LA-UR-02-5009
August 2002

LOS ALAMOS NATIONAL LABORATORY

CLOSURE PLAN FOR FENTON HILL GEOTHERMAL 1-MG SERVICE POND AND EE-2A PRODUCTION WELL

Prepared by:

Los Alamos National Laboratory
Los Alamos, New Mexico 87545

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LIST OF ABBREVIATIONS/ACRONYMS

1-MG	1-million gallon
ft	feet/foot
HDR	Hot Dry Rock Geothermal Project
HSR-1	Health Physics Operations Group
in.	inch(es)
LANL	Los Alamos National Laboratory
NM	New Mexico
NORM	naturally occurring radioactive material
OCD	Oil Conservation Division
P&A	plugging & abandonment
PPE	personal protective equipment
PVC	poly vinyl chloride
SSHSP	Site-Specific Health and Safety Plan
TA	technical area
yd^3	cubic yard(s)

FENTON HILL
GEOTHERMAL 1-MILLION GALLON SERVICE POND AND EE-2A PRODUCTION WELL CLOSURE PLAN

1.0 INTRODUCTION

Los Alamos National Laboratory (LANL) intends to close the 1-million gallon (1-MG) service pond and the EE-2A geothermal production well associated with the Hot Dry Rock (HDR) Geothermal Project at the Technical Area (TA) 57 Fenton Hill site. The TA-57 Fenton Hill site is located approximately 30 miles west of Los Alamos on State Road 126 in Sandoval County, New Mexico, at an elevation of 8,700 feet (ft). Fenton Hill is the site of the first HDR geothermal research experiment in the world and is located at the western margin of the Valles Caldera in Northern New Mexico. The purpose of the experiment was to utilize the natural heat present beneath the surface of the Valles Caldera as geothermal energy for commercial production.

The HDR experiment involved the drilling of two wells into an impermeable rock formation and fracturing the space between the wells. Cold water from the surface was then injected into the first well and heated by geothermal energy from the rock formation. The heated water was returned to the surface through the second well, passed through a turbine or heat exchanger and was re-circulated through the system. The site originally consisted of four wells: two for experimental confirmation of the technology and two for verification of commercial applicability. The HDR experiment has since been concluded and the U.S. Department of Energy has determined that geothermal energy production at the site is cost prohibitive.

This closure plan describes the methods by which the 1-MG service pond and EE-2A production wellhead will be decommissioned. The plugging and abandonment (P&A) of the EE-2A production well is not covered by this closure plan. The closure plan describes existing site conditions, decommissioning procedures for the pond and wellhead, waste management, site characterization, and restoration of the site.

2.0 SITE DESCRIPTION

The 1-MG service pond and EE-2A production well are located in the southwest section of TA-57 as indicated on Figure 1. Detailed photographs of the site are provided in

Table 1
Summary of Analytical Results of Geothermal Fluid Sample from the 1-Million Gallon Service Pond at TA-57 Fenton Hill

Analyte	Result (mg/L) [a]	Maximum Concentration of Contaminants (40CFR 261.24) (mg/L)
Silver	<0.01	5.0
Aluminum	<0.01	NA
Arsenic	3.56	5.0
Boron	22.2	NA
Barium	1.3	100.0
Beryllium	<0.002	NA
Cadmium	<0.01	1.0
Chlorine	7612	NA
Cobalt	<0.01	NA
Chromium	<0.01	5.0
Copper	<0.01	NA
Fluorine	1.26	NA
Iron	0.03	NA
Mercury	0.0003	0.2
Lithium	10.7	NA
Magnesium	134	NA
Manganese	0.039	NA
Molybdenum	0.02	NA
Sodium	3220	NA
Nickel	<0.01	NA
Lead	<0.01	5.0
PH	7.91	NA
Selenium	<0.0002	1.0
Antimony	<0.1	NA
Sulfate	179	NA
Strontium	5.08	NA
Titanium	<0.002	NA
TDS	36,728 [b]	NA
TSS	32.9 [b]	NA
Vanadium	<0.002	NA
Zinc	<0.01	NA

a Sample collected on April 18, 2002.
b Sample collected on July 30, 2002.

NA = not applicable
mg/L = milligrams per liter

2.1.2 Sludge

Fenton Hill project personnel estimate the volume of sludge located in the 1-MG service pond to be approximately 35 cubic yards (yd^3). The exact composition of this material is currently unknown. One representative sample of the sludge will be collected prior to the commencement of closure activities to determine characteristics for waste disposal. This

The closure of the 1-MG service pond and EE-2A production wellhead is not subject to the requirements of the Resource Conservation and Recovery Act because wastes generated due to geothermal exploration are exempt in accordance with 40 CFR 261.4(b)(5). This includes

> *Drilling fluids, produced waters, and other wastes associated with the exploration, development, or production of crude oil, natural gas or geothermal energy.*

The 1-MG service pond contents (i.e., geothermal fluids, and sludge) currently consist of both exempt geothermal fluids and non-exempt Milagro Project wastewater as described in Section 2.1.1. However, the Milagro Project wastewater has been limited to less then 5% of the total volume of the pond, in accordance with the mixing policy of the NM OCD. This maintains the applicability of the exemption for the overall contents of the pond. The mixing of Milagro Project wastewater with the pond contents was approved by the NM OCD on May 10, 1999 in accordance with a LANL request for modification of the Ground Water Discharge Plan GW-031. The request for modification is provided in Appendix E. The NM OCD approval letter is provided in Appendix F.

The LANL Groundwater Discharge Permit GW-031 regulates the P&A of the EE-2A production well. The P&A of the EE-2A production well is outside of the scope of this closure plan.

4.0 HEALTH AND SAFETY REQUIREMENTS

Job hazards associated with closure activities will be identified, controls developed, and workers briefed before closure activities are conducted, in accordance with LANL safety procedures. Personnel involved in closure activities will wear appropriate personal protective equipment (PPE), specified by Health Physics Operations Group (HSR-1) and Industrial Hygiene and Safety Group, and will follow good hygiene practices to protect themselves from exposure to hazardous waste. Minimum PPE requirements will consist of coveralls, steel-toed shoes, and safety glasses. All workers involved in closure activities will be required to have appropriate training including HAZWOPER for general site workers (40 hours and refresher) and TA-57 site specific, as appropriate.

- Removal of approximately 5,800-ft of 4-ft high chain link fence from the perimeter of the pond.
- Removal of the primary and secondary pond liners.
- Excavation and removal of the three concrete reinforced drain bulkheads and piping.
- Excavation and removal of the leak detection piping and fill.
- Excavation and removal of the sump located at the east-end of the pond including the piping connecting it to the pond.
- Excavation and removal of the leak detection well
- Removal of approximately 5 hydrants from the perimeter of the site. These hydrants will be cut and capped below the hydrant assembly. The piping will be abandoned in place.

The fencing, hydrants, concrete, liners, piping, and fill will be staged on-site pending recycling and/or disposal as described in Section 9.0.

5.3.1 1-MG Service Pond Liners

The 1-MG service pond consists of a primary and secondary liner system with leak detection and pads. After the geothermal fluids and sludge have been removed from the 1-MG service pond, the primary liner will be pressure washed to remove any excess sludge. The water will be collected and staged with the sludge on-site for disposal as described in Section 9.0. After the liner is cleaned it will be cut into manageable pieces and removed from the service pond for staging on-site prior to waste disposal. The primary liner will be managed to ensure that it meets solid waste landfill criteria as described in 19 NMAC 15.9.712, prior to disposal.

The secondary liner is located beneath the leak detection system (i.e., gravel, sand, perforated piping). The fill material will be removed from the service pond as described in Section 5.3.2. If any evidence of a breach in the primary liner is present in the fill material, the secondary liner will also be pressure washed to ensure that it meets solid waste landfill criteria for disposal. It will then be cut into manageable pieces and removed from the containment for staging on-site prior to waste disposal. The secondary liner will

The well casing, pipe, and concrete removed during the cutting will be staged on-site to be recycled or disposed at a solid waste landfill. Prior to disposal, the waste from cutting will be surveyed for naturally occurring radioactive material (NORM) by LANL HSR-1 personnel. Results of the survey and written authorization from the NM OCD will be required prior to recycling or disposal of the material in accordance with 19 NMAC 15.9.712.

6.0 SITE CHARACTERIZATION

The 1-MG service pond is identified as PRS 57-004(b) in LA-UR-96-1062, "RFI Report for Potential Release Sites at TA-57" (LANL, 1996). Section 1.2.1.3 of the RFI report indicates that there is no evidence of contaminate release from the 1-MG service pond and that the sediments will be investigated upon decommissioning of the site. Characterization and/or confirmation soil samples may be collected from the soils underneath the liner and around the drain and feed line excavations by the Environmental Restoration Group prior to the commencement of restoration activities at the site.

6.1 Inspection of Surface beneath the Secondary Liner

The ground beneath the secondary liner of the 1-MG service pond will be inspected for moisture accumulation and/or soil discoloration. If any evidence of leakage is detected, the affected soil will be excavated, sampled, and analyzed for contamination. The affected soil will be staged on-site for waste disposal in accordance with the level of contamination as described in Section 9.0.

6.2 Geodetic Survey

A geodetic survey will be conducted of the excavated pond area and all associated structures (i.e., sumps, drains, and the EE-2A production well) following complete removal of all equipment and materials associated with the 1-MG service pond.

7.0 SAMPLING ACTIVITIES

The following sections describe procedures and methods for sampling, analysis, and documentation applicable to closure activities. Sampling will be conducted in accordance with procedures given in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, " *SW-846* (EPA, 1986).

During backfilling and restoration activities, temporary silt fencing and straw bale check dams will be installed, maintained, and routinely inspected. All disturbed areas will be re-seeded according to the LANL seeding specifications provided in Appendix G and in accordance with U.S. Forest Service requirements. A geodetic survey will be conducted at the site following restoration activities.

Upon completion of the restoration activities, LANL will schedule a site inspection for NM OCD officials to finalize approval of the closure.

9.0 WASTE MANAGEMENT

All closure activities will be conducted with waste minimization goals in mind. All waste materials generated will be controlled, handled, and disposed of in accordance with LANL waste management procedures. Several waste streams will be generated during the decommissioning activities associated with this closure plan. Table 2 provides a summary of the anticipated waste streams, the waste type, anticipated volume, and appropriate disposal options.

Table 2
Potential Waste Streams, Types, Volumes, and Disposal Options

Waste Stream	Waste Type	Estimated Volume [a]	Disposal Options
1-MG service pond fluids	Liquid	30,000 –100,000 gallons	• On-site treatment • NM OCD Permitted Facility
Sludge	Solid	35 yd^3	• NM OCD Permitted Facility
Concrete	Solid	10 – 20 yd^3	• LANL Recycle Program • Solid Waste Facility
Piping (metal)	Solid	100-150 ft	• LANL Recycle Program • Solid Waste Facility [b]
Piping (PVC)	Solid	150 – 200 ft	• LANL Recycle Program • Solid Waste Facility
Gravel (Leak Detection System)	Solid	20 – 60 yd^3	• Backfill • NM OCD Permitted Facility
Hydrants/Scrap metal	Solid	<1 yd^3	• LANL Recycle Program
Pumps	Solid	<1 yd^3	• LANL Recycle Program
Liner	Solid	150 –200 yd^3	• Solid Waste Facility

a Estimated from as-built drawings of the 1-MG service pond and EE-2A well casing.
b Must be accompanied by analytical data for NORM and written authorization for disposal from OCD.

ft = feet/foot
LANL = Los Alamos National Laboratory
NM OCD = New Mexico Oil Conservation Division
PVC = polyvinyl chloride
yd^3 = cubic yard(s)

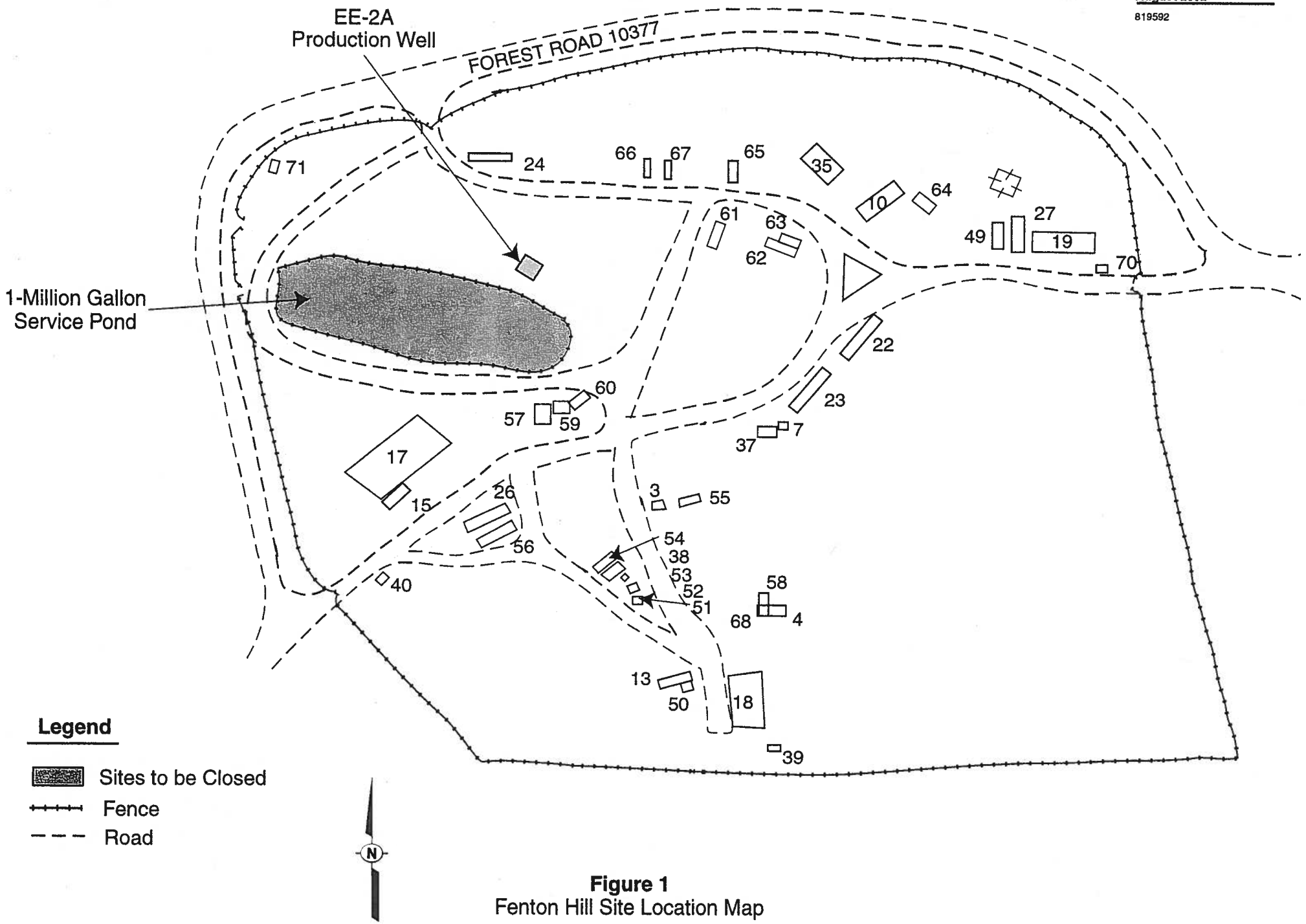


Figure 1
Fenton Hill Site Location Map

Figure 2
1-Million Gallon Service Pond, Site Grading Plan [1989]

WELL NO. 1
NO. 57-45

8.0 DIA. STEEL TANK
RIM ELEV. 8702.71

8.0' DIA. STEEL TANK
RIM ELEV. 8702.79

12" PVC FEED LINE

12" PVC FEED LINE

8696

8695

8694

8695

8692

8683

BASE LINE

TOP OF POND

8694.80

INVERT ELEV. 91.96

INVERT ELEV. 91.57

TOE OF SLOPE

ELEV. 8684° TO 8682°

TOE OF SLOPE

INVERT ELEVATION 90.38

INVERT ELEV. 91.25

TOP OF POND

8695

8694

8690

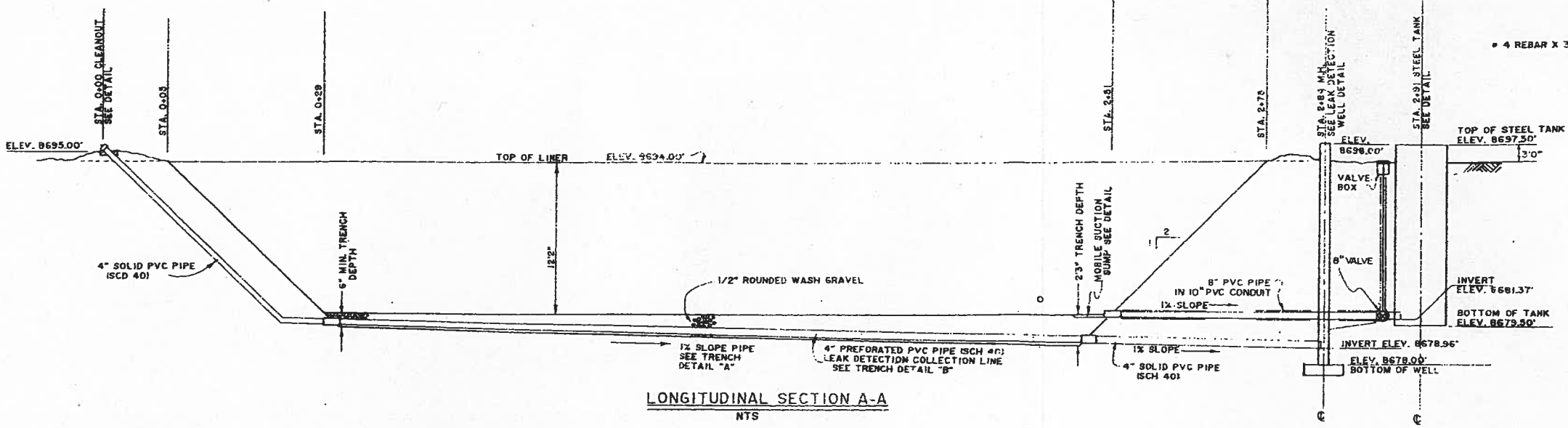
21" x 15" CM PIPE

DRAIN PIPE

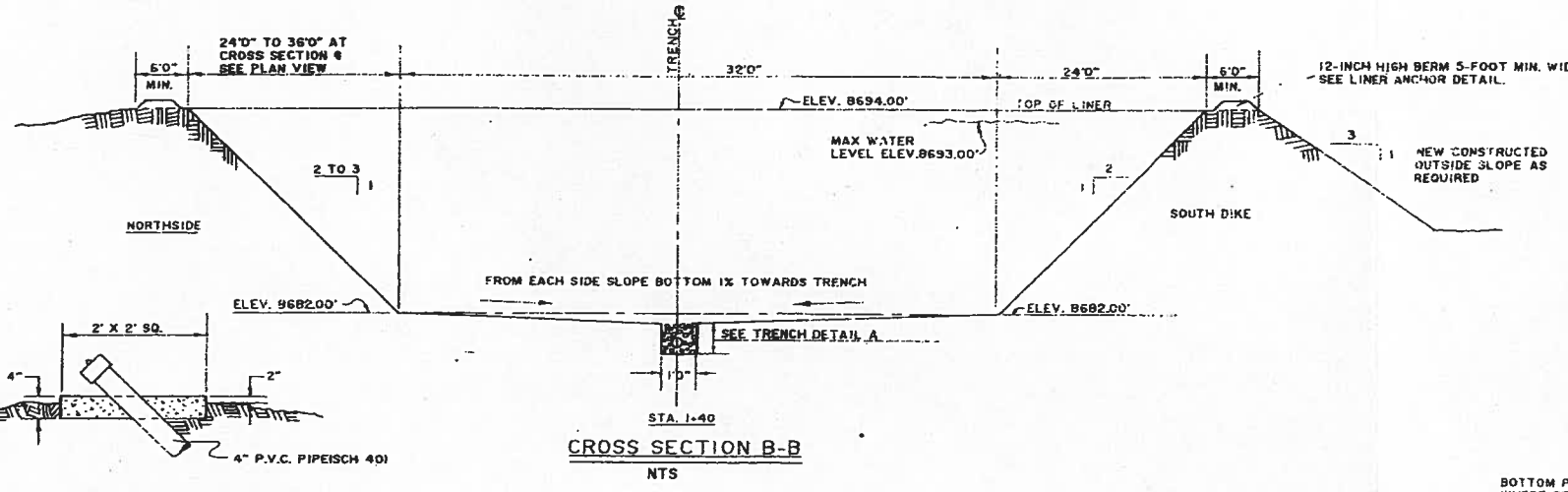
DROP INLET

535.89'

Figure 3
1-Million Gallon Service Pond,
Site Grading Plan Showing Drains [1989]

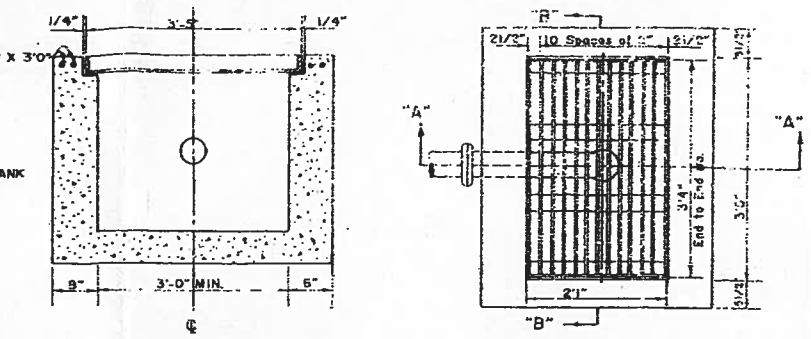


LONGITUDINAL SECTION A-A
NTS



CROSS SECTION B-B
NTS

CLEANOUT DETAIL
NTS

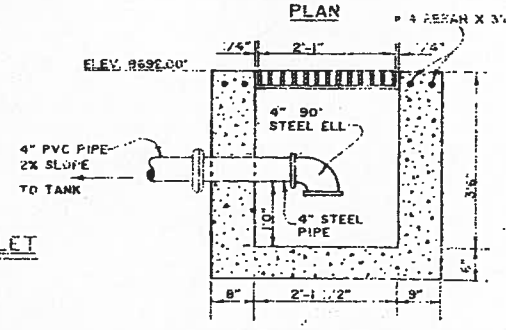


SECTION B-B

PLAN

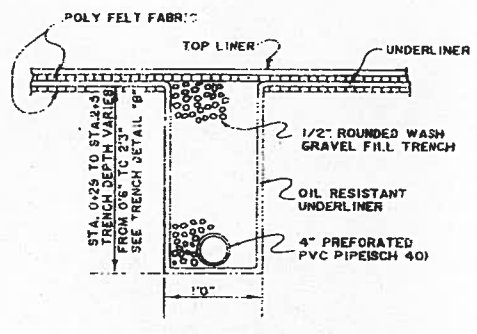
NOTE:
Structural Steel Required
13 Bars - 3" x 1/2" x 3'4"
6 Bars - 3" x 1/2" x 2'1"

All connections to be made by welding each side of bar.

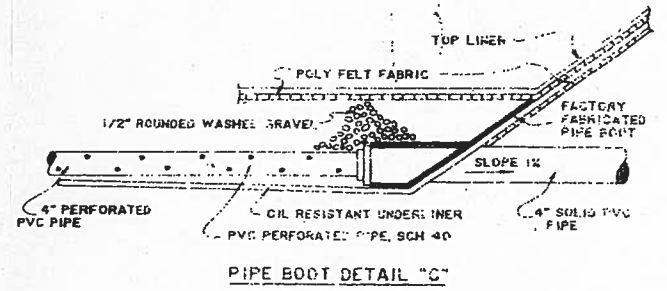


SECTION A-A

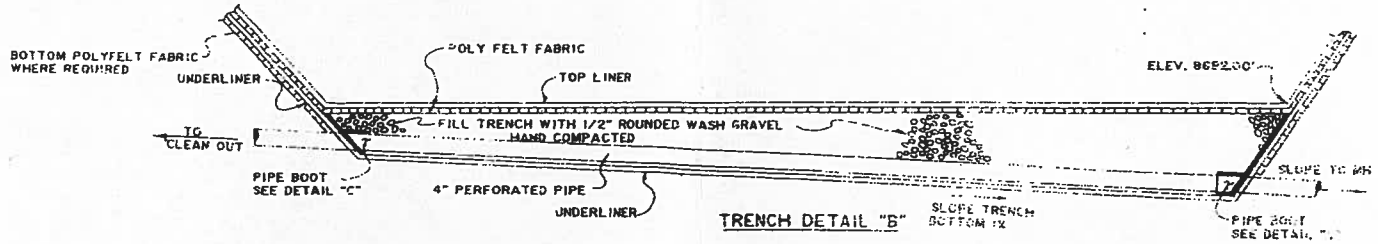
DROP INLET
NTS



TRENCH DETAIL "A"

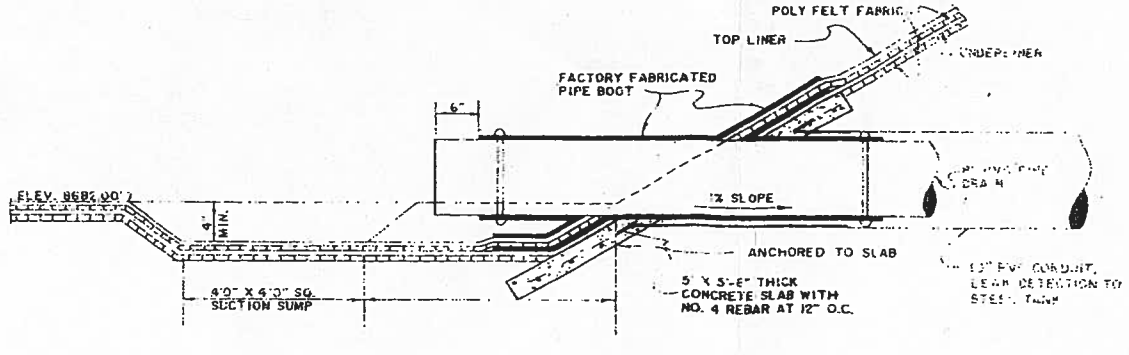


PIPE BOOT DETAIL "C"

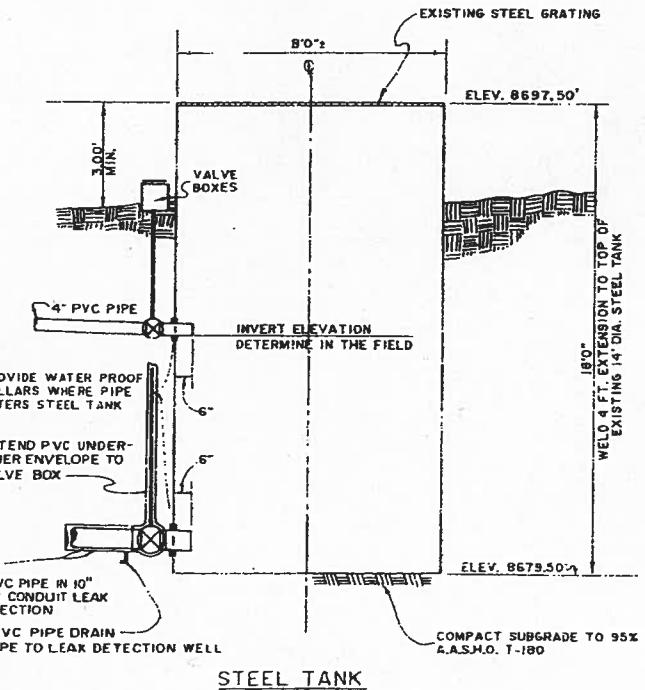


TRENCH DETAIL "B"

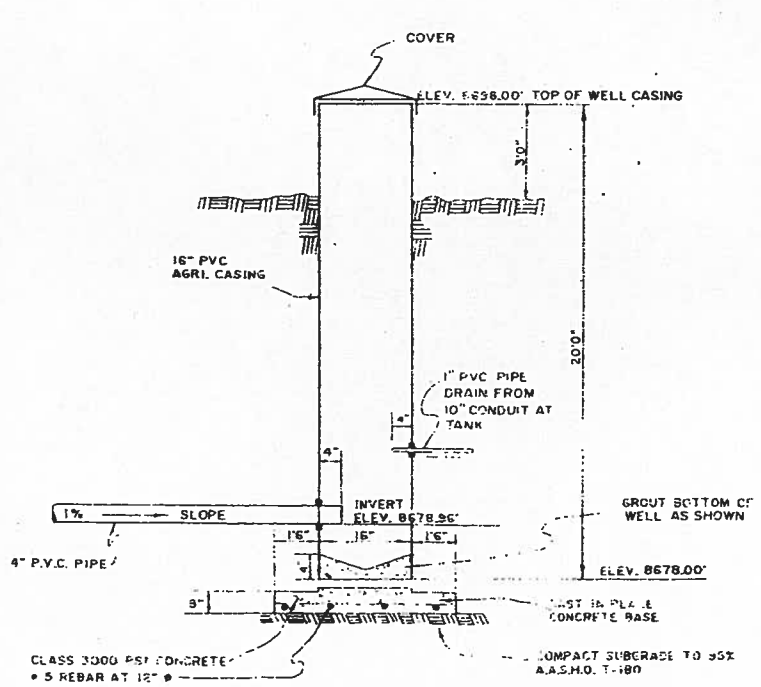
LEAK DETECTION COLLECTOR SYSTEM
NTS



SUCTION SUMP DETAIL
NTS



STEEL TANK
SCALE: 3/8" = 1'0"



LEAK DETECTION WELL
NTS

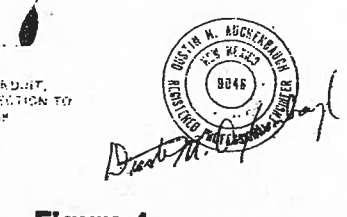


Figure 4
1-Million Gallon Service Pond Detail
(Leak Detection System)

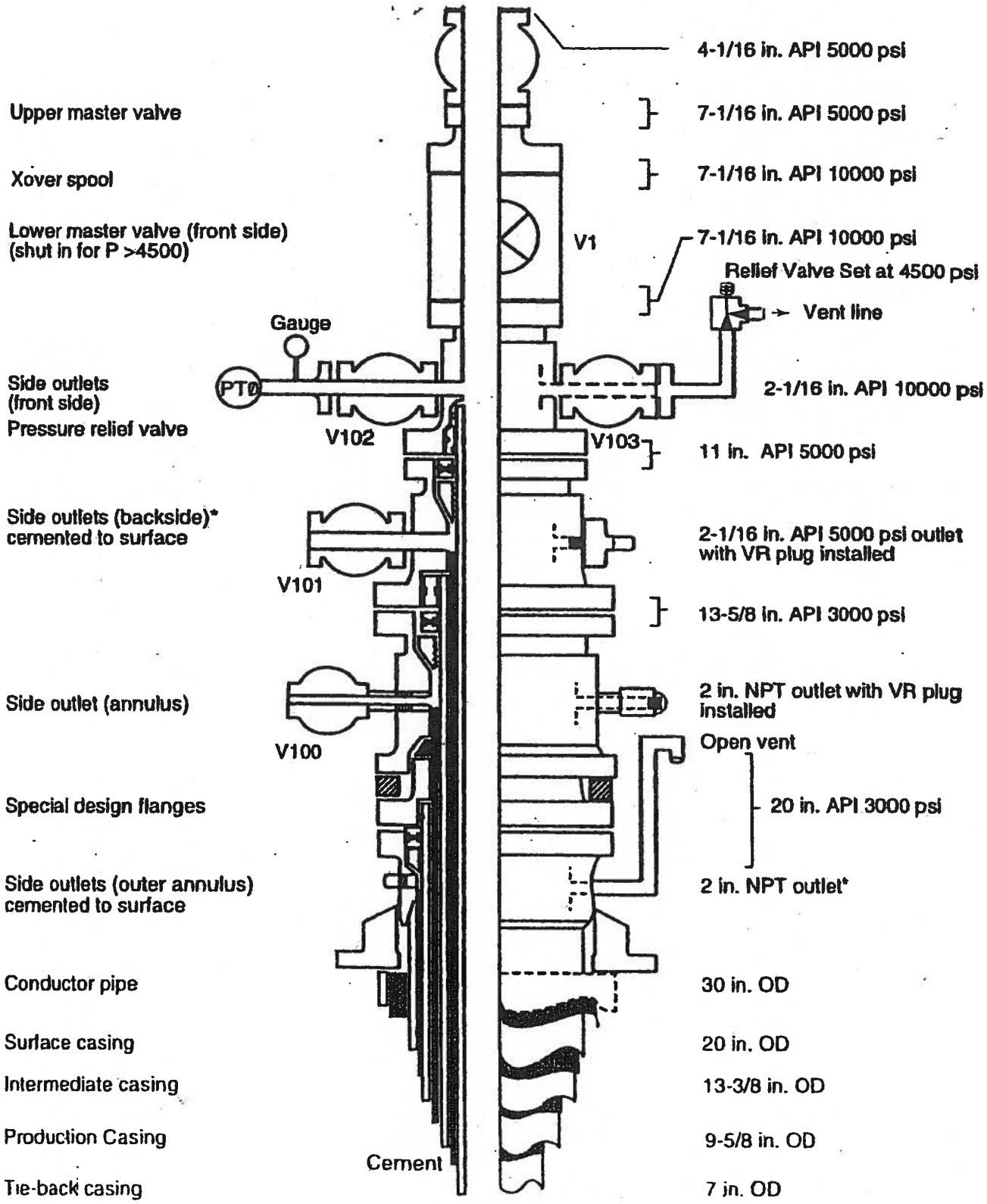


Figure 5
EE-2A Production Wellhead Schematic

CERTIFICATION

I certify under penalty of law that this document and all appendices were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

14 Aug '02

Paul Weber
EES Division Director
Los Alamos National Laboratory
Operator

Date Signed

APPENDIX A

Fenton Hill Site Photographs

TA-57, Fenton Hill, Site Photograph Looking Southeast
EE-2A Production Well and Tower
(June 25, 2002)

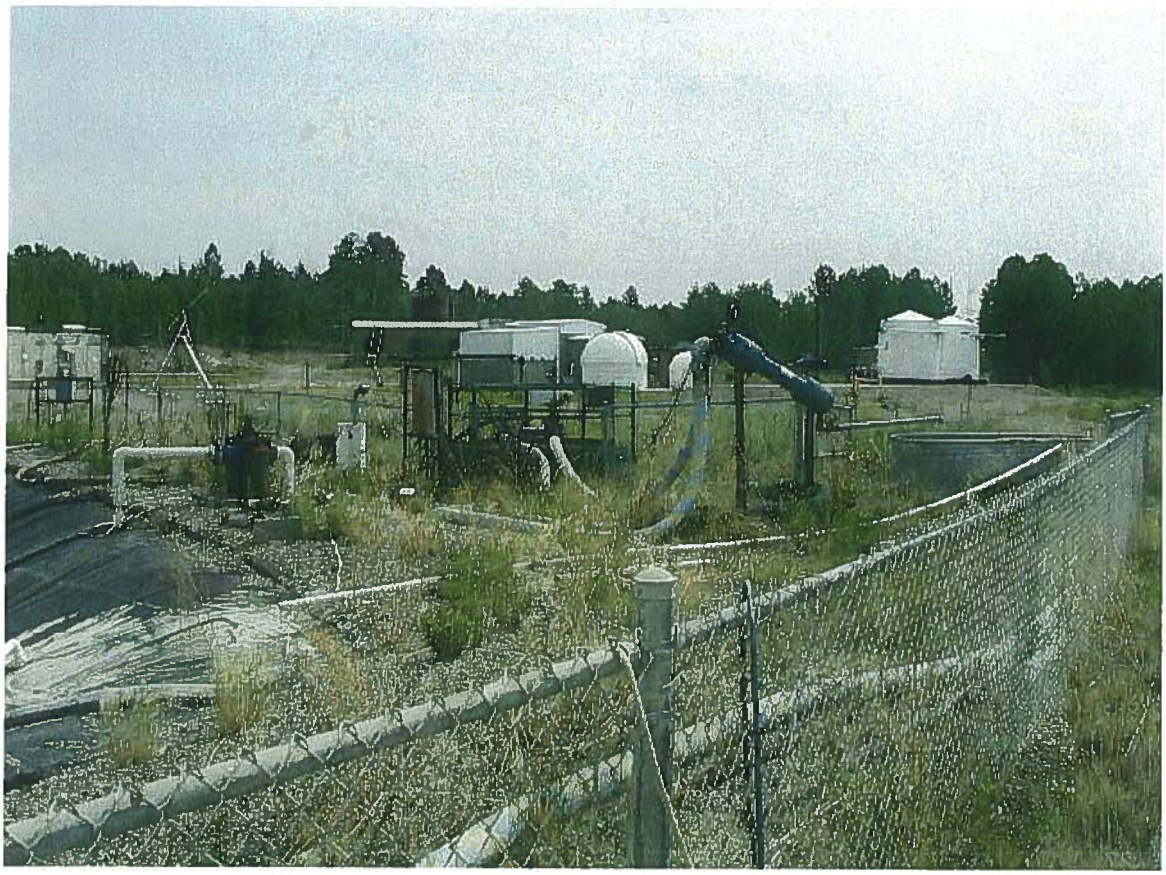
TA-57, Fenton Hill, Site Photograph Looking Southwest
1-Million Gallon Service Pond
(June 25, 2002)

TA-57, Fenton Hill, Site Photograph Looking Northwest
1-Million Gallon Service Pond
(June 25, 2002)

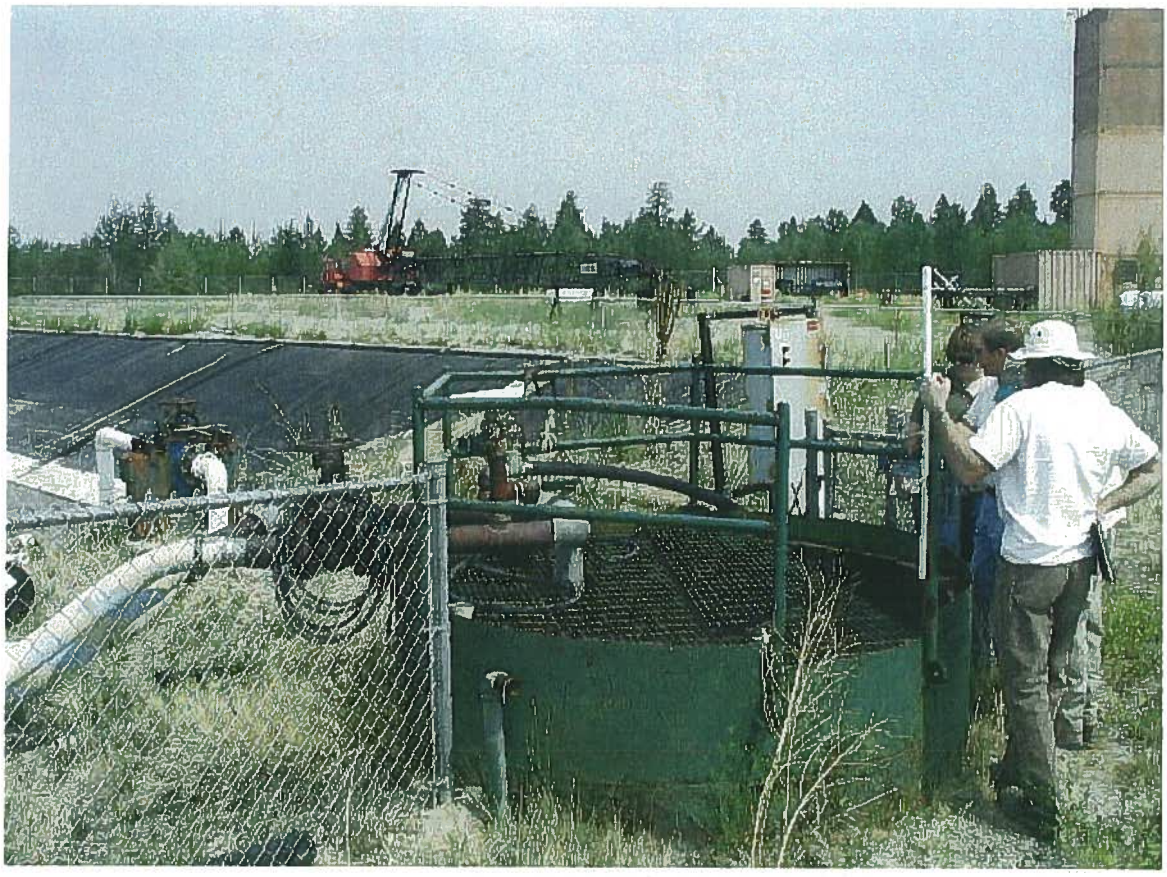
TA-57, Fenton Hill, 1-Million Gallon Service Pond
(June 25, 2002)

TA-57, Fenton Hill, 1-Million Gallon Service Pond Looking Northeast
(June 25, 2002)

TA-57, Fenton Hill, 1-Million Gallon Service Pond Bunker and Drain
(June 25, 2002)

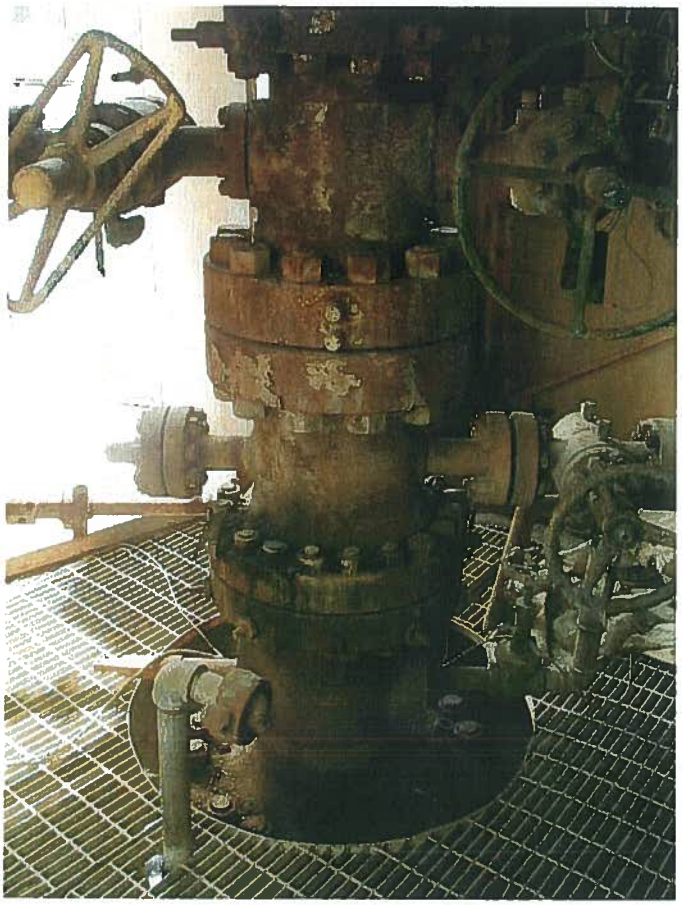


TA-57, Fenton Hill, 1-Million Gallon Service Pond Sump and Leak Detection Well
(June 25, 2002)



TA-57, Fenton Hill, Sump Exterior
(June 25, 2002)

TA-57, Fenton Hill, Sump Interior
(June 25, 2002)



TA-57, Fenton Hill, EE-2A Well Head
(June 25, 2002)

TA-57, Fenton Hill, Hydrant
(June 25, 2002)

APPENDIX B

NM OCD Form C-103 and LANL Plugging and Abandonment Procedures for Geothermal Well EE-2A

Submit 3 Copies To Appropriate District Office
District I
1625 N. French Dr., Hobbs, NM 88240
District II
01 W. Grand Ave., Artesia, NM 88210
District III
1000 Rio Brazos Rd., Aztec, NM 87410
District IV
1220 S. St. Francis Dr., Santa Fe, NM 87505

State of New Mexico
Energy, Minerals and Natural Resources

OIL CONSERVATION DIVISION
1220 South St. Francis Dr.
Santa Fe, NM 87505

Form C-103
Revised March 25, 1999

WELL API NO.
EE-2A (non-API)

5. Indicate Type of Lease
STATE ☐ FEE ☐

6. State Oil & Gas Lease No.
N/A

SUNDRY NOTICES AND REPORTS ON WELLS
(DO NOT USE THIS FORM FOR PROPOSALS TO DRILL OR TO DEEPEN OR PLUG BACK TO A DIFFERENT RESERVOIR. USE "APPLICATION FOR PERMIT" (FORM C-101) FOR SUCH PROPOSALS.)

7. Lease Name or Unit Agreement Name:
Fenton Hill Hot Dry Rock Geothermal Project

1. Type of Well:
Oil Well ☐ Gas Well ☐ Other – Experimental geothermal production well

2. Name of Operator
Los Alamos National Laboratory

8. Well No. – EE-2A

3. Address of Operator
P.O.Box 1663, Los Alamos, NM 87545

9. Pool name or Wildcat
N/A

10. Well Location

Unit Letter_____: well is located 1609 feet from the East line and 1405 feet from the North line

Section 13 Township 19N Range 2E NMPM Sandoval County

10. Elevation *(Show whether DR, RKB, RT, GR, etc.)*
KB

11. Check Appropriate Box to Indicate Nature of Notice, Report or Other Data

NOTICE OF INTENTION TO:				SUBSEQUENT REPORT OF:			
PERFORM REMEDIAL WORK	☐	PLUG AND ABANDON	☒	REMEDIAL WORK	☐	ALTERING CASING	☐
TEMPORARILY ABANDON	☐	CHANGE PLANS	☐	COMMENCE DRILLING OPNS.	☐	PLUG AND ABANDONMENT	☐
PULL OR ALTER CASING	☐	MULTIPLE COMPLETION	☐	CASING TEST AND CEMENT JOB	☐		
OTHER:			☐	OTHER:			☐

12. Describe proposed or completed operations. (Clearly state all pertinent details, and give pertinent dates, including estimated date of starting any proposed work). SEE RULE 1103. For Multiple Completions: Attach wellbore diagram of proposed completion or recompilation.

Please find detailed procedure and well diagrams attached. It is currently estimated that the abandonment will occur in September, 2002. NMOCD will be notified by LANL of the exact time that the abandonment work will commence at least 48 hours in advance.

I hereby certify that the information above is true and complete to the best of my knowledge and belief.

SIGNATURE Paul G. Weber TITLE Division Leader DATE 9 July '02

Type or print name PAUL G. WEBER Telephone No. 505-667-57

(This space for State use)

APPPROVED BY Ryan Johnson TITLE DISTRICT SUPERVISOR DATE 7-19-02

Conditions of approval, if any:

PLUGGING AND ABANDONMENT PROCEDURES FOR GEOTHERMAL WELL EE-2A

Fenton Hill Hot Dry Rock Geothermal Project
Los Alamos National Laboratory

July 1, 2002

Geophysics Group – EES-11
Earth and Environmental Sciences Division

Water Quality and Hydrology Group – RRES-WQH
Risk Reduction and Environmental Stewardship Division

REGULATORY APPROVAL:

Mr. Roy Johnson, N.M. Oil Conservation Division Date

EXTERNAL REVIEWERS:

Mr. Fred Oneyear, U.S. Bureau of Land Management
Mr. John Peterson, U.S. Forest Service, Jemez Ranger District
Ms. Linda Gordan, N.M. Office of the State Engineer

Procedures for abandonment of HDR Well EE-2A
July 1, 2002

Current well configuration: EE-2 was drilled and completed in 1979-80. The original well was damaged following a wellhead failure that ended a massive hydraulic fracturing treatment. Following an extensive well reentry, repair, and plug back procedure, the well was sidetracked and redrilled in 1987-88. The well was completed as a geothermal production well with 7" casing and the annulus cemented to surface. 7-inch OD, 35 lb./ft, S-90, NSCC premium (internal flush) joint threaded and coupled casing was installed from just above the production interval at 10,770 ft to 9,500 ft. A 7-inch OD, 32 lb./ft, C-95, NSCC T&C tie-back string was then installed from 9,500 ft to the surface and cemented-in. The production interval, 10,770' to 12,360' total depth (TD) is uncased open hole. Casing schematics can be found in Attachments 1 and 2. Attachment 3 contains a wellhead diagram. Attachment 4 is a well trajectory survey for well EE-2A.

Although the well was used for geothermal production intermittently for several years, no steam flashing has ever occurred in the wellbore and it is unlikely that any significant scale deposits are present on the inner casing wall.

P&A procedures:

The minimum acceptable coiled tubing diameter for the required operations is 1-1/2" OD.

1) A bridge plug will be set in the 7" casing at 10,700 ft
   a) A casing scraper shall be run to the bridge plug setting depth on wireline or coiled tubing prior to running the bridge plug.
   b) The plug will be capable of maintaining a positive seal against a differential pressure of at least 5,000 psi at a temperature of 430° F
   c) The bridge plug may be deployed on wireline or coiled tubing.
   d) The bridge plug shall be tagged with 1000 lb. set down force using the end of the (cementing shoe on the) coiled tubing prior to pumping the first cement plug to assure proper set and depth.
   e) The initial cement plug shall be tagged to confirm proper location prior to proceeding with mud displacement. This is the only cement plug that will be tagged.
2) A plugging mud shall be displaced into the well from the bottom plug to the surface. The plugging mud shall:
   a) Have sufficient viscosity and density to prevent movement of the cement plugs
   b) Be compatible with the cement slurries proposed.
   c) Remain in the hole between the cement plugs
   d) Contain a sufficient quantity of corrosion inhibitor to provide long-term protection from casing degradation.
3) There is a remote possibility that Hydrogen Sulfide gas may be present in the fluid displaced from the well. Standard industry precautions, ie. H2S monitoring equipment, shall be present and operational during fluid displacement.

4) Every effort shall be made by the vendor to minimize the amount of waste water, mud and materials produced by the operations.
5) Cement plugs may be placed sequentially up the hole. It will not be necessary to tag any cement plugs other than the bottom plug.
6) Required cement plug placement depths, as specified by NMOCD, shall be located in the intervals shown on Table 1. The temperature at the bottom of each interval is included. Cement formulations shall be designed accordingly.
7) After Plug #6 is placed, wash the top of the plug out to 5-ft below the bottom of the wellhead and rig down BOPE and the CTU.
8) Demobilize equipment.

TABLE 1 – NMOCD Plugging Intervals and Estimated Temperature

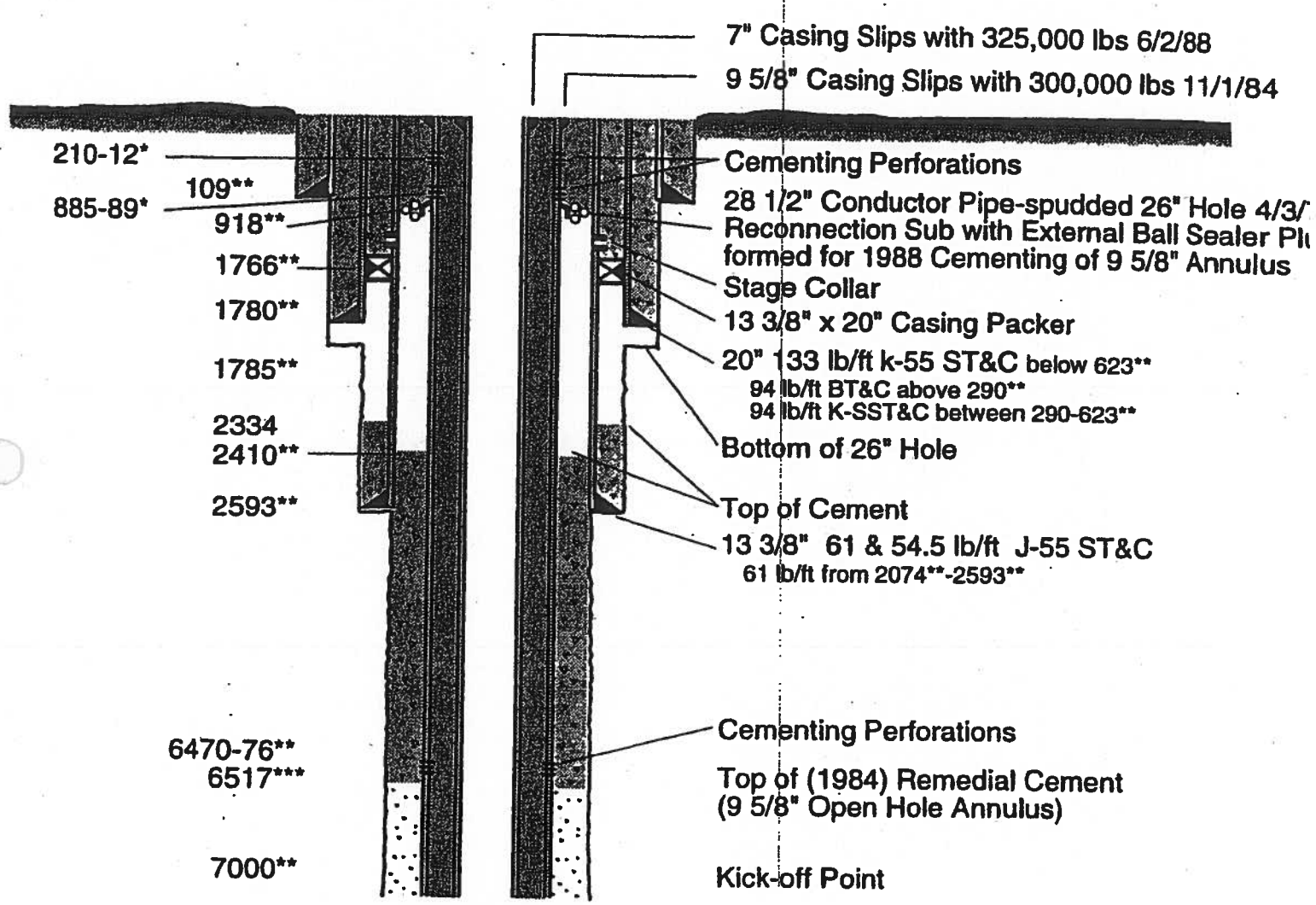
Plug #	Interval (ft)	Length (linear feet)	Temp.°F *
1	10,700 – 10,500	200	423
2	9,600 – 9,400	200	386
3	6,550 – 6,450	100	285
4	3,550 – 3,450	100	212
5	2,693 – 2,493	200	169
6	75 – surface**	75	53
*	Estimated temperature of the hole prior to circulation.		
**	Circulate out cement to 5-ft below the well head after placing cement.		

ATTACHMENT 1

Present Configuration of EE 2-A

As completed June 17, 1988

(Drawing revised 7/15/91, all depths in ft)



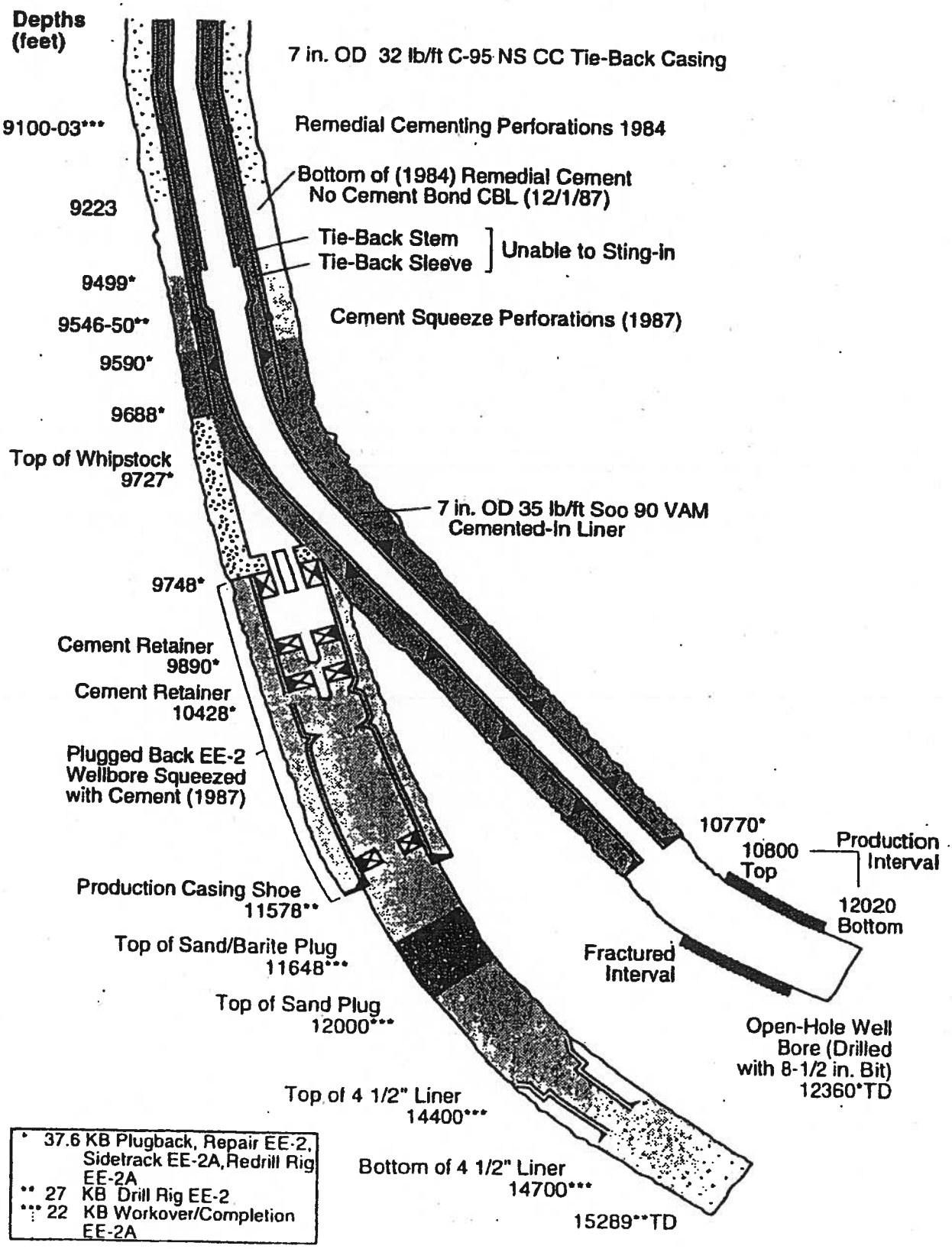
* 37.6 KB Plugback, Repair EE-2, Sidetrack EE-2A, Redrill Rig EE-2A

** 27 KB Drill Rig EE-2

*** 22 KB Workover/Completion EE-2A

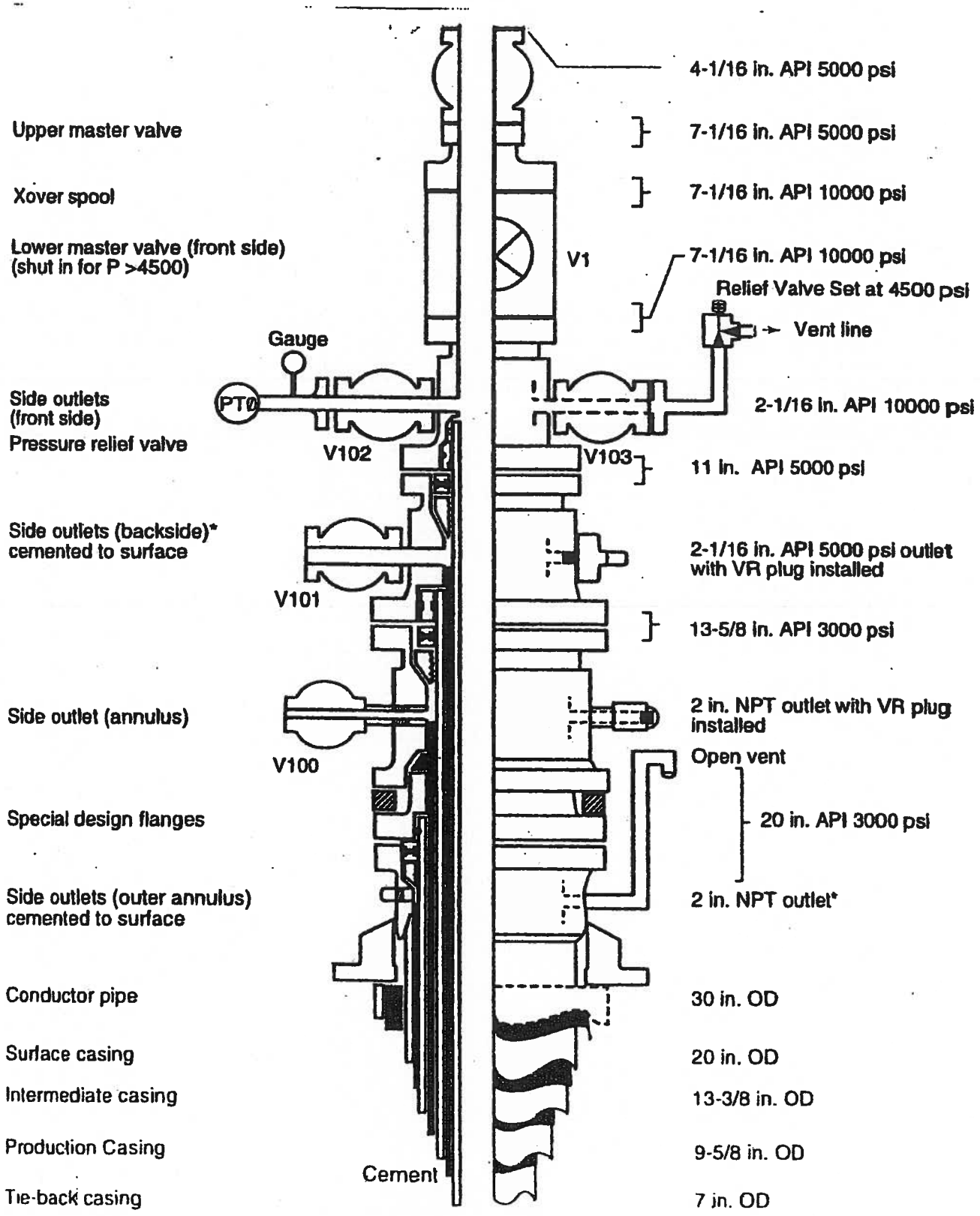
ATTACHMENT 2

Present Configuration of EE-2A. Completed June 17, 1988
(Drawing revised 7/15/91, all depths in ft)

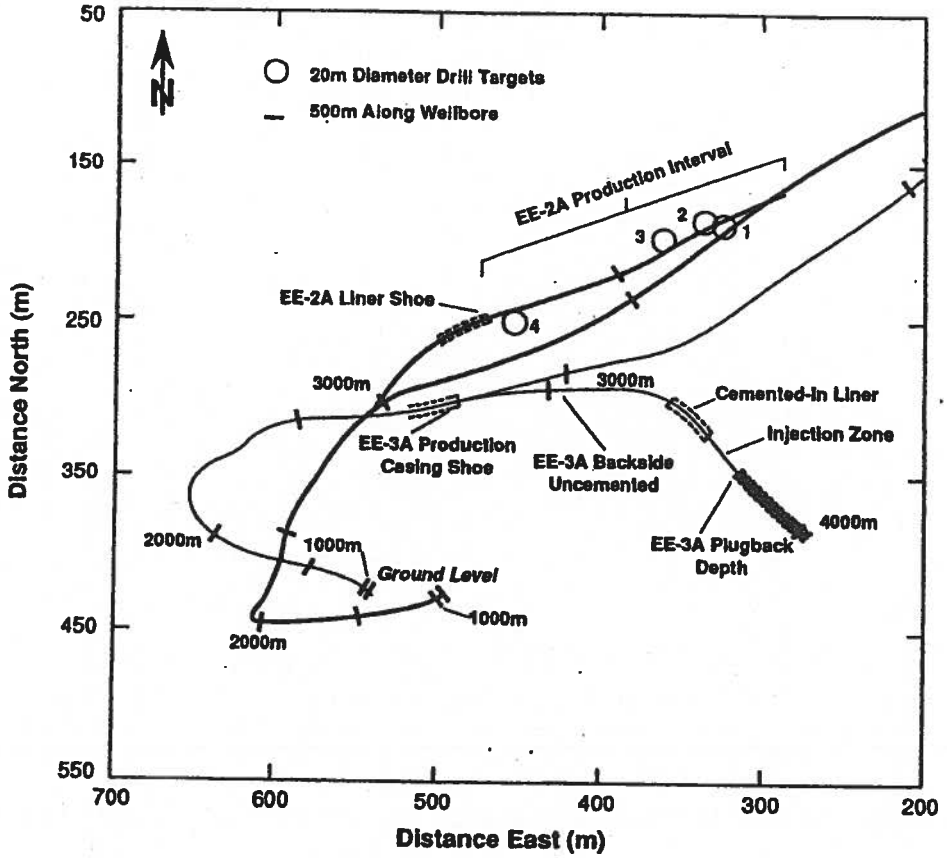


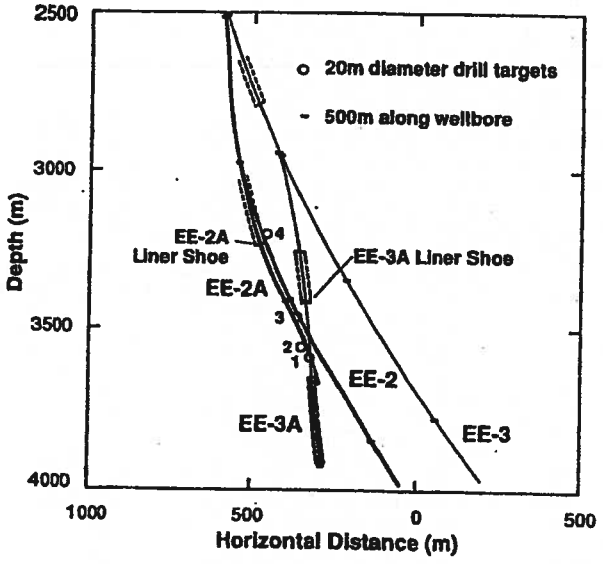
ATTACHMENT 3

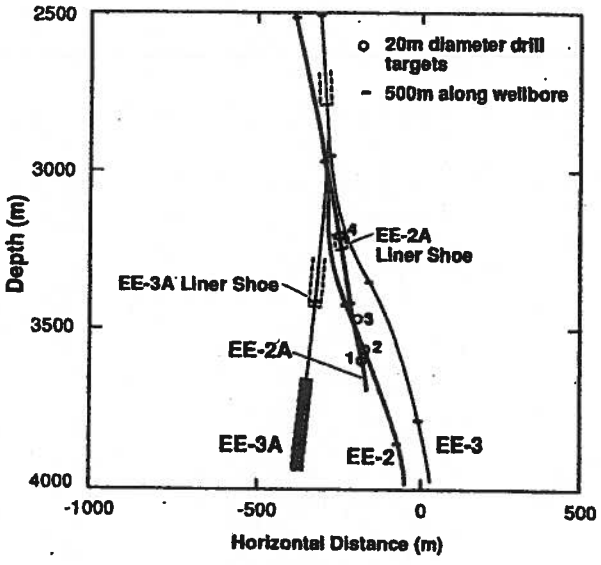
EE-2A Production Wellhead



ATTACHMENT 4





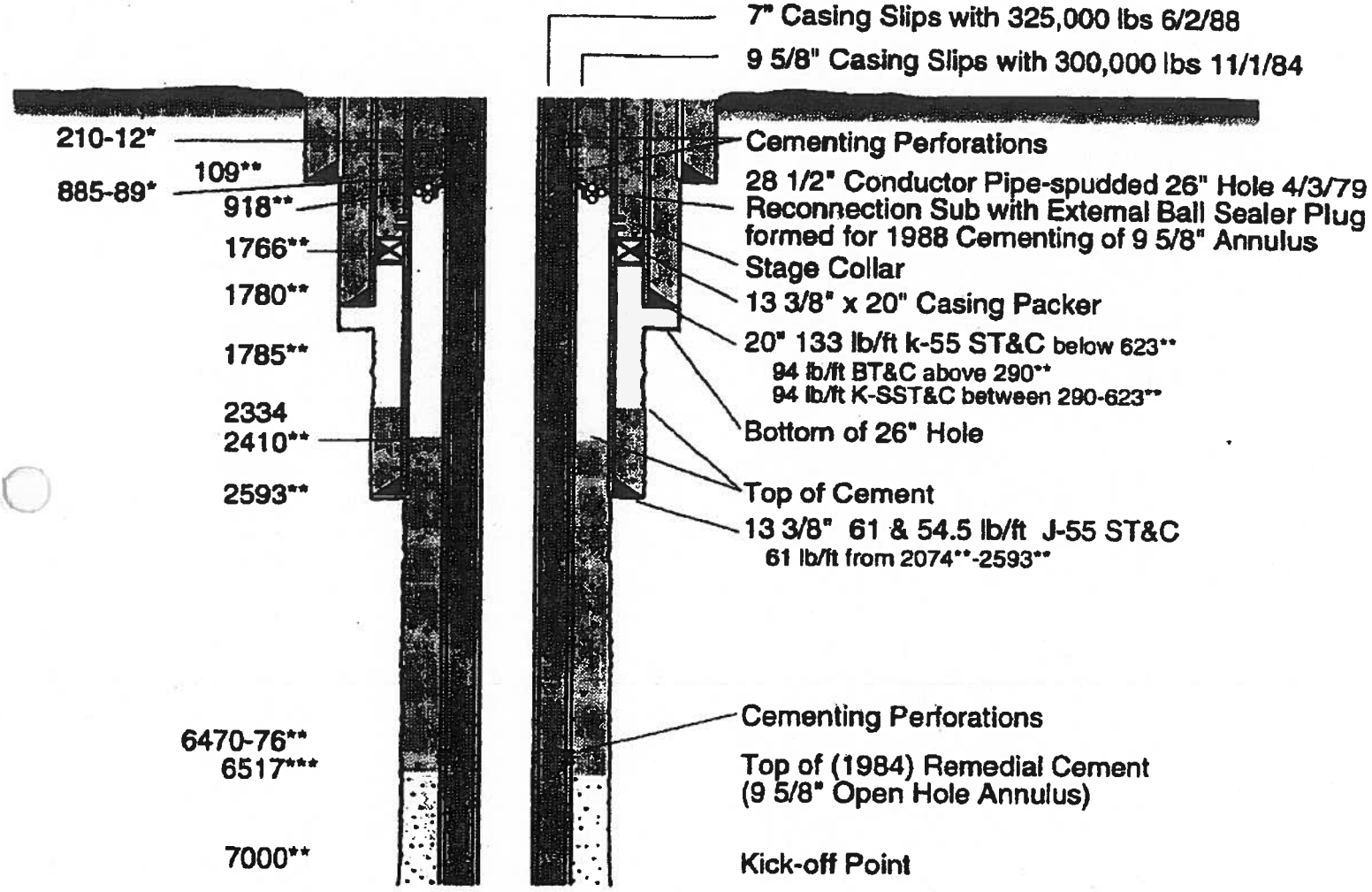


EE-2A targets and drilled trajectory.

APPENDIX C

EE-2A Well Casing Schematic

Present Configuration of EE 2-A
As completed June 17, 1988
(Drawing revised 7/15/91, all depths in ft)



* 37.6 KB Plugback, Repair EE-2, Sidetrack EE-2A, Redrill Rig EE-2A
** 27 KB Drill Rig EE-2
*** 22 KB Workover/Completion EE-2A

Effective 4/30/92

APPENDIX D

19 NMAC 15.9.712

(1) within one (1) year after the effective date permitted facilities submit the information required in Subsection B, Paragraph (1), Subparagraphs (a, h, i and l) of 19.15.9.711 NMAC not already on file with the Division;

(2) within one (1) year after the effective date unpermitted facilities submit the information required in Subsection B, Paragraph (1), Subparagraphs (a) through (j) and Subsection B, Paragraph (1), Subparagraph (l) of 19.15.9.711 NMAC;

(3) comply with Subsections C and D of 19.15.9.711 NMAC unless the Director grants an exemption from a requirement in these sections based upon a demonstration by the operator that such requirement is not necessary to protect public health and the environment.

[6-6-88...2-1-96; 19.15.9.711 NMAC - Rn, 19 NMAC 15.I.711, 11-30-00]

19.15.9.712. DISPOSAL OF CERTAIN NON-DOMESTIC WASTE AT SOLID WASTE FACILITIES.

A. General - Certain non-domestic waste arising from the exploration, development, production or storage of crude oil or natural gas, certain nondomestic waste arising from the oil field service industry, and certain non-domestic waste arising from the transportation, treatment or refinement of crude oil or natural gas, may be disposed of at a solid waste facility.

B. Definitions - The following words and phrases have particular meanings for purposes of this section:

(1) "BTEX." The acronym "BTEX" in this section refers to benzene, toluene, ethelbenzene and xylene.

(2) "Discharge Plan." A "discharge plan" is a plan submitted and approved by the Division pursuant to NMSA 1978, Section 70-2-12(B)(22) (2000 Cum.Supp.) and rules and regulations of the Water Quality Control Commission.

(3) "EPA." The acronym "EPA" refers to the United States Environmental Protection Agency.

(4) "EPA Clean." The phrase "EPA Clean" refers to cleanliness standards established by the EPA in 40 C.F.R. Part 261, Section 261.7(b).

(5) "NESHAP." The acronym "NESHAP" refers to the National Emission Standards for Hazardous Air Pollutants of the EPA, 40 C.F.R. Part 61.

(6) "NORM." The acronym "NORM" refers to naturally occurring radioactive materials regulated by 20 NMAC 3.1, Subpart 14.

(7) "Section." "Section" or "this section" refers to Section 19.15.9.712.

(8) "Solid Waste Facility." A "solid waste facility" is a facility permitted or authorized as a solid waste facility by the New Mexico Environment Department pursuant to the Solid Waste Act, NMSA 1978, Sections 74-9-1 et seq. and rules and regulations of the Environmental Improvement Board, to accept industrial solid waste or other special waste.

(9) "TCLP" The acronym "TCLP" in this section refers to the testing protocol established by the EPA in 40 C.F.R. Part 261, entitled "Toxicity Characteristic Leaching Procedure" or an alternative hazardous constituent analysis approved by the Division.

(10) "TPH." The acronym "TPH" in this section refers to the phrase "total petroleum hydrocarbons."

(11) "Waste." The word "waste" refers to nondomestic waste resulting from the exploration, development, production or storage of crude oil or natural gas pursuant to NMSA 1978, Section 70-2-12(B)(21) and nondomestic waste arising from the oil field service industry, and certain non-domestic waste arising from the transportation, treatment or refinement of crude oil or natural gas pursuant to NMSA 1978, Section 70-2-12(B)(22).

C. Procedure

(1) Waste Listed in Subsection D, Paragraph (1) of Section 19.15.9.712. Waste listed in Subsection D, Paragraph (1) of Section 19.15.9.712 may be disposed of at a solid waste facility without prior written authorization of the Division.

(2) Waste Listed in Subsection D, Paragraph (2) of Section 19.15.9.712. Waste listed in Subsection D, Paragraph (2) of Section 19.15.9.712 may be disposed of at a solid waste facility after testing and prior written authorization of the Division. Before authorization is granted, copies of test results must be provided to the Division and to the solid waste facility where the waste is to be disposed. Disposal may commence only after written authorization of the Division. In appropriate cases and so long as a representative sample is tested, the Division may authorize disposal of a waste stream listed in Subsection D, Paragraph (2) of Section 19.15.9.712 without individual testing of each delivery.

(3) Waste Listed in Subsection D, Paragraph (3) of Section 19.15.9.712. Waste listed in Subsection D, Paragraph (3) of Section 19.15.9.712 may be disposed of at a solid waste facility on a case-by-case basis after testing required at the discretion of the Division and after prior written authorization of the Division. Before authorization is granted, copies of test results must be provided to the Division and to the solid waste facility where the waste is to be disposed. Disposal may commence only after written authorization of the Division.

(4) Simplified Procedure for Holders of Discharge Plans. Holders of an approved discharge plan may amend the discharge plan to provide for disposal of waste listed in Waste Listed in Subsection D, Paragraph (2) of Section 19.15.9.712 and, as applicable, Subsection D, Paragraph (3) of Section 19.15.9.712. If the amendment to the Discharge Plan is approved, wastes listed in Subsection D, Paragraph (2) of Section 19.15.9.712 and Subsection D, Paragraph (3) of Section 19.15.9.712 may be disposed of at a solid waste facility without the necessity of prior written authorization of the Division.

D. Waste Governed By This Section

(1) Waste That Does Not Require Testing Before Disposal:

(a) Barrels, drums, 5-gallon buckets, 1-gallon containers so long as empty and EPA-clean.

(b) Uncontaminated brush and vegetation arising from clearing operations.

(c) Uncontaminated concrete.

(d) Uncontaminated construction debris.

(e) Non-friable asbestos and asbestos contaminated waste material, so long as the disposal complies with all applicable federal and state regulations for nonfriable asbestos materials and so long as asbestos is removed from steel pipes and boilers and, if applicable, the steel recycled.

(f) Detergent buckets, so long as completely empty.

(g) Fiberglass tanks so long as the tank is empty, cut up or shredded, and EPA clean.

(h) Grease buckets, so long as empty and EPA clean.

(i) Uncontaminated ferrous sulfate or elemental sulfur so long as recovery and sale as a raw material is not possible.

(j) Metal plate and metal cable.

(k) Office trash.

(l) Paper and paper bags, so long as empty (paper bags).

(m) Plastic pit liners, so long as cleaned well.

(n) Soiled rags or gloves. If wet, must pass Paint Filter Test prior to disposal.

~~(o) Uncontaminated wood pallets.~~

(2) Waste That Must Be Tested:

(a) Activated alumina must be tested for TPH and BTEX.

(b) Activated carbon must be tested for TPH and BTEX.

(c) Amine filters must be tested for BTEX (and air-dried for at least 48 hours before testing).

(d) Friable asbestos and asbestos-contaminated waste material must be tested pursuant to NESHAP (and so long as the disposal otherwise complies with all applicable federal and state regulations for friable asbestos materials, and so long as asbestos is removed from steel pipes and boilers and, if applicable, the steel should be recycled before disposal).

(e) Cooling tower filters must be tested for TCLP/chromium (and drained and then air-dried for at least 48 hours before testing).

(f) Dehydration filter media must be tested for TPH and BTEX (and drained and then air-dried for at least 48 hours before testing).

(g) Gas condensate filters must be tested for BTEX (and drained and then air-dried for at least 48 hours before testing).

(h) Glycol filters must be tested for BTEX (and drained and then air-dried for at least 48 hours

before testing).

(i) Iron sponge must be oxidized completely and then undergo Ignitability Testing.

(j) Junked pipes, valves, and metal pipe must be tested for NORM.

(k) Molecular sieve must be tested for TPH and BTEX (and must be cooled in a non-hydrocarbon inert atmosphere and hydrated in ambient air for at least 24 hours before testing).

(l) Pipe scale and other deposits removed from pipeline and equipment must be tested for TPH, TCLP/metals and NORM.

(m) Produced water filters must be tested for Corrosivity (and drained and then air-dried for at least 48 hours before testing).

(n) Sandblasting sand must be tested for TCLP/metals or, at the discretion of the Division, TCLP/total metals.

(o) Waste oil filters must be tested for TCLP/metals (and must be drained thoroughly of oil for at least 24 hours before testing and oil and metal parts must be recycled).

(3) Waste That May Be Disposed Of On A Case-By-Case Basis:

(a) Sulfur contaminated soil.

(b) Catalysts.

(c) Contaminated soil other than petroleum contaminated soil.

(d) Petroleum contaminated soil in the event of an emergency declared by the director.

(e) Contaminated concrete.

(f) Demolition debris not otherwise specified herein.

(g) Unused dry chemicals (in addition to any testing required by the Division, a copy of the Material Safety Data Sheet shall be forwarded to the Division and the solid waste facility on each chemical proposed for disposal).

(h) Contaminated ferrous sulfate or elemental sulfur.

(i) Unused pipe dope.

(j) Support balls.

(k) Tower packing materials.

(l) Contaminated wood pallets.

(m) Partial sacks of unused drilling mud (in addition to any testing required by the Division, a copy of the Material Safety Data Sheet shall be forwarded to Division and the solid waste facility at which the partial sacks will be disposed).

(n) Other wastes as applicable.

E. Testing

(1) General - Testing required herein shall be conducted according to the Test Methods for Evaluating Solid Waste, EPA No. SW-846. Any questions concerning the standards or a particular testing facility should be directed to the Division.

(2) Methodology - Testing must be conducted according to the test method listed:

(a) TPH: EPA method 418.1 or 8015 (D-R-O and G-R-O only) or an alternative hydrocarbon analysis approved by the Division.

(b) TCLP: EPA Method 1311 or an alternative hazardous constituent analysis approved by the Division.

(c) Paint Filter Testing: EPA Method 9095A.

(d) Ignitability Test: EPA Method 1030.

(e) Corrosivity: EPA Method 1110.

(f) Reactivity: Test procedures and standards established on a case-by-case basis by the Division.

(g) NORM. 20 NMAC 3.1, Subpart 14.

(3) Limits - To be eligible for disposal pursuant to this section, substances found during testing shall not exceed the following limits:

(a) Benzene: Less than 10 mg/Kg.

(b) BTEX: Less than 500 mg/Kg (sum of all).

(c) TPH: Shall not exceed 1000 mg/Kg.

(d) Hazardous Air Pollutants: Shall not exceed the standards set forth in NESHAP.

(e) TCLP: Shall not exceed the following:

(i) Arsenic: 5.0 mg/l
(ii) Barium: 100.0 mg/l
(iii) Cadmium: 1.0 mg/l
(iv) Chromium: 5.0 mg/l
(v) Lead: 5.0 mg/l
(vi) Mercury: 0.2 mg/l

(vii) Selenium: 1.0 mg/l
(viii) Silver: 5.0 mg/l

19.15.9.713 This entire section moved and renumbered to 19 NMAC 15.A.32.
[12-30-95, 2-1-96; A, 6-15-99; 19.15.9.713 NMAC - Rn, 19 NMAC 15.I.713; 11-30-00]

19.15.9.714 DISPOSAL OF REGULATED NATURALLY OCCURRING RADIOACTIVE MATERIAL (REGULATED NORM)

A. Purpose - This rule establishes procedures for the disposal of regulated naturally occurring radioactive material (Regulated NORM) associated with the oil and gas industry. Any person disposing of Regulated NORM, as defined at 19 NMAC 15.A.7, is subject to this rule and to the New Mexico Environmental Improvement Board regulations at 20 NMAC 3.1, Subpart 14.

B. Nonretrieved Flowlines and Pipelines

(1) The Division will consider a proposal for leaving flowlines and pipelines (hereinafter "pipeline") that contain Regulated NORM in the ground provided such abandonment procedures are performed in a manner to protect the environment, public health, and fresh waters. Division approval is contingent on the applicant meeting the following requirements as a minimum:

(2) An application submitted to the Division must contain the following as a minimum:

(a) The pipeline layout over its entire length on an OCD Form C-102 (Well Location and Acreage Dedication Plat) including the legal description of the location of both ends and all surface ownership along the pipeline.

(b) Results of a radiation survey conducted at all accessible points and a surface radiation survey along the complete pipeline route in a form approved by the Division. All surveys are to be conducted consistent with procedures approved by the Division.

(c) The type of material for which the pipeline had been used.

(d) The procedure to be used for flushing hydrocarbons and/or produced water from the pipeline.

(e) An explanation as to why it is more beneficial to leave the pipeline in the ground than to retrieve it.

(f) Proof of notice of the proposed abandonment to all surface owners where the pipeline is located. Additional notification may be required as described in Subsection F of 19.15.9.714 NMAC.

(3) Procedure

(a) Upon approval of the application by the Division, the operator must notify the OCD District office at least 24 hours prior to beginning any work on the pipeline abandonment.

(b) As a condition of completion of the pipeline abandonment, all accessible points must be permanently capped.

APPENDIX E

LANL Request for Minor Modification to the Ground Water Discharge Plan GW-031, July 1998

Los Alamos
NATIONAL LABORATORY

Los Alamos National Laboratory
Los Alamos, New Mexico 87545

Date: July 20, 1998
In Reply Refer To: ESH-18/WQ&H:98-0232
Mail Stop: K497
Telephone: (505) 667-7969

Mr. Roger C. Anderson
Environmental Bureau Chief
Oil Conservation Division
New Mexico Energy, Minerals, and Natural Resources Department
2040 South Pacheco St.
Santa Fe, New Mexico 87505

SUBJECT: MINOR MODIFICATION OF GROUND WATER DISCHARGE PLAN GW-031

Dear Mr. Anderson:

Enclosed please find Los Alamos National Laboratory's Minor Modification of Ground Water Discharge Plan GW-031 for the Fenton Hill Geothermal Facility, Sandoval County, New Mexico. Also enclosed is the required $50.00 filing fee. This minor modification is being submitted to your agency in accordance with Section 3107.C of the Water Quality Control Commission Regulations due to the following operational changes which have been implemented, or are being proposed, at the facility:

1) Discontinuation of the Fenton Hill NPDES Permit No. NM0028576,
2) Installation of an enhanced evaporation system on the 1 MG pond, and
3) The proposed mixing of exempt and nonexempt wastes in the 1 MG pond in accordance with N.M. Oil Conservation Division's mixture policy.

If you have any questions concerning this submittal, please feel free to call Bob Beers of my staff at (505) 667-7969.

Sincerely,

Steven R. Rae
Group Leader
Water Quality and Hydrology Group

RB/rj

Enclosures: a/s

Cy: J. Peterson, Jemez Ranger District, U.S. Forest Service, Jemez Springs, New Mexico, w/enc.
W. Whatley, Jemez Pueblo, New Mexico, w/enc.
G. Suazo, CIO, w/enc., MS A117
P. Bustamante, NMED/GWQB, Santa Fe, New Mexico, w/enc.
G. Saums, NMED/SWQB, Santa Fe, New Mexico, w/enc.
B. Koch, DOE/LAAO, w/enc., MS A316
J. Albright, EES-4, w/enc., MS D443
G. Sinnis, P-23, w/enc., MS H803
D. Thomas, P-FM, w/enc., MS D459
J. Thomson, EES-4, w/enc. MS D443
S. Rae, ESH-18, w/enc., MS K497
N. Williams, ESH-18, w/enc., MS K497
WQ&H File, w/enc., MS K497
CIC-10, w/enc., MS A150

ENCLOSURES

1) Minor Modification of Ground Water Discharge Plan (GW-031)

2) Letter from EPA Approving the Discontinuation of NPDES Permit No. NM0028576

3) Figure 1.0. Schematic of 1 MG Pond Enhanced Evaporation System

4) Table 1.0. Water Quality Data: GAC Filter Backwash Water

5) Table 2.0. Water Quality Data: Softener Regeneration Water

6) Assaigai Analytical Laboratories, Inc. Report: Sample ID Nos. MGRO 5A-11C

7) Figure 2.0. Schematic of Proposed Mixing of Exempt and Nonexempt Wastes

8) Figure 3.0. Schematic of 5 MG Pond to 1 MG Pond Piping

9) Table 3.0. Final Mixture Summary and Estimated Volumes of Exempt and Nonexempt Wastes

Discontinuation of NPDES Permit No. NM0028576

On December 29, 1997, the EPA approved a request by the U.S. Department of Energy and Los Alamos National Laboratory to discontinue the Fenton Hill Geothermal Site NPDES Permit No. NM0028576. Please find the enclosed copy of the EPA approval letter. The Fenton Hill Geothermal Facility had not discharged through the NPDES outfall since June 1988.

Enhanced Evaporation System

The Fenton Hill Geothermal Facility's 1 million gallon (MG) pond has been outfitted with an enhanced evaporation system. Figure 1.0 illustrates the system's basic configuration. The evaporation system consists of two segments of 2" PVC pipe, each running the length of the pond, one on the north side and the other on the south. Adjustable hose nozzles are installed at 10 ft. intervals on the 2" lines; a total of 25 nozzles on each side, 50 in all. The spray from each nozzle is directed towards the center of the pond at a 45 degree angle. The nozzles are adjusted to produce a fine mist, maximizing evaporation. All piping and nozzles are contained within the perimeter of the pond's liner. A pressure switch has been installed in the pump control circuitry to shut off the system in the event of a line break or plug. A large duplex basket strainer is installed near the pump to remove solids. The estimated volume being spayed is approximately 2 gallons per minute (gpm) per nozzle or approximately 100 gpm for the entire system.

The enhanced evaporation system is managed to ensure that wind blown drift does not travel beyond the perimeter of the pond's liner. The system is monitored twice daily and as wind conditions change the nozzles are adjusted to confine any drift to within the pond's liner. Under severe wind conditions, the evaporation system will be shut off.

Mixing of Exempt and Nonexempt Wastes

Exempt Wastes. Since 1989, the Fenton Hill Geothermal Facility has retained exclusive use of the 1 MG pond for the containment of geothermal production fluids. These fluids are exempt from Resource Conservation and Recovery Act (RCRA) regulation due to a specific exclusion for geothermal exploration, development, or the production of produced waters and other associated wastes [40 CFR 261.4(b)(5)]. In September 1997, approximately 675,000 gallons of geothermal fluids and sludge were removed from the pond and transported off-site for disposal. The pond had not been cleaned since its construction in 1989.

Currently, geothermal well EE-2 is the only remaining source of geothermal fluids discharging to the 1 MG pond. All of the facility's other geothermal wells were plugged and abandoned in 1996. Fluids vented from EE-2 originate from the Phase II geothermal reservoir. Annual venting volumes from EE-2 have been estimated at approximately 100,000 gallons per year.

Mixing of Exempt and Nonexempt Wastes (con't)

Nonexempt Wastes. Since 1995, the Milagro Project has been using the 5 MG pond at Fenton Hill for astrophysical research. In December 1995, the Laboratory submitted to the OCD a Notice of Changed Conditions for Discharge Plan GW-031 (ESH-18/WQ&H:95-0574) which detailed the modifications made to the 5 MG pond by the Milagro Project. Due to the nature of the Milagro Project's research, it is necessary for the water in the pond to be ultra-pure. Fill and make-up water for the 5 MG pond come from the Fenton Hill facility's potable water supply well. In addition, the Milagro Project installed a water treatment system with the following components: (1) granular activated carbon (GAC) filtration, (2) ion exchange (water softener), and (3) ultraviolet (UV) disinfection. Maintenance of both the GAC filter and the water softener result in the generation of wastewater discharges.

The GAC filter requires periodic backwashing to maintain efficient operation. Table 1.0 presents the analytical results from sampling of the GAC filter backwash water in December 1997. The sample results show that the GAC filter backwash water is nonhazardous and, with the exception of boron (B), contains no contaminants at concentrations greater than NM WQCC ground water standards. The GAC filter is used during both the filling of the pond and during the routine circulation of pond water. It is estimated that approximately 62,500 gallons of backwash wastewater (25 backwash cycles @ 2500 gallons per cycle) will be generated when the 5 MG pond is filled in 1998 and approximately 4,000 gallons per month during subsequent routine circulation.

The water softener requires periodic regeneration with sodium chloride to maintain efficient operation. Table 2.0 presents the analytical results from sampling of the softener regeneration water in December 1997. As expected, the sample results show that the softener regeneration water contains elevated total dissolved solids (TDS). Softener regeneration is required only during the filling of the pond. It is estimated that approximately 75,000 gallons of regeneration wastewater (30 regeneration cycles @ 2500 gallons per cycle) will be generated when the pond is filled in 1998.

Mixing. As illustrated in Figure 2.0, the Laboratory proposes to mix the Milagro Project's nonexempt wastes (softener regeneration wastewater and GAC filter backwash wastewater) with the Geothermal Project's exempt wastes (geothermal production fluids). Mixing would occur in the Geothermal Project's 1 MG pond. Figure 3.0 illustrates how an existing 8" buried cast iron pipe would be used to convey the nonexempt wastes to the 1 MG pond (Note: To control corrosion, after the discharge of high TDS water the pipe will be flushed with fresh water).

Mixing of Exempt and Nonexempt Wastes (con't)

The Laboratory's proposal to mix nonexempt and exempt waste meets the following two requirements of the New Mexico Oil Conservation Division's mixture policy (rev. 9/97):

First, sampling and analysis of the nonexempt portion of the waste, the softener regeneration wastewater and the GAC filter backwash wastewater, shows that the waste is nonhazardous (See Table 1.0 and 2.0); and

Second, the total nonexempt portion of the waste constitutes no more than five (5) percent by volume of the final mixture. Table 3.0 presents an estimate of the volume of exempt and nonexempt solids that would accumulate in the 1 MG pond if mixing were to occur for nine years of operation. Using the best information available, the Laboratory estimates that the final mixture will be 3 percent nonexempt wastes.

(Note: A final mixture based upon the volume of solids in the 1 MG pond, rather than the combined volume of solids and liquid, is being proposed due to the facility's capability to evaporate off the liquid fraction.)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
1445 ROSS AVENUE, SUITE 1200
DALLAS, TX 75202-2733

December 29, 1997

REPLY TO: 6WQ-CA

Mr. G. Thomas Todd
Area Manager
Department of Energy
Los Alamos Area Office
Los Alamos, New Mexico 87544

Re: NPDES Permit No. NM0028576-Dept. Of Energy-Los Alamos National Laboratory, Fenton Hill Geothermal Site

Dear Mr. Todd:

In accordance with your request on file in this office that the referenced NPDES Permit No. NM0028576 be discontinued, you are hereby notified that the permit has been discontinued.

Any resumption of the discharge without a permit will be unlawful. Should you again propose to discharge any pollutant from this facility to waters of the United States, it will be necessary to file a new application at least 180 days in advance of the proposed discharge. Any permit issued as a result of such reapplication will contain conditions and limitations consistent with the situation, and the law and the regulations in effect at the time of reissuance, irrespective of any previously issued permit.

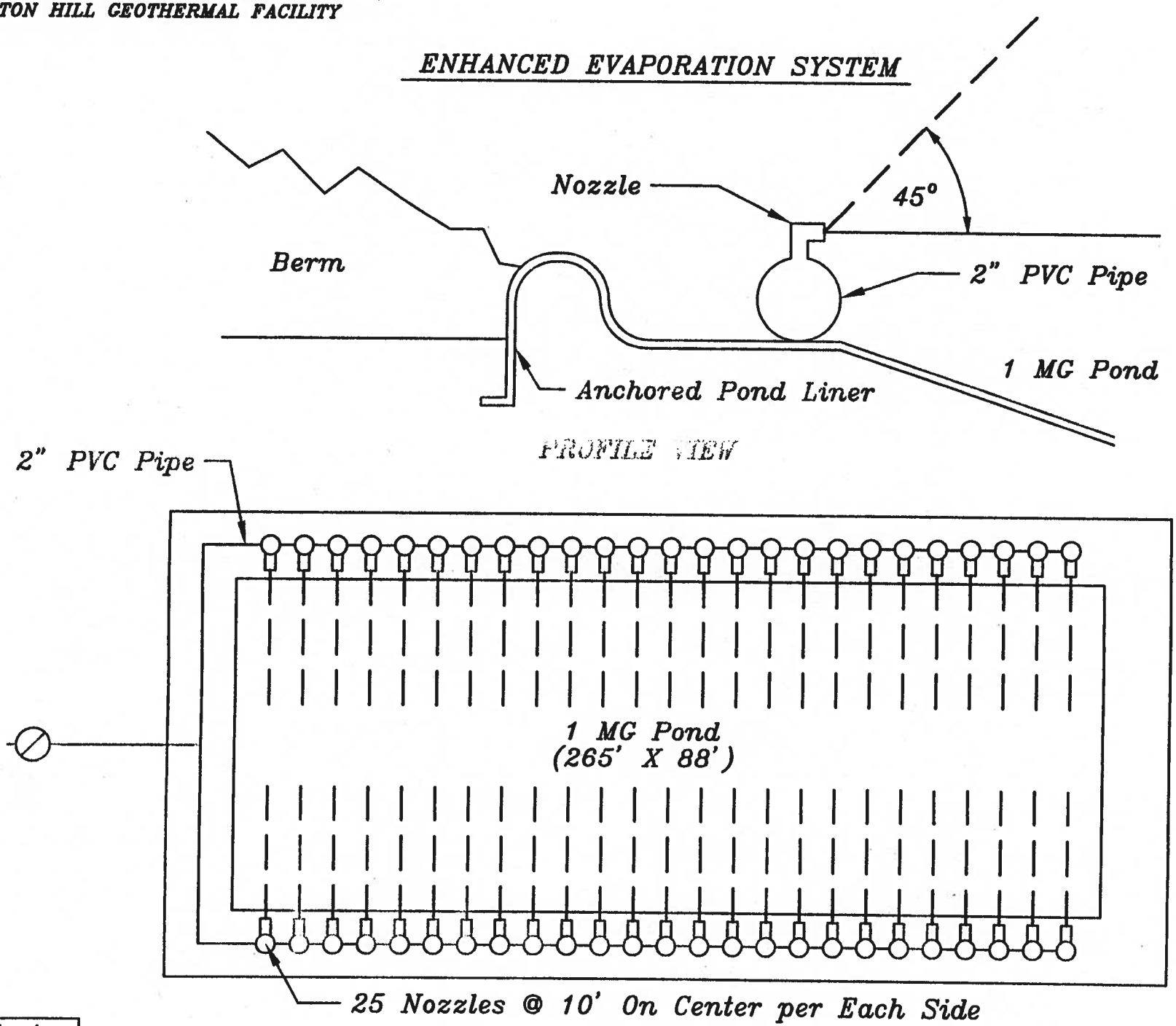
If you have any questions, please contact Wilma Turner at the above address or telephone (214) 665-7516.

Sincerely yours,

Jack V. Ferguson, P.E.
Chief
NPDES Branch (6WQ-P)

cc: New Mexico Environment Department

Mr. Mike Saladen
University of California
Management Contractor for Operation
Los Alamos National Laboratory
Los Alamos, New Mexico 87545



07/06/98

Figure 1.0

Milagro Project at Fenton Hill

Water Quality Data: GAC Filter Backwash Water

Sample Date: 12/12/97

Sample Type: total, unfiltered

Sample ID No.: MGRO-5A, 7A, 8A, 9A, 9B, 10A, and 10B

Analyte	Results (mg/L)	40 CFR 261 TCLP Concentration Limits (mg/L)	NM WQCC 3103. Ground Water Standards (mg/L)
Al	<0.5		5.0
As	<0.06	5.0	0.1
Ba	0.06	100.0	1.0
Be	<0.004		
B	1.2		0.75
Cd	<0.008	1.0	0.01
CN	<0.02		0.2
Cr	<0.04	5.0	0.05
Co	<0.01		0.05
Cu	<0.04		1.0
Fe	0.6		1.0
Hg	<0.0002	0.2	0.002
Pb	<0.06	0.4	0.05
Mn	<0.01		0.2
Mo	<0.02		1.0
Ni	<0.04		0.2
Se	<0.005	1.0	0.05
Ag	<0.02	5.0	0.05
Tl	<0.3		
U	0.0049		5.0
Zn	0.3		10.0
Nitrate-N	<0.2		10.0
pH (standard units)	7.4		between 6 and 9
TDS	422		1000.0
TSS	9		
Chloride	67.7		250.0
Fluoride	<0.5		1.6
Sulfate	12.7		600.0
Semi-volatiles			
SW846-8270	Non-detect		
Volatiles			
SW846-8240	Non-detect		

Milagro Project at Fenton Hill
Water Quality Data: Softener Regeneration Water
Sample Date: 12/12/97
Sample Type: total, unfiltered
Sample ID Nos.: MGRO-11A, 11B, and 11C

Analyte (Sample ID No.)	Results (mg/L)	40 CFR 261 TCLP Concentration Limits (mg/L)	NM WQCC 3103 Ground Water Standards (mg/L)
TDS (11A)	422	NA	1,000
TDS (11B)	9,930	NA	1,000
TDS (11C)	12,550	NA	1,000

NOTES:

Softner backwash cycle took 85 minutes to complete. Sample 11A was collected 3 minutes into the cycle, 11B was collected 25 minutes in the cycle, and 11C was collected 55 minutes into the cycle.

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Client: **LOS ALAMOS NATIONAL LABS**
Project: **9712126 FENTON HILL**

Client Sample ID: **MGRO-2A,2B** Sample Matrix: **WATER_COMP**

Collect	Fraction	QC Group	Analyte	Result	Units	Limit	*	Run Group - #	Run Dat
			EPA-335 / SM-4500						
12/12/97	9712126-02A	W97547	Cyanide	< 0.02	mg / L	0.02		MW.1997.1027 - 10	12/17/97

Client Sample ID: **MGRO-3A,3B** Sample Matrix: **WATER_COMP**

Collect	Fraction	QC Group	Analyte	Result	Units	Limit	*	Run Group - #	Run Dat
			EPA-300 Series						
12/12/97	9712126-03A	W97543	Nitrate, Nitrogen	< 0.2	mg N/ L	0.2		MW.1997.1025 - 16	12/16/97

Client Sample ID: **MGRO-4A,4B** Sample Matrix: **WATER_COMP**

Collect	Fraction	QC Group	Analyte	Result	Units	Limit	*	Run Group - #	Run Date
			EPA-150.1						
12/12/97	9712126-04A	WPH-573	pH	7.4	units	0.1		MT.1997.446 - 4	12/13/97
			EPA-160.1						
12/12/97	9712126-04A	WTDS-435	Total Dissolved Solids	406	mg / L	10		MT.1997 476 - 6	12/16/97
		WTSS-484	Total Suspended Solids	< 4.0	mg / L	4		MT.1997.469 - 7	12/17/97
			EPA-300 Series						
12/12/97	9712126-04A	W97543	Chloride	71.4	mg / L	0.5		MW.1997.1025 - 22	12/16/97
		W97543	Fluoride	< 0.5	mg / L	0.5		MW.1997.1025 - 13	
		W97543	Sulfate	13.0	mg / L	0.5		MW.1997.1025 - 13	

Client Sample ID: **MGRO-5A GAC Filter Backwash** Sample Matrix: **WATER**

Collect	Fraction	QC Group	Analyte	Result	Units	Limit	*	Run Group - #	Run Date
			ARSENIC UNIQUE						
12/12/97	9712126-05A	MT.1998.91	Uranium, total	0.0049	mg/L	0.0001		MT.1998.91 - 2	01/09/98
			EPA-200 series AA/GF						
12/12/97	9712126-05A	M97914	Molybdenum	< 0.02	mg / L	0.02		MW.1997.1044 - 12	12/23/97
		M97914	Selenium	< 0.005	mg / L	0.005		MW.1998.6 - 15	01/05/98
			EPA-200.7 ICP						
12/12/97	9712126-05A	M97927	Aluminum	< 0.5	mg / L	0.5		MW.1998.1 - 23	12/31/97
		M97927	Arsenic	< 0.06	mg / L	0.06		MW.1998.1 - 23	
		M97927	Barium	0.06	mg / L	0.01		MW.1998.1 - 23	
		M97927	Beryllium	< 0.004	mg / L	0.004		MW.1998.1 - 23	
		M97927	Boron	1.2	mg / L	0.1		MW.1998.21 - 23	01/06/98
		M97927	Cadmium	< 0.008	mg / L	0.008		MW.1998.1 - 23	12/31/97
		M97927	Chromium	< 0.04	mg / L	0.04		MW.1998.1 - 23	
		M97927	Cobalt	< 0.01	mg / L	0.01		MW.1998.1 - 23	
		M97927	Copper	< 0.04	mg / L	0.04		MW.1998.1 - 23	
		M97927	Iron	0.6	mg / L	0.2		MW.1998.21 - 23	01/06/98
		M97927	Lead	< 0.06	mg / L	0.06		MW.1998.1 - 23	12/31/97
		M97927	Manganese	< 0.010	mg / L	0.01		MW.1998.1 - 23	
		M97927	Nickel	< 0.04	mg / L	0.04		MW.1998.1 - 23	
		M97927	Silver	< 0.02	mg / L	0.02		MW.1998.1 - 23	
		M97927	Thallium	< 0.3	mg / L	0.3		MW.1998.1 - 23	
		M97927	Zinc	0.3	mg / L	0.1	B	MW.1998.21 - 23	01/06/98

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Project: **9712126 FENTON HILL**

			EPA 300 Series					
12/12/97	9712126-05A	W97543	Nitrate, Nitrogen	< 0.2	mg N/ L	0.2	MW 1997 1025 - 8	12/16/9
			SW846-7470 / EPA-245.1					
12/12/97	9712126-05A	M97925	Mercury	< 0.0002	mg / L	0.0002	MW 1997 1051 - 14	12/24/9

Client Sample ID: **MGRO7A** GAC After Backwash — Sample Matrix: **WATER**

Collect	Fraction	QC Group	Analyte	Result	Units	Limit *	Run Group - #	Run Da
			EPA 335.2 Titrimetric					
12/12/97	9712126-07A	W97547	Cyanide	< 0.02	mg / L	0.02	MW.1997 1027 - 11	12/17/9

Client Sample ID: **MGRO8A** GAC After Backwash — Sample Matrix: **WATER**

Collect	Fraction	QC Group	Analyte	Result	Units	Limit *	Run Group - #	Run Dat
			EPA 150.1 pH					
12/12/97	9712126-08A	WPH-573	pH	7.4	units	0.1	MT.1997.446 - 1	12/13/97
			EPA 160 Series					
12/12/97	9712126-08A	WTDS-435	Total Dissolved Solids	422	mg / L	10	MT 1997 476 - 7	12/16/97
		WTSS-494	Total Suspended Solids	9.0	mg / L	4	MT.1997.469 - 8	12/17/97
			EPA 300 Series					
12/12/97	9712126-08A	W97543	Chloride	67.7	mg / L	0.5	MW.1997 1025 - 23	12/16/97
		W97543	Fluoride	< 0.5	mg / L	0.5	MW.1997.1025 - 7	
		W97543	Sulfate	12.7	mg / L	0.5	MW.1997 1025 - 7	

Client Sample ID: **MGRO9A** GAC [illegible] — Sample Matrix: **WATER**

Collect	Fraction	QC Group	Analyte	Result	Units	Limit *	Run Group - #	Run Date
			SW846-8270 / EPA-625 Base/Neutrals					
12/12/97	9712126-09A	X97468	1,2,4-Trichlorobenzene	< 2.2	ug / L	1	XG.1997 373 - 10	12/19/97
		X97468	1,2-Dichlorobenzene	< 2.2	ug / L	1	XG.1997.373 - 10	
		X97468	1,3-Dichlorobenzene	< 2.2	ug / L	1	XG.1997 373 - 10	
		X97468	1,4-Dichlorobenzene	< 2.2	ug / L	1	XG 1997 373 - 10	
		X97468	1-Methylnaphthalene	< 2.2	ug / L	1	XG.1997 373 - 10	
		X97468	2,3,4,6-Tetrachlorophenol	< 110	ug / L	50	XG.1997 373 - 10	
		X97468	2,4,5-Trichlorophenol	< 22	ug / L	10	XG.1997 373 - 10	
		X97468	2,4,6-Trichlorophenol	< 22	ug / L	10	XG.1997.373 - 10	
		X97468	2,4-Dichlorophenol	< 22	ug / L	10	XG.1997 373 - 10	
		X97468	2,4-Dimethylphenol	< 2.2	ug / L	1	XG 1997 373 - 10	
		X97468	2,4-Dinitrophenol	< 110	ug / L	50	XG.1997 373 - 10	
		X97468	2,4-Dinitrotoluene	< 22	ug / L	10	XG.1997.373 - 10	
		X97468	2,6-Dinitrotoluene	< 22	ug / L	10	XG.1997 373 - 10	
		X97468	2-Chloronaphthalene	< 2.2	ug / L	1	XG.1997 373 - 10	
		X97468	2-Chlorophenol	< 2.2	ug / L	1	XG.1997 373 - 10	
		X97468	2-Methylnaphthalene	< 2.2	ug / L	1	XG 1997 373 - 10	
		X97468	2-Methylphenol	< 2.2	ug / L	1	XG 1997 373 - 10	
		X97468	2-Nitroaniline	< 22	ug / L	10	XG.1997 373 - 10	
		X97468	2-Nitrophenol ccc	< 22	ug / L	10	XG.1997 373 - 10	
		X97468	3+4 Methylphenol	< 2.2	ug / L	1	XG.1997 373 - 10	
		X97468	3,3'-Dichlorobenzidine	< 22	ug / L	10	XG.1997 373 - 10	
		X97468	3-Nitroaniline	< 22	ug / L	10	XG.1997 373 - 10	

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12/12/97	9712126-09A	X97468	4,6-Dinitro-2-methylphenol	< 22	ug / L	10	XG 1997 373 - 10	12 19 9
		X97468	4-Bromophenyl-phenylether	< 2.2	ug / L	1	XG 1997 373 - 10	
		X97468	4-Chloro-3-methylphenol	< 22	ug / L	10	XG 1997 373 - 10	
		X97468	4-Chloroaniline	< 22	ug / L	10	XG 1997 373 - 10	
		X97468	4-Chlorophenyl-phenylether	< 2.2	ug / L	1	XG 1997 373 - 10	
		X97468	4-Nitroaniline	< 22	ug / L	10	XG 1997 373 - 10	
		X97468	4-Nitrophenol	< 44	ug / L	20	XG 1997 373 - 10	
		X97468	Acenaphthene	< 2.2	ug / L	1	XG 1997 373 - 10	
		X97468	Acenaphthylene	< 2.2	ug / L	1	XG 1997 373 - 10	
		X97468	Aniline	< 22	ug / L	10	XG 1997 373 - 10	
		X97468	Anthracene	< 2.2	ug / L	1	XG 1997 373 - 10	
		X97468	Azobenzene&1,2-Diphenylhydrazine	< 2.2	ug / L	1	XG 1997 373 - 10	
		X97468	Benzo (a) anthracene	< 2.2	ug / L	1	XG 1997 373 - 10	
		X97468	Benzo(a)pyrene	< 2.2	ug / L	1	XG 1997 373 - 10	
		X97468	Benzo(b & k)fluoranthene	< 2.2	ug / L	1	XG 1997 373 - 10	
		X97468	Benzo(g,h,i)perylene	< 22	ug / L	10	XG 1997 373 - 10	
		X97468	Benzoic acid	< 220	ug / L	100	XG 1997 373 - 10	
		X97468	Benzyl alcohol	< 110	ug / L	50	XG 1997 373 - 10	
		X97468	bis (2-Chloroethyl) ether	< 2.2	ug / L	1	XG 1997 373 - 10	
		X97468	bis(2-Chloroethoxy)methane	< 2.2	ug / L	1	XG 1997 373 - 10	
		X97468	bis(2-Chloroisopropyl)ether	< 2.2	ug / L	1	XG 1997 373 - 10	
		X97468	bis(2-Ethylhexyl)phthalate	< 22	ug / L	10	XG 1997 373 - 10	
		X97468	Butylbenzylphthalate	< 2.2	ug / L	1	XG 1997 373 - 10	
		X97468	Chrysene	< 2.2	ug / L	1	XG 1997 373 - 10	
		X97468	di-n-Butylphthalate	< 22	ug / L	10	XG 1997 373 - 10	
		X97468	di-n-Octylpthalate	< 22	ug / L	10	XG 1997 373 - 10	
		X97468	Dibenz(a,h)anthracene	< 22	ug / L	10	XG 1997 373 - 10	
		X97468	Dibenzofuran	< 2.2	ug / L	1	XG 1997 373 - 10	
		X97468	Diethylphthalate	< 2.2	ug / L	1	XG 1997 373 - 10	
		X97468	Dimethylphthalate	< 2.2	ug / L	1	XG 1997 373 - 10	
		X97468	Fluoranthene	< 2.2	ug / L	1	XG 1997 373 - 10	
		X97468	Fluorene	< 2.2	ug / L	1	XG 1997 373 - 10	
		X97468	Hexachlorobenzene	< 2.2	ug / L	1	XG 1997 373 - 10	
		X97468	Hexachlorobutadiene	< 2.2	ug / L	1	XG 1997 373 - 10	
		X97468	Hexachlorocyclopentadiene	< 110	ug / L	50	XG 1997 373 - 10	
		X97468	Hexachloroethane	< 2.2	ug / L	1	XG 1997 373 - 10	
		X97468	Indeno(1,2,3-cd)pyrene	< 22	ug / L	10	XG 1997 373 - 10	
		X97468	Isophorone	< 2.2	ug / L	1	XG 1997 373 - 10	
		X97468	n-Nitroso-di-n-propylamine	< 2.2	ug / L	1	XG 1997 373 - 10	
		X97468	n-Nitroso-dimethyl-amine	< 22	ug / L	10	XG 1997 373 - 10	
		X97468	n-Nitrosodiphenylamine	< 2.2	ug / L	1	XG 1997 373 - 10	
		X97468	Naphthalene	< 2.2	ug / L	1	XG 1997 373 - 10	
		X97468	Nitrobenzene	< 2.2	ug / L	1	XG 1997 373 - 10	
		X97468	Pentachlorophenol	< 22	ug / L	10	XG 1997 373 - 10	
		X97468	Phenanthrene	< 2.2	ug / L	1	XG 1997 373 - 10	
		X97468	Phenol	< 22	ug / L	10	XG 1997 373 - 10	
		X97468	Pyrene	< 2.2	ug / L	1	XG 1997 373 - 10	
		X97468	Pyridine	< 22	ug / L	10	XG 1997 373 - 10	

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Client: **LOS ALAMOS NATIONAL LABS**

Project: **9712126 FENTON HILL**

Client Sample ID: **MGRO 9B GAC FILTER BACKWASH** Sample Matrix: **WATER**

Collect	Fraction	QC Group	Analyte	Result	Units	Limit	*	Run Group - #	Run Da
			SW846-8270 / EPA/625 Semi-Volatiles						
12/12/97	9712126-10A	X97468	1,2,4-Trichlorobenzene	< 2.0	ug / L	1		XG.1997 373 - 11	12/19/9
		X97468	1,2-Dichlorobenzene	< 2.0	ug / L	1		XG.1997 373 - 11	
		X97468	1,3-Dichlorobenzene	< 2.0	ug / L	1		XG.1997.373 - 11	
		X97468	1,4-Dichlorobenzene	< 2.0	ug / L	1		XG.1997.373 - 11	
		X97468	1-Methylnaphthalene	< 2.0	ug / L	1		XG.1997 373 - 11	
		X97468	2,3,4,6-Tetrachlorophenol	< 100	ug / L	50		XG.1997 373 - 11	
		X97468	2,4,5-Trichlorophenol	< 20	ug / L	10		XG.1997.373 - 11	
		X97468	2,4,6-Trichlorophenol	< 20	ug / L	10		XG.1997 373 - 11	
		X97468	2,4-Dichlorophenol	< 20	ug / L	10		XG.1997.373 - 11	
		X97468	2,4-Dimethylphenol	< 2.0	ug / L	1		XG.1997 373 - 11	
		X97468	2,4-Dinitrophenol	< 100	ug / L	50		XG.1997.373 - 11	
		X97468	2,4-Dinitrotoluene	< 20	ug / L	10		XG.1997.373 - 11	
		X97468	2,6-Dinitrotoluene	< 20	ug / L	10		XG.1997 373 - 11	
		X97468	2-Chloronaphthalene	< 2.0	ug / L	1		XG.1997.373 - 11	
		X97468	2-Chlorophenol	< 2.0	ug / L	1		XG.1997.373 - 11	
		X97468	2-Methylnaphthalene	< 2.0	ug / L	1		XG 1997.373 - 11	
		X97468	2-Methylphenol	< 2.0	ug / L	1		XG.1997 373 - 11	
		X97468	2-Nitroaniline	< 20	ug / L	10		XG.1997.373 - 11	
		X97468	2-Nitrophenol ccc	< 20	ug / L	10		XG.1997 373 - 11	
		X97468	3+4 Methylphenol	< 2.0	ug / L	1		XG.1997.373 - 11	
		X97468	3,3'-Dichlorobenzidine	< 20	ug / L	10		XG.1997.373 - 11	
		X97468	3-Nitroaniline	< 20	ug / L	10		XG.1997 373 - 11	
		X97468	4,6-Dinitro-2-methylphenol	< 20	ug / L	10		XG.1997 373 - 11	
		X97468	4-Bromophenyl-phenylether	< 2.0	ug / L	1		XG.1997 373 - 11	
		X97468	4-Chloro-3-methylphenol	< 20	ug / L	10		XG 1997 373 - 11	
		X97468	4-Chloroaniline	< 20	ug / L	10		XG.1997 373 - 11	
		X97468	4-Chlorophenyl-phenylether	< 2.0	ug / L	1		XG.1997 373 - 11	
		X97468	4-Nitroaniline	< 20	ug / L	10		XG.1997 373 - 11	
		X97468	4-Nitrophenol	< 41	ug / L	20		XG 1997 373 - 11	
		X97468	Acenaphthene	< 2.0	ug / L	1		XG.1997 373 - 11	
		X97468	Acenaphthylene	< 2.0	ug / L	1		XG.1997 373 - 11	
		X97468	Aniline	< 20	ug / L	10		XG.1997 373 - 11	
		X97468	Anthracene	< 2.0	ug / L	1		XG 1997 373 - 11	
		X97466	Azobenzene&1,2-Diphenylhydrazine	< 2.0	ug / L	1		XG.1997 373 - 11	
		X97468	Benzo (a) anthracene	< 2.0	ug / L	1		XG.1997 373 - 11	
		X97468	Benzo(a)pyrene	< 2.0	ug / L	1		XG.1997 373 - 11	
		X97468	Benzo(b & k)fluoranthene	< 2.0	ug / L	1		XG.1997 373 - 11	
		X97468	Benzo(g,h,i)perylene	< 20	ug / L	10		XG.1997 373 - 11	
		X97468	Benzoic acid	< 200	ug / L	100		XG 1997 373 - 11	
		X97468	Benzyl alcohol	< 100	ug / L	50		XG.1997 373 - 11	
		X97468	bis (2-Chloroethyl) ether	< 2.0	ug / L	1		XG.1997.373 - 11	
		X97468	bis(2-Chloroethoxy)methane	< 2.0	ug / L	1		XG.1997 373 - 11	
		X97468	bis(2-Chloroisopropyl)ether	< 2.0	ug / L	1		XG.1997 373 - 11	
		X97468	bis(2-Ethylhexyl)phthalate	< 20	ug / L	10		XG.1997 373 - 11	
		X97468	Butylbenzylphthalate	< 2.0	ug / L	1		XG.1997 373 - 11	

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12/12/97	9712126-10A	X97468	Chrysene	< 2.0	ug / L	1	XG.1997 373 - 11	12/19/97
		X97468	di-n-Butylphthalate	< 20	ug / L	10	XG.1997 373 - 11	
		X97468	di-n-Octylpthalate	< 20	ug / L	10	XG.1997 373 - 11	
		X97468	Dibenz(a,h)anthracene	< 20	ug / L	10	XG.1997 373 - 11	
		X97468	Dibenzofuran	< 2.0	ug / L	1	XG.1997 373 - 11	
		X97468	Diethylphthalate	< 2.0	ug / L	1	XG.1997 373 - 11	
		X97468	Dimethylphthalate	< 2.0	ug / L	1	XG.1997.373 - 11	
		X97468	Fluoranthene	< 2.0	ug / L	1	XG.1997.373 - 11	
		X97468	Fluorene	< 2.0	ug / L	1	XG.1997.373 - 11	
		X97468	Hexachlorobenzene	< 2.0	ug / L	1	XG.1997 373 - 11	
		X97468	Hexachlorobutadiene	< 2.0	ug / L	1	XG.1997.373 - 11	
		X97468	Hexachlorocyclopentadiene	< 100	ug / L	50	XG.1997.373 - 11	
		X97468	Hexachloroethane	< 2.0	ug / L	1	XG.1997.373 - 11	
		X97468	Indeno(1,2,3-cd)pyrene	< 20	ug / L	10	XG.1997 373 - 11	
		X97468	Isophorone	< 2.0	ug / L	1	XG.1997 373 - 11	
		X97468	n-Nitroso-di-n-propylamine	< 2.0	ug / L	1	XG.1997.373 - 11	
		X97468	n-Nitroso-dimethyl-amine	< 20	ug / L	10	XG.1997 373 - 11	
		X97468	n-Nitrosodiphenylamine	< 2.0	ug / L	1	XG.1997 373 - 11	
		X97468	Naphthalene	< 2.0	ug / L	1	XG.1997.373 - 11	
		X97468	Nitrobenzene	< 2.0	ug / L	1	XG.1997.373 - 11	
		X97468	Pentachlorophenol	< 20	ug / L	10	XG.1997 373 - 11	
		X97468	Phenanthrene	< 2.0	ug / L	1	XG.1997 373 - 11	
		X97468	Phenol	< 20	ug / L	10	XG.1997 373 - 11	
		X97468	Pyrene	< 2.0	ug / L	1	XG.1997 373 - 11	
		X97468	Pyridine	< 20	ug / L	10	XG.1997 373 - 11	

Client: MGRO 10A Sample ID: GAC Filter BACKWASH Sample Matrix: WATER

Collect	Fraction	QC Group	Analyte	Result	Units	Limit *	Run Group - #	Run Date
			SW846-8240 Volatiles					
12/12/97	9712126-11A	X97483	1,1 Dichloroethane	< 1.0	ug / L	1	XG.1997 380 - 7	12/24/97
		X97483	1,1 Dichloroethene	< 1.0	ug / L	1	XG.1997 380 - 7	
		X97483	1,1,1 Trichloroethane	< 1.0	ug / L	1	XG.1997 380 - 7	
		X97483	1,1,1,2 Tetrachloroethane	< 1.0	ug / L	1	XG.1997 380 - 7	
		X97483	1,1,2 Trichloroethane	< 1.0	ug / L	1	XG.1997 380 - 7	
		X97483	1,1,2,2 Tetrachloroethane	< 1.0	ug / L	1	XG.1997 380 - 7	
		X97483	1,2 Dibromoethane (EDB)	< 1.0	ug / L	1	XG.1997 380 - 7	
		X97483	1,2 Dichlorobenzene	< 1.0	ug / L	1	XG.1997 380 - 7	
		X97483	1,2 Dichloroethane	< 1.0	ug / L	1	XG.1997 380 - 7	
		X97483	1,2 Dichloropropane	< 1.0	ug / L	1	XG.1997 380 - 7	
		X97483	1,2,3 Trichloropropane	< 1.0	ug / L	1	XG.1997 380 - 7	
		X97483	1,3 Dichlorobenzene	< 1.0	ug / L	1	XG.1997 380 - 7	
		X97483	1,4 Dichloro-2-butene	< 10	ug / L	10	XG.1997 380 - 7	
		X97483	1,4 Dichlorobenzene	< 1.0	ug / L	1	XG.1997 380 - 7	
		X97483	2-Butanone (MEK)	< 5.0	ug / L	5	XG.1997 380 - 7	
		X97483	2-Chloroethylvinylether	< 5.0	ug / L	5	XG.1997 380 - 7	
		X97483	2-Hexanone (MBK)	< 5.0	ug / L	5	XG.1997 380 - 7	
		X97483	4-Methyl-2-pentanone (MIBK)	< 5.0	ug / L	5	XG.1997 380 - 7	
		X97483	Acetone	< 5.0	ug / L	5	XG.1997 380 - 7	

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Client: **LOS ALAMOS NATIONAL LABS**
Project: **9712126 FENTON HILL**

12/12/97	9712126-11A	X97483	Acrolein	< 20	ug / L	20	XG.1997 380 - 7	12:24:97
		X97483	Acrylonitrile	< 20	ug / L	20	XG.1997.380 - 7	
		X97483	Benzene	< 1.0	ug / L	1	XG.1997.380 - 7	
		X97483	Bromodichloromethane	< 1.0	ug / L	1	XG.1997 380 - 7	
		X97483	Bromoform	< 1.0	ug / L	1	XG.1997.380 - 7	
		X97483	Bromomethane	< 5.0	ug / L	5	XG.1997 380 - 7	
		X97483	Carbon disulfide	< 5.0	ug / L	5	XG.1997 380 - 7	
		X97483	Carbon tetrachloride	< 1.0	ug / L	1	XG.1997 380 - 7	
		X97483	Chlorobenzene	< 1.0	ug / L	1	XG.1997.380 - 7	
		X97483	Chlorodibromomethane	< 1.0	ug / L	1	XG.1997 380 - 7	
		X97483	Chloroethane	< 5.0	ug / L	5	XG.1997.380 - 7	
		X97483	Chloroform	< 1.0	ug / L	1	XG.1997.380 - 7	
		X97483	Chloromethane	< 5.0	ug / L	5	XG.1997.380 - 7	
		X97483	cis-1,2 dichloroethene	< 1.0	ug / L	1	XG.1997.380 - 7	
		X97483	cis-1,3 dichloropropene	< 1.0	ug / L	1	XG.1997.380 - 7	
		X97483	Dibromomethane	< 1.0	ug / L	1	XG.1997.380 - 7	
		X97483	Ethyl methacrylate	< 5.0	ug / L	5	XG.1997.380 - 7	
		X97483	Ethylbenzene	< 1.0	ug / L	1	XG.1997.380 - 7	
		X97483	Freon 113	< 5.0	ug / L	5	XG.1997 380 - 7	
		X97483	Freon 12	< 10	ug / L	10	XG.1997 380 - 7	
		X97483	Iodomethane	< 5.0	ug / L	5	XG.1997.380 - 7	
		X97483	Methyl t-butyl ether (MTBE)	< 1.0	ug / L	1	XG.1997.380 - 7	
		X97483	Methylene chloride	< 10	ug / L	10	XG.1997.380 - 7	
		X97483	o-Xylene	< 1.0	ug / L	1	XG.1997.380 - 7	
		X97483	p/m Xylenes	< 2.0	ug / L	2	XG.1997 380 - 7	
		X97483	Styrene	< 1.0	ug / L	1	XG.1997 380 - 7	
		X97483	t-1,2 Dichloroethene	< 1.0	ug / L	1	XG.1997.380 - 7	
		X97483	t-1,3 Dichloropropene	< 1.0	ug / L	1	XG.1997 380 - 7	
		X97483	Tetrachloroethene	< 1.0	ug / L	1	XG.1997 380 - 7	
		X97483	Toluene	< 1.0	ug / L	1	XG.1997 380 - 7	
		X97483	Trichloroethene	< 1.0	ug / L	1	XG.1997 380 - 7	
		X97483	Trichlorofluoromethane	< 5.0	ug / L	5	XG.1997 380 - 7	
		X97483	Vinyl acetate	< 5.0	ug / L	5	XG.1997 380 - 7	
		X97483	Vinyl chloride	< 5.0	ug / L	5	XG.1997 380 - 7	

Client: [redacted]
Sample ID: [redacted] WATER

Collect	Fraction	QC Group	Analyte	Result	Units	Limit	Run Group - #	Run Date
12/12/97	9712126-12A	X97483	1,1 Dichloroethane	< 1.0	ug / L	1	XG.1997 380 - 8	12:24/97
		X97483	1,1 Dichloroethene	< 1.0	ug / L	1	XG.1997 380 - 8	
		X97483	1,1,1 Trichloroethane	< 1.0	ug / L	1	XG.1997 380 - 8	
		X97483	1,1,1,2 Tetrachloroethane	< 1.0	ug / L	1	XG.1997 380 - 8	
		X97483	1,1,2 Trichloroethane	< 1.0	ug / L	1	XG.1997 380 - 8	
		X97483	1,1,2,2 Tetrachloroethane	< 1.0	ug / L	1	XG.1997 380 - 8	
		X97483	1,2 Dibromoethane (EDB)	< 1.0	ug / L	1	XG.1997 380 - 8	
		X97483	1,2 Dichlorobenzene	< 1.0	ug / L	1	XG.1997 380 - 8	
		X97483	1,2 Dichloroethane	< 1.0	ug / L	1	XG.1997 380 - 8	
		X97483	1,2 Dichloropropane	< 1.0	ug / L	1	XG.1997 380 - 8	

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Client: **LOS ALAMOS NATIONAL LABS**
Project: **9712126 FENTON HILL**

12/12/97	9712126-12A	X97483	1,2,3 Trichloropropane	< 1.0	ug / L	1	XG.1997.380 - 8	12.24.9
		X97483	1,3 Dichlorobenzene	< 1.0	ug / L	1	XG.1997.380 - 8	
		X97483	1,4 Dichloro-2-butene	< 10	ug / L	10	XG.1997.380 - 8	
		X97483	1,4 Dichlorobenzene	< 1.0	ug / L	1	XG.1997.380 - 8	
		X97483	2-Butanone (MEK)	< 5.0	ug / L	5	XG.1997.380 - 8	
		X97483	2-Chloroethylvinylether	< 5.0	ug / L	5	XG.1997.380 - 8	
		X97483	2-Hexanone (MBK)	< 5.0	ug / L	5	XG.1997.380 - 8	
		X97483	4-Methyl-2-pentanone (MIBK)	< 5.0	ug / L	5	XG.1997.380 - 8	
		X97483	Acetone	< 5.0	ug / L	5	XG.1997.380 - 8	
		X97483	Acrolein	< 20	ug / L	20	XG.1997.380 - 8	
		X97483	Acrylonitrile	< 20	ug / L	20	XG.1997.380 - 8	
		X97483	Benzene	< 1.0	ug / L	1	XG.1997.380 - 8	
		X97483	Bromodichloromethane	< 1.0	ug / L	1	XG.1997.380 - 8	
		X97483	Bromoform	< 1.0	ug / L	1	XG.1997.380 - 8	
		X97483	Bromomethane	< 5.0	ug / L	5	XG.1997.380 - 8	
		X97483	Carbon disulfide	< 5.0	ug / L	5	XG.1997.380 - 8	
		X97483	Carbon tetrachloride	< 1.0	ug / L	1	XG.1997.380 - 8	
		X97483	Chlorobenzene	< 1.0	ug / L	1	XG.1997.380 - 8	
		X97483	Chlorodibromomethane	< 1.0	ug / L	1	XG.1997.380 - 8	
		X97483	Chloroethane	< 5.0	ug / L	5	XG.1997.380 - 8	
		X97483	Chloroform	< 1.0	ug / L	1	XG.1997.380 - 8	
		X97483	Chloromethane	< 5.0	ug / L	5	XG.1997.380 - 8	
		X97483	cis-1,2 dichloroethene	< 1.0	ug / L	1	XG.1997.380 - 8	
		X97483	cis-1,3 dichloropropene	< 1.0	ug / L	1	XG.1997.380 - 8	
		X97483	Dibromomethane	< 1.0	ug / L	1	XG.1997.380 - 8	
		X97483	Ethyl methacrylate	< 5.0	ug / L	5	XG.1997.380 - 8	
		X97483	Ethylbenzene	< 1.0	ug / L	1	XG.1997.380 - 8	
		X97483	Freon 113	< 5.0	ug / L	5	XG.1997.380 - 8	
		X97483	Freon 12	< 10	ug / L	10	XG.1997.380 - 8	
		X97483	Iodomethane	< 5.0	ug / L	5	XG.1997.380 - 8	
		X97483	Methyl t-butyl ether (MTBE)	< 1.0	ug / L	1	XG.1997.380 - 8	
		X97483	Methylene chloride	< 10	ug / L	10	XG.1997.380 - 8	
		X97483	o-Xylene	< 1.0	ug / L	1	XG.1997.380 - 8	
		X97483	p/m Xylenes	< 2.0	ug / L	2	XG.1997.380 - 8	
		X97483	Styrene	< 1.0	ug / L	1	XG.1997.380 - 8	
		X97483	t-1,2 Dichloroethene	< 1.0	ug / L	1	XG.1997.380 - 8	
		X97483	t-1,3 Dichloropropene	< 1.0	ug / L	1	XG.1997.380 - 8	
		X97483	Tetrachloroethene	< 1.0	ug / L	1	XG.1997.380 - 8	
		X97483	Toluene	< 1.0	ug / L	1	XG.1997.380 - 8	
		X97483	Trichloroethene	< 1.0	ug / L	1	XG.1997.380 - 8	
		X97483	Trichlorofluoromethane	< 5.0	ug / L	5	XG.1997.380 - 8	
		X97483	Vinyl acetate	< 5.0	ug / L	5	XG.1997.380 - 8	
		X97483	Vinyl chloride	< 5.0	ug / L	5	XG.1997.380 - 8	

Client Sample ID: **MGR011A** WATER

Collect	Fraction	QC Group	Analyte	Result	Units	Limit	Run Group - #	Run Date
			EPA 160.1					
12/12/97	9712126-13A	WTDS-435	Total Dissolved Solids	426	mg / L	10	MT 1997 476 - 8	12/16/97

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Client: **LOS ALAMOS NATIONAL LABS**
Project: **9712126 FENTON HILL**

Client Sample ID: **MGRO 11B** SOFTENER REGEN. WATER — Sample Matrix: **WATER**

Collect	Fraction	QC Group	Analyte	Result	Units	Limit	*	Run Group - #	Run Dat
			EPA 160 Series						
12/12/97	9712126-14A	WTDS-435	Total Dissolved Solids	9930	mg / L	10		MT.1997.476 - 9	12/16/9

Client Sample ID: **MGRO 11C** SOFTENER REGEN. WATER — Sample Matrix: **WATER**

Collect	Fraction	QC Group	Analyte	Result	Units	Limit	*	Run Group - #	Run Dat
			EPA 160 Series						
12/12/97	9712126-15A	WTDS-435	Total Dissolved Solids	12550	mg / L	10		MT.1997.476 - 10	12/16/97

Client Sample ID: **MGRO 12** — Sample Matrix: **WATER**

Collect	Fraction	QC Group	Analyte	Result	Units	Limit	*	Run Group - #	Run Date
			EPA 200.8 ICP/MS						
12/12/97	9712126-16A	MT.1998.91	Uranium, total	0.0029	mg/L	0.0001		MT.1998.91 - 3	01/09/98
			EPA 200.7 ICP Metals, Aqueous						
12/12/97	9712126-16A	M97914	Molybdenum	< 0.02	mg / L	0.02		MW.1997.1044 - 13	12/23/97
		M97914	Selenium	< 0.005	mg / L	0.005		MW.1998.6 - 16	01/05/98
			EPA 200.7 ICP						
12/12/97	9712126-16A	M97927	Aluminum	< 0.5	mg / L	0.5		MW.1998.1 - 26	12/31/97
		M97927	Arsenic	< 0.06	mg / L	0.06		MW.1998.1 - 26	
		M97927	Barium	< 0.01	mg / L	0.01		MW.1998.1 - 26	
		M97927	Beryllium	< 0.004	mg / L	0.004		MW.1998.1 - 26	
		M97927	Boron	1.4	mg / L	0.1		MW.1998.21 - 26	01/06/98
		M97927	Cadmium	< 0.008	mg / L	0.008		MW.1998.1 - 26	12/31/97
		M97927	Chromium	< 0.04	mg / L	0.04		MW.1998.1 - 26	
		M97927	Cobalt	< 0.01	mg / L	0.01		MW.1998.1 - 26	
		M97927	Copper	< 0.04	mg / L	0.04		MW.1998.1 - 26	
		M97927	Iron	< 0.2	mg / L	0.2		MW.1998.21 - 26	01/06/98
		M97927	Lead	< 0.06	mg / L	0.06		MW.1998.21 - 26	
		M97927	Manganese	< 0.010	mg / L	0.01		MW.1998.1 - 26	12/31/97
		M97927	Nickel	< 0.04	mg / L	0.04		MW.1998.1 - 26	
		M97927	Silver	< 0.02	mg / L	0.02		MW.1998.1 - 26	
		M97927	Thallium	< 0.3	mg / L	0.3		MW.1998.1 - 26	
		M97927	Zinc	0.7	mg / L	0.1	B	MW.1998.21 - 26	01/06/98
			Mercury, Aqueous EPA 245.1						
12/12/97	9712126-16A	M97925	Mercury	< 0.0002	mg / L	0.0002		MW.1997.1051 - 17	12/24/97

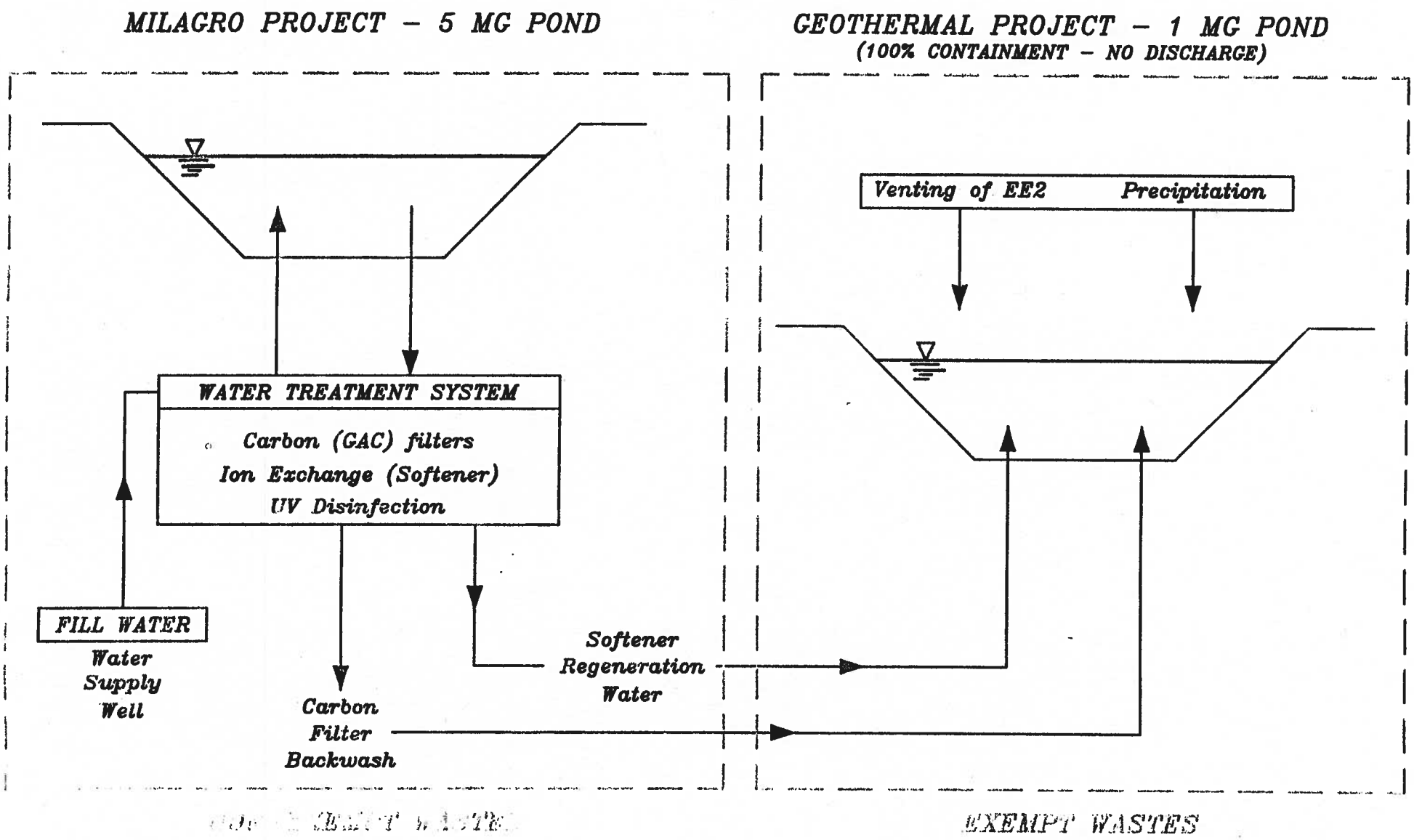
Client Sample ID: **MGRO 13** — Sample Matrix: **WATER**

Collect	Fraction	QC Group	Analyte	Result	Units	Limit	*	Run Group - #	Run Date
			EPA 335.2 SM 4500						
12/12/97	9712126-17A	W97547	Cyanide	< 0.02	mg / L	0.02		MW.1997.1027 - 13	12/17/97

Client Sample ID: **MGRO 14** — Sample Matrix: **WATER**

Collect	Fraction	QC Group	Analyte	Result	Units	Limit	*	Run Group - #	Run Date
			EPA 300 Series						
12/12/97	9712126-18A	W97543	Nitrate, Nitrogen	< 0.2	mg N/ L	0.2		MW.1997.1025 - 18	12/16/97

MIXING OF EXEMPT AND NON-EXEMPT WASTES



07/01/98

Figure 2.0

5 MG POND to 1 MG POND PIPING SCHEMATIC

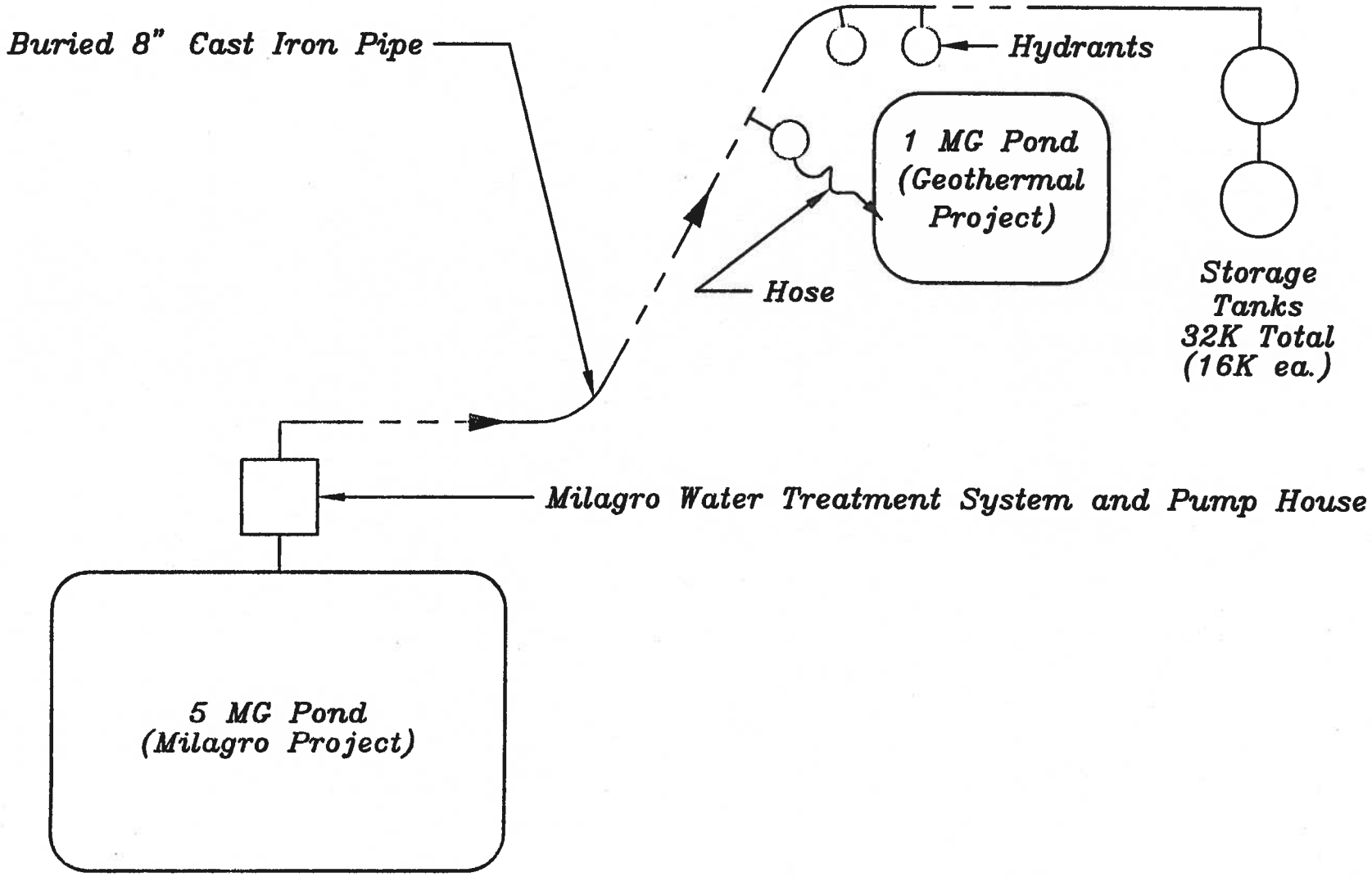


Figure 3.0

FINAL MIXTURE SUMMARY: 1 MG Pond: 1998-2006[1]	
Total Estimated Nonexempt Solids (ft^3)	106
Total Estimated Exempt Solids (ft^3)	4,184
Percent of Final Mixture that is Nonexempt	3%

Milagro Project Nonexempt Wastes: Softener Regeneration & GAC Filter Backwash Wastewater

Years	Source	Wastewater Volume (gal)	Wastewater Volume (liters)	TDS (mg/L)	TDS (kg)	TSS (mg/L)	TSS (kg)	Total Solids TSS+TDS (kg)	Total Solids Volume (ft^3)[2]
1998	GAC Filter	78,500	297,123	422	125	9	3	134	3
1998	Softener	75,000	283,875	12,550	3,563	9	3	3,572	88
1999	GAC Filter	48,000	181,680	422	77	9	2	78	2
2000	GAC Filter	48,000	181,680	422	77	9	2	78	2
2001	GAC Filter	48,000	181,680	422	77	9	2	78	2
2002	GAC Filter	48,000	181,680	422	77	9	2	78	2
2003	GAC Filter	48,000	181,680	422	77	9	2	78	2
2004	GAC Filter	48,000	181,680	422	77	9	2	78	2
2005	GAC Filter	48,000	181,680	422	77	9	2	78	2
2006	GAC Filter	48,000	181,680	422	77	9	2	78	2
								Estimated volume of nonexempt solids after 9 years of operation (ft^3)	106

Geothermal Project Exempt Wastes: 1 MG Pond[4]

Year	Source	Wastewater Volume (gal)	Wastewater Volume (liters)	% Solids	Solids Volume (gal)	Solids Volume (ft^3)
2006	Geothermal	25,000	94,625	20	18,925	2,536
	Geothermal	650,000	2,460,250	0.5[3]	12,301	1,648
				Estimated volume of exempt solids after 9 years of operation (ft^3)		4,184

NOTES:

[1] Final mixture is based upon nine years of operation.

[2] Weight-to-volume conversions are based upon an estimated solids weight of 90 lbs/ft^3.

[3] A percent solids of 0.5% is equivalent to a TDS/TSS concentration of 5,000 ppm. Analysis of the 1 MG pond water on 5/5/97 showed a TDS concentration of 5,034 ppm.

[4] The estimated volume of solids in the 1 MG pond in the year 2006 are based upon the volume of solids removed during pond cleaning in Sept., 1997, after 9 years of operation.

APPENDIX F

NM OCD Approval of July 1998 Minor Modification Request, May 1999

NEW MEXICO ENERGY, MINERALS
& NATURAL RESOURCES DEPARTMENT

OIL CONSERVATION DIVISION
2040 South Pacheco Street
Santa Fe, New Mexico 87505
(505) 827-7131

May 10, 1999

CERTIFIED MAIL
RETURN RECEIPT NO. Z 559 573 595

Mr. Steven Rae
Los Alamos National Laboratory
MS K497
Los Alamos, NM 87545

Subject: Minor Modification of Ground Water Discharge Plan GW-031

Dear Mr. Rae:

The New Mexico Oil Conservation Division (NMOCD) is receipt of Los Alamos National Laboratory's (LANL) letter dated July 20, 1999 requesting a minor modification to the existing discharge plan GW-031. The NMOCD hereby approves of the minor modification subject to the following conditions:

1. All waste will be disposed of at an OCD approved facility.

2. The 8" (inch) buried cast iron pipe using to convey the wastewater from the 5 (mmgal) pond to the 1 (mmgal) pond shall be tested to demonstrate mechanical integrity at present and then every 5 years thereafter, or prior to discharge plan renewal. Permittees may propose various methods for testing such as pressure testing to 3 pounds per square inch above normal operating pressure or other means acceptable to the OCD. The OCD will be notified at least 72 hours prior to all testing. **LANL shall perform this mechanical integrity test and submit the results by June 15, 1999.**

Please be advised that NMOCD approval of this minor modification does not relieve LANL of liability should their operations fail to adequately investigate and remediate contamination that pose a threat to ground water, surface water, human health or the environment. In addition, NMOCD approval does not relieve LANL of responsibility for compliance with any other federal, state, or local laws and/or regulations.

If you have any questions, please contact Wayne Price of my staff at (505-827-7155). On behalf of the staff of the OCD, I wish to thank you and your staff for your cooperation during this discharge plan review.

Sincerely,

Roger Anderson
Environmental Bureau Chief

xc: Roy Johnson

APPENDIX G

LANL Draft Seeding Specification

SECTION 02936

SEEDING

****

LANL MASTER CONSTRUCTION SPECIFICATION

When editing to suit project, author shall add job-specific requirements and delete only those portions that in no way apply to the activity (e.g., a component that does not apply). To seek a variance from applicable requirements, contact the LEM Civil POC.

When assembling a specification package, include applicable specifications from all Divisions, especially Division 1, General Requirements.

Delete information within "stars" during editing.

Specification developed for ML-3 projects. For ML-1 / ML-2, additional requirements and QA reviews are required.

****

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Preparation of seedbed.

B. Seeding.

C. Mulching and erosion control blankets.

D. Watering and maintenance.

1.2 RELATED SECTIONS

A. Section 02270, Slope Protection and Erosion/Sediment Control

1.3 SUBMITTALS

A. Submit the following in accordance with Section 01330, Submittal Procedures:

1. Catalog data, including sources of supply for amendments, mulch, tackifier, fertilizer and erosion control blankets.

2. Certification substantiating that material complies with specified requirements. Submit certified seed bag tags and copies of seed invoices identified by project name.

3. Installation instructions, including proposed seeding schedule. Coordinate with specified maintenance periods to provide maintenance from date of final acceptance. Once schedule is accepted, revise dates only with LANL approval after documentation of delays.

1.4 QUALITY ASSURANCE

A. Contractor Qualifications:

1. Perform work by a single firm experienced with the type and scale of work required and having equipment and personnel adequate to perform the work satisfactorily.

B. Material Quality Control:

1. Provide seed mixture in containers showing species percentages in seed mix; test information including, purity, germination and noxious/restricted weeds; net weight; date of packaging; and location of packaging.

2. Furnish seed labeled in accordance with the requirements of federal and New Mexico statutes and regulations governing seed labeling. Such resulting requirements include but are not necessarily limited to: Federal Seed Act and Amendments, rules and regulations established by the United States Department of Agriculture; the New Mexico Seed Law; and all resulting regulations or restrictions established by New Mexico State University or other authorized entity.

3. In addition, ensure seed mix and its application complies with the requirements of all other federal and New Mexico statutes and regulations governing seeds, plants, and weeds. These requirements include but are not necessarily limited to: the Noxious Weed Control Act and all rules, regulations, or control measures by a noxious weed control district embracing Los Alamos County, New Mexico; and the Harmful Plant Act.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver packaged materials in sealed containers showing weight, analysis and name of manufacturer. Protect materials from deterioration during delivery and while stored at site. Opened or wet seed shall be rejected and returned to the responsible party.

PART 2 PRODUCTS

2.1 PRODUCT OPTIONS AND SUBSTITUTIONS

A. Comply with 01630, Product Options and Substitutions.

2.2 SEED

A. Obtain native grass seed from sources whose origin would ensure site adaptability at LANL. Plant sources from New Mexico or surrounding states are preferred.

B. Obtain shrub and wildflower seed from sources whose origin would ensure site adaptability at LANL. Plant sources from New Mexico or surrounding states are preferred.

C. Cover crops (e.g., annual barley, oats, winter rye, etc.) may be used only as a temporary stabilization measure and shall not be used in conjunction with a perennial seed mix.

D. Furnish certification, showing origin of seed and pure live seed (PLS) content as determined by a certified authority. Provide bags of seed that are tagged and sealed in accordance with the State Department of Agriculture or other local certification authority within the state of origin. The tag or label shall indicate analysis of seed and date of analysis, which shall not be more than 9 months prior to delivery date. Seed may be premixed by the seed dealer and appropriate data indicated on the bag label for each variety.

E. Seed mixture shall be:

****

Develop seed mixture from the following guidelines. Choose a minimum of 5 grass species from the list. Should wildflowers be included in the mix, use a ratio of 80 – 90 percent grasses and 10-20 percent wildflowers. Choose 3 –5 species from the forb and wildflowers list.

****

NATIVE PERENNIAL MIX

Common Name	Scientific Name	% of Mix
Grasses		
Blue grama*	*Bouteloua gracilis*	5 – 10%
Galleta grass*	*Hilaria jamesii*	5- 10%
Mutton grass	*Poa fendleriana*	10-15%
Sideoats grama*	*Bouteloua curtipendula*	10-15%
Arizona fescue†	*Festuca arizonica*	10 – 15%
Prairie junegrass†	*Koeleria macrantha*	5 – 10%
Bottlebrush squirreltail*	*Elymus elymoides*	15 – 20%
Little bluestem†	*Schizachyrium scoparium*	10 – 15%
Indian ricegrass*	*Oryzopsis hymenoides*	10 – 15%
Mountain brome†	*Bormus marginatus*	10 – 15%
Sand dropseed*	*Sporobolus cryptandrus*	1 - 8%
Thickspike wheatgrass	*Agropyron dasystachyum*	20 – 25%
Needle and Thread grass*	*Stipa comata*	5 – 10%
New Mexico needlegrass*	*Stipa neomexicana*	10 - 15%
Sheep fescue	*Festuca ovina*	10 – 15%
Forbs/ Wildflowers		1%
Firewheel	*Gaillardia pulchella*	2%
Evening primrose	*Oenothera caespitosa*	1%
Gooseberry leaf Globemallow	*Sphaeralcea grossulariafolia*	1.5%

Common Name	Scientific Name	% of Mix
Scarlet gilia	*Ipomopsis aggregata*	1%
Plains aster	*Aster biglovii*	1%
Western yarrow	*Achillea millifolium*	½%
Fringed sage	*Artemisia frigida*	1%
Blue flax	*Linum perenne lewisii*	4%
Scarlet bulgler	*Penstemon barbatus*	2%
Palmer penstemon	*Penstemon palmerii*	2%
Prairie coneflower	*Ratibida columnifera*	1%
Showy golden-eye	*Heliomerus multiflora*	1%
Purple geranium	*Geranium caespitosum*	5%

***Species particularly suited for especially dry sites**
†Species particularly suited for higher elevations (above 7000 ft.)

2.3 STRAW MULCH

A. Straw shall be stalks from oats, wheat, rye, barley, or rice that are free from noxious weeds, mold, or other objectionable material. At least 65 percent of the herbage by weight of each bale of straw shall be 10 inches in length or longer. Rotted, brittle or molded straw is not acceptable. Straw from introduced grasses is acceptable if cut prior to seed formation. If possible, provide marsh grass composed of mid to tall native grasses (usually tough and wiry grass and grass-like plants found in the lowland areas within the Rocky Mountain Region).

2.4 HYDRAULIC MULCH/TACKIFIER

A. Provide mulch material consisting of 100 percent virgin wood fibers manufactured expressly from whole wood chips, such as Eco-Fibre, Conwed, etc. Process chips in such a manner as to contain no growth or germination inhibiting factors. Do not produce fiber from recycled material such as sawdust, paper, cardboard, or residue from pulp and paper plants. Provide materials free from contaminants such as lead paint, varnish or other metal contaminants. Hydraulic mulch shall contain non-toxic dye to assist in visually determing even distribution. Mulch material shall meet the following specifications:

Parameter	Value
pH at 3% consistency	4.5 +/- 0.5
Ash content	0.8% +/- 0.2%
Moisture holding capacity	1250 (grams water/100 grams oven dry fiber)
Moisture content	12% +/- 3% (Wet weight basis)

B. Combine mulch with an organic plantago based tackifier, such as M-binder, etc., that has no growth or germination inhibiting factors and is nontoxic. Apply the uniform mixture to the seeded area.

C. Bagged mulch/tackifier mix that is homogenous within the unit package may also be used. Tackifier shall adhere to the fibers during manufacturing to prevent separation during shipment and to avoid chemical agglomeration during mixing in the hydraulic mulching equipment.

2.5 EROSION CONTROL BLANKET

A. Provide erosion control blankets of a uniform web of interlocking excelsior wood fibers, weed-free straw, or a combination of straw and coir fibers.

****

Use an appropriate blanket chosen for the site conditions and functionality for the desired growing seasons.

****

1. 3:1 slopes or gentler

Single netted blankets	A machine produced erosion control blanket using 100 percent straw or excelsior fibers sewn into a medium weight photo degradable bottom net. Minimum weight of blanket 0.5 lbs/ square yard, such as Greenfix America WS05, etc.

2. 3:1 – 2:1 slopes

Double netted blankets	A machine produced erosion control blanket using 100 percent straw or excelsior fibers sewn into a medium weight photo degradable top net and a light weight photo degradable bottom net. Minimum weight of blanket 0.7 lbs/ square yard, such as Greenfix America WS072, etc.

3. 2:1 slopes and steeper and/or 2 growing seasons of protection

Straw/ coir blend blankets	A machine produced straw /coir fiber erosion control blanket using 70 percent straw /30 percent coir fibers sewn into a heavy weight photo degradable top net and a medium weight photo degradable bottom net. Minimum weight of blanket 0.7 lbs/square yard, such as Greenfix America CFS072R, etc.

B. Staples: U-shaped, 11 gauge or heavier steel wire, minimum leg length of 8 inches after bending, with a throat approximately 2 inches wide.

C. Wood Stakes: Use 2 x 2 x 12 inch pine or fir stakes, beveled at one end, in place of wire staples in tuff locations.

2.6 BONDED FIBER MATRIX

A. Provide Bonded Fiber Matrix (BFM) composed of natural color, long strand wood fiber, produced by therm-mechanical defribration of wood chips and joined together by a high strength non-toxic adhesive, such as Eco-Ageis, etc. The product shall be composed of 90 percent wood fiber, 9 percent blended hydrocolloid-based binder, and 1 mineral activators, all by total weight. The BFM shall be 100 percent biodegradable and non-toxic to fish and wildlife, and it shall not contain any synthetic fibers.

2.7 AMENDMENTS / SOIL ADDITIONS

A. Fertilizer: Apply slow-release organic fertilizers such as Biosol Mix, Biosol, Osmocote, composted manure or approved equal to minimize deficiencies of the topsoil. If composted manure is to be applied, test the nutrient content and interpret before it is used.

B. Water: Clean, fresh, and free of substances or matter that could inhibit vigorous growth.

C. Sand: Clean, washed, and free of toxic materials.

D. Wood chips: Wood chips shall have a relatively large surface area to volume ratio to be more easily broken down in the soil. Incorporate wood chips at low rates (0.5 ton/ acre) in order to assure the Carbon to Nitrogen ratio in soil is at favorable conditions for plant germination and growth. If higher rates are used, add nitrogen fertilizer to assure nutrient availability to plants.

PART 3 EXECUTION

3.1 PREPARATION

A. Preparation of the Seedbed:

1. Prepare seedbed to a maximum depth of 4 inches by tilling with a disc harrow or chiseling tool. Uproot all competitive vegetation during seedbed preparation and work soil uniformly, leaving surface rough to reduce surface erosion. Remove large clods and stones, or other foreign material that would interfere with seeding equipment.

2. Do not till on ground that is already loose to a depth of 2 inches or more that has undergone regrading and fill. Till newly cut slopes.

3. Perform tillage across slope when practical and perform in 2 directions whenever one pass is insufficient to adequately break up soil. Do not till up and down slopes, as this will create excessive surface erosion problems.

4. Do not do work when moisture content of soil is unfavorable or ground is otherwise in a non-tillable condition. To minimize dust problems for adjoining areas, do not till when wind speeds are over 10 mph.

5. The extent of seedbed preparation shall not exceed the area on which the entire seeding operation can be accomplished within a 24-hour period.

B. Soil Amendments/Additions: Uniformly apply slow release organic fertilizer to prepared seedbed in accordance with manufacturer recommended rates.

C. Prepare seedbed again if prior to seeding LANL Construction Inspector determines that rain or some other factor has affected prepared surfaces and that it may prevent seeding to proper depth.

D. On excessively steep slopes (steeper than 2:1), hydraulic/broadcast seeding may be appropriate. If seeding in this fashion, multiply application rate of seed by a factor of 2.

E. If cover crop has been established in area to be seeded, mow cover crop early in growing season before cover crop is ready to drop seeds.

3.2 APPLICATION OF SEED

A. General:

1. Avoid seeding between August 1 and September 30. Do not seed during windy weather, or when topsoil is dry, saturated or frozen.

2. Equip seed boxes used for drill and broadcast seeding with an agitator.

3. To prevent stratification of seed mix, do not run seed box agitators while seeding is not being performed.

4. If seed mix is transported to site in a seed box or other equipment that subjects mix to shaking or similar movement that has the potential to cause stratification, remix seed prior to application.

5. Calibrate seeding equipment in presence of LANL Construction Inspector to determine that equipment setting is appropriate to distribute seed at the specified rates.

6. Unless otherwise shown on Drawings, seed areas disturbed by or denuded by construction operations or erosion.

7. Use markers to ensure that no gaps will exist between passes of seeding equipment.

8. If cover crop has been established, mow the crop and drill seed perennial seed mix into the crop stubble.

B. Drill Seeding:

When drill seeding, