2 (b). Purposes. The purposes of this Act are to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved, to provide a program for the conservation of such endangered species and threatened species, and to take such steps as may be appropriate to achieve the purposes of the treaties and conventions set forth in subsection (a) of this section.

(c) Policy. It is further declared to be the policy of Congress that all Federal departments and agencies shall seek to conserve endangered species and threatened species and shall utilize their authorities in furtherance of the purposes of this Act.

Sec. 3(5) (A). The term "critical habitat" for a threatened or endangered species means (i) the specific areas within the geographical area occupied by the species, at the time it is listed in accordance with the provisions of Section 4

of this Act, on which are found those physical or biological features (1) essential to the conservation of the species and (11) which may require special management considerations or protection.

(C) Except in those circumstances determined by the Secretary, critical habit shall not include the entire geographical area which can be occupied by the threatened or endangered species.

Sec. 4(b)(4). In determining the critical habitat of any endangered or threatened species, the Secretary shall consider the economic impact, and any other relevant impacts, of specifying any particular area as critical habitat, and he may exclude any such area from the critical habitat if he determines that the benefits of such exclusion outweigh the benefits of specifying the area as part of the critical habitat, unless he determines, based on the best scientific and commercial data available, that the failure to designate such area as critical habitat will result in the extinction of the species.

(f)(4). Any proposed or final regulation which specifies any critical habitat of any endangered species or threatened species shall be based on the best scientific data available, and the publication in the Federal Register of any such regulation shall, to the maximum extent practicable, be accompanied by a brief description and evaluation of those activities (whether public or private) which, in the opinion of the Secretary, if undertaken, may adversely modify such habitat, or may be impacted by such designation.

Sec. 5(a). Program. The Secretary, and the Secretary of Agriculture with respect to the National Forest System, shall establish and implement a program to conserve fish, wildlife, and plants, including those which are listed as endangered species or threatened species pursuant to Section 4 of this Act. To carry out such a program, the appropriate Secretary (1) shall utilize the land acquisition and other authority under the Fish and Wildlife Act of 1956, as amended; the Fish and Wildlife Coordination Act, as amended; and the Migratory Bird Conservation Act, as appropriate; and (2) is authorized to acquire by purchase, donation, or otherwise, lands, waters, or interest therein, and such authority shall be in addition to any other land acquisition authority vested in him.

Sect. 6(c). Cooperative Agreements. (1) In furtherance of the purposes of this Act, the Secretary is authorized to enter into a cooperative agreement in accordance with this section with any State which establishes and maintains an adequate and active program for the conservation of endangered species and threatened species.

Sec. 7 (a). Consultation. Each Federal agency shall, in consultation with and with the assistance of the Secretary, insure that any action authorized, funded, or carried out by such agency (hereinafter in this section referred to as an "agency action") does not jeopardize the continued existence of any endangered species or threatened species, or result in the destruction or adverse modification of habitat of such species which is determined by the Secretary, after consultation as appropriate with the affected States, to be critical, unless such agency has been granted an exemption for such action by the Committee pursuant to subsection (h) of this section.

Geothermal Resource Operational Order 4., U.S.D.I., Geological Survey, 1980. Issued under Geothermal Steam Act of 1970 (30 C.F.R. 270). General Environmental Protection Requirements.

The lessee shall be responsible for the monitoring of readily identifiable localized environmental impacts associated with specific activities that are under the control of the lessee.

2. Land Use and Reclamation. Operating plans shall be designed so that operations will result in the least disturbance of land, water, and vegetation. Existing roads shall be used where suitable. Entry upon certain environmentally-fragile land areas, as designated by the surface management agency, may be either seasonally restricted or restricted to special vehicles or transportation methods which will minimize disturbance to the surface or other resources, as specified by the Supervisor and surface management agency. Operating plan shall provide for the reclamation and revegetation of all disturbed lands in a manner approved by the Supervisor and the appropriate surface management agency. Land reclamation may include preparation and seeding with prescribed wildlife food and plant cover, or improved and acceptable substitutes thereof which will equal or enhance the food values for indigenous wildlife species and domesticated animals. Temporary fencing for such reclaimed areas may be required to facilitate restoration thereof.

6. Biota. The lessee shall conduct all operations in such a manner as to afford reasonable protection of fish, wildlife, and natural habitat.

9. Pollution, Waste Disposal, and Fire Prevention.

The lessee shall comply with all applicable Federal and State standards with respect to the control of all forms of air, land, water, and noise pollution by liquid, solid, and gaseous wastes.

The Supervisor may, at his discretion, establish additional and more stringent standards. Plans for disposal of well effluents must be approved by the Supervisor before any implementation action is undertaken. Immediate corrective action shall be taken in all cases where pollution has occurred.

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

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

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

4. Pits and Sumps. Pits and sumps shall be lined with impervious material and purged of environmentally-harmful chemicals and precipitates before backfilling. In no event shall the contents of a pit or sump be allowed to contaminate streams, lakes, and groundwaters. Pits and sumps shall be constructed in a manner and in such locations so as to minimize damage to the natural environment and aesthetic values of the lease or adjacent property. When no longer used or useful, pits and sumps shall be backfilled and the premises restored to as near

a natural state as reasonably possible. Temporary fencing of unattended pits and sumps to protect wildlife, livestock, and the public may be required by the Supervisor and the surface management agency.

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

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

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

Code of Federal
Regulations.
Reg. 36CFR 223.1,
U.S.F.S. Title
2400, Timber
Management

(e)(1). Free use may be granted to individuals for firewood for personal use.

(e)(3). Supervisors may designate portions or all of a National Forest as a free use area, where such action is compatible with land management plans, and shall give public notice of their action. Within such area, any dead timber or any green timber previously marked or designated by forest officers may be cut.

2. Objective. The objective of 36 CFR 223.1(e) as it pertains to firewood is to make such material available to as wide a range of individuals as practical, and to provide an opportunity for utilization of material which might otherwise be wasted.

3. Policy. Making Firewood Available.

Forest officers will take positive steps to make existing firewood available to all potential users.

c. To Whom Granted. Material to be used for firewood may be given free to any applicant.

h. Resource Protection Needs. The free use program must be consistent with overall resource protection needs.

Federal Land
Policy and Manage-
ment Act of 1976.
43 USC 1712
et seq.

Title II. Sec. 202. Land Use Planning; the
development and revision of land use plans
for public lands.

Title III. Administration

Sec. 302. Management of Use, Occupancy and
Development. (a) The Secretary shall manage
the public lands under principles of multiple
use and sustained yield, in accordance with the
land use plans developed by him under Section
202 of the Act when they are available, except
that where a tract of such public land
has been dedicated to specific uses according
to any other provisions of law it shall be managed
in accordance with such law.

BIBLIOGRAPHY WITH ABSTRACTS

Avery, M.L., P.F. Springer and N.S. Dailey

1980

Avian Mortality at Man-Made Structures: An Annotated Bibliography (Revised), prepared for U.S. Fish and Wildlife Service, FWS/O135-80/54, July, 1980.

The adverse effects of man-made structures to birds in flight have long been recognized. However, the proliferation in recent years of radio and TV towers, tall buildings, power lines, cooling towers and tall stacks constitutes an increasing hazard to birds. The effects of mortality on species and populations are undetermined. However, the growing public awareness of the need to respect our environment demands that proposed projects be evaluated beforehand as to their potential impacts on wildlife and their habitats and the means by which adverse impacts may be mitigated. This bibliography will aid future investigators by providing a ready source of reference to past studies of bird mortality at man-made structures.

Bloom, S.G., B. Cornaby and W. Martin

1977

A Guide to Mathematical Models Used in Steam Electric Power Plant Environmental Impact Assessment, prepared for U.S. Fish and Wildlife Service by Battelle Columbus Laboratories, FWS/OBS-78101, February, 1978.

This guide's purpose is to provide a nontechnical review of modelling approaches for predicting and assessing environmental impacts of steam electric power plant operation on fish and wildlife resources. Models include: processes, hydrodynamic, aquatic dispersion, atmospheric dispersion, biological transfer and biological effects. An extensive bibliography on such models is also presented.

Eagles, Thomas W., J. Cohon, C. ReVelle and J. Current

1979

Multiobjective Programming in Power Plant Location Planning prepared for the U.S. Fish and Wildlife Service, Office of Biological Services, FWS/OBS-78155, September, 1979.

A large number of power plant location decisions with substantial environmental implications must be made in the next few years. In the past, such decisions often have been without sufficient input from those knowledgeable in environmental sciences. This lack of input has been one of the causes of the dissension and litigation over nearly every proposed site. This report describes a first step toward the development of a new tool that might enable environmental scientists to sit down with electric utility planners and provide useful input to the power plant location process. At the heart of the method is a location model, which is a particular type of mathematical model used to determine placement of facilities.

Eu, March Fong

1977-1978 California Roster. California State, County, City and Township Officials, State Officials of the United States, Directory of Services of the State of California.

General Services Administration, Office of the Federal Register, National Archives and Records Service

1977-1978 United States Government Manual.

Organization diagrams and functions of the different agencies of the Federal government.

Goddard, Frank

1980 Forester with the California Department of Forestry.
Dec. Personal communication.

1. Timber harvesting requirements on private forest lands under Z'Berg-Nejedly Forest Practice Act were discussed.
2. Removal of dead material and some timber thinning benefits timber production and reduces fire hazard.
3. Nutrient cycling may be interfered with at some level of biomass removal.
4. Competition for firewood may become a problem.

Hawk, Stephen

1980 Wildlife Biologist, Bureau of Land Management, Susanville
Dec. District.
Personal communication.

Bighorn sheep introduction into the Amedee Mts.-Spencer Basin area is not considered feasible for the following reasons:

1. The loss of the introduced bighorns in the Lava Bed National Monument due to natural causes depleted the source of animals available for transplant.
2. There was a high incidence of foot-rot and high mortality among mule deer in the Skeddadle-Amedee Mountains area in 1980.
3. There is competition between domestic sheep and big-game animals for forage on the proposed introduction area.

4. Detonation of over-age ammunition at the base of the Amedee Mountains by the Sierra Army Depot would greatly disturb bighorn sheep.

The overall impact of the construction of a hybrid power plant on the proposed site would not have a significant impact on the wildlife of the area.

Humm, Peter

1980 Realty Specialist, Bureau of Land Management, Susanville
Dec. District.

Personal communication.

Discussed rights-of-way, easements, leasing, and non-competitive sales of National Resource Lands for geothermal developments.

Kiefer, Lloyd

1980 Unit Range, Lassen-Modoc Unit, State of California,
Dec. Department of Forestry.

Personal communication.

Discussed Department of Forestry authority and procedures for timber harvest plans and environmental protection of private forest lands.

McMillin, James

1980 Biology teacher, Lassen College. Personal communication.
Dec. McMillin is concerned about the effect of more human intrusion on raptor nesting and brooding, and the disruption of the normal activities of other wildlife in the general area. He feels that an increase in human population in the Wendel area would result from the power plant construction and operation, and that would increase the number of human intrusions into sensitive areas.

Nordstrom, Gerald

1980 Biology Teacher, Lassen High School. President of the local
Dec. chapter of the Audubon Society.

Personal communication.

1. Golden eagle, peregrine falcon, and prairie falcon activities may be disrupted by too much human intrusion or excessive noise levels.
2. All species of wildlife are impacted by too much human intrusion.
3. The present air inversion problems in the Honey Lake Valley may be increased by smoke emission from the power plant.

4. The wilderness values of areas in close proximity to the power plant will be further degraded.
5. Toxic substances or high concentrations of dissolved salts in geothermal hot water may degrade existing surface water and/or ground water sources.
6. Power plant construction may preclude an introduction of bighorn sheep to the Amedee Mountains-Spencer Basin area.

Smith, Ronald

1981 Geologist, Bureau of Land Management, Susanville District.
February Personal communication.

Discussed Federal government procedures for geothermal developments on National Resource Lands.

Sparrowe, Rollin D.

1977 "Use of Critical Parameters for Evaluating Wildlife Habitat,"
Classification, Inventory, and Analysis of Fish and Wildlife Habitat, U.S. Fish and Wildlife Service, Biological Services Program, FWS/OBS-78/76.

This paper reviews some contemporary methods of objectively rating the value of wildlife habitats for the purpose of negotiating trade-offs with proposed developments, identifies concepts which these methods have in common, and presents preliminary results of developing a handbook for habitat evaluations to supplement the Habitat Evaluation Procedures (HEP) being developed by the U.S. Fish and Wildlife Service, Division of Ecological Services, and cooperating state agencies. Currently active methods of evaluating wildlife habitats, including HEP, are based on assessing the capability of that habitat to provide food, water, cover and any special reproductive requirements of animals common to that geographic area. Preliminary results of testing a set of carefully-developed evaluation criteria at a field site in Missouri showed that a handbook of such criteria can save field time, standardize scores and decrease variation in scoring. More intensive testing and further analysis of habitat evaluations must be done to improve and standardize judgment-based evaluation of wildlife habitat in the field.

States, James B., et. al.

1978 A Systems Approach to Ecological Baseline Studies, prepared for Western Energy and Land Use Team, U.S. Fish and Wildlife Service, by Ecology Consultants, Incorporated, FWS/OBS-78121, March, 1978.

This manual attempts to define and standardize a holistic approach to ecological baseline studies for energy conversion projects in the western United States. It defines the decision making framework as it relates to ecological baseline study needs and how to state purposes, goals, and objectives for the baseline studies. It lists the various methods for conducting baseline studies and concludes with a discussion on how to interpret and present baseline results to decisionmakers.

Thompson, Larry S.

1977

"Identification of Critical Wildlife Habitat Using an 'Impact Risk' Mapping Technique," Classification, Inventory, and Analysis of Fish and Wildlife Habitat, U.S. Fish and Wildlife Service, Biological Services Program, FWS/OBS-78/76.

A method is presented for mapping areas where relative risk for adverse impact to the wildlife resource is greatest. For purposes of project planning, such areas are assumed to represent "critical" wildlife impact. Impact risk was modelled using the following steps: 1) wildlife species of greatest concern are identified and ranked numerically, based upon several measures of relative importance and the relative magnitude of probable impacts; 2) a habitat map is prepared and the habitat categories rated according to potential suitability for each species; 3) the distribution maps and the habitat map are digitized and combined; and 4) each resultant category is weighted according to the numerical ranking of its resident species, as well as its suitability in five impact risk categories. For purposes of project planning, the highest ranking is considered critical wildlife habitat. Examples of maps produced by this process, using different rating schemes or different means of combining resource data, are compared and the applications and shortcomings of this approach to project planning are discussed.

Tiehm, Arnold

1980

June

Field search for Proposed Threatened and Endangered Species on a 2.6 square mile area in northern Honey Lake Valley near Wendel. Conducted for GeoProducts Corporation on May 29 and June 2, 1980. Unpublished.

No endangered plant species were encountered.

U.S. Department of the Interior, Bureau of Land Management, Proposed Geothermal Leasing, Honey Lake Valley, Final Environmental Assessment Record, Biology Section, August 1978.

1978

This Environmental Assessment Record has been written in compliance with the Geothermal Steam Act of 1970 and the Federal regulations, Title 43CFR, Part 3200 and Parts 270 and 271, for leasing Federal land for geothermal development.

If a decision is made to lease Federal lands where significant unavoidable impacts may occur, then an environmental statement is to be prepared (I-I).

The Federal lands involved are located in Townships 27, 28 and 29 North and Ranges 15 and 16 East, M. D. B. M., in Lassen County, California, and are administered by the Bureau of Land Management. The lands lie within the Wendel-Amedee Known Geothermal Resource Area (KGRA) and encompass about 10,324 acres (I-I; Appendix Map 3, I-7).

This abstract deals with the environmental impacts of a power plant using geothermal hot water as the only source of energy for generating electricity (I-20). The original E.A.R. deals both with the impacts of (1) developing power plants for generating electricity; and (2) using geothermal resources for food production and other industrial purposes.

The Existing Environment

1. Vegetation.

- a. The proposed project area contains six vegetative types or associations: (1) annual grass, primarily on a burned-over area, (2) sagebrush-bitterbrush-bluebunch-wheatgrass association, (3) greasewood, (4) saltgrass association, (5) salt desert shrubs, and (6) cropland (Appendix Map 13, II-40, and Appendix IIa; II-38, 39, 51, 52).
- b. No rare or endangered plant species were identified in the area.

2. Wildlife.

- a. There are several species of non-game birds in the area. Among the more common birds in this category are sparrows, larks, wrens, kingbirds, and blackbirds (II-55, 56, 71).
- b. Birds of prey are relatively abundant within the project area and include several species of hawks, owls, falcons and eagles. Some of these are indigenous to the area and some are migratory (Appendix Map 17, II-64; II-62).
- c. Upland game birds found within the area are chukar partridge, mourning doves and California quail (II-72, 73).
- d. There is a variety of migratory waterfowl on Honey Lake and in the State Wildfowl Management Area. Canadian geese, swans, coots, cranes and many species of ducks either nest in the area or use it as a resting and feeding area during migration (Appendix Map 18, II-67; II-66, 66, 69).
- e. There are many species of shorebirds in the Honey Lake area such as herons, grebes, avocets, killdeer and snipes (II-70).
- f. The bald eagle is a rare and endangered species within the project area. It is a migratory bird that does not nest within the area but is quite dependent on waterfowl as a food source (II-31, 32).

3. Fisheries (II-77)

- a. Fishery habitat within the proposed project area consists of (1) the lower Susan River, (2) ponds and canals in the Fleming Unit of the Honey Lake Wildlife Management Area, (3) some agricultural canals and wasteways, and (4) east and southwest margins of Honey Lake.
- b. Gamefish identified as occurring within the area are bass, bullhead, crappie, bluegill, sunfish and Sacramento perch.
- c. Non-game fish include reidside shiners, Lahontan suckers and speckled dace. The non-game fish are considered an important food source for fish-eating water birds.
- d. Intermittent drought periods and the drying up of Honey Lake and many ponds result in large-scale losses of fish.

