



MAR 13 1978

UNITED STATES
DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY
Area Geothermal Supervisor's Office
Conservation Division, MS 92
345 Middlefield Road
Menlo Park, CA 94025

MAR 8 1978

Memorandum

To: INTERESTED PARTIES

From: ^{Acting} Area Geothermal Supervisor

Subject: Supplemental Plan of Operation, Aminoil USA, Inc., Multiple Well Drill Site No. 3, Federal Lease CA-958, Geysers-Calistoga KGRA, Lake County, CA Ref: 1760 CA-958 POO Drill Site EA#87-8

Aminoil USA, Inc., has submitted Supplement III (copy enclosed) to a previously approved Plan of Operation (approved November 1, 1974), in accordance with 30 CFR 270.34, to construct multiple well drill site, access road, install steam transmission line, and drill two or more 2438 meter (8,000')± geothermal resource wells on Federal Lease CA-948, in the Geysers-Calistoga KGRA, Lake County, CA.

Environmental Analysis 87-8 will be prepared for the proposed action by the office of the Area Geothermal Supervisor. A field inspection is tentatively scheduled for March 29, 1978, at the Union "76" Service Station in Middletown, CA. Uncertainties of weather or other conditions may require rescheduling. Those planning to attend should notify Ted Hudson, Santa Rosa District Supervisor, 777 Sonoma Ave., Room 213, Santa Rosa, CA (Telephone (707) 525-4326, FTS 623-1326), by March 22, 1978. Only those responding by such time will be advised of later changes.

All comments concerning the proposed action must be received no later than April 5, 1978, by:

Area Geothermal Supervisor
Conservation Division
U.S. Geological Survey
345 Middlefield Rd., MS 92
Menlo Park, CA 94025

We urge you to send written commentary and will appreciate hearing from you even if you are of the opinion that the existing regulations, lease terms, and operational orders provide adequate environmental protection.

Further, we solicit your comments and suggestions on the proposed action. All comments will be given serious consideration in the preparation of the Environmental Analysis and any subsequent conditions of approval.

The Area Geothermal Supervisor's Office will not send a draft Environmental Analysis to interested parties for review for the proposed action. Certain parties however, such as the surface managing agency, the lessee, GEAP, and USFWS will receive a copy of the completed EA. Other interested parties will not receive a copy of the final EA unless such parties comment on the proposed action in writing or request a copy of the particular EA pursuant to the Freedom of Information Act. Copies of Environmental Analyses are available for inspection during normal business hours at the Area Geothermal Supervisor's Office, the Santa Rosa District Geothermal Supervisor's Office, and the Ukiah BLM District Manager's Office.

Barry A. Boudreau

INTERESTED PARTIES EA #87-8
Geysers-Calistoga KGRA
Lake County, California

Aminoil USA
Plan of Operation

Supplement III for a multiple well drill pad site, segments of a steam transmission pipeline, and two or more geothermal resource wells (Federal Lease CA-958)

U. S. Bureau of Land Management
District Office
555 Leslie Street
Ukiah, CA 95482
(707) 462-3873

USGS-Conservation Division
Attn: Ted Hudson
District Geothermal Supervisor
777 Sonoma Ave., Federal Bldg., Rm 213
Santa Rosa, CA 95404
(707) 525-4326
FTS: 8-623-1326

USGS-Conservation Division
Conservation Manager, Western Region
Attn: Environmental Staff
345 Middlefield Road, MS 80
Menlo Park, CA 94025
(415) 323-8111, Ext. 2093
FTS: 467-2093

USGS-Conservation Division
Attn: Henry Cullins
Area Geologist, Pacific Area
345 Middlefield Road, MS 80
Menlo Park, CA 94025
(415) 323-8111, Ext. 2563
FTS: 467-2563

Geothermal Environmental Adv. Panel
Attn: Max Crittenden, Chairman
345 Middlefield Road, MS 75
Menlo Park, CA 94025
(415) 323-8111, Ext 2317
FTS: 467-2317

U.S. Bureau of Land Management
State Director
Federal Office Bldg.
2800 Cottage Way, Rm E-2841
Sacramento, CA 95825
(916) 484-4676
FTS: 468-4676

U.S. Bureau of Land Management
Geothermal Specialist
Attn: Theodore W. Holland
Denver Federal Center, Bldg 50 (D-3)
Denver, CO 80225
(303) 234-5098
FTS: 234-5089

U.S. Fish and Wildlife Service
Office of Biological Services
Attn: L. A. Mehrhoff
Geothermal Advisor - Region I
4620 Overland Road, Rm 210
Boise, Idaho 83705
(208) 834-1931
FTS: 554-1931

U.S. Fish and Wildlife Service
Attn: Felix Smith, Field Supervisor
2500 Cottage Way, Rm E-2727
Sacramento, CA 95825
(916) 484-4731
FTS: 468-4731

U.S. Department of Energy
Div. of Geothermal Energy, 3rd Floor
Attn: A. G. Follett
20 Massachusetts Ave., NW
Washington, D. C. 20545
(202) 376-1690
FTS: 376-1690

U.S. Environmental Protection Agency
Environmental Monitoring & Support I
Attn: Michael O'Connell
P.O. Box 15027
Las Vegas, NV 89114
(702) 736-2969
FTS: 595-2969

State of California
Dept. of Fish & Game
Attn: Don Lollock
1416 Ninth St.
Sacramento, CA 95814
(916) 455-1383
FTS: 465-1383

State of California
Dept. of Fish and Game
Attn.: John Emig
P.O. Box 47
Yountville, CA 94599
(707) 944-2443

State of California
Division of Oil and Gas
Attn: Jack Miller
240 "D" Coddington Center
Santa Rosa, CA 95401

State of California
Dept. of Parks and Recreation
States Resources Agency
Attn: Knox Mellon, SHPO
P.O. Box 2390
Sacramento, CA 95811
(916) 445-2358

State of California
Calif. Regional Water Quality
Control Board
North Coast Region
Attn: David Snetsinger
1000 Coddington Center
Santa Rosa, CA 95401
(707) 545-2620

State of California
Water Resources Control Board
Attn: Alvin Franks
P.O. Box 100
Sacramento, CA 95801

Sonoma County Planning Director
Attn: Tom Cordill
County Adim. Bldg., Room 105A
255 Mendocino Ave.
Santa Rosa, CA 95401
(707) 527-2412

Lake County Planning Director
Attn: Don Johnson
255 N. Forbes St.
Lakeport, CA 95453
(707) 263-5471, Ext. 248

State of California
Governor's Office of Planning
and Research
State Clearing House
Attn: Bill Kirkham
1400 Tenth St.
Sacramento, CA 95814
(916) 445-0613
FTS: 465-0613

AMAX Exploration
Attn: Larry Hall
4704 Harlan St.
Denver, CO 80212
(303) 433-6151

Anadarko Production Company
Attn: John Syptak
P.O. Box 1330
Houston, TX 77001
(713) 526-5421

Calif. Energy Company, Inc.
Attn: Paul V. Storm
P.O. Box 3909
Santa Rosa, CA 95402
(707) 526-1000

Chevron USA, Inc.
Attn: J.G. Turner/P. Smith
P.O. Box 3722
San Francisco, CA 94119
(415) 894-2726

Dresser Industries
MAGCOBAR Division
Attn: Jim Fox
475 17th St., Suite 1600
Denver, CO 80202

Earth Science Laboratory
University of Utah Research Institute
Research Park
391 Chipeta Way
Salt Lake City, UT
(801) 581-5226

Energy and Natural Resources Consultants
Attn: Richard Jodry
P.O. Box 941
Richardson, TX 75080

Geothermal Power Corp.
Attn: Frank G. Metcalfe
P.O. Box 1186
Novato, CA 94947
(415) 897-7833

GeothermEx, Inc.
Attn: James B. Koenig
901 Mendocino Ave.
Berkeley, CA 94707
(415) 524-9242

Getty Oil Company
Attn: Dan W. Sparks
P.O. Box 5237
Bakersfield, CA 93308
(805) 399-2961

Gulf Mineral Resources Co.
Exploration Department
Attn: E.W. Westrick
1720 S. Bellaire St.
Denver, CO 80222
(303) 758-1700

Hydro-Search, Inc.
Attn: Virgil Wilhite
333 Flint St.
Reno, NV 89501
(702) 322-4173

ICF, Inc.
Attn: Doug Fried
1990 M Street, NW
Washington, D.C. 20036
(202) 785-3440

Mr. Clyde E. Kuhn
2207 Carroll St., Apt. 3
Oakland, CA 94606
(415) 451-3714

Magma Power Company
Attn: Dick Foss/Tom Hinrichs
631 S. Witmer St.
Los Angeles, CA 90017
(213) 483-2285

Mr. Jack McNamera
Law Center, Room 422
University of Southern California
Los Angeles, CA 90007
(213) 741-7569

Occidental Geothermal, Inc.
Attn: B.J. Wyant
5000 Stockdale Highway
Bakersfield, CA 93309
(805) 327-7351

Phillips Petroleum Company
Attn: R.L. Wright
P.O. Box 752
Del Mar, CA 92014
(714) 755-0131

Republic Geothermal, Inc.
Attn: Dwight Carey
P.O. Box 3388
Santa Fe Springs, CA 90670
(213) 945-3661

Republic Geothermal, Inc.
Attn: J.L. Sheidenberger
2544 Cleveland Avenue
Santa Rosa, CA 95401
(707) 527-7755

Shell Oil Company
Attn: Fred Nantker
Worldway Center
P.O. Box 92047
Los Angeles, CA 90009
(805) 648-2751

Sunoco Energy Development Co.
Attn: C.T. Clark, Jr.
12700 Park Central Pl., Suite 1500
Dallas, TX 75251
(214) 233-2600, Ext. 515

Thermal Power Company
Attn: K.R. Davis
601 California Street
San Francisco, CA 94108
(415) 981-5700

Union Oil Company of California
Geothermal Division
Attn: Neil J. Stefanides
Union Oil Center, Box 7600
Los Angeles, CA 90051

Union Oil Company
1250 Coddington Center
P.O. Box 6854
Santa Rosa, CA 95406
(707) 542-9543

bcc: Subj. file 1760 CA-958 (EA#87-8)
OPE (3)
ENG
ENV
Reading file 101-02

Aminoil USA, Inc.
P.O. Box 11279
Santa Fe, California 97519
707-827-5331

AMINOIL USA

February 3, 1978

U. S. Department of Interior
Geological Survey
Conservation Division
345 Middlefield Road
Menlo Park, CA 94025

Attention: Mr. Reid T. Stone
Area Geothermal Supervisor

Gentlemen:

Pursuant to 30 CFR 270.34, enclosed in triplicate is Supplement III, which further supplements and amends the Aminoil USA, Inc. (formerly Burmah Oil and Gas Company) Plan of Operation and Supplement I to the Plan of Operation for Federal Lease Unit 10 CA 958, submitted September 26, 1974 and October 10, 1974 and approved by USGS letters of October 10, 1974 and November 1, 1974 respectively.

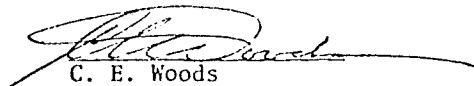
Sundry Notice will be filed pursuant to 30 CFR 270.72 for specific construction projects as defined in Supplement III to the Plan of Operation under separate cover. Sundry Notices will be appended with appropriate soils engineering and geological investigation reports, construction and design specifications and engineering drawings.

An application for Permit to Drill (form 9-331 c) will be filed pursuant to 30 CFR 270.71 under separate cover for the respective CA 958 and CA 956 wells. The application for Permit to Drill will be appended with a drilling program summary, appropriate references and a plat showing well locations.

Lease Unit 10 CA 958 and lease Unit 8 CA 956 were included in the area covered by the "Environmental Impact Report, Castle Rock Springs, Geothermal Steam Area, Burmah Oil and Gas Company (now Aminoil USA, Inc.), Lake County, California", prepared by Atlantis Scientific August 22, 1975 and certified by the County of Lake, March 18, 1976.

Upon approval of the Plan of Operation, both the USGS and the BLM will be notified by Aminoil prior to commencement of any operations.

Yours very truly,


C. E. Woods

CEW:aa
ENC:

PLAN OF OPERATION
SUPPLEMENT III
3 February 1978

Lease Unit 10 CA 958
Geysers Area KGRA
Lake & Sonoma Counties
California

30 CFR 270.34

Aminoil USA, Inc.

AMINOIL USA, INC.
PLAN OF OPERATION
LEASE UNIT 10 CA 958
SUPPLEMENT III

Pursuant to 30 CFR 270.34, Aminoil USA, Inc., formerly Burmah Oil and Gas Company, hereby submits a third revision which further supplements and amends the Plan of Operation for Lease Unit 10 CA 958 submitted September 26, 1974 and approved October 10, 1974 and the Supplement I to the Plan of Operation for Lease Unit 10, CA 958 submitted October 9, 1974 and approved November 1, 1974.

Aminoil USA, Inc. has been duly designated operator of Lease Unit 10 CA 958 by the lessee, Occidental Petroleum Corporation (designation of Operator, September 25, 1974).

Project Description

Aminoil USA, Inc., Geothermal Division, proposes to construct an access road, a multiple well drill pad site, segments of a steam transmission pipeline and drill two or more geothermal resource wells to a depth of + 8000 feet from Lease Unit 10 CA 958 in the Geysers KGRA, Lake and Sonoma Counties, California (Exhibit A). The planned drill pad site, access road and pipeline segments are shown on Exhibit "B", which also depicts the topography of the leased and surrounding lands, boundary of Federal Lease Unit 10 CA 958, boundary of Federal Lease Unit 8 CA 956, drainage patterns, existing road systems, elevations and section lines and existing Aminoil wells.

The proposed multiple well pad site is to be constructed on Lease Unit 10 CA 958 at a location being approximately 750 feet north and 1650 feet east of the southwest corner of Section 34, Township 11 North, Range 8 West, MDB & M, Sonoma County, California. Location for the drill pad was selected and designed to utilize existing topographic features and to minimize grading and environmental impacts. All proposed earthwork has been designed to provide balanced cuts and fills. Sundry Notice was filed with the United States Department of Interior, Geological Survey, Menlo Park, June 1, 1977 and approved June 28, 1977 providing for Notice of Intention to excavate three exploratory trenches in the vicinity of the proposed pad site to determine soil suitability and stability. The "Soil Engineering and Geological Investigation" performed by Hawke Engineers, San Francisco, California (copy on file with USGS, Menlo Park), resulted in the determination that with properly engineered cuts and fills and drainage, a stable drill site and waste disposal sump could be constructed at the proposed location. Careful geological reconnaissance of the proposed site has revealed no evidence of landslide or soil creep within the areas of major construction. Of the two wells now proposed to be drilled from the pad site, the CA 958 well is proposed to be drilled to a bottom hole location on Lease Unit 10 CA 958 and the CA 956 well to be directionally drilled to a bottom hole location under Lease Unit 8 CA 956.

The proposed access road extends approximately 2700 feet, commencing at a point along an existing road being approximately 1150 feet north and 2100 feet west of the southeast corner of Section 34, Township 11 North, Range 8 West, MDB & M, Sonoma County, California and traverses in a general southwesterly direction across Lease Unit 8 CA 956 and Lease Unit 10 CA 958 to a point terminating at the proposed well pad site. The proposed road alignment is to follow the natural contours of the land with grades limited to 15 percent and utilize any existing trails where possible to minimize environmental impacts. The road width is to be limited to the width required to provide for safe equipment operation and safely accommodate heavy drilling equipment. Turnouts are to be provided at strategic locations. The road has been designed to utilize balance cuts and fills wherever possible.

Construction areas are to be stripped of vegetation and fills are to be benched and keyed into undisturbed ground and compacted to 90% of ASTM D-1557-70 "Moisture Density Relations Test for Soils". Upon completion of grading, cut and fill slopes are to be seeded and hydromulched to control erosion.

The proposed pipeline segments are designed to eventually connect Federal Lease Unit 8 CA 956 and Federal Lease Unit 10 CA 958 steam wells with the steam transmission pipeline system for the Pacific Gas and Electric Company, Geysers Power Plant Unit 13 (Exhibit C). The pipeline segments, as shown on Exhibit A, will follow existing roadways wherever practical to minimize additional disturbance and environmental impacts. Where pipeline segments follow existing roadways, some widening may be required. Where such widening is required and where pipeline segments cross areas apart from roadways, vegetation will be cleared to ground level preserving plant root systems wherever possible and practical to promote rapid regrowth. Pipeline support intervals, expansion loop intervals and general pipeline construction and installation will be in accordance with design specifications as prepared by Hawke Engineers, San Francisco, California and the American National Standard Code for Pressure Piping, Power Piping, ANSI B-31.1, 1977 Edition, published by American Society of Mechanical Engineers.

All proposed new construction including drill pad site, access road alignment and pipeline segment routes will be flagged for appropriate inspection by USGS and BLM personnel prior to commencement of operations.

As specified in each geothermal lease, a competent archeological firm was consulted and has performed an archeological reconnaissance of Aminoil's Federal leaseholds. The report "Archeological Assessment of Cultural Resources of Geothermal Leaseholds in the Lake and Sonoma Counties, California" prepared by Ann S. Peak, Consulting Archeologist, October 27, 1974, under Antiquity Permit No. 74 EM 016 (copy on file with USGS, Menlo Park), found that no archeological sites were located within the proposed project area and determined that no impact on cultural resources would occur as a result of proposed construction of facilities required for the development of geothermal resources. Should any artifacts be uncovered during construction activities, Aminoil is prepared to take appropriate mitigative measures as provided in the Supplement to the Plan of Operation for Lease Unit 10 CA 958 as submitted October 9, 1974 and approved by USGS letter of November 1, 1974.

A report to Shell Oil Company "Observations on Populations of the rare *Streptanthus Morrisonii* Complex in The Central and Southern Mayacmas Mts., Lake, Sonoma and Napa Counties, California" by Dr. James A. Neilson, PhD., May 15, 1977,

located a small population (15) of unidentified *Streptanthus* variant and a population (57) of *Streptanthus majorii* which extended onto Federal Lease Unit 8 CA 956 in the vicinity of the proposed access road and drill pad site. A rare plant survey (Exhibit D) was conducted for Aminoil by Western Ecological Services Company, San Rafael, California, along the proposed access road and well pad site between July 30 and August 19, 1977. A thorough search of the serpentine barrens along the construction route revealed no populations of the rare *Streptanthus morrisonii* complex. The report, "A Rare Plant Survey of the Aminoil Well Pad Access Road", Barbara Malloch, August 30, 1977, recognized the serpentine plant association as a unique feature of the California landscape and though the serpentine along the proposed construction route did not support any rare and endangered plant species, it did support a characteristic association of serpentine dependent species. The serpentine barrens, which support the most delicate of these plants, have been identified such that care can be taken where the access road crosses these sites to minimize the disturbance of any existing habitat.

The major impact to these areas from installation of the pipeline segments would result from the construction of pipeline supports. Construction of pipeline supports requires minimum areal disturbance and in most cases, where necessary, design parameters would be sufficiently flexible to allow consideration of specifically sensitive locations.

Water Supply And Road Building Material

Water supply for the construction and drilling operations defined in the project would be imported by pipeline or vehicle from sources off Aminoil's Federal leased lands and stored in close proximity to the project operations in a container of sufficient capacity to allow for continuous uninterrupted operations.

Source of road building materials would be as stated in the Supplement I of the Plan of Operations for Lease Unit 10 CA 958 dated October 9, 1974. All earth movement including, but not limited to roads, drill pads and sumps and all revegetation activities will be done in accordance with any Bureau of Land Management, Ukiah District Office recommendations.

Camp Sites, Air Strips and Other Supporting Facilities

Completion of the project as proposed does not alter Aminoil's plan to utilize its support facilities located on adjacent private lands. No new support facilities other than those included in the project definition are presently contemplated by Aminoil to be constructed on Federal lands.

Topographic Features And Drainage Patterns

In general, the area to be disturbed by the project lies at elevations from 2900 feet to 3300 feet. Drainage from the major construction area is basically by unnamed ephemeral tributaries which empty into the upper reaches of Big Sulphur Creek.

Methods For Disposing Of Waste Material

Waste Disposal for the project will be in accordance with methods described in the Supplement I to the Plan of Operation for Lease Unit 10 CA 953 submitted October 9, 1974 and approved November 1, 1974.

Measures For The Protection Of The Environment

Measures for Protection of the Environment will also be in accordance with provisions as described in the Supplement I to the Lease Unit 10 CA 958 Plan of Operation. Contingency plans for (1) Emergency Accidental Spills and Discharge Control Procedures, (2) Emergency Fire Control Procedures, (3) Hydrogen Sulfide Contingency Plan and (4) Blowout Contingency Plan were forwarded under cover letter of July 26, 1977 and are on file at U. S. Department of Interior Geological Survey, Conservation Division MS 92, Menlo Park, California.

All other comments as contained in the Aminoil USA (Burmah Oil and Gas Company) initial Lease Unit 10 CA 958 Plan of Operations as submitted September 26, 1974 and approved October 10, 1974 and the Supplement I to the Plan of Operation Lease Unit 10 CA 958 submitted October 9, 1974 and approved November 1, 1974, continue to be applicable.

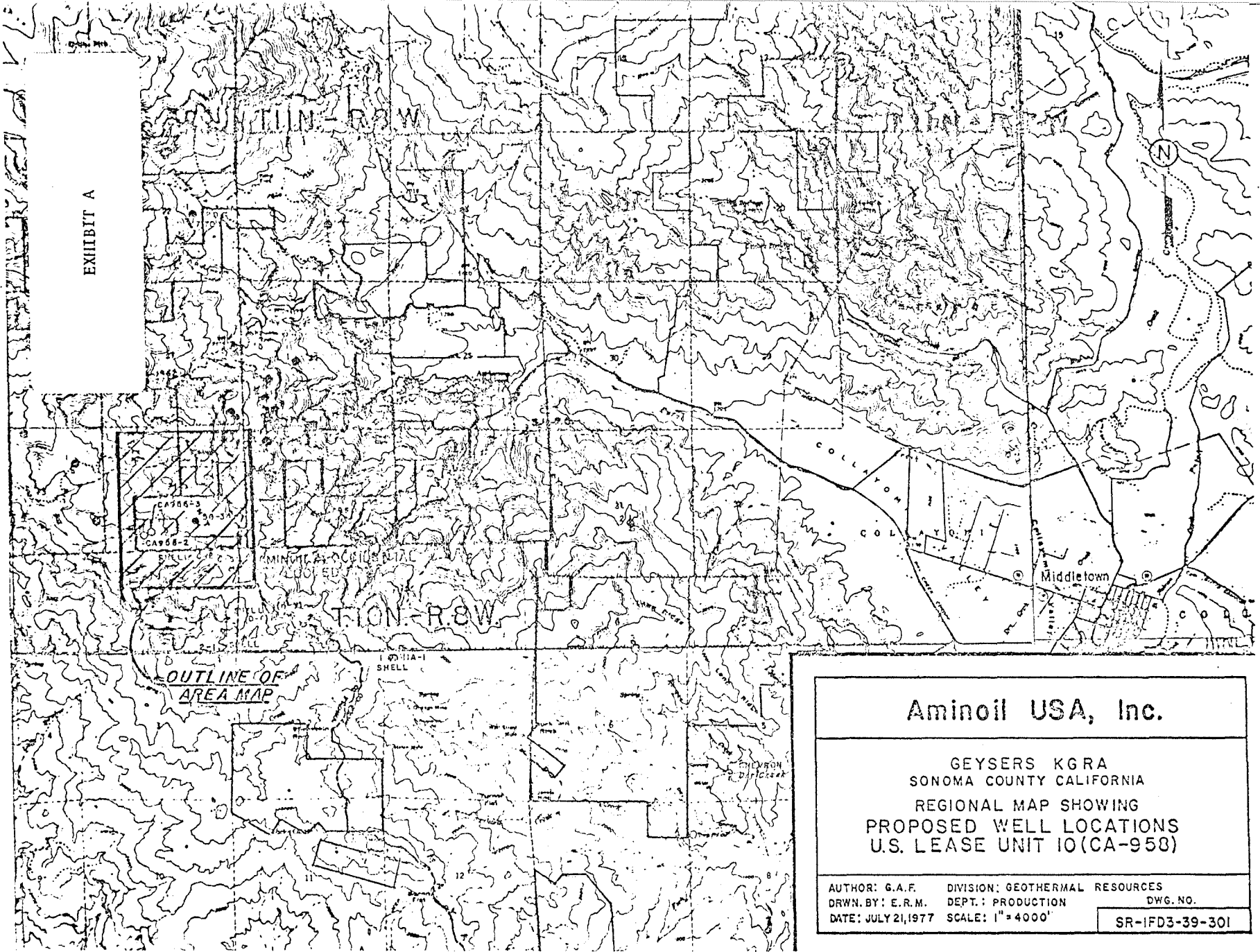


EXHIBIT A

OUTLINE OF
AREA MAP

Aminoil USA, Inc.

GEYSERS KGRA
SONOMA COUNTY CALIFORNIA
REGIONAL MAP SHOWING
PROPOSED WELL LOCATIONS
U.S. LEASE UNIT 10(CA-958)

AUTHOR: G.A.F. DIVISION: GEOTHERMAL RESOURCES
DRWN. BY: E.R.M. DEPT.: PRODUCTION DWG. NO.
DATE: JULY 21, 1977 SCALE: 1" = 4000'

SR-IFD3-39-301



WESTERN ECOLOGICAL SERVICES COMPANY

Sept. 3, 1977

EXHIBIT D

Mr. C.E. Woods
AMINOIL
P.O. Box 11279
Santa Rosa, CA 95406

Dear Mr. Woods:

Enclosed is the rare plant study you requested and recently completed by Mr. Ralph Osterling, and a statement for professional consulting services.

The report discusses the presence of the rare Strepanthus species; the individuals collected on the site were taken to the University of California Herbarium for verification. Unreasonable delays were encountered because experts were absent and because there were very fine differences in rare versus non-rare species. Those collected on-site were confirmed as the non-rare species.

A population of rare and endangered Strepanthus presently exists approximately 150 feet downhill from the proposed road intersection. It is imperative that the road junction not be moved and that construction activities avoid that flat at all costs.

Mr. Osterling extends his appologies for the delay in completing the report. If you have any questions please don't hesitate to contact us or Mr. Osterling.

Sincerely yours,
WESTERN ECOLOGICAL SERVICES COMPANY

Jeffrey H. Peters

Jeffrey H. Peters
Principal

Enclosure

CONSULTANTS IN THE NATURAL ENVIRONMENTAL SCIENCES

natural resource inventories · impact evaluation · applied environmental
studies · environmental management · feasibility analysis
forestry · vegetation survey · forest hydrology · soils · wildlife biology · fisheries · pollution control · water quality

4340 REDWOOD HIGHWAY, SUITE 145 · SAN RAFAEL, CALIFORNIA 94903 · TELEPHONE (415) 479-9392

A RARE PLANT SURVEY OF THE PROPOSED AMINOIL ACCESS ROAD

Barbara Malloch
August 30, 1977

A RARE PLANT SURVEY OF THE AMINOIL WELL PAD ACCESS ROAD

Introduction

Between July 30 and August 19, 1977, a rare plant survey was conducted along a proposed access road to an Aminoil well pad site. The objectives of the survey were to determine which rare plants are known to occur in the vicinity of the proposed road, to conduct a field survey of the proposed route itself for rare plant species, and to identify areas which support rare or unusual species.

For the purposes of this report, a plant is defined as rare if it appears on the main list of the California Native Plant Society's (CNPS) Inventory of Rare and Endangered Vascular Plants of California. The inventory lists about 700 species which are rare in California.

Materials and Methods

Maps prepared by the CNPS were referred to in order to determine which rare plants have been known to occur within three miles of the proposed access road. Ecological information of their habitat was assembled from floral manuals.

The site survey was conducted by walking the proposed route and scanning for rare or unusual plants within 20 feet of the flagged centerline of the road. Notes were taken on habitats, species present, and other features.

Plants were taken to the University of California herbarium at Berkeley for verification by taxonomic experts.

Results and Discussion

Based on information from the CNPS maps and Inventory, two rare species are known to occur in the region of the study area. These are the Cobb Mountain lupine, Lupinus sericatus, and the Contact Mine streptanthus, Streptanthus brachiatus. The lupine's habitat is open wooded slopes in mixed evergreen and yellow pine forest. It is commonly found where logging or other human activities have removed canopy and some understory and where there is some bare soil. The streptanthus is a serpentine endemic; that is, it is found only on soils derived from the parent material serpentine. It occurs on serpentine barrens where the soil is poorly formed, thin and rocky, and where few other plants can survive. Both species are highly restricted geographically, the streptanthus more so than the lupine.

In addition to the plant localities recorded by the CNPS, Dr. James Neilson has reported the occurrence of another rare species from the vicinity, Streptanthus morrisonii, another serpentine endemic. Dr. Neilson has pointed out some of the taxonomic

problems associated with the S. morrisonii complex and is presently preparing a revision of the group. Until such a revision is accepted widely, the most recent by F.W. Hoffmann remains the definitive work on the group Streptanthus.

The proposed access road is located in the southwest quarter of Section 34, Township 11 North, Range 8 West. It extends about 3000 feet from the ridgeline road to the well pad site, with an elevational drop of 273 feet. (Figure 1). A departure from the proposed route was taken from the route near the well pad site. No flagging could be found for the last 300 feet of the road. Along this small portion of the road, a thorough search was made of the general vicinity of the road route as shown on the map.

The proposed road route crosses mainly serpentine chaparral. Dominant species include Stanford manzanita (Arctostaphylos stanfordiana), leather oak (Quercus durata) and Jepson's ceanothus (Ceanothus jepsonii). The chaparral is broken by many small to large barrens where serpentine talus is vegetated only by small herbaceous species of squirreltail (Sitanion hystrix), sickle-leaved onion (Allium falcifolium) and streptanthus (Streptanthus breweri). Portions of the proposed access road cross small stands of McNab cypress (Cupressus macnabiana) and knobcone pine (Pinus attenuata) and where the soil is better developed and moisture more available, there are small meadows supporting wild oats (Avena sp.) and yampah (Perideridia sp.). At the end of the road near the proposed well pad site the vegetation grades into a mixed evergreen forest association, including black oak (Quercus kelloggii) and California bay (Umbellularia californica). In an intermittent stream bed about 200 feet upstream from the proposed well pad site are several large white alders (Alnus oregona). One is over 60 feet tall and has a basal diameter of 35 inches. It is one of the largest the author has observed in The Geysers area.

A thorough search of the serpentine barrens revealed that only the widespread serpentine endemic, S. breweri, was present along the proposed access route. All plants observed were annuals, had small white flowers with purplish venation, and purplish calyces. The siliques were somewhat recurved to reflexed. Due to the lateness of the survey, most of the plants were in fruit and had begun to drop their leaves. Comparison with herbarium material permitted positive identification by taxonomic experts.

Summary of Areas of Special Interest

The intermittent stream above the well pad site is an area of special interest because of the large and very old white alders supports. The trees are impressive because of their size and their remoteness from other alders.

The serpentine plant association is a unique feature of the California landscape. Although this serpentine along the proposed access road site does not support and rare and endangered plant

species, it does support a characteristic association of serpentine-dependent species. The serpentine barrens, the least stable substratum, support the most delicate of these plants. It is recommended that the road be carefully constructed across the barrens to minimize disturbance of the habitat.

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REFERENCES

Abrams, L. 1951. An Illustrated Flora of the Pacific States..
Stanford University Press. 4 vols.

Munz, P.A., and D.D. Keck. 1968. A California Flora. U.C. Press.
1681 pp.

Powell, W.R. (ed.) 1974. Inventory of Rare and Endangered Vascular
Plants of California. CNPS, 56 pp.