Environmental Impacts

1. Vegetation.

- a. Removing vegetation and crushing the vegetation in the immediate vicinity of the proposed power plant and well drilling area would adversely impact the natural environment.
- b. Road and trail construction and an increase in off-road vehicle use would probably have the most serious impact on the native vegetation (III-24, 25). Off-road vehicle travel refers to any travel over a route that is not an existing vehicle trail or road. Surveying and layout of pipelines and transmission line routes may entail off-road travel. Maintenance of these structures may also require off-road travel after the power plant is in operation.
- c. The highly saline soils and the low precipitation makes reestablishment of vegetation difficult on areas now occupied by the salt desert shrubs.
- d. Halogeton glomeratus, a plant that is quite toxic for grazing animals, may invade areas where the salt desert shrubs are now dominant if the vegetation is destroyed on such sites. Halogeton is presently growing along Highway 320 and other roadsides in the area.
- e. Russian thistle, tumble mustard, fiddleneck and other undesirable, weedy annuals generally invade disturbed soils quickly in such low rainfall areas. More desirable grasses and shrubs are often difficult to establish without irrigation.

- f. Loss of the variety of shrubs, forbs and grasses which exist in the native vegetation results in a loss of diversity that affords food sources and escape cover for many birds and small animals (III-24, 25).
- g. If high concentrations of harmful salts occur in the wastewater from the power plant, or if high concentrations of toxic gases are emitted from geothermal wells, they may kill vegetation with which they come into contact.

2. Wildlife.

- a. Increased human activity and intrusion into areas surrounding the site will result in less use of these areas by deer and antelope and several species of the birds of prey (III-30, 31; X-34, X-59, X-69).

The breeding and nesting activities of the birds of prey may be disrupted by human intrusion (Appendix Map 17, II-64). The introduction of bighorn sheep into the Amedee Mountains and Spencer Basin area may not be feasible with any substantial increase in human activities (Appendix Map 16, II-63; II-62, III-35, X-69). Bighorn sheep are considered to be quite sensitive to human activities of any kind and therefore, any area chosen for an introduction of these animals must be quite isolated from human activities. An introduction of bighorn sheep to the Amedee Mts.-Spencer Basin area was proposed by the Department of Fish and Game a few years ago. However, such an introduction would be on public lands administered by the Bureau of Land Management, and BLM biologists do not believe that an introduction is feasible. The present level of human activity may be too great for bighorn sheep; the high incidence of foot-rot among mule deer in the area may result in infection and mortality among bighorn sheep; and the competition between domestic sheep and big-game animals for forage may make the introduction impractical.

- b. Withdrawing large quantities of groundwater from wells during drilling and production testing, and to supply the proposed power plant, may disrupt the flow from springs and seeps in the areas surrounding the proposed power plant. Loss of flow from springs and seeps would be very detrimental to big game animals and to such upland birds as chukar, partridge and quail (III-33).
- c. If the water from the geothermal wells contained significant quantities of such toxic substances as boron, arsenic, fluoride and zinc, it could be very hazardous to waterfowl and other species of wildlife (Appendix I-33 and Table 8, I-34; III-30, 32, 33).

If the geothermal wastewater did not contain excessive amounts of toxic substances, it could be used to improve existing waterfowl habitat significantly (Appendix Table 24, II-17; and Table 25, II-18).

If geothermal water significantly increased the temperature of the water in ponds and along the shoreline of Honey Lake, it could alter the food chains and be detrimental to waterfowl and shore birds.

The additional water supply could prove very beneficial during drought years.

- d. The loss of native vegetation as a result of exploratory drilling, road construction, off-road vehicle use, and excessive toxic gases such as hydrogen sulfide would result in some loss of habitat for most wildlife species. The diversity of the existing vegetation is very important in meeting the different seasonal requirements of non-game birds, as well as game animals and game birds. The diversity of the native vegetation is very difficult to achieve with artificial revegetation, and natural revegetation is a very long-term process in this arid environment (III-24, 25, 26, 33).
- e. Loss of rabbit and rodent habitat through vegetation destruction or changes, and through vehicle use and other activities of man, may significantly affect birds of prey through loss of their food sources.

Mitigating Measures

1. Vegetation.

- a. To avoid unnecessary destruction of vegetation, trail and road construction should be held to a minimum, and operations during periods of intense run-off or ground thaw should be suspended (IV-12).
- b. Topsoil removed from construction sites should be stockpiled for re-use on disturbed areas. Avoid mixing subsoil with topsoil (IV-12).
- c. Reseed disturbed areas with desirable, adapted grasses, broad-leaved herbaceous plants and shrubs. Native vegetation should be restored to the extent that is possible (IV-13).
- d. A qualified botanist should search any proposed construction site to determine whether any threatened or endangered plant species occur on the site. Suitable action should be taken to preserve such plant species (IV-13).

2. Wildlife.

- a. Sumps, evaporating pits, reservoirs, etc., should be properly enclosed to reduce hazardous conditions for wildlife.
- b. Avoid construction or other intrusions within one-half mile of all identified raptor nesting and brooding areas. A buffer zone of one mile should be established between February 1 and September 1 of each year (IV-14, 15).
- c. The bald eagle is considered a threatened and endangered species and is a winter resident in this area. Consultation with the U.S. Fish and Wildlife Service should precede any proposed activity that may disrupt the bald eagle's use of the area and threaten its existence there (Sec. 7, Endangered Species Act of 1973, Fed. Reg. 43(2):870-876) (IV-13, 15, 16).

U.S. Department of the Interior, Bureau of Land Management
1977 Environmental Analysis Report, Antelope Introduction for
California Department of Fish and Game, May 1977.

The California Department of Fish and Game proposed to release between 60 and 70 head of antelope on national resource lands near the California-Nevada state line in Township 29 South, Range 17 East, M.D.B.M. This area is some 36 miles east of Susanville.

Vegetation in the proposed release area is comprised primarily of sagebrush, bitterbrush, native perennial bunchgrasses and forbs. The average annual precipitation in the area is from 10 to 12 inches.

Other wildlife species in this area are chukar partridge, sage grouse, mountain quail, mourning doves, cottontail rabbit and deer. Several bands of wild horses also use the area.

It was determined that, other than a minimum amount of competition for forage between antelope and livestock, there would be no significant adverse impacts from the antelope transplant.

The primary purpose of the proposed transplant is to increase the antelope range in northeastern California and to provide a larger population for managed big game hunting.

U.S. Department of the Interior, Bureau of Land Management
1975 Environmental Analysis Record, Surprise and Warner
Valleys, Proposed Geothermal Leasing, Susanville
District, California; Lakeview District, Oregon.

This Environmental Analysis Record analyzes the impact of geothermal resource leasing and project development on approximately 1,231,000 acres located in northeastern California, south-central Oregon and northwestern Nevada. It encompasses two Known Geothermal Resource Areas (KGRAs): Lake City in California (37,800 acres) and Crump Geyser in Oregon (23,700 acres) (I-1).

The intensity of development projected, for purposes of anticipating environmental impacts, was two 100-megawatt power plants on each 2560-acre lease area. In addition to the power plants, such project features as wells, disposal ponds, pipelines, roads and transmission lines were considered and these features were projected to about 360 acres for each 2560-acre lease area. Geothermal fluid production was anticipated to vary between 440,000 gallons and 900,000 gallons per day, with 15 to 25 percent flashing to steam. Reinjection of the geothermal fluids was considered to be the most practical method of disposal (I-3 through 6).

U.S. Department of the Interior, Bureau of Land Management, Susanville District; and U.S. Department of Agriculture, Forest Service, Modoc National Forest.

1976 The Upper Pit River Proposed Geothermal Leasing, Environmental
Analysis Record, Final.

This report analyzes the environmental impacts of developing geothermal resources for electrical power generation for Federal lands considered for leasing in northeastern Modoc County, California. The exterior boundaries of the area described in this report encompasses approximately 193,320 acres. About one-half of that area is Federal land administered by the Bureau of Land Management and the U.S. Forest Service.

Two 100-megawatt power plants are projected for each 2,650-acre lease area.

Possible Mitigating Measures for Living Components:

Mitigating measures to reduce loss of native vegetation include 1) special stipulations imposed on plans of operations, 2) minimum road and trail construction, 3) stockpiling topsoil for rehabilitation of disturbed areas, and 4) reseeding disturbed areas.

The following actions will be undertaken to reduce the impacts of geothermal development on fish and wildlife resources:

1) endangered species habitat will be protected in accordance

with the Endangered Species Act of 1973, 2) no surface disturbance of kidding grounds, strutting grounds or migration corridors, 3) prescribed distances between any new structures and critical habitat, migration routes, streams, lakes, ponds and wet meadows, 4) new construction on only areas with lowest habitat values, and 5) potential hazards to wildlife (sumps, eliminated toxic water, etc.) eliminated by appropriate safety measures.

U.S. Department of the Interior, Fish and Wildlife Service, Office of Biological Sciences
1976 Geothermal Project, Geothermal Handbook, NP-21172, pp. 153-154, 170-175.

This publication deals with several means of mitigating impacts of geothermal development on wildlife and on wildlife habitat.

Table 37 lists as feasible habitat improvement methods 1) vegetation planting along roads, 2) brushpiling, 3) developing guzzlers and other watering sources, 4) sump development for waterfowl and shorebirds, 5) revegetation of disturbed areas, and 6) the development of roosting structures. Each of these improvements is coordinated with the different phases of the geothermal development.

There is a discussion of the impact of noise upon some wildlife species that typically are native to western geothermal areas. Unusually loud noises may decrease the capacity of owls, deer, rabbits, squirrels and other wildlife to catch prey or to escape from danger because of the dependence of these species upon aural efficiency. The timing of certain geothermal development operations should be such as to cause the least impact on wildlife when critical habitat areas are in close proximity to the well-drilling sites.

U.S. Department of the Interior, Fish and Wildlife Service
1978 Impacts of Transmission Lines on Birds in Flight, Proceedings of a conference, January 31 - February 2, 1978, Oak Ridge, Tennessee.

The current and future patterns of electric power transmission and distribution lines across the country will increase the potential for interference with the daily, seasonal and migrational movements of birds. Habitats and flight pathways of birds are unavoidably altered by the presence of overhead powerlines and associated structures. Migration and distribution patterns will also be affected if birds avoid areas adjacent to these structures. Mitigation of transmission line wire strikes can be accomplished through engineering design and habitat modification. Evaluation of a proposed transmission line's impacts on waterfowl and eagles is also presented.

West, Heidi

Personal communication. Office of Planning and Research,
State of California.

Discussed responsibilities and authorities of various
State agencies for permits and EIRs for geothermal
power plants.

Williams, Cook, and Mocine

1968

Lassen County, California, General Plan: 1990

1. A major goal of the program of industrial development is to diversify the industrial base and lessen reliance on lumber and livestock (p. 22).
2. Among the types of industrial development to be encouraged within Lassen County is geothermal power development (p. 23).
3. It is a policy of the County to promote a tourist industry based on the natural scenic resources of the region. Tourism makes a very substantial contribution to the economy of Lassen County (pp. 10, 11).
4. For land use in the Wendel area see Lassen County, California, General Plan Map.

Woodward-Clyde Consultants

1978

Impact Prediction Manual for Geothermal Development, prepared for U.S. Fish and Wildlife Service, Western Energy and Land Use Team, FWS/OBS-78/77, June 1978.

This manual presents techniques for predicting the probable effects of geothermal energy development on fish and wildlife resources. The techniques are designed for use on a broad range of potential, commercial-scale geothermal projects in the western United States. The manual's purpose is to assist users in evaluating development proposals so plans can be altered (where necessary) to be compatible with the continued productivity of important eco-systems, or so that decision-makers can at least have the benefit of knowing the implications of proposed development plans.

SENSITIVE ENVIRONMENTAL ISSUES

A review of literature pertaining to the anticipated impacts of geothermal power plant development on the vegetation and wildlife environment indicated a general concern about the following:

1. Cross-country travel, new roads and trails, well-drilling or power plant and other construction activities may destroy native vegetation valuable as wildlife habitat and as protection against soil erosion;
2. Geothermal fluids that may contain toxic substances or high concentrations of dissolved salts may be disposed of in a manner causing loss of vegetation or animals and pollution of surface or groundwater sources;
3. Activity resulting from development may interfere with the nesting, brooding and feeding activities of birds of prey and waterfowl in close proximity to the developed area;
4. Lowering the groundwater table by pumping large quantities of water for cooling may result in loss of water for irrigation, and loss of springs or seeps that serve as water sources for wildlife on upland areas near the project site;
5. Waterfowl collisions with transmission lines could increase;
6. Improperly constructed sumps or inadequately fenced and shielded sumps for geothermal wastes may result in groundwater pollution and poisoning of birds and animals;
7. Competition for groundwater between users may result in loss of a water source for maintaining waterfowl habitat;
8. Noise levels may adversely affect some birds of prey and such animals as deer that depend upon a keen sense of hearing to detect prey or to escape from danger;
9. Power plant and truck hauling emissions may contain noxious or toxic gases (such as CO, SO₂, NO) and particulates that kill vegetation or have an adverse impact on birds and animals;
10. Saline or alkali soils are not easily revegetated, especially where the supply of water for irrigation is limited.

III. GEOTECHNICAL ENVIRONMENT

GENERAL COMMENTS

The geotechnical environment of the project area has been described in detail in previous documents submitted to GeoProducts Corporation, particularly in the BLM and GeothermEx reports. Therefore, this will only briefly describe the environment as it relates to the environmental concerns outlined below.

Regional Geology

The Honey Lake Valley is a northwest-trending structural and topographic valley which represents an embayment of the Basin and Range physiographic province into the east flank of the Sierra Nevada. The valley is apparently bounded by faults on the northeast and southwest, and is filled to a depth of about 5,000 feet by sediments and volcanic rocks. Deep wells drilled in this basin, in the Wendel area, reportedly penetrated predominantly sands from the surface to 650 feet, lakebed clays with fragmented volcanic material from 650 to 1,900 feet, and volcanic rocks from 1,900 to 4,800 feet. Basement Mesozoic granitic rocks were encountered below 4,800 feet.

Faulting and Seismicity

The Litchfield, Amedee and Honey Lake faults are thought to be the major structures transecting the general Honey Lake area. The Litchfield and Honey Lake faults are thought to bound the structural valley on the northeast and southwest, respectively. The Amedee fault trends north-south and borders Honey Lake on its east side. The Fort Sage fault lies about seven miles southeast of Honey Lake where it truncates the southeast end of Honey Lake Valley. It trends north-south and is roughly aligned with the Amedee fault.

The Skedaddle fault trends northeast through the proposed project area. Its relationship to the Amedee and Litchfield faults is obscure. Based on recent epicenter locations and earthquakes in 1875, 1885 and 1889, the region of greatest seismic activity appears to be on the south side of Honey Lake in the vicinity of the escarpments formed by the Honey Lake and Fort Sage faults. The Honey Lake fault, which is actually a zone of faulting with parallel breaks, is thought to be active. The Fort Sage fault is known to be active, and ground breakage occurred along this fault during an earthquake in 1950. The activity status of the Litchfield and Amedee and Skedaddle faults is unknown, although the literature suggests that they may be inactive Quaternary faults.

Surface Soils

Surface soils over most of the site area reportedly are sandy loams and sands which are moderately to highly permeable. No data is available concerning the engineering properties of these soils for foundation support; however, because of their composition, we do not believe that they are expansive.

Groundwater

Groundwater is present in the formations below the valley floor. It has been estimated that the storage capacity of Honey Lake Valley to a depth of 750 feet is about 16 million acre-feet. The Bureau of Land Management (BLM, 1980) has estimated that recharge to the basin may be less than withdrawal, and, therefore, the basin may be in overdraft condition. We have been advised that other agencies, notably USGS and DWR, do not agree with this position.

Thermal Waters

Little is known concerning the hydrogeology of the thermal waters. They are thought to be deep circulating meteoric waters with primary recharge areas in the Plio-Pleistocene volcanic rocks which crop out in the mountains north of the site. The thermal springs at Wendel and Amedee are thought to be due to upward flow of these thermal fluids along faults. Mixing of the shallow groundwater and the thermal water is not well understood. Data in this regard is contradictory, but it would be surprising if some mixing is not occurring.

ORDINANCES, STATUTES AND GUIDELINES

State of California Statutes

Public Resources Code, Division 3, Chapter 4 (Section 3700 et. seq.), Geothermal Resources	Requires notice of intention to drill or redrill a geothermal well; requires \$250,000 bond; requires adequate casing program and blowout-prevention equipment. Authorizes Geothermal Resources Board to issue upon request a certificate of primary purpose, which establishes a rebuttable presumption that applicant has absolute title to the geothermal resource. Requires monthly production reports.
Administrative Code, Title 14, Chapter 4 (Division of Oil and Gas Regulations), Subchapter 4 (State-wide Geothermal Regulations)	Requires notice of intention to drill or redrill a well; requires fee and bond and exact location of a well. Requires soils report on unstable ground. Establishes casing program and blowout-prevention equipment. Requires drilling records on completion. Establishes subsidence responsibility.
Chapter 1271, 1978 Legislative Session (AB 2644)	Defines geothermal field development project; provides that only one permit from lead agency and one permit from each responsible agency will be required for all drilling, construction, operation and maintenance activities. Defines geothermal exploratory project; provides that such projects are separate and distinct from subsequent field development projects; designates Division of Oil and Gas as lead agency under CEQA for exploratory projects; requires action under CEQA within 135 days of application; provides that Division of Oil and Gas may delegate lead agency responsibility to a county which has adopted a geothermal element for its general plan.

BIBLIOGRAPHY WITH ABSTRACTS

Bonham, H.F.

1969

Geology and Mineral Deposits of Washoe and Stoney Counties, Nevada, Bulletin 70, Nevada Bureau of Mines.

This is a complete geologic review of the Nevada end (east end) of Honey Lake Valley. Discussions of rock types, age of deposits, structural geology, geologic history and principal economic deposits of metals and industrial minerals are included in this report. A geologic map and cross sections are presented.

Bryant, W.A.

1979

"Earthquake Near Honey Lake, Lassen County, California." California Geology, Vol. 32, No. 5, pp. 106-109, May 1979.

"A moderate earthquake (M 5.2, Berkeley) occurred at 7:57 A.M. on February 22, 1979, in Lassen County. The epicenter was located in the southeast portion of Honey Lake Valley about 80 kilometers (km) north of Truckee....." The paper states brief regional geology, lithology and seismicity of the Honey Lake Valley. The recent event of December 1950 is discussed. A generalized geologic map and epicenter location map are presented. Bryant concludes that the general area around Honey Lake Valley is seismically active.

California Department of Water Resources, Division of Resource Planning
1960 Northeastern Counties Investigation, Bulletin No. 58, June 1960.

"Objective of this investigation was to estimate the ultimate water needs of the designated counties..." "Honey Lake Basin ...at elevation 4,000 feet, contains much of the agricultural development in the area." This report describes the land use, regional geology, area (size), rainfall and historical data. Also included are numerous tables such as on the characteristics of ground water basins within the northeastern counties. This table describes the water-bearing units, thickness, recharge area, inflow and outflow, direction of water movement, structure affecting groundwater movement and storage, pressure area and other water budget information. The data presented is relative to cultural and agricultural needs and uses. Dynamic response and interrelation of groundwater resources and safe yield information are also presented.

California Department of Water Resources

1980 "Wood Fuel Heat Enhancement Using Geothermal Energy, Wendel-Amedee KGRA, Lassen County, California, Volume 1, Technical Proposal," GeoProducts Corporation, September 15, 1980.

Data is presented, relative to geotechnical concern, which documents the regional and local geology (with a stratigraphic section). Extensive geophysical information is contained in this report. From the geophysics, the rock types, depth, porosities, permeabilities, structure (faulting) and a conceptual geologic model are theorized. Hydrologic data are included; water budget (inflow, outflow and storage) and quantified hydrologic cycle are discussed. Subsidence, "induced seismic" concerns and liquefaction potential are discussed relative to the groundwater, and production-reinjection data presented.

Diller, J.S.

1908 Geology of the Taylorsville Region, California, Bulletin 353, United States Geological Survey.

This report gives a complete background on regional geology, topography and drainage. Geologic information, such as rock types by age and lithology, is also presented. Discussions of structure (including Honey Lake fault), geology, history and economic geology can be found. Many maps, tables and figures are presented in this report.

Durrell, C.

1967 "Geology of the Feather River Country and Adjacent Regions," Open File Report, California Division of Mines and Geology, page 57.

Baseline geologic data, such as geologic history, bedrock units, structure, faulting, etc., is presented in this report. Generally, the information is relative to an overview of the Feather River area; however, Honey Lake Valley is discussed. Numerous figures and plates are presented within the text.

Hardt, W.F., F.H. Olmsted and F.W. Trainer

1975 "Susanville - Honey Lake Geothermal Reconnaissance, Southern Lassen County, California," United States Department of the Interior, Geologic Survey.

The paper presents information on the regional geology of the Susanville - Honey Lake area, along with many maps, geologic sections and composite stratigraphic sections. Much of the data has been compiled from previously published and unpublished information. The brief geologic summary was developed by compilation. Geophysical data, such as gravity maps and resistivity maps, are also included. However, the data are not sufficiently detailed to indicate structural features within the study area. The regional geohydrology is also discussed.

Hilton, G.S.
1963

"Water Resources Reconnaissance in Southeastern Part of Honey Lake Valley, Lassen County, California," Water Supply Paper 1619 Z, United States Geological Survey.

Honey Lake Valley is a basin of interior drainage underlain by alluvial and lacustrine deposits. The rocks are divided into three units: Basement Complete, Volcanic Rock, and Alluvial and Lacustrine Deposits. The area lies within the Basin and Range Province. The elevation of Honey Lake is about 4,000 feet. Alluvial fans (up to eight miles) encroach on the lake bed. Basement complex of Igneous and Metamorphic rocks are pre-Tertiary and yield water almost entirely from secondary openings. Volcanic rocks are predominantly andesite, which is fractured and vesicular; there are also flow turners and lava tubes which transmit and store substandard quantities of groundwater. Yields from lava in excess of 700 gpm have been reported. Quaternary and Tertiary alluvial deposits underlie the southeast part of the valley. Alluvial fans from adjacent creeks merge and interfinger valley-ward and are the major source of groundwater in the area. Precipitation within the area is the ultimate source of water resources in Honey Lake Valley.

Hoover, D.B., and J.A. Dietech
1969

"Seismic Activity During the 1968 Test Pumping at the Rocky Mountain Arsenal Disposal Well," Circular 613, United States Geological Survey.

Deep well pressure injection of waste fluids at the Rocky Mountain Arsenal was suspected to be responsible for a marked increase in microseismic activity in the region. To evaluate this, a monitoring network was set up and baseline activity levels were established while pumping was suspended. Upon resumption of pumping, activity increased. Studies were performed to evaluate volume/pressure relationships to activity levels. It was found that there was a pumping pressure threshold above which seismic activity was involved.

Jenkins, O.P.
1932

"Report Accompanying Geologic Map of Northern Sierra Nevada," Mining in California, Vol. 28, pp. 279-298.

This is a brief review of the geologic map of the northern Sierra Nevada. The motivation for producing the map was to present: 1) principal groups of geologic formations, 2) principal exposed gravel deposit, 3) the area covered by Mother Lode system, and 4) locations of some of the principal gold mines.

McNitt, J.R., and W.R. Wilde

1980

"Recommendation for Geothermal Exploration Well Sites, Wendel-Amedee KGRA, Lassen County, California," Geothermax, Inc., October 1980.

Not reviewed at the request of J.R. McNitt (personal communication, November 1980).

Pease, R.W.

1969

"Normal Faulting and Lateral Shearing in Northeastern California," Geological Society of America Bulletin, Vol. 80, No. 4, pp 715, April 1969.

"Extension of the Earth's crust is necessarily related to normal faulting. Causes of the necessary extension are obscure, however, and have been the subject of a variety of explanations. In northeastern California there is strong indication that the extension is the product of deepseated right-lateral shear deformation related to the Walker Lane. Tectonic evidence, sharply etched in volcanic materials, suggests that (1) in a broad zone of lateral shear, normal faulting is due to the dynamic tension of the shear deformation and will differ in nature from that produced by compressive stress fields, and (2) an older set of Walker Lane lineaments exists which has been rotated away from present lateral stress and is now under constructional controls. Northeastern California provides evidence for the hypothesis suggested by Wise in 1963."

Pritchard, J.I., and G.P. Zebal

1978

"Honey Lake KGRA Geophysical Survey and Drilling Tests," Geothermal Energy: A Novelty Becomes a Resource, Transactions, Vol. 2, pp. 545-546, Geothermal Resources Council.

"An integrated geophysical survey of the Honey Lake, California, KGRA was conducted by Electrodyne Surveys for GeoProducts Corporation of Oakland, California, to aid in the evaluation of the geothermal resource potential that exists in the vicinity of the Wendel Hot Springs." Gravity, ground magnetics, scalar AMT-MT (audio-magnetotelluric and magnetotelluric) soundings, and tensor MT soundings geophysical investigative methods were employed. Results indicated that the study area is structurally complex. Wendel Hot Springs is coexistent with fault intersection. A college consortium will utilize a forty-acre tract, defined by the geophysics, for study of non-electric geothermal use.

Raleigh, Barry

1976

Personal communication, U.S. Geological Service.

Induced seismic events have been possibly correlated with the withdrawal of fluids in Long Beach, California.

Reed, M.J.
1975

Chemistry of Thermal Water in Selected Geothermal Areas of California, Report No. TR15, "Honey Lake Valley, Lassen County," California Division of Oil and Gas, pp. 31.

Described herein are: 1) geologic setting, and 2) water chemistry. From a geotechnical standpoint, this cursory geologic overview adds little to other regional geologic data. However, a short discussion of Quaternary faulting is included. The geochemistry of waters, obtained within the Honey Lake Valley, is correlated to mapped Quaternary faulting.

United States Department of Energy
1980

An Assessment of Geothermal Development in the Imperial Valley of California, University of California, Livermore, California, July 1980.

This documents the types of subsidence problems which have been and can be created within an alluviated valley area by pumping of geothermal fluids. Overview of mechanics of subsidence, subsidence control requirements, subsidence monitoring, site specific analysis, etc., is presented. Additionally, induced seismicity (from reinjection) is discussed.

United States Department of the Interior, Bureau of Land Management
1980 "Proposed Geothermal Leasing, Honey Lake Valley, Environmental Assessment Resource."

The record documents the regional and local geology: specifically, the stratigraphy, geomorphology, structure and lithology of the Honey Lake Valley. Included are a generalized geologic map, stratigraphic section and soil map. The seismicity of the area is also discussed. Incidence of seismic events and epicentral data are presented. A short discussion about slope stability is included. A detailed coverage of soils can be found in this report. Aspects such as liquefaction, surface hydrology and groundwater, are covered to some degree.

United States Geological Survey
1976 Assessment of Geothermal Resources of the United States, Geological Survey Circular 790.

United States Geological Survey
1977 "Aeromagnetic Map of the Wendel Area, California," Open File Report 77-795.

Tomlin, Lyle
1976

"Environmental Assessment for the Susanville Geothermal Investigation." Unpublished Memorandum No. MP-726 120.3. U.S. Department of the Interior, Bureau of Reclamation, December 22, 1976.

This seven-page, Bureau of Reclamation inter-office memorandum outlines plans for a study to determine the feasibility of a geothermal energy utility system for the City of Susanville, culminating in a demonstration site or sites with one or more slim pilot testing wells. The memo outlines the existing environment (excepting cultural resources and socio-economic factors), and the environmental impacts of the proposed three main actions: seismic surveys, electrical resistivity surveys and the drilling of exploratory test holes. Finally, the significance of the impacts is briefly described.

U.S. Department of the Interior

1976

Bureau of Reclamation. Susanville Geothermal Investigations: Special Report. June 1976.

This study of the north part of Honey Lake Valley from Susanville to Amedee Hot Springs was made to appraise the area's geothermal resources. The work included gathering and analyzing existing data, conducting and evaluating an electrical resistivity survey and an aerial thermal infrared survey, and drilling and logging temperature gradient holes. The study concluded that the Wendel and Amedee anomalies show the most promise of hot water at shallow depths.

Viets, V.F., C.K. Vaughan and R.C. Harding

1979

Environmental and Economic Effects of Subsidence, Geothermal Subsidence Research Management Program, EDAW, Inc., Earth Science Associates, May 1979.

Copious data on subsidence. Specifically, vertical settlement, surface tilt, horizontal displacements and strains, fissuring, and surface deformation. No direct study of Honey Lake Valley. This management program relates to possible subsidence problems created by geothermal development. Other elements of the study, such as physical theory of subsidence, properties of materials, simulation of subsidence and subsidence control, are available through this research program.

SENSITIVE ENVIRONMENTAL ISSUES

Subsidence

Subsidence of the ground surface in the Honey Lake area could result from withdrawal of the deep thermal fluids or as a result of withdrawal of the shallower groundwater. Withdrawal of thermal fluids could promote subsidence within the reservoir itself or in formations overlying the reservoir. Little is known concerning the lithology of the thermal reservoir and its potential for subsidence. Withdrawal of the fluids could reduce the pore pressure and could cause compaction of the reservoir materials by the weight of the overlying formations. Studies performed at the Imperial Valley geothermal fields (DOE, 1980) suggest that subsidence may also occur in the relatively impermeable aquicludes which overlie the reservoir. Apparently, withdrawal of thermal fluids destroys the existing hydrologic equilibrium and provides drainage at the base of the aquicludes. The weight of the overlying strata then tends to squeeze the water from the aquicludes with resultant slow subsidence.

The literature suggests that in the Wendel-Amedee area, the thermal aquifers are overlain by aquicludes, which are relatively impermeable lake beds. Little is known concerning the lithology of the reservoir rocks or the overlying aquicludes. However, based on the published data concerning subsidence in the Imperial Valley, it should be recognized that subsidence due to extraction of geothermal fluids may occur in the Honey Lake area.

Reinjection of the thermal fluids after use may limit the amount of subsidence. Studies (DOE, 1980) have shown that subsidence can be divided into recoverable and non-recoverable subsidence. Recoverable subsidence is due to rearranging of the grains of the rigid reservoir rocks into a more dense configuration, and this type of subsidence can be reversed by reinjection. Non-recoverable subsidence occurs when plastic deformation of the rock occurs when the fluid is squeezed out of highly porous, relatively uncompacted materials. It can also occur when the fluid is squeezed out of the relatively impermeable clayey aquicludes. Experience with oil fields indicates that injection can limit or totally prevent subsidence. However, in oil field injection programs, the injection usually takes place relatively close to producing wells. Geothermal injection wells will probably be located at some distance from producing wells, in order to maintain the high temperature of the produced fluids. Therefore, there is some uncertainty that reinjection in a thermal field will experience the same abatement of subsidence as has been documented for oil fields.

Reinjection of the spent fluids in some geothermal fields has resulted in plugging of the formation by the brines. This possibility should be studied when considering reinjection.

Subsidence could also occur due to withdrawal of the shallow groundwater. The literature suggests that the Honey Lake groundwater basin is in an overdraft condition. Thus, surface subsidence is probably now occurring due to the same mechanisms discussed for subsidence due to thermal withdrawal. Additionally, if the shallow groundwater basin is connected with the thermal basin, as suggested in some of the literature, the thermal fluid withdrawal could create drawdown in the cold groundwater basin which could increase subsidence. Insufficient data is available to determine if this condition will occur.

Subsidence in other areas has resulted in reduced stream flows, ground cracking and damage to structures, highways, pipelines, drainage canals and irrigation systems. Subsidence is a complex process and little is known concerning the potential for subsidence at this site. However, it can probably be safely concluded, given the limited amount of data concerning the lithology of the subsurface strata, that some subsidence will very probably occur.

Settlement

Settlement, as used in this report, is defined as compression of the near surface soils under externally applied loads (i.e., the power plant). No engineering data concerning the near surface soils was encountered during the literature review. These near surface materials are apparently recent lake beds. The literature describes these materials variously as sands and/or clays. However, considering the origin and age of the lake sediments, there exists a possibility for settlement due to the large loads that are generally required for power plants. Until more data is available, from a foundation investigation, it would be prudent for preliminary design purposes to consider that pile support may be required in some cases.

Seismicity

As previously noted, the site area is situated in a seismically active region which has experienced moderate earthquakes during recorded history. The principal seismic hazards are: 1) surface rupture, 2) ground shaking, and 3) ground failure.

Surface Rupture. According to the available data, there may be numerous faults within the site area. Many of these faults are thought to occur only at depths and were interpreted from geophysical data. These geophysical anomalies could be due to phenomena other than faulting. However, the data suggests that these hypothetical faults do not reach the surface and consequently may not represent a surface rupture hazard.

The literature also indicates that the Litchfield fault, which is thought to bound the Honey Lake graben on the north and the Skedaddle fault, may occur within the site area. These faults do not appear to have been active in recent times, although the existing record is very short. The location of the Skedaddle fault has been determined

based on the alignment of tufa deposits from hot spring activity which reaches the surface. This suggests that the fault may have broken the ground surface at some time in the recent past. There are apparently tufa deposits also associated with the Litchfield fault. Due to the apparent recency of movement, these site faults have to be considered as potentially active until additional data becomes available to more accurately assess their activity status. Consequently, rupture of the site ground surface along an earthquake fault may be a site hazard.

Ground Shaking. The site area will likely be subject to ground shaking due to earthquakes on nearby faults. The seismic record is relatively short and, therefore, cannot be considered a reliable indicator of the frequency or magnitude of future seismic events. Most of the recorded seismic events which have occurred since 1934 were apparently related to seismic activity on the Fort Sage fault. However, some pre-1934 events have been assigned to the Honey Lake fault. The seismicity of the site and vicinity has not been studied in detail and, therefore, the potential for ground shaking is not accurately known. Future seismic studies should be directed toward assigning maximum credible and maximum probable earthquakes to the area faults and estimation of ground shaking potential at the site for plant design purposes. However, all of the recorded earthquakes in this general area appear to have had Richter magnitudes of between 4.0 and 6.0. Consequently, it can be assumed, for preliminary design purposes, that the plant site will probably be subjected to at least one earthquake of magnitude 6.0 within its life.

Ground Failure. The potential for ground failure at the plant site would be limited to liquefaction below the water table or compaction settlement above the water table. These phenomena generally occur in sands to a depth of about 40 feet below the surface. Groundwater levels in the site vicinity are unknown. The literature indicates that the site may be underlain by sand, but no data concerning the density of these materials is available. Therefore, liquefaction or compaction settlement at the plant site is an environmental hazard which will have to be considered until additional data, from a foundation investigation, is obtained.

Induced Seismicity. The spent thermal fluids may be reinjected into the thermal reservoir. Reinjection of fluids appears to have triggered earthquakes at other sites, notably in Colorado. Though apparently associated with faults along the Rocky Mountain front, this area of Colorado is otherwise relatively aseismic. There is no way of knowing what effect reinjection will have in a seismically active area such as that of the proposed plant site. The Litchfield fault is thought to be a frontal fault and the potential to induce earthquakes by reinjection of spent thermal fluids has to be considered. This phenomena has not been studied in detail and, therefore, the potential for such occurrences is unknown. Induced seismic events could generate the same seismic hazards as detailed for natural seismic events and possibly could cause generation of a larger than

seismic events. ReInjection of steam condensate at The Geysers has, to our knowledge, also shown no detectable effects on the occurrence of micro-earthquakes. However, at The Geysers, less than 20% of the fluid produced is reinjected, and it is our understanding that it is not pressure reinjected.

There is no way of knowing what effects reinjection will have in a seismically active area such as that of the proposed plant site. However, on the basis of the foregoing discussion, it is our judgement that the probability is low for induced seismicity due to fluid withdrawal from the proposed well sites. We believe the probability to be even less due to reinjection of fluids derived from these wells, provided injection pressures are kept low.

Induced seismic events could present the same seismic hazards as detailed for natural seismic events. However, the induced event may be centered closer to the site than natural events. Thus, a small magnitude induced event could produce more shaking than a larger, natural event farther from the site.

Groundwater

The groundwater pool below the Honey Lake Valley includes both near surface cold water and deeper thermal water. Several faults in the site vicinity are thought to act as conduits for the upward migration of thermal fluids to form the Amedee and Wendel hot springs. The literature also speculates that there is probably mixing of the thermal and cold groundwater. If there is mixing, pumping of the thermal fluids could possibly reverse the process and allow groundwater to percolate downward into the thermal reservoir. It could decrease the amount of thermal water supplied to the shallow groundwater basin, and possibly could cause the springs to either dry up or decrease in flow.

The presence of the plant could, unless carefully designed, lead to pollution of the groundwater by emissions from the plant.

The plant will require a supply of water other than the thermal fluids. The obvious source for this water would be the shallow groundwater aquifers. Table IV-1 indicates that plant demand would be about 1,300 acre feet per year. Considering this limited demand, it is doubtful that it will have a significant impact on the groundwater basin. However, if the basin is in an overdraft condition, as speculated by the BLM, this plant demand might cause groundwater levels to fall, which could increase the subsidence potential previously discussed.

Erosion

The site is relatively flat, but does slope toward Honey Lake. The surface soils are moderately to highly permeable. Runoff from the plant site could erode these loose sandy soils even in relatively flat terrain. However, there are engineering methods available to alleviate or reduce any erosion potential to an acceptable level.

Conclusions

The environmental issues of greatest concern would seem to be the effects of subsidence, the potential for natural or induced seismic events and the effects of the project on the existing, shallow groundwater basin. The potentials for settlement and erosion, while important, are not major issues because there are engineering methods available to eliminate or reduce their effects to tolerable levels.

Concerning seismicity, the plant can probably be designed to withstand expected, natural seismic events and it would have no effect on the frequency or magnitude of these events. Considering the little that is known about induced seismicity, the plant can probably also be designed to withstand any earthquakes from this source. However, the effect of induced events on preexisting structures and on the thermal or groundwater reservoirs is unknown.

The existing data available from the literature review is generally not sufficient or sufficiently detailed to provide a basis for accurate evaluation of the environmental issues. Most of the available data is of a general nature, with virtually no site specific data other than speculative conclusions concerning thermal reservoir characteristics, site faults, induced seismicity and groundwater hydrology. No data exists concerning the engineering characteristics of site soils.

IV. SURFACE WATER, GROUNDWATER AND WASTE DISPOSAL

GENERAL COMMENTS

The proposed power plant will require water for a variety of uses which may include fuel drying, boiler feed, cooling water, domestic use and maintenance. The project will also produce solid wastes and wastewaters of varying strength. In this semi-arid area, which in many locations has marginal surface and near-surface water quality and which may not have the natural geophysical structure to support continuous one-way withdrawal of deep geothermal fluid, the source and subsequent fate of all waters involved in the project, as well as solid wastes, represents a topic of environmental concern.

STATUTES AND REGULATIONS

In California, the appropriation of water and the treatment and disposal of liquid and solid wastes are accomplished under the regulatory direction of the State Water Resources Control Board (SWRCB) and, in particular, its Division of Water Rights and the Lahontan Regional Water Quality Control Board (RWQCB). Further control is vested in the Solid Waste Management Board (SWMB) and the Department of Health Services (DOHS). The policies of these agencies and the applicable statutes and regulations that relate to the Honey Lake project's water use and waste disposal are discussed herein.

A summary of the principal statutes and regulations governing waste discharge in California follows.

Federal Statutes

Clean Water Act as Amended in 1972 and 1977.

This act provides guidance and the means to appropriate federal funds to restore and maintain the nation's water quality (principally navigable waters). Authority for implementation of the act rests with the Environmental Protection Agency, which in turn has delegated some responsibility to State agencies (State Water Resources Control Board in California).

The act directs states to prepare water quality protection plans for all basins and continually to monitor, update and enforce the provisions of approved plans.

Consolidated Permitting Regulations. 40 CFR, Parts 122, 123, 124,
Federal Register, Vol. 45, No. 98, May 19, 1980.

Part 122 contains additional program requirements for the National Pollutant Discharge Elimination System (NPDES); the Hazardous Waste Permit Program; and the Underground Injection Control Program which are not specified in applicable statutes such as the Clean Water Act and Resource Recovery and Conservation Act.

Part 123 establishes State program requirements and the procedures for EPA to approve same.

Part 124 establishes procedures for issuing, modifying or revoking permits under the programs listed above, as well as for the Prevention of Significant Deterioration (PSD) Program.

Part 125 establishes criteria and standards for the NPDES.

Steam Electric Power Generating Point Source Category Effluent
Limitations, 40 CFR Part 423, Federal Register, Vol. 39, No. 196,
October 8, 1974.

Though aimed primarily at fossil fuel and nuclear powered generating facilities, these regulations establish effluent limitations for wastewater discharges resulting from thermal-electric power plants.

State Statutes, Regulations and Policies

Porter-Cologne Water Quality Control Act as Amended. Division 7,
California Water Code.

This act establishes the nine California Regional Water Quality Control Boards (RWQCB) and directs them to formulate, adopt and enforce water quality control plans for all areas of each region. The act contains requirements for all waste dischargers to file reports of discharge and obligates them to comply with discharge requirements set by the RWQCB. Means of enforcing discharge requirements are set forth.

The act further directs the State Department of Health Services to establish criteria for wastewater reclamation and reuse.

The act regulates the use of waste injection wells.

The act governs transportation of liquid waste and sets criteria for registration of waste haulers. The RWQCBs are directed to approve sites suitable for disposal of different kinds of liquid waste.

California Administrative Code, Title 23, Chapter 3, Subchapters 9 and 15

These regulations were adopted by the State Water Resources Control Board to implement the statutory requirements of the Porter-Cologne Water Quality Control Act.

Subchapter 9: This governs waste discharge reports and requirements. RWQCBs are given guidance in the formulation of waste discharge requirements, monitoring for compliance and disposal of pollutants into wells, and are given specific enforcement procedures.

Subchapter 15: This governs liquid and solid waste disposal to land including waste injection wells. Three categories of disposal sites are classified which vary due to the potential for groundwater contamination of the waste which they are to handle. Three corresponding waste categories are defined. The RWQCBs are directed to issue waste discharge requirements for disposal sites.

Water Quality Control Plan for the North Lahontan Basin. State Water Resources Control Board, October 1975

Establishes a non-degradation policy with respect to surface and groundwaters. Water quality objectives are established generally and for specific surface waters in the basin, including the Honey Lake hydrologic unit. Constituents for which objectives are noted are total filterable residue, chloride, sulfate, percent sodium, boron, total nitrogen and total phosphorus.

An implementation plan is incorporated establishing minimum discharge limitations for certain pollutants and other measures to obtain the objectives of the plan.

The plan notes Honey Lake as an environmental resource of critical concern due to its function as a wildlife waterway.

Recommends specific policies and actions to be pursued by the State Water Resources Control Board and the Regional Water Quality Control Board in implementing the plan.

Water Quality Control Policy on the Use and Disposal of Inland Waters Used for Power Plant Cooling, SWRCB, Adopted June 19, 1975, reprinted December 1977.

This policy establishes a priority ranking for SWRCB approval of cooling water sources. These are, in order of preference: (1) wastewater being discharged to the ocean, (2) ocean, (3) brackish water from natural sources or irrigation return flow, (4) inland wastewaters of low TDS, and (5) other inland waters.

The policy also states that use of fresh inland waters for power plant cooling will be approved by the Board only when it is demonstrated that the use of other water supply sources or other methods of cooling would be environmentally undesirable or economically unsound, and further states that unlined evaporation ponds to concentrate salts from blowdown waters will be permitted only at salt sinks approved by the Regional and State Boards.

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Chemistry of Thermal Water in Selected Geothermal Areas
Of California. Report No. TR 15.

The chemical composition of thermal water in five California geothermal areas is analyzed. Water samples from springs and wells in Honey Lake Valley are of either the sodium-sulfate or sodium-bicarbonate type, with the latter type thought to represent local meteoric water. Samples from both Wendel and Amedee Hot Springs seemed to come from the same thermal reservoir containing water above 140°C, perhaps due to deep circulation of ground water in fault conduits.

California State Water Resources Control Board
1975 Water Quality Control Policy on the Use and Disposal of
Inland Waters Used for Powerplant Cooling. Adopted June 19, 1975,
reprinted December 1977.

In its effort to provide consistent, statewide water quality principles and guidelines, the State Water Resources Control Board has established the following policy:

1. " . . powerplant cooling water should come from the following sources in this order of priority depending on site specifics such as environmental, technical and economic feasibility consideration: (1) wastewater being discharged to the ocean, (2) ocean, (3) brackish water from natural sources or irrigation return flow, (4) inland wastewaters of low TDS, and (5) other inland waters."
2. "Where the Board has jurisdiction, use of fresh inland waters for powerplant cooling will be approved by the Board only when it is demonstrated that the use of other water supply sources or other methods of cooling would be environmentally undesirable or economically unsound."
3. " . . unlined evaporation ponds to concentrate salts from blowdown waters will be permitted only at salt sinks approved by the Regional and State Boards. Proposals to utilize unlined evaporation ponds for final disposal of blowdown waters must include studies of alternative methods of disposal. These studies must show that the geologic strata underlying the proposed ponds or salt sinks will protect usable groundwater."

The report also includes the Board's discharge prohibitions and policies concerning the implementation of its requirements.

California State Water Resources Control Board

1980

Waste Discharge Requirements for Nonsewerable Waste Disposal to Land.

This document governs waste disposal to land and establishes a disposal site and waste classification system on a statewide basis. The classification of disposal sites is based upon the geologic and hydrologic features of the disposal area and the capability for protection of surface and groundwater quality. The categorization of wastes is based upon the threat that the type of waste material presents to water quality.

California Energy Commission

1978

Brackish Groundwater for Power Plant Cooling in California

A literature review was conducted to summarize current knowledge of quantity, quality and location of brackish groundwater in California; criteria for analyzing the occurrence, availability and potential of a brackish water supply; considerations which could constrain development or use of brackish water for power plant cooling; and measures which have been identified to confirm the adequacy of brackish groundwater for power plant cooling.

Cooper and Clark, Consulting Engineers

1980

Disposal of Energy Plant Residues, report prepared for West County Agency of Contra Costa County (California).

A review of the literature was conducted to determine characteristics of bottom and fly ash and the leachate that might be derived from such sources. Options for disposal of energy plant residue are discussed.

Energy Resources Conservation and Development Commission

1977

Power Plant Cooling Options in California

Report discusses cooling water requirements for wet, dry and wet/dry cooling methods. Discusses use of agricultural wastewater for cooling use. Some cost figures are presented.

Host, John R., and Roger Pfenninger

1978

Plant Nutrients in Flyash From Bark-Fired Boilers

Flyash from bark-fired boiler plants was found to be a low strength fertilizer, having a beneficial combination of essential micro- and macronutrients. Analysis shows the nutrient level to be low but also of long duration, which enhances the use of flyash as a source of plant nutrients.

U.S. Department of Agriculture, Economic Research Service, Forest Service,

1975

Soil Conservation Service

Water and Related Land Resources - Central Lahontan Basin

In this semi-arid basin most of the hay and other agricultural crops are produced under irrigation. Years of lower than average precipitation occur relatively frequently. The use of water for irrigation is generally considered as the highest priority use in the basin for water of the quality suitable for irrigation. Prolonged droughts have a severe impact on fish populations and riparian vegetation that provides waterfowl habitat.

In addition to the lower quantity of water in drought years, the percentage of dissolved salts in the water and the temperature of the water increases with the decreased streamflow.

The higher concentrations of salts adversely affect agricultural crops. The higher water temperatures and the higher salt concentration adversely affect fish.

The pumping of groundwater from irrigation wells to augment surface water from streams is important for both agricultural crop production and maintenance of waterfowl habitat. Groundwater in some areas is contaminated by excessive mineralization or geothermal hot water. Irrigation return flows often contain high concentrations of salts from saline or alkali soils.

More complete utilization of logging and sawmill residues is considered to contribute to overall resource conservation.

U.S. Department of the Interior, Bureau of Land Management
1977

Draft Environmental Assessment Record. Proposed Geothermal Leasing,
Honey Lake Valley.

This document gives a detailed assessment of potential environmental impacts from proposed geothermal resource leasing in the Honey Lake Valley. The existing environment is described in detail and potential impacts and mitigation measures cited for soils and geology, water, air and noise, vegetation, wildlife and human interest components.

Specific information developed relative to water indicates a possible groundwater overdraft condition in the Honey Lake Valley. Recharge is limited by minimal precipitation and high groundwater in certain areas. Geologic and water bearing formations are identified and discussed and groundwater storage capacity in the basin estimated. Groundwater quality varies greatly throughout the basin. The existing adverse salt balance is expected to deteriorate further as expected development in the basin becomes a reality. Surface water quality varies greatly in quality with Honey Lake serving as a settling basin for leached salt and agricultural wastewater.

Potential impacts on water quality are those related to drilling (disposal of development fluids, potential blowouts contaminating groundwater aquifers, disposal of drilling mud, etc.), and the possible use of waste injection wells (exposure of near-surface waters to contaminants). Water quality impacts in the area adjacent to the Honey Lake Hybrid Project site are generally classified as low to moderate.

This publication deals with the environmental impacts on surface water to be anticipated during the various stages of geothermal development, i.e.: (1) road construction (2) construction of well-drilling pads (3) construction of sumps (4) discharge of groundwater from the well into streams, lakes, ponds, or watering holes during drilling operations (5) the use of groundwater for cooling, etc., and (6) minor diversions of water from streams to be used for drilling operations. Diversions from existing streams or lowering groundwater levels by pumping may significantly reduce stream-flow and reduce those organisms that serve as a food source for fish and aquatic birds. Pollution of surface water with toxic substances from a geothermal well or from spills or wasted petroleum products may adversely affect aquatic plant and animal life. Excessive amounts of hot water wasted into streams, lakes or ponds may result in accelerated growth of algae and reduction of dissolved oxygen available for fish and other aquatic animal life and cause significant mortality. On the positive side, the addition of desirable nutrients in acceptable quantities, and the addition of water that does not degrade existing surface water may be quite beneficial.

United States Geological Survey

1978 Water Resources for California Water Year 1977, Vol. 4.

This is a compilation of water discharge records. They give location, drainage area (size), dates and Q (discharge in cubic feet per second) for the water year October 1976 through September 1977. Water quality records are also included.

Viets, V.F., C.K. Vaughan and R.C. Harding

1979 Environmental and Economic Effects of Subsidence, Geothermal Subsidence Research Management Program, EDAW, Inc., Earth Science Associates, May 1979.

This report contains copious data on subsidence; specifically on vertical settlement, surface tilt, horizontal displacements and strains, fissuring and surface deformation. There is no direct study of Honey Lake Valley. This management program relates to possible subsidence problems created by geothermal development. Other elements of the study, such as physical theory of subsidence, properties of materials, simulation of subsidence and subsidence control, are available through this research program.

Waring, G.A.

1915

"Springs of California," Water Supply Paper 338, United States Geological Survey, p. 410.

This paper gives a short description of Amedee Hot Springs and other hot springs within the Honey Lake Valley area. Some water quality data are available with flow rates and temperatures.

SENSITIVE ENVIRONMENTAL ISSUES

Water Requirements and Potential Sources

The Honey Lake project will require water for the following major needs:

1. Wood fuel dehydration;
2. Preheat boiler feed;
3. Boiler make-up;
4. Cooling system make-up; and
5. Domestic and maintenance uses.

Geothermal fluid from the deep reservoir will be the source for dehydration of the fuel and may be suitable for all other needs with the possible exception of those in the domestic category. Preliminary assessments of the deep reservoir water quality indicate that it should be suitable for most planned uses although it will likely require some form of pretreatment for use in the boiler or cooling system (Fogleman, 1980)

Near-surface sources could also be considered to supplement all or part of the make-up streams; however, there are potential environmental and economic problems with this as discussed below.

Water for domestic use would most likely come from a relatively shallow well into a near-surface aquifer.

Continuous, reliable surface waters are not present on or immediately adjacent to the project site.

A summary of the project's water needs and their potential sources is contained in Table IV-1.

The potential exists for source-related environmental impact due to use of water by the project. Of prime concern is the issue of subsidence, which, given the local geology, is possible if the deep geothermal reservoir is tapped without corresponding replenishment in equal volumes. This subject is addressed in Chapter III. Should reinjection not be required

TABLE IV-1
WATER NEEDS AND SOURCES

<u>Water Need</u>	<u>Approx. Quantity acf/yr</u>	<u>Possible Source</u>		<u>Comments</u>
		<u>Geothermal</u>	<u>Near-Surface</u>	
Wood fuel dehydration	2,000	X		1
Preheat boiler feed	u	X		2
Boiler feed make-up	u	X	X	3
Cooling system make-up	1,000	X	X	4
Domestic and maintenance	300		X	5

u = unknown

-
1. Approximate quantity based on average of flows required for 250°F and 300°F reservoir temperature (GeothermEx, 1980).
 2. Geothermal water could be used for this, or use steam or condensate off turbine.
 3. Quantity is unknown but relatively small.
 4. Quantity for estimating purposes based upon being directly proportional to water requirement of 20,000 acf/yr for 1,000 MWe plant.
 5. Quantity based on assumed average demand of about 200 gallons per minute.

to avoid subsidence, the expense of reinjection wells is eliminated. However, surface discharge of spent geothermal fluid and other liquid wastes requires analysis of its own economic and environmental impacts. If subsidence is indeed a possibility, reinjection should reduce the chances of this occurring, but will be subject to scrutiny by the RWQCB, as discussed later in this section.

Use of substantial volumes of near-surface groundwater could be a problem in that current withdrawals from these aquifers in the Honey Lake Basin may exceed the safe yield. Annual groundwater recharge is estimated to be 38,000 acre-feet, while groundwater use is about 49,000 acre-feet (U.S. Department of Interior, 1977).

The apparent contradiction between a groundwater overdraft and the high groundwater table in the area of Honey Lake may be explained by the relatively flat gradients of the lands surrounding Honey Lake. Since the lake water surface establishes the groundwater table near the lake, groundwater will be near the surface for some distance from the shoreline because of these flat gradients. Overdraft of the deep groundwater basin occurs when withdrawals and losses exceed recharge.

California Department of Fish and Game (CDFG) representatives at the Honey Lake Wildlife Area support the conclusion that an overdraft situation exists. Well water is used by CDFG to irrigate grain crops for water fowl feeding and to maintain marsh lands for water fowl habitat and hunting. Groundwater pumping at the wildlife area (both Fleming and Dakin Units) totaled about 9,100 acre-feet in 1979 and 5,500 acre-feet in 1980, most of which was pumped during summer and fall periods. Drawdowns in CDFG wells have increased in recent years. During heavy pumping associated with the 1979-1980 drought, five of the seven Honey Lake Wildlife Area wells broke suction and were lowered. Suction intakes of the wildlife area wells are presently 150 to 260 feet deep, while well depths range from 239 to 535 feet (Blake, 1981; Weld, 1981).

Discharge of used, near-surface groundwater or geothermal water from the Honey Lake hybrid wood-geothermal power plant to the wildlife area could reduce withdrawals by CDFG wells. If discharge of used water to the wildlife area is feasible, reductions in groundwater use by the wildlife area would offset groundwater withdrawals by the powerplant.

Use of surface or near-surface fresh waters for cooling purposes will be subject to SWRCB policy on this matter (SWRCB, 1975[a]) which assigns fresh inland waters the very lowest priority for this purpose. Naturally occurring brackish inland waters, irrigation return or wastewater would be the more desirable sources unless use of these waters or other cooling methods could be demonstrated to be environmentally or economically unsound. Consideration of sources other than fresh water, or evaluation of other cooling methods may be necessary by the plant's designers to comply with this policy.

Wastewater Disposal

General. A number of liquid waste streams will result from the Honey Lake power plant. The largest ones are listed below, although some of these may not materialize, depending on the actual source of water used, its quality, and whether or not pretreatment is required.

1. Used geothermal fluid;
2. Waste from boiler feed treatment process;
3. Waste from treatment of cooling system make-up;
4. Cooling system blow down;
5. Boiler blow down;
6. Moisture evaporated from wood fuel;
7. Site drainage; and
8. Sewage produced on-site from domestic sources, plant washdown and other miscellaneous sources.

It is anticipated at this time that moisture evaporated from the wood will be released to the atmosphere as steam and will not constitute a liquid waste.

Leachate from wood-chip piles has been identified as a possible wastewater source. The Eugene, Oregon Water and Electric Board reportedly moves and aerates its wood-chip piles approximately every 18 months to avoid problems with leachate. Wood-chip piles at the proposed power plant would typically be used in 30 days. The maximum intended wood-chip pile storage period is 90 days (Fogleman, 1981). Because of the relatively short anticipated storage period and the limited rainfall in the area, leachate from wood-chip piles should not be a significant wastewater source.

The discharge of liquid wastes in the project area is regulated by the RWQCB. The RWQCB maintains and enforces through the permit process and punitive action, a policy of "non-degradation" with respect to proposed or existing discharge of liquid wastes to surface or groundwaters. Simply stated, the policy prohibits discharge of a liquid waste which will degrade the quality of a receiving water or its current and/or future beneficial uses. In the case of the Honey Lake project, this would include the deep geothermal reservoir, near-surface aquifers and any surface streams, rivers or lakes. This policy is the principal regulatory tool which will govern all liquid and solid waste discharge from the project.

Disposal Methods. The ultimate disposal of liquid wastes from the project may be accomplished in one or a combination of several ways, the environmental and economic feasibility of which will be determined following further study. The alternatives that were considered in this study are:

1. Reinjection to deep geothermal reservoir;
2. Surface discharge
 - a. Honey Lake
 - b. Susan River
 - c. Irrigation canals
 - d. Wildfowl management areas
3. On-site disposal by evaporation;
4. On-site disposal by percolation.

Each disposal method and its associated environmental concerns are discussed below with respect to the waste streams that must be disposed of.

Reinjection.

The used geothermal fluid represents the largest quantity of water to be disposed of and, as discussed earlier, the nature of the deep geothermal reservoir may require reinjection of this fluid to avoid the possibility of subsidence. Of prime concern with this disposal method, particularly if other waste streams are combined with the spent geothermal fluid, would be protection of the deep reservoir water quality and avoidance of violation of the RWQCB's non-degradation policy. The possibility exists that injection of blowdown waters, brines resulting from pretreatment of boiler and

cooling system feed and/or other wastewaters identified, could degrade the deep geothermal reservoir not only for this project's use but for future or concurrent beneficial uses. Furthermore, there is concern that if liquid wastes were injected into the geothermal reservoir, near-surface aquifers could be contaminated during the injection process or by some hydrologic continuity between the geothermal reservoir and near-surface waters.

Surface Disposal.

If reinjection of geothermal fluid is not necessary to avoid subsidence, discharge of some of the wastewater produced by the plant to surface waters could be considered. This possibility exists because the expected quality of the geothermal water (GeothermEx, 1980) is similar, though marginally so, to that which has been reported in Honey Lake (SWRCB, 1975[b]). While we speak here of the geothermal water alone, other waste streams could be combined with it for surface disposal, assuming the geothermal fluid itself or in combination with other wastewaters would not degrade the beneficial uses of the receiving water.

The concern here would be degradation of surface or near-surface waters through discharge of deleterious amounts of salt, metals, and/or oxygen demand, as well as water of high temperature, pH or solids content. The area's high groundwater level, which is within five feet of the surface, (U.S. Department of Interior, 1980) would make shallow groundwater vulnerable to contamination from percolation of wastewaters discharged to the surface.

Discharge to local irrigation canals is not likely to be a viable alternative due to the agriculturally toxic boron concentration which is believed to exist in the geothermal fluid (GeothermEx, Inc. 1980).

The potential exists for beneficial use of the geothermal fluid through discharge to one or both of the wildfowl management areas located on the north side of Honey Lake. The State Department of Fish and Game (DFG) operates two wildfowl management areas on Honey Lake and could possibly benefit from a steady flow of water to an area otherwise dependent upon sparse natural rainfall which has historically cycled between periods of sufficient water to support a wildlife habitat and almost complete dryness.

Preliminary contact with DFG (Blake, 1980) has brought some of their concerns over this alternative to light; however, they prefer to review and comment only on specific detailed proposals. The concerns are not all water quality-related since the plant itself, power lines, roads and gaseous emissions can affect migrating birds. Specific water-related questions center around the quality of the water to be discharged and the effect the project will have on the near-surface groundwater. Surface discharge would likely require a permit under the National Pollutant Discharge Elimination System (NPDES) as issued by the RWQCB.

Evaporation.

This disposal method may have to be considered for part of the liquid wastes (particularly the brine streams) if significant problems preclude the use of others. On the average, there is approximately a 36-inch (91.44 cm) annual differential between evaporation potential and rainfall in the project area (U.S. Department of Commerce, 1980; Department of Water Resources, 1979). This would allow disposal of some of the smaller waste streams, but is probably not large enough to dispose practically of all liquid wastes.

There are two prime concerns with this disposal method, one being protection of the near-surface groundwater from salt, metals or other contamination, and the other being disposal of the concentrated salt residue following evaporation. The first concern is complicated by the high groundwater table in the project area, so measures would have to be taken to eliminate the possibility of pollution of this water body. The salt residue is classified by SWRCB policy as a Group I solid waste (SWRCB, 1980), which in California is the designation given the most toxic wastes or those with the greatest potential for groundwater contamination. Although exceptions may be given, the policy referenced above requires that this class of wastes must be disposed of in a Class I landfill or, when proper precautions are taken, a Class II-1 landfill. Class I landfills are a considerable distance from the project site, the closest being in Minden, Nevada, and the San Francisco Bay area. A Class II-1 site is located near Susanville which can be considered a potential disposal site for the salt residue. Use of the site would depend upon acceptance of the waste by Lassen County, which operates the site, and approval by the State Solid Waste Management Board and the RWQCB. The major concern is protection of the local groundwater, and disposal at this site might require modifications, monitoring wells or other improvements.

Percolation.

The consideration of percolation as a disposal method carries with it a number of environmental concerns due to the high groundwater table in the area. The probable inability to excavate suitable basins, together with the very thin soil mantle through which to percolate, may effectively eliminate this option from consideration.

Consideration of a septic system for domestic wastewater disposal is also cause for concern due to the high groundwater table. Local health officials have expressed doubt that this method would work in the project area (Ames, 1980).

Solid Waste Disposal

General. The Honey Lake power plant will produce a certain amount of solid residue from the combustion process. Other solid wastes (dry salts or sludges) may also result from evaporation of waste brine streams from the

boiler, cooling system and/or conditioning or pretreatment processes. This matter is discussed previously. Although the exact quantity of the ash is unknown, it can be estimated and is significant enough to warrant consideration of methods of disposal and the effects this may have on the environment.

Solid Waste Quantity and Characteristics. The principal source of solid waste from the project will be the combustion residue from burning wood waste, both fly and bottom ash. It is assumed here that all wood fuel products will be brought to the plant site in usable form and that no further processing which would generate additional solid waste will occur. Processing waste could be significant, although the assumption is made that it will not be concentrated in a single location since wood waste will be gathered and chipped from a number of sources.

The ultimate ash content of the local wood products to be used varies between 0.9 and 4.5 percent (Resource Management Services, Inc., 1980). Fogleman (Chief Mechanical Engineer, EIC, March 1981) estimates of that 1 to 2 percent ash will be produced, resulting in 10 to 20 tons ash produced per day. If this ash were buried in a landfill with an in-place density of 100 pounds per cubic foot, a net volume of 50 to 100 acre-feet would be required over the 30-year life of the project.

The SWRCB and SWMB generally classify solid wastes as Group 1, 2 or 3, reflecting their toxicity and/or potential for groundwater contamination, with Group 1 wastes being the most toxic. Generally speaking, landfill sites suitable for these wastes are correspondingly classified as Class I, II or III. Although the regulatory agencies prefer to review each case individually before classifying a waste and prescribing various conditions and requirements, it appears that wood ash would fall into the Group 2 category. Final determination would be made after a chemical analysis of the ash, with the major concern being its salt content and the resultant threat of groundwater pollution.

Disposal Options and Environmental Concerns. The ash will have to be disposed of by burial in a properly operated landfill, by reuse of some sort, or a combination of both. Each of these is discussed below.

In order to bury the wood ash, the landfill site would have to be constructed and operated in accordance with SWMB and SWRCB guidelines and be rated Class II-1 (assuming the waste is a Group 2 waste). An existing landfill in the area could possibly be used, or a special one could be constructed on or near the project site. The descriptions, requirements and criteria for disposal of various types of solid waste, and for construction of the proper landfills, is set forth in an SWRCB publication entitled Waste Discharge Requirements for Nonsewerable Waste Disposal to Land, 1980.

There is currently a Class II-1 landfill operated by Lassen County in the vicinity of the project as shown on Figure IV-1. This is the only existing landfill of appropriate classification in the project area. County

public works staff indicate that this landfill has about 10 years of capacity, but could not estimate the remaining volume (Tuholski, 1980). Use of this site would, of course, require County approval and the approval of the SWMB, DOHS, and RWQCB. Improvements or modifications to the site might be required.

Local independent solid waste haulers currently provide transportation of solid wastes to the landfill. Enough ash is estimated to be produced each day that, on the average, several trips per day to the disposal site would be required. At a distance of about 20 miles (one way), the fuel consumption and other expenses for hauling could be significant.

As an option to the County landfill site, a landfill specifically for the project could be constructed on or near the project site. The landfill would have to meet Class II-1 requirements as a minimum. Generally, these guidelines mandate protection from the 100-year flood, and protection of groundwater from both vertical and horizontal leaching by the use of natural or artificial barriers. Other, more restrictive requirements could be placed on the installation depending upon the specific nature of the site and the waste itself. Hauling expense would, of course, be minimized with on-site disposal.

A significant concern with on-site disposal is the high groundwater table in the project area which is normally within five feet of the surface. This could make construction and operation of a site very difficult and expensive or preclude its consideration altogether. Local health officials indicate the best sites for new landfills are in the Susanville area (Ames, 1980).

Regardless of whether County landfill or on-site disposal is used, the air quality problems of disposing of the light, finely-divided ash particles is a concern.

A possible method for reducing both the economic and environmental impacts of ash disposal is to put the residue to beneficial use. Wood ash can be used as a fertilizer, feedstock, used directly for its potassium content or mixed with compost. Fly ash from coal-fired plants has been used in concrete, an application that might apply for wood ash. The commercial potential for reuse would have to be investigated and is a possibility particularly because of the agricultural activity in the region.

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V. CULTURAL RESOURCES

GENERAL COMMENTS

Cultural resources include evidence of prehistoric occupation or use (prehistoric sites), similar evidence from the post-contact period (historic properties), and places of significance to Native Americans, which can include places of religious importance, traditional gathering areas, burial grounds, et cetera. The discussion of federal and state ordinances, statutes and guidelines below, describes the history of legislation leading to the steps which must be taken regarding cultural resources as part of the EIS/EIR process.

The necessary steps may be briefly described as:

- a. Examination of various registers of cultural resources to determine if resources have been previously recorded in or near the project area.
- b. Interviews, literature review, and archival research (as appropriate) to develop background information on the cultural history of the project and vicinity.
- c. Field inspection of the project area by trained specialists.
- d. Description and evaluation of significance of all cultural resources identified in the previous phases.
- e. Identification of potential impacts of the project to significant resources.
- f. If potential adverse impacts to significant resources are identified, development of a plan to eliminate or mitigate the adverse impact.
- g. Implementation of the management plan.

Specific application of these steps to the present project is discussed in the Second Phase Report.

ORDINANCES, STATUTES AND GUIDELINES

Federal Statutes and Guidelines

The Antiquities
Act of 1906
(34 Stat. 225)

This act establishes protection for archeological sites by requiring permits for the examination of archeological remains, and authorizes the Secretaries of the Interior, Agriculture and Army to make and publish uniform rules and regulations to carry out this responsibility.

The Historic
Sites Act of
1935 (49 Stat.
666)

This act establishes as public policy preservation of archeological remains of national significance for the inspiration and benefit of the people of the United States. It directs the Secretary of the Interior to carry out investigations and research regarding archeological sites.

National Historic
Preservation Act
of 1966 (80 Stat.
915)

This act augments the provisions of the 1935 act to include sites and/or districts of local and regional significance as well as national significance. It establishes as national policy "the protection, rehabilitation, restoration and reconstruction of districts, sites, buildings, structures, and objects significant in American history, architecture, archeology, or culture."

The National
Environmental
Policy of 1969
(91 Stat. 852)

This act includes as a responsibility of the federal government the preservation of "important historic, cultural and natural aspects of our national heritage." Section 102 of the Act directs federal agencies to implement systematic, interdisciplinary studies to assess the impacts of project actions upon man's environment and aid in decision-making regarding such impacts along with economic and technical considerations.

Executive Order
11593, "Protection
and Enhancement of
the Cultural
Environment,"
May 13, 1971
(36 F.R. 8921,
16 U.S.C. 470).

This order places leadership in the preservation of cultural resources of the nation on the various federal agencies, directing them to insure that cultural resources in their control are not endangered, and creating the responsibility of such agencies to identify properties qualified for nomination to the National Register.

The Federal Land Policy and Management Act of 1976.

This Act extends the previous considerations into the realm of general planning as opposed to specific-case planning.

Procedures for the Protection of Historic and Cultural Properties (36 CFR 800)

This code establishes procedures for compliance with the above laws, particularly the National Historic Preservation Act and Executive Order 11593. It requires federal agencies to evaluate "undertakings" under their jurisdiction to determine whether they will have an adverse impact on significant cultural resources. "Significant" is defined as "eligible for the National Register of Historic Places." Criteria for eligibility, documentation necessary to request a determination of eligibility, and guidelines for minimum professional standards of individuals supplying this documentation are specified in other parts of Title 36 (60, 63, and 64). Surveys must be conducted to identify sites and determine their significance (with test excavation, if necessary). If Register-quality sites are identified, the potential adverse effect of the project on these sites must be determined and measures must be taken either to avoid the impact or to mitigate the adverse effect to a non-significant level. The latter is normally done through a systematic program of data recovery.

American Indian Religious Freedom Act. (92 Stat. 469).

This gives Native Americans the opportunity to lobby for protection and access to religious sites, traditional gathering areas, etc., on federal land or licensed projects by declaring the protection of the American Indians' freedom to practice his traditional religion to be federal policy. This protection includes access to sites, use and possession of sacred objects and freedom to practice traditional rites.

State Statutes and Guidelines

California Environmental Quality Act (and, by extension, State EIR Guidelines)

Cultural resources have been found to fall under the provisions of CEQA by the decision in Society for California Archaeology v. County of Butte (1977) 65 Cal. App. 3d 832. Therefore, the effects of a project on cultural resources must be considered in the same manner as any other adverse effect on the environment. While detailed descriptions of the methods to be applied to cultural resources are lacking in state law, in practice they closely parallel the federal. In Appendix G of the State EIR Guidelines, one "significant effect" is that:

"[The project will] disrupt or alter an archaeological site over 200 years old, an historic site or a paleontological site except as part of a scientific study of the site...."

Public Resources
Code, Division 5,
Chapter 1.75,
Section 5097.9.

This establishes the Native American Heritage Commission with, among other responsibilities, the task of identifying and cataloguing places of cultural significance to Native Americans. In practice, this is being done by requiring cultural resource specialists to consult with local Native Americans as part of the evaluation of projects for which EIRs will be prepared.

BIBLIOGRAPHY WITH ABSTRACTS

As is usual with cultural resources studies regarding specific projects, very little concrete information is available on the specific study area. Those references which have the strongest bearing on the cultural resources of this vicinity are annotated below.

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Describes the development of Nobles' Trail, among others. This trail route has been marked at Susanville and Viewland as State Historic Landmarks.

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1916 Fairfield's History of Lassen County, California. H.S. Crocker, San Francisco.

Like most of the early county histories, it suffers from uncritical acceptance of information, but still is the best general history of the area.

Fenega, Franklin, and Francis A. Riddell

1949 "Excavation of Tommy Tucker Cave, Lassen County, California." American Antiquity 14(3):203-14.

Report on excavations of a dry cave on the east side of Honey Lake Valley. Provides comparative data for a later integrative study (Riddell 1960a).

Hopkins, Sarah Winnemucca

1883 Life Among the Paiutes: Their Wrongs and Claims. Reprint, 1969. Chalfant Press, Bishop, California.

Although this does not discuss the Honey Lake Valley specifically, it provides an excellent overview of the effects on the Paiute of Euro-American contact.

Layton, Thomas N.

1970 "High Rock Archaeology: An Interpretation of the Prehistory of the Northwestern Great Basin." Unpublished Ph.D. dissertation. Harvard University, Cambridge.

Riddell (1960a) provides the chronological and cross-comparative bases for study of the prehistory of the area. Layton provides the ecological framework and refinements of chronology along with a wider discussion of interrelationships.

Riddell, F.A.

1960a The Archeology of the Karlo Site (Las-7), California. University of California Archaeological Survey Report 53.

Excavation report of an open site in Secret Valley, with occupation dating from about 2000 B.C. to the protohistoric. Results are compared with other work in this area (including his own unpublished excavations at Amedee Cave) and the Western Great Basin in general to provide a three-stage chronological sequence for the prehistory of Honey Lake Valley.

1960b Honey Lake Paiute Ethnography. Nevada State Museum Anthropological Papers 4.

A description of the society of the Honey Lake Paiute, focused on reconstruction of the pre-contact lifeways as remembered by informants.

Steward, Julian H.

1938 Basin-Plateau Aboriginal Sociopolitical Groups. Bureau of American Ethnology Bulletin 120.

Relates Riddell's ethnography to wider cultural patterns and social mechanisms.

1882 Illustrated History of Plumas, Lassen and Sierra Counties, with California from 1513 to 1850. Fariss and Smith, San Francisco.

This very early history has become available again through a 1971 reproduction by Howell-North Books, Berkeley. In the 1971 publication, an introduction by historian W.H. Hutchinson mentions several minor errors of fact, but is generally full of praise for the value of this history, written when many of the early pioneers were still alive. It describes the founding and development of most of the communities in Honey Lake Valley and the grand plans, as of 1882, of the Lassen Flume and Land Company, which built the Eagle Lake Ditch.

SENSITIVE ENVIRONMENTAL ISSUES

There is a strong possibility of finding significant prehistoric resources within the study area. Honey Lake was formerly a western arm of pluvial Lake Lahontan. As this lake dried up, in relatively recent times, shoreline occupation/use areas necessarily moved from the surrounding hills down into the valley. This movement has resulted in the presence of a large number of archeological resources in Honey Lake Valley. It has also made it virtually impossible to predict their exact location since optimal locations vary with the time period in question. At this point, all that can be said with certainty is that the records of the Bureau of Land Management (Susanville) and the Regional Office of the California Archaeological Sites Survey (California State University, Chico) indicate a very dense site distribution in nearby areas. There is no reason to assume that the situation will be different in the study area.

In the case of historic properties, there is one potentially significant resource known in the study area, the Eagle Lake Ditch. The ditch was constructed in the years after 1875, as part of an irrigation project which would have brought water from Eagle Lake through a 6,000' tunnel to Willow Creek, and down the creek some eighteen miles to the head of the ditch, which was to serve as the main artery of a system, irrigating up to 150,000 acres west, north and east of Honey Lake. The developers, in order to purchase this huge tract at a price which insured economic feasibility for their project, secured passage of the federal Desert Land Act. Without more investigation of its present condition, within the project area, and its importance in regional history, its significance cannot be precisely assessed. However, dependent upon the major category of significance, it is possible that the property could be eligible either for the National Register of Historic Places or the Historic American Engineering Record.

The ditch runs near and roughly parallel to the Southern Pacific tracks, through the project area. For this reason, it seems possible that the plant could be sited in a manner that would avoid or minimize impact to this property.

Native American concerns have yet to be addressed, particularly the determination of presence or absence of locales of ceremonial/religious importance or traditional gathering areas.

This can only be addressed through interviews with Native Americans in the project vicinity who are knowledgeable in the traditional ways of their people.

These concerns, and others which may be identified later, must be studied during completion of the steps outlined at the beginning of this section. The means of doing this are described in the Second Phase Report.

VI. HEALTH, INDUSTRIAL HYGIENE AND NOISE

GENERAL COMMENTS

Potential power plant air pollutant emissions not covered by current air quality regulations (see below) are the primary public health concern. The emission of these fuel-derived air pollutants is not well defined and is expected to create public debate during the environmental permitting process. Emissions from the geothermal portion of the power plant will create added issues to be examined. Provisions for public safety from the operation of the power plant will need to be incorporated into the power plant design.

The industrial hygiene aspects of the operation of the plant must be addressed during design, construction and operation of the power plant.

Cal-OSHA requirements will determine the allowable noise exposure for workers. CNEL noise levels in neighboring land use areas must be within limits established by the Noise Element of the Lassen County General Plan.

Hazardous Air Pollutants Not Regulated Under Specific Emission Rules

Part of the power plant's particulate emissions may contain absorbed organic compounds, polynuclear aromatic hydrocarbons (PAH), polychlorinated dibenzofurans (PCDF) and polychlorinated dibenzo-p-dioxins (PCDD). These organic combustion products could pose a hazard to public health. Any wood fuel containing residual 2, 4-D and/or 2, 4, 5-T from spraying would release these compounds, if not completely combusted, or add them to the combustion process that forms polychlorinated dibenzo-furans and -p-dioxins. Any mill waste fuel containing preservative-treated wood could release the following treatment chemicals: arsenic, copper, chromium and penta chlorophenal (PCP), itself a precursor to PCDF and PCDD. Inorganic chlorides from salting mountain roads could produce unanticipated emissions of HCl.

The flashing of geothermal wastes could emit mercury, H_2S , NH_3 or boron, depending on their concentrations in the geothermal wastes.

Control of wood dust to prevent added particulate emissions from fugitive dust and for prevention of explosions must be designed into the power plant.

Industrial Hygiene Aspects

Proper plant design will be required to prevent employee exposures to airborne contaminants and hazardous materials, both in wood waste and the geothermal portions of the plant. All handling and feeding operations should have engineered dust control. Typical power plant exposures to chemical and physical agents (e.g., noise) should be considered during design and controlled by good engineering practice. Special attention should be given to the handling and disposal of fly ash, any bottom ash, air pollution control sludges and any geothermal fluids or sludges, e.g., from the cooling tower basins.

Noise Source Characteristics

Well Drilling. During well drilling, noise levels of 80 to 90 dBA at 50 feet from rig power generators may be expected. Drilling normally continues 24 hours a day for approximately two months per well (Gennis & Associates, 1979-1980).

Power Plant Construction. During construction, the highest noise levels will be attributable to large construction equipment. Impact equipment, such as a pile driver, can produce noise levels exceeding 100 dBA at 50 feet. Clearing and earthmoving equipment can produce noise levels over 95 dBA at 50 feet.

Power Plant Operation. Possible sources of noise during power plant operation include wood unloading, moving, and chipping machinery; pumps, power transformers, and power generating equipment. Noise levels produced by these services should generally not exceed 80 to 90 dBA at 50 feet.

STATUTES AND GUIDELINES

The following will produce guidelines or policies affecting plant design:

Public Health

1. Review of Environmental Impact Report or Application for Small Power Plant Exemption by U.S. EPA, California ARB, Lassen County APCD, California DOHS and California Energy Commission.
2. Special conditions which may be imposed by U.S. EPA, California ARB, or LCAPCD on Authority to Construct and Permit to Operate applications; for example, type of fuel, amount of fuel, combustion conditions, special abatement equipment and operations, shutdown requirements, etc.
3. Special monitoring and environmental studies under CEC certification requirements, unless exempted.

Industrial Hygiene

All requirements of Title 8, California Administrative Code, must be met. This contains industrial safety orders and Cal-OSHA regulations on employee health and safety.

Noise

A summary of the principal statutes and regulations pertaining to noise are as follows:

Federal. The Occupational Safety and Health Act (OSHA) of 1970 establishes noise exposure standards in the work place. This regulation is primarily to safeguard employee health.

State: Cal-OSHA adapts the federal OSHA regulations to the State of California General Safety Industrial Orders (8CAC Article 105) and regulates noise exposure. The California Highway Patrol Motor Vehicle Noise Laws apply noise limits to motor vehicles (Section 23130, California Vehicle Code).

Insofar as noise is considered as a nuisance,* action may be taken by the State to correct or abate the nuisance under provisions of the following: the State Civil Code (Section 3483 to 3503), the State Health and Safety Code (Sections 205 and 206), the State Government Code (Sections 25845, 26528, 38771 and 38773, and the State Penal Code (Sections 370 and 373).

Lassen County. The Noise Element of the Lassen County General Plan stipulates a maximum community Noise Equivalent Level (CNEL) of 65 dBA at the property line.

* A nuisance is defined in Section 3479 and 3480 of the State Civil Code as "anything which is injurious to health, oris offensive to the senses,....so as to interfere with the comfortable enjoyment of life or property....A public nuisance is one which affects at the same time, an entire community or neighborhood."

BIBLIOGRAPHY WITH ABSTRACTS

Public Health and Industrial Hygiene

Bumb, R.R., et. al.

1980

"Trace Chemistries of Fire: A Source of Chlorinated Dioxins." Science, Vol. 210, Number 4468, pp. 385-390.

New, highly specific and sensitive analytical methodology has been applied to the determination of chlorinated dibenzo-p-dioxins in particulate matter. The results show that the dioxins are present in particles from many types of combustion sources and in dust and soil in the vicinity of combustion sources. The data indicate that chlorinated dioxins may occur in particulate matter from the combustion of most types of organic material and suggest the hypothesis that chlorinated dioxins result from trace chemical reactions occurring in fire.

California Air Resources Board

To be released

soon

"ARB Contract to Study Cooling Tower Drift Emission From Geothermal Sources." ARB contact: D. Westerdahl, Contract Officer, Sacramento, California.

California Energy Commission

1979

Draft Environmental Impact Report, Pacific Gas and Electric Company, Geysers Unit 8, Geothermal Power Plant, Sonoma County, California, P700-79-015, December 1979.

Deleterious substances present in geothermal steam and/or cooling tower plume will be carried in the air, deposited on soils, vegetation and wildlife, and in populated areas. The effects of the small concentrations and the cumulative deposition of these substances is not sufficiently understood. Therefore, the cumulative drift impacts of longer distance deposition cannot be accurately assessed. However, deposition immediately adjacent to geothermal power plants has been shown to affect some vegetation adversely. Rates and amounts of emissions can be reduced by appropriate design of the cooling tower and other facilities.

Hahn, Jeffrey L.

1979

"Occupational Hazards Associated with Geothermal Energy." Geothermal Resources Council, Transactions, Vol. 3,. California Department of Health Services, Berkeley, California, September 1979.

Exposure to noise, H₂S, NH₃, hazardous chemicals and wastes, and heat are the major occupational health hazards associated with geothermal energy development--from drilling to power production. Exposures to these agents, although not unique to geothermal energy development, occur in situations peculiar to the industry.

Reports show that occupational illnesses associated with geothermal energy development have increased, and most result from the H₂S abatement systems used in response to environmental pollution regulations.

Kaplin, Edward J.

1980 "Letter to Editor." Environmental Science and Technology, Vol. 14, No. 9, pp. 1149-1150.

Letter of comment on a previous article elaborating on possible chemical reactions of HCl released from municipal incinerators.

Levine, Steven, and William Zegel, panelists

1980 "Acid Rain: An International Concern, An Air Pollution Control Association Panel Presentation." Journal of the Air Pollution Control Association. Vol. 30, No. 10, October 1980.

At the 73rd Annual Meeting of the Air Pollution Control Association, this session was chaired by Steven Levine (Ford Motor Company) and William Zegel (Water and Air Research). It brought together prominent members of the United States and Canadian Departments of Energy and Environmental Protection, executives from the coal mining and smelting industries, as well as a European expert on long-range pollutant transport.

Saint, D.G., and J.J. McFeters

1980 "Comparison of Personal Exposure Levels of Nitrogen Dioxide, Sulfur Dioxide, and Fly Ash Found in TVA Coal Fired Steam Plants." Presented at American Industrial Hygiene Conference, May 18-23, 1980, Albert Thomas Convention Center, Houston, Texas.

As part of a TVA/NIOSH cooperative project which should be completed by the end of July 1980, an investigation is being conducted into worker exposure levels of respirable fly ash, nitrogen dioxide and sulfur dioxide in TVA power plants of different basic design. Johnsonville and Paradise Steam Plants, both representative of TVA's twelve steam plants, are being evaluated as examples of different plant designs, the balanced draft boiler system and the positive pressure boiler system.

Swann, R.

1980 Personal communication. Air Pollution Control Officer, Mendocino County, California.

Mr. Swann supplied information relevant to air pollution permits and source test data from the wood waste boiler at the Masonite Company, Ukiah, California.

Noise

California Energy Commission (CEC)
1979 California Department of Water Resources (DWR) Bottle
Rock Geothermal Power Plant Draft EIR.

Expected noise levels from this power plant at normal operation are predicted to range from 60 to 65 dBA at 500 to 700 feet. The source and intensities of noise from the plant would add to the area's existing ambient sound level. Ambient sound levels in this region typically range from 30 to 40 dBA.

California Energy Commission
1980 Geysers Unit 18 Geothermal Power Plant, Final
Environmental Impact Report (EIR).

Noise levels from Unit 18 will be similar to the noise levels created by similar existing units in the area. It will have the following three major sources of noise during normal operation: cooling tower, turbine building, and steam jet ejector. The power plant's combined sound level is not expected to exceed 60±5 dBAs at 500 feet. Recommended noise suppression techniques include installation of barriers, mufflers, and insulation.

Gennis and Associates, Engineers
1979-1980

Gennis and Associates, Engineers, conducted periodic field noise measurements of an exploratory geothermal well drilling project in Colusa County, California. The average noise level measured at 100 feet from the drilling rig ranged from 80 to 85 dBA. Noise level reduction at this project was achieved by using an electric powered drilling rig and large mufflers on the diesel generator units.

SENSITIVE ENVIRONMENTAL ISSUES

Wood Combustion

The release of polychlorinated dibenzo-furans and -p-dioxins is expected to be a major environmental/public health issue. Also, any wood with residual 2, 4-D or 2, 4, 5-T that is combusted may cause release of those materials or add to the release of PCDF and PCDD. If any waste preservative-treated lumber is burned, release of several hazardous air pollutants will result.

Emissions of polyaromatic hydrocarbons must be addressed, as well as long-range transport of TSP and contribution of the power plant emissions to acid rain.

Geothermal

Release of non-condensable gases from the geothermal waters and cooling tower drift with geothermal constituents must be addressed.

Industrial Hygiene

Proper recognition and engineering controls can eliminate most airborne exposures; however, wood dust, geothermal sludges and fly ash must be given special attention.

Possible Noise Impacts

The Noise Element of the Lassen County General Plan states that CNEL noise levels should not exceed 65 dBA at the project property line. CNEL noise levels are average levels weighted according to time of day in which the noise occurs. Assuming that a steady state near-source (at 50 feet) noise level of 80 dBA is produced by a point-source, attenuation due to spherical spreading of the sound wave alone would attenuate noise from this source to a CNEL level of 65 dBA within about 4,000 feet. This rough analysis indicates that noise impacts may be a concern if the Honey Lake hybrid wood-geothermal power plant is within about 4,000 feet of the property line. A more detailed analysis will be required that considers the size of the noise source, ambient noise levels, other sources, frequency and duration characteristics of noise generators, excess attenuation, and specific locations of noise generators and receptors.

VII. SOCIO-ECONOMICS

GENERAL COMMENTS

Socio-economic issues that may be significant with regard to the Honey Lake hybrid wood-geothermal power plant include employment, financial impacts, housing, public facilities, and competition for firewood.

STATUTES AND REGULATIONS

Socio-economic issues are generally addressed in environmental impact documents. Measures to avoid or mitigate socio-economic impacts may be conditions of permits issued by the lead agency or responsible agencies.

California Environmental Quality Act (Chapters 1, 2, 2.5, 2.6, 3,4,5 and 6, Division 13, Public Resources Code,

and

Guidelines for Implementation of the California Environmental Quality Act of 1970 (Title 17, California Administrative Code, Section 15).

Environmental Impact Reports shall consider ". . . relevant specifics of the area, the resources involved, physical distribution, population distribution, population concentration, human use of the land (including commercial and residential development) and other aspects of the resource base such as water, scenic quality, and public services" (14 Cal. Admin. Code 15143 a).

Environmental Impact Reports shall "Discuss ways in which the proposed project could foster economic or population growth, either directly or indirectly" (14 Cal. Adm. Code 15143 g).

Actual or preceived competition for firewood may be affected by Code of Federal Regulations. Reg 36CFR 223.1, U.S. Forest Service, Title 2400, Timber Management.

Free use of National Forests may be granted to individuals to obtain firewood for personal use. The objective shall be to make firewood available to as wide a range of individuals as is practical, and to provide an opportunity to use materials that might otherwise be wasted.

Bibliography With Abstracts

Bibow, John

1981 Personal communication. Employee of Resource Management Services, Inc., January 30, 1981.

The harvesting of slash will generally run from May 1 through November 30 and will occur in logging areas. Mr. Bibow estimated the numbers and categories of personnel that will be needed for this activity, the number of new employees and the probable traffic routes.

Fogelman, Sam

1981 Personal communication. Chief Mechanical Engineer, I.E.C., January 30, 1981.

Mr. Fogelman estimated the number of people, work shifts and days per week needed to operate the Honey Lake hybrid wood-geothermal power plant.

California Energy Commission (CEC)

1979 California Department of Water Resources (DWR)
Bottle Rock Geothermal Power Plant Draft Environmental Impact Report.

Environmental impacts and mitigation measures are discussed in the areas of socio-economics, public services, transportation, aesthetics and noise.

Socio-economic aspects of the power plant development are examined cumulatively with other concurrent and proposed geothermal projects in the Lake-Sonoma County area. Cumulative demand for labor may reach 550 persons; however, the existing idle labor pool from previous geothermal development in this region will ratify the bulk of this need. The authors predict that the impacts of the Bottle Rock project, individually or cumulatively with other geothermal projects in the area, will not significantly affect the local population. No significant increases are anticipated in demands for public services. Lake County has proposed reconstruction of the proposed primary county access road on a cost-sharing basis with DWR.

The visual intrusion of a power plant facility upon a natural forested area will be mitigated by a landscape plan specifically developed by DWR. Both the Lake County Planning Commission and the CEC will review and approve this plan.

California Energy Commission

1980

Geysers Unit 18 Geothermal Power Plant, Final
Environmental Impact Report.

Sections of this FEIR are related to socio-economics, noise, aesthetics (visual), and transportation.

Portions of Sonoma and Lake County have historically been subjected to geothermal development; however, no significant labor employment trends have been identified with geothermal development. No additional adverse impacts are expected to occur in the labor market due to any indirect effects of plant construction and operation. Only slight increases in rents and housing costs are expected as a result of the slight population increase attributable to Unit 18. This increase will probably not promote housing construction in the area. Police, fire and medical services requirements for construction workers and their families will not significantly increase the existing demands for these services. Use of public roads by heavy equipment may accelerate the deterioration of these roads. If the county determines that the roads within its jurisdiction are being abused by heavy truck and construction equipment, the county will ask PG&E to participate in maintenance costs.

The construction of the Geysers Unit 18 facility will have a definite impact upon the project area's visual environment because it will introduce industrial type structures into a forested and meadow-grassland natural area. However, this type of development is consistent with the county's projected use of this land.

California Health and Welfare Agency, Employment Development
Department

1980

Labor Market Newsletter, Lassen County.

This publication discusses labor force trends and outlooks in Lassen County, describes selected occupations, and presents social and economic data in tabular form. Labor force and wage analysis figures from 1972 to 1979 are presented in our appendix.

The 1980 and 1981 employment situation in all Lassen County employment sectors will be impacted by an economic downturn projected to last through 1981.

Employment is forecasted to grow by 225 persons over the next two years. Government employment will retain its dominant place in Lassen County's economy, and service industries are predicted to overtake manufacturing as the second largest employment sector. There will be a moderate demand for skilled workers in most occupations except for lumber and wood products and construction occupations, where a surplus of experienced workers is expected. The county's major manufacturing activity is now the lumber and wood products industry.

Edmunds, Stahrl W. and Adam Z. Rose
1979 Geothermal Energy and Regional Development, Praeger
Publishers

Three chapters of this book discuss the sociological impacts and economic impacts of geothermal development in Imperial County. Imperial County is a relatively remote area of California undergoing geothermal development, and is somewhat distinct from other geothermal areas in California because of its dependence on agriculture and conditions created by proximity to the Mexican border. Characteristics of Imperial County include low average income, urban concentration in towns of 4,000 to 20,000, low average educational attainment, low average age, and occupational concentration in agriculture. Socio-economic characteristics relevant to geothermal energy were studied by computer mapping and correlated among energy regions. Indications are that the agriculturally-based economy will be a critical element in geothermal development. Women will probably become a more important source of labor in the future. Much of the geothermal energy produced in Imperial County will likely be exported to neighboring counties. Geothermal development is projected to add \$700 million per year to the total personal income of Imperial County by year 2020.

Resource Management Services, Inc.
Chapter entitled "Wood Fuel Transportation System" received from Kevin Johnson, January 22, 1981.

Good highway and railroad networks exist throughout the Procurement Area to transport forest-based and mill-based wood fuel materials to the power plant site at Wendel. Characteristics and costs of both modes indicate that the majority of materials would be transported by truck, but shipment of selected products by rail from some locations could yield delivery cost advantages resulting from distance and volume considerations.

U.S. Department of the Interior, Bureau of Land Management
1977 Proposed Geothermal Leasing, Honey Lake
Valley Draft EIR.

Existing social and economic characteristics are described under the existing environment. The entire Honey Lake Valley is within Lassen County. Population, income, and ethnic group figures are presented in tabular form. The Lassen County population is predominantly white with per capita income below the equivalent statewide measure. Government is the county's largest employment sector. Most of the county's manufacturing employment is in the production of forest products. New housing development has stagnated since the decline in the county's lumber industry in the 1950's.

The greatest social and economic effect of geothermal leasing in Lassen County would occur during the power plant operation stage of development. It is during this phase that greatest property tax revenues would accrue to Lassen County. Operation of a non-electric geothermal development could employ more of the county's population than a power plant. Noise impacts of geothermal development are discussed under the social and economic subject area.

Vollintine, L.R., L. Kunin and J.A. Sathaye
1977 The Lake County Economy: Potential Socio-Economic
Impacts of Geothermal Development, prepared for
the U. S. Energy Research and Development
Administration by Lawrence Berkeley Laboratory,
University of California, February, 1977.

Lake County is a sparsely populated, rural, Northern California county. It's economy is centered around recreation, retirement and agriculture, but it faces the imminent possibility of large-scale geothermal development. Lake County's present economic and social characteristics make it highly vulnerable to socio-economic disruption resulting from uncontrolled development. Payroll impacts are now beginning to be felt, as are impacts on school enrollments, traffic, public protection and county tax revenues.

SENSITIVE ISSUES

Employment

In 1979, Lassen County's labor force consisted of 8,200 workers, 825 (10%) of whom were job seekers (annual average). Government agencies employ approximately 40% of the total labor force. In addition to various state, federal, and local agencies, public sector jobs are bolstered by employment at the Sierra Army Depot at Herlong and the California Conservation Center near Litchfield. Wholesale and retail trade (12%), manufacturing (9%), and service industries (9%) are other major employment sectors. About 90% of those employed in manufacturing industries are in lumber or wood-related industries. Percentages given are for total (employed and unemployed) labor force on an annual basis for 1979. (Source: State of California EDD, May, 1980).

Estimated direct employment resulting from construction and operation of the Honey Lake hybrid wood-geothermal power plant is tabulated in Table VII-1.

Well drilling with a rotary drilling rig of the type used in oil and gas or geothermal exploration requires about 20 men for two to four months per well. The drilling crew is typically about 20 men. The drilling crew is typically relatively transient, moving with the rig from location to location (Vollintine, et al., 1977). Therefore, local employment should not be directly affected by well-drilling activities.

The employment force required to construct a 55 MW hybrid wood-geothermal power plant may be approximated by construction employment estimates for comparable-sized geothermal power plants in The Geysers KGRA (CEC, 1979; CEC, 1980). It is estimated that an average of about 40 workers would be required, with a peak of about 80 workers midway through the approximately two and one-half year construction process.

Operating the power plant will require from five to ten people per shift (Fogelman, 1981). Therefore, about 20 to 40 people will be employed full time in plant operation.

Approximately 15 people will be employed full time in procuring wood fuel. These individuals will be professional foresters and support personnel capable of evaluating and negotiating wood fuel purchases (Bibow, 1981).

Seasonally, between about May 1 and November 30, about 50 people will work in the harvesting of wood fuels. Only about

TABLE VII-1

ESTIMATED DIRECT EMPLOYMENT
55 MW WOOD-GEOTHERMAL POWER PLANT

<u>Activity</u>	<u>Approximate Duration</u>	<u>Estimated No. of People Employed</u>	<u>Source of Estimate</u>
Well Drilling (One to three production wells and possibly one reinjection well will be required)	2 months per well	20 men per rig	1
Power Plant Construction	2-1/2 Years	10 to 80 (average about 40)	2
Power Plant Operation	Year-round	20 to 40	3
Wood Procurement	Year-round	15	4
Wood Harvesting	7 months/year	50	4
Wood Hauling	7 months/year	95	4

1. Based on experience in The Geysers KGRA (Vollintine, et. al., 1977).
2. Estimated by PG&E for 55 MW geothermal power plant in The Geysers area (California Energy Commission, December 1979). Estimate confirmed by Sam Fogleman, IECU, March 1981.
3. Telephone conversation: Sam Fogleman, I.E.C., January 1981.
4. Telephone conversation: John Bibow, R.M.S., January 1981.

one-half of these 50 people represent an increase in employment because slash gathering and disposal is presently a part of logging operations (Bibow, 1981).

During the same seasonal seven-month period, about 97 people will be employed hauling wood fuel to the power plant site. These individuals will be truck owner-operators (Bibow, 1981).

Many of the persons employed in power plant construction and operation, and in wood procurement, harvesting and hauling, will probably be drawn from either Lassen County or the Reno-Sparks area of Nevada. If 80 to 90 people were drawn from Lassen County, this would represent about 1% of the county's total labor force.

In addition to the direct employment impacts, expenditures for goods and services will have indirect or induced employment effects. Indirect employment may be experienced in industries such as retail sales, transportation or housing. The availability of moderately hot geothermal waters (after power plant use) and power may also affect employment indirectly. The Honey Lake hybrid wood-geothermal power plant project may be expected to employ some of Lassen County's unemployed work force; however, the significance of this impact will depend upon various factors including:

1. The skills of unemployed workers, and the skill requirements of fuel supply and power plant-related jobs;
2. The coincidence of unemployed workers and seasonal jobs; and
3. Indirect or secondary employment resulting from power plant construction and operation.

Financial Impacts

Increased economic activity may be expected in Lassen County and the Reno area as a result of constructing and operating the Honey Lake hybrid wood-geothermal power plant. Construction, retail trade and transportation sectors would be affected.

Property tax assessment against the power plant would be based on an allocation of assessment by the State Board of Equalization. The Board appraises as a unit all property in the state belonging to a public or private utility as a function of capitalization, historical costs less depreciation, market values of stock and debt, and the rate base. The allocation per plant of this total allocation of assessment is based upon replacement costs new less depreciation of that particular plant. Assuming that property

tax assessments are about one percent of the initial capital investment, estimated to be about \$65 million (Fogelman, March, 1981), the annual property tax assessment would be \$650,000.

Power plants' beneficial financial impacts may be partially offset by increased road maintenance costs (see following discussion) or other indirect county services attributable to the project.

Housing and Public Facilities

Some workers employed directly or indirectly as a result of the Honey Lake hybrid wood-geothermal power plant may be drawn from outside the local area, resulting in increased housing demands. The quality and quantity of the county's existing housing stocks has tended to decline since the county's lumber industry declined in the 1950's. The county's recent (since 1970) population growth, plus the influx of students to the new campus of Lassen Community College at Susanville, has resulted in a tight housing market (BLM, 1977). Increased demands for available housing could induce new housing construction or affect rents and housing prices.

Public roads are the public facilities most likely to be affected by power plant construction and operation. The existing road system in the vicinity of the plant is described in a draft report on the Wood Fuel Transportation System prepared by Resource Management Services, Inc. (RMS). The power plant site may be reached by way of Wendel Road from State Highway 395. These roads probably will carry construction equipment, materials and wood-fuel to the power plant site. During the harvest season (May 1 through November 30), a fleet of about 47 trucks will haul fuel to the power plant site. About 80 percent of this truck traffic will come from the northwest through Susanville (Bibow, 1981).

The aforementioned RMS report concludes that wood-fuel truck traffic would not have a significant effect on traffic flow through Susanville. Two possible routes through Susanville are discussed--Main Street and Riverside Drive. Highway 395 and Wendel Road carry relatively light traffic volumes. Therefore, traffic congestion as a result of equipment, material, or wood-fuel hauling may not represent a significant problem.

Heavy truck traffic to the power plant site will be concentrated on Wendel Road. Accelerated deterioration and increased maintenance costs may result from this increased heavy truck traffic on Wendel Road.

Competition for Firewood

A potential area of major public concern is that the proposed Honey Lake hybrid wood-geothermal power plant will compete with the local population for firewood. The public should be provided with the following information to reduce or alleviate the concern:

1. The quantity of wood slash and non-commercial timber available in local forests.
2. The quantity of this non-commercial wood presently harvested by local residences, and the quantity that would be harvested for power plant use.
3. Harvesting procedures and proposed measures to assure that sufficient wood will be available for the local populace.

VIII. SUMMARY OF APPLICABLE
PERMITTING AUTHORITY RULES
AND REGULATIONS

GENERAL ENVIRONMENTAL AUTHORITIES

<u>AGENCY</u>	<u>CODE, ACT OR LAW</u>	<u>APPLICABILITY</u>
Federal: National Environmental Policy Act of 1969 (NEPA)	Public Law 91-190 91st Congress S.1075 January 1, 1970 42 USC 4321-4347 40 CFR Parts 50, 60 and 61	The Act defines the national policy for the environmental, provides for establishment of a Council on Environmental Quality and directs all agencies of the Federal Government to consider environmental factors in their policies, regulations and public laws. The Act identifies means by which environmental concerns may be implemented by the agencies but does not stipulate laws, rules or regulations which are directly applicable to the GeoProducts/DWR Hybrid Power Project.
State: California Environmental Quality Act as Amended 1976 (CEQA)	Div. 13, CPRC Section 21000 et. seq. 14 Cal. Adm. Code 1500 et. seq. CEC: PRC Section 25000 et. seq. 20 CAC Section 2300 et. seq. CPRC Section 25541	<p>To maintain a high-quality environment for the general welfare The California Legislature has expressed the intent that all agencies of the state government which regulate activities found to affect the quality of the environment, shall regulate so that major consideration is given to preventing environmental damage. To achieve these objectives environmental impact reports (EIR) shall be prepared to identify significant effects of a project, to identify alternatives and indicate effects to be mitigated or avoided. State guidelines for preparation of an EIR in accordance with CEQA are developed by the Office of Planning and Research.</p> <p>A written statement, "Negative Declaration", briefly describing the reasons that a proposed project will not have a significant effect on the environment may negate necessity for preparation of an EIR.</p> <p>All projects within California must comply with CEQA. The California Energy Commission (CEC) with exclusive authority for siting approval of power plants and facilities requires information, in consideration of its approval, adequate for preparation of an EIR in accordance with CEQA.</p> <p>Permitting authority of the CEC is based upon the size of the proposed power plant. The CEC may exempt thermal-power plants with a generating capacity up to 100 megawatts if no substantial adverse impact on the environment. Geothermal power plants with a generating capacity less than 50 megawatts are exempt from CEC permitting authorization.</p> <p>An inquiry has been directed to the Executive Director of the CEC for a determination of site certification requirements for the GeoProducts/DWR Hybrid Power Project. (Copy appended.)</p>

GEOHERMAL RESOURCE DEVELOPMENT

<u>AGENCY</u>	<u>CODE, ACT OR LAW</u>	<u>APPLICABILITY</u>
California Department of Conservation, Division of Oil & Gas (DOG)	Title 14, Div. 2, Chapter 2, Sections 1681 et. seq. PRC Section 3715.5	The Division of Oil and Gas is the Lead Agency for geothermal exploratory projects, however, Lead Agency responsibilities may be delegated to a county upon request by the Chairman of the Board of Supervisors indicating the county's adopted geothermal element, final environmental document (EIR) and the county's CEQA procedures. The State Oil and Gas Supervisor may at his discretion, after consultation with the Office of Planning and Research (OPR) delegate Lead Agency responsibility. Upon application for a geothermal exploratory project the DOG shall prepare required environmental documents and make a decision on the project in 135 days or less.
	Title 40, Div. 2, Chapter 4, Sections 1941 et. seq. PRC Section 3703 et. seq.	In accordance with DOG Statewide Geothermal Regulations, the Supervisor may in an emergency give verbal approval to drill provided a written notice is sent within 5 days. The Notice of Intention to Drill must be filed on DOG form (OGG105) accompanied by fee and bond. Depth of casing, cementing and monitoring are prescribed to protect the environment and resource. As a practical matter the operation usually has an EIR prepared and seeks designation of the County as Lead Agency to conserve time, reduce costs and prevent redundant efforts.
Lahontan Regional Water Quality Control Board (LRWQCB)	Porter-Cologne Water Quality Control Act Title 23 CAC Subchapter 15 SWRCB Non-Degradation Policy Resolution No. 68-16, Oct. 28, 1968 Federal Water Pollution Control Act, Pub. Law 92-500 33 USC 1321	The Regional Water Quality Control Board is mandated by the State Water Resources Control Board (SWRCB) to issue Waste Discharge Requirements to dischargers of liquid waste who affect water quality, including both surface waters and ground waters. The Regional Boards are authorized to issue waste discharge permits under provisions of federal law. A Surveillance and Monitoring Program checks for compliance, conducts aerial surveillance and coordinates data from other state and federal agencies. Enforcement includes issuance of administrative cleanup and cease-and-desist orders and/or referral to Attorney General for court action. During geothermal drilling primary concern is directed toward construction of the mud sump disposal of drilling wastes and erosion control. In addition to acquisition of waste discharge permits a Contingency Plan for Accidental Spills and Discharges must be developed and approved.
Lassen County Planning Department	Lassen County Ordinances 293 et. seq. Lassen County, California General Plan: 1990 Resolution No. 78-79-102	The Lassen County Planning Department designates zoning in Lassen County with respect to land use. The Planning Department is responsible for issuing Use Permits for development and construction within the county. Although there is no specific designation for geothermal power plants a Use Permit will be required for geothermal exploration and development. Lassen County has established a Procedure for Review of Environmental Impact in accordance with CEQA. The Planning Department performs the function of Lead Agency for the County in consultation and concurrence of other county departments.
Lassen County Department of Public Works	Lassen County Building Code.	An Application for Use Permit requires identification of location, plan of construction and specifications for grading, filling compaction and means for access. Evidence of rights-of-way and an encroachment permit from the Department of Public Works and appointment of an inspector for the county may be expected. The County Health Department will require a Sanitation Permit if appropriate. A Burning Permit will be required by the County Fire Marshal with concurrence of the County Air Pollution Control Officer.
Lassen County Health Department	Lassen County Health & Safety Ord.	
Lassen County Fire Marshal	Lassen County Fire Code.	
Lassen County Air Pollution Control Officer	Rules & Regulations of the Lassen County Air Pollution Control District.	

GEOHERMAL RESOURCE DEVELOPMENT

<u>AGENCY</u>	<u>CODE, LAW OR ACT</u>	<u>APPLICABILITY</u>
Lassen County Air Pollution Control District (LCAPCD)	Rules and Regulations of the Lassen County Air Pollution Control District October 1, 1971	A Use Permit for the GeoProducts/DWR exploration and development of geothermal resources may as a condition require completion of grading and drainage structure during the dry period of the year; a condition which may impact the project schedule. As the Lead Agency, the County Planning Department will usually require evidence of compliance with all regulations related to environmental impact.
	Calif. Health and Safety Code Sections 24242 or 24243	Rules and Regulations of the Lassen County Air Pollution Control District are administered by the Air Pollution Control Officer (APCO) of the Lassen County Air Pollution Control District.
		An Authority to Construct for the APCO is required for any building, erecting, altering or replacing any article, machine, equipment or other contrivance which may cause issuance of air contaminants or may eliminate or reduce or control issuance of air contaminants.
		A Permit to Operate is required from the APCO before any article, machine, equipment or contrivance may be operated or used which may cause issuance of air contaminants.
		The Rules and Regulations of the Lassen County Air Pollution Control District are understood to be in the process of revision to comply with the rules and regulations of other Air Pollution Control Districts. No substantial changes in requirements or practices are anticipated.
		For geothermal exploration and development in Lassen County, no geothermal steam or excessive air pollution is contemplated, only open air burning of combustible refuse, cleared brush and the like, will concern the APCO and Fire Marshal.

POWER PLANT SITING

<u>AGENCY</u>	<u>CODE, ACT OR LAW</u>	<u>APPLICABILITY</u>
California Energy Commission (CEC)	Warren-Alquist State Energy Resources Conservation & Development Act Public Resources Code (PRC), Section 25000, et. seq. Title 20, California Administrative Code (CEC), Section 1701 et. seq. and Section 25000 et. seq.	<p>The Act established the California Energy Commission (CEC) with exclusive power to certify all power plant sites and related facilities in the state. Certification by the CEC is in lieu of any permit, certificate, or similar document required by any state, local or regional agency, or federal agency to the extent permitted by federal law.</p> <p>The CEC has acted as lead agency in permitting all stationary power plants with cooperative participation and concurrence of federal, state and local agencies.</p> <p>Power plants of limited size or capacity may be exempt from CEC certification. The Commission may exempt thermal power plants generating less than 100 megawatts and geothermal power plants generating less than 50 megawatts where it is determined that there is no substantial adverse impact on the environment or energy resources and generating capacity will not add substantially to forecasted excess capacity.</p> <p>An inquiry has been submitted to the CEC for a determination of exemption for the proposed GeoProducts/DWR Hybrid Power Plant.</p> <p>Certification is approved upon review and approval of a Notice of Intention to file an Application for Certification (NOI) and/or an Application for Certification (AFC). The statutory period for review of an NOI is 9 months with an additional 9 months for review of the AFC. However, upon a determination of availability of a commercial geothermal resource, an accelerated 12 month review of an AFC is available without necessity for a previous NOI.</p> <p>In consideration for certification of a power plant the CEC conducts a thorough evaluation of environmental impacts. As a rule, site specific Environmental Impact Study is conducted prior to filing an NOI or AFC. During the review and certification process the CEC prepares an environmental impact report (EIR) in compliance with the procedures of the California Environmental Quality Act (CEQA).</p> <p>The Commission has compiled relevant local, regional, state and federal land use, public safety, environmental, and other standards to be met in designing, siting, and operating facilities. Except for air and water quality the adopted standards may be different from or be more stringent than those adopted by local, regional or other state agencies or by federal agencies if permitted by federal law.</p> <p>Both geothermal and nongeothermal NOI and AFC procedures require substantial environmental considerations although the emphasis and manner defined for presentation varies. Nevertheless environmental considerations must address:</p> <p>Air Quality; Hydrology, water quality and water supply; Geology and seismicity; Agriculture and soils; Biological resources; Noise; Cultural resources; Social and economic effects; and Health and Safety.</p>

POWER PLANT SITING

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During review for certification, the CEC consults the following agencies and considers the following codes, regulations and standards with respect to particular environmental concerns.

AIR QUALITY:

Lassen County Air Pollution Control District (LCAPCD)

Rules and Regulations of the Lassen County Air Pollution Control District
October 1, 1971

The county Air Pollution Control District is considered the lead agency regarding air quality impact determination by the CEC and the California Air Resources Board (CARB). A Determination of Compliance by the County Air Pollution Control Officer (APCO) is considered evidence of compliance with CEQA, NEPA and California Health and Safety Code and California Air Resources Rules.

The Rules and Regulations of the Lassen County Air Pollution Control District currently require an Authority to Construct and a Permit to Operate "any article, machine, equipment or other contrivance, the use of which may cause the issuance of air contaminants or the use of which may eliminate or reduce or control the issuance of air contaminants".

Northeast Plateau Air Basin Plan
Clean Air Act 42 USC 7401 et. seq.

The APCO applies the New Source Review Rule as adopted by the Northeast Plateau Air Basin regarding emission limitations and standards under the Clear Air Act. Thus "a net increase in emissions of 250 or more pounds during any one day of any pollutants for which there is a national ambient air quality standard (NAAQS), excluding CO, or any precursor of such a pollutant; or a net increase in emissions of 2500 or more pounds during any day of CO" requires application of best available control technology (BACT).

Air contaminants according to the Lassen County regulations include smoke, charred paper, dust, soot, grime, carbon, aerosols, noxious acids, fumes, gases, odors or particulate matter, or any combination thereof. Combustion contaminants or particulate matter discharged into the atmosphere from the burning of any kind of material containing carbon in a free or combined state.

Emission prohibitions of the Lassen County APCD rules limit:

Lassen County APCD Rule 4.0
Lassen County APCD Rule 4.2

Lassen County APCD Rule 4.3
Lassen County APCD Rule 4.4a
Lassen County APCD Rule 4.4b
Lassen County APCD Rule 4.4c
Lassen County APCD Rule 4.10
Lassen County APCD Rule 4.12

Visible emissions;
Emission of air contaminants or other materials which cause injury, a detriment, a nuisance or annoyance;
Particulate matter;
Sulphur compounds;
Combustion contaminants;
Combustion gases;
Burning gaseous fuel containing defined amounts of sulphur; and
Dust and fumes exceeding defined amounts.

It has been reported that the LCAP regulations are being revised in accordance with those of other Air Pollution Control Districts. No substantial changes in requirements or practices are anticipated.

Applicability of the Rules and Regulations of the Lassen County Air Pollution Control District to the GeoProducts/DWR Hybrid Power Plant must be determined from technical analysis of plant construction and operating conditions.

POWER PLANT SITING

<u>AGENCY</u>	<u>CODE, ACT OR LAW</u>	<u>APPLICABILITY</u>
Environmental Protection Agency (EPA)	Reorganization Plan No. 3 of 1970 December 2, 1970 42 USC Section 1857 C-6 Title 40, Chapter 1, Subchapter C Parts 50, 60 and 61 The Clean Air Act of 1970: Public Law 91-604 Amended 1977: Pub. Law 95-95, 127(a) Pub. Law 91 Stat. 731 Pub. Law 95-190, 14(a) Pub. Law 91 Stat. 1401	<p>The Agency's mission is to control and abate pollution in the areas of air, water, solid waste, noise, radiation and toxic substances. In practice, the EPA, in accordance with NEPA seeks to enforce the requirements of the Clean Air Act of 1970 as amended 1977.</p> <p>In lieu of a State Implementation Plan (SIP) the EPA has implemented a Prevention of Significant Deterioration (PSD) Approval to Construct. In application of PSD, facilities are required to show use of best available control technology (BACT) to abate identified pollutants in accordance with the National Ambient Air Quality Standards (NAAQS), Standards of Performance for New Stationary Sources (NSPS) and National Emission Standards for Hazardous Air Pollutants (HESHAP).</p> <p>If a stationary plant emits 250 tons per year or more of a pollutant, BACT will be required to reduce those emissions.</p> <p>Pollution limitations are imposed according to the ambient air increments in areas designated as Class I, II or III. International Parks, National wilderness areas exceeding 5,000 acres, National memorial parks exceeding 5,000 acres and National parks exceeding 6,000 acres are designated Class I. All other areas are initially designated Class II with provisions for redesignation.</p> <p>Applicability of PSD/BACT requirements to the GeoProducts/DWR Hybrid Power Project must be determined from technical analysis of plant operating conditions. Considerations must also be given to the proximity of wildlife preserves and wilderness areas which may be impacted by the project.</p>
HYDROLOGY, WATER QUALITY AND WATER SUPPLY:		
Lahontan Regional Water Quality Control Board (LRWQCB)	Porter-Cologne Water Quality Control Act Title 23 CAC Chapter 3, Sub- chapter 15 SWRCB Non-Degradation Policy Resolution No. 68-16, Oct. 28, 1968 Federal Water Pollution Control Act Pub. Law 92-500 33 USC 1321	<p>The Regional Water Quality Control Board is mandated by the State Water Resources Control Board (SWRCB) to issue Waste Discharge Requirements to dischargers of liquid wastes who affect water quality, including both surface waters and ground waters. The Regional Boards are authorized to issue waste discharge permits under provision of federal law.</p> <p>A Surveillance and Monitoring Program checks for compliance, conducts aerial surveillance and coordinates data from other state and federal agencies.</p> <p>Enforcement includes issuance of administrative clean up and cease-and-desist orders and/or referral to Attorney General for court action.</p> <p>In addition to acquisition of waste discharge permits a Contingency Plan for Accidental Spills and Discharges must be developed and approved.</p> <p>Of particular concern is sedimentation of surface waters and contamination of both surface water and ground water by toxic and hazardous substances including arsenic, boron, cadmium, chromium, copper, lead, mercury, zinc and biological contaminants.</p>

POWER PLANT SITING

<u>AGENCY</u>	<u>CODE, ACT OR LAW</u>	<u>APPLICABILITY</u>
AGRICULTURE AND SOILS:		
State Solid Waste Management Board (SWMB).	Waste Discharge Requirements for Nonseverable Waste Disposal to Land, 1980. Sections 65714, 66714.1 and 66719 of GAC.	The basic mission of the Solid Waste Management Board (SWMB) is to protect California from environmental degradation of the land due to improper disposal of wastes. The Board is responsible for the statewide development, implementation and enforcement of minimum standards and policies for solid waste management. The Board is designated the lead agency for solid waste under the Federal Government Resources Conservation and Recovery Act (RCRA). The Board continuously monitors to correct deficiencies of existing and proposed waste disposal facilities. The GeoProducts/DWR Hybrid Power Project will generate a substantial amount of solid waste material for disposal. The amount of material, primarily ash residue and sludge from water treatment, and analysis for toxic and/or hazardous substances will dictate the manner of disposal. A classified land fill disposal site, as administered by the SWMB, will most likely be required.
BIOLOGICAL RESOURCES:		
U.S. Fish and Wildlife Service Department of Interior	Fish and Wildlife Act of 1956 70 Stat. 1119. Reorganization Plans No. 3 and 4 1974 88 Stat. 92. Ecological Reserve Act of 1970. Endangered Species Act of 1970 and 1973 Pub. Law 93-205.	As the Nation's principal conservative agency, the Department of Interior has responsibility for most of our natural resources. The Fish and Wildlife Service is responsible for protecting wild birds, mammals, inland sport fisheries and preserving the environment. Environmental impacts are assessed with respect to protected rare and endangered species.
California Department of Fish and Game	Fish and Game Code, Sections 2050-2055. California Endangered Species Act of 1970. Fully Protected Species Act Fish and Game Code, Sections 3511, 4700, 5000, 5050 and 5515.	The Department of Fish and Game has responsibilities for protection, conservation, propagation, and enhancement of California's wildlife resources. The Department cooperates with and aids local and other governmental agencies in acquiring and developing projects for recreation and for conservation of wildlife. The GeoProducts/DWR Hybrid Power Plant is proposed to be located near a waterfowl refuge and proposed wilderness area. Not only will a comprehensive study of the project area be required but a determination of potential impact on surrounding environs to assure preservation of uncommon, threatened and endangered (UTE) plants and wildlife species.
NOISE:		
Lassen County Planning Department	Basic Zoning Ordinance 293	A condition of county Use Permit is compliance with limitations on noise which may constitute an annoyance or health hazard.

POWER PLANT SITING

<u>AGENCY</u>	<u>CODE, ACT OR LAW</u>	<u>APPLICABILITY</u>
California Division of Industrial Safety, Occupational Health.	California Occupational Safety and Health Act, 1973. Cal-OSHA Noise Regulations 8 CAC Sections 5095 et. seq. Cal. Vehicle Code, Sections 23130. Federal Occupational Safety and Health Act, 1970.	The CAL-OSHA is designated as responsible for administration of the Federally-approved occupational safety and health program, and is sole enforcement agency for CAL-OSHA standards. Noise regulations and concerns will prevail during geothermal resource development, power plant construction and operation. Determinations of noise emissions are required, measures to mitigate noise identified and a monitoring program developed.
CULTURAL RESOURCES:		
California Energy Commission (CEC)	National Historic Preservation Act 16 USC 470 et. seq. 36 CFS 800 et. seq. Native American Historical, Cultural and Sacred Sites CAL-PRC Section 5097.9 et. seq.	The CEC in its determination of plant siting during the NOI/AFC process considers the potential impacts on identified cultural resources. Cultural resources are considered those properties having archaeological, historical, or ethnographic significance or of unique religious or scientific value. During plant site selection and for submission to the CEC for site certification, cultural resources listed, declared eligible for or nominated to the National Register of Historical Places must be identified within the project environs. A survey of archaeologic and ethnographic significant locations must be performed and Native American consultants contacted.
SOCIAL AND ECONOMIC EFFECTS:		
California Energy Commission (CEC)	Title 20 CAC, Chapter 2, Subchapter 5 Information Requirements for NOI/AFC Lassen County Basic Zoning Ordinance 293.	The CEC in its determination of plant siting during the NOI/AFC process requires a determination of the social and economic effects of the proposed project on the local community. In particular the applicant is required to investigate compliance with present and proposed future land use and identify locations of municipal, county, regional, state and federal parks, recreational areas, scenic areas, wildlife sanctuaries, religious sanctuaries or natural areas in the vicinity of the proposed project. Economic impacts of the project are determined by evaluation of project construction and operation on labor requirements and availability, potential immigration, the local economy and availability of public services.

POWER PLANT SITING

<u>AGENCY</u>	<u>CODE, ACT OR LAW</u>	<u>APPLICABILITY</u>
Lassen County Department of Public Works	Uniform Building Code, 1976 Ed. Chapter 70	A Grading Permit must be obtained and county inspection provided for grading and excavation as set forth in the Uniform Building Code adopted by the State of California Regulations for cuts, fills, compaction and drainage as defined. A Soil Engineering Report, an Engineering Geology Report and Final Reports are prepared as the Building Official may require.
		A winter grading moratorium may be identified as a condition of the Use Permit required from the County to mitigate erosion and sedimentation of surface waters.
Lassen County Public Health Department	Lassen County Health and Safety Ordinance	A Sanitary Permit must be obtained for sewage disposal to assure surface water and ground water will not be contaminated.
U.S. Environmental Protection Agency (EPA)	Reorganization Plan No. 3 of 1970 December 2, 1970 42 USC Section 1857 C-6 Title 40, Chapter 1, Subchapter C Parts 50, 60 and 61 WPQA: Pub. Law 92-500 86 Stat. 816 33 USC 466 et. seq.	The Agency is mandated to control and abate water pollution. In accordance with NEPA the EPA seeks to enforce the requirements of the Federal Water Pollution and Control Act (WPQA) of 1972. Design, construction and operation of the GeoProducts/DWR Hybrid Power Plant must, to prevent impact on water quality, consider plant location with regard to topography, water shed and proximity to environmentally protected surface waters and ground water. In particular grading and fills for site preparation, erosion control, drainage, precipitation from cooling tower plume and discharge of toxic or hazardous material from plant operations.
GEOLOGY AND SEISMICITY:		
California Energy Commission (CEC)	Title 20 CAC Section 1701 et. seq. PRC Section 25000 et. seq. Uniform Building Code, 1976 Ed. (UBC 76), excepting Sections 2312 (Note: The UBC 76 is adopted as the minimum legal state building standard.) American Society of Mechanical Engineers' Boiler and Pressure Vessel Code (ASME BPV Code) (Note: The ASME BPV Code is adopted by Title 8, CAC.) American National Standards Institute "B 31.1 Power Piping Code" (ANSI B 31.1). American Concrete Institute (ACI) "Building Code Requirements for Reinforced Concrete (ACI 318-77). ACI "Building Code Requirements for Structural Plain Concrete" (ACI 322-72).	The CEC in its siting determination considers the geology, stratigraphy and seismicity of the proposed power plant site with regard to safety and reliability. Of particular concern is the characteristics of the site with regard to structural integrity, resistance to seismic movement and shock, and potential subsidence upon withdrawal of geothermal resource. Proximity of earthquake faults, though inactive, and ground water in the area of the proposed site for the GeoProducts/DWR Hybrid Power Plant may prove to be problems in obtaining certification by the CEC. Tectonic, geological and seismic investigations will be required, upon which seismic design criteria will be developed for foundations and structures of the plant.

POWER PLANT SITING

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ACI "Commentary on Building Code Requirements for Reinforced Concrete" (ACI 318C-77).

American Institute of Steel Construction (AISC) "Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings", Nov. 1978 (AISC 78).

AISC "Commentary on the Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings" (AISC C 78).

AISC "Specification for Structural Joints Using ASTM A325 or A490 Bolts", April 1978 (AISC SST 78).

American Iron and Steel Institute (AISI) "Specification for the Design of Light Gauge Cold Formed Steel Structural Members" (AISI).

Steel Joist Institute "Standard Specifications and Load Tables" (SJI).

American Welding Society "Structural Welding Code AWS D.1.1-79" (AWS D.1.1-79).

American Welding Society AWS D12.1-75 "Reinforcing Steel Welding Code".

"National Design Specification for Stress-Grade Lumber and Fastenings 1977" (NDS 77).

POWER PLANT SITING

<u>AGENCY</u>	<u>CODE, ACT OR LAW</u>	<u>APPLICABILITY</u>
PUBLIC HEALTH & SAFETY:		
California Division of Occupational Safety & Health (CAL-OSHA)	California Occupational Safety & Health Act, 1973. Title 8, CAC Ch. 4. Federal Occupational Safety & Health Act, 1970. Safety Regulations, CAL LAB Code Section 7620. Title 8, CAC General Safety Order 3203. Construction Safety Order 1509 by CAL-OSHA.	The Division enforces the State Labor Code, the CAL-OSHA Act of 1973 and the job safety and health standards of the California Administrative Code. Under agreement with the U.S. Department of Labor the Division implements the Federal OSHA Act of 1970.
California Air Resources Board (ARB)	Ambient Air Quality Standards CAL Health & Safety Code, Section 425, 39602 and 39606. ARB Rule 1609 regarding Sulfates.	An Accident Prevention Program must be developed for the GeoProducts/DWR Power Plant construction and operation in accordance with CAL-OSHA requirements. A determination of ambient concentrations of pollutants and extent of potentially toxic or hazardous materials used in, discharged or emitted from the proposed plant identified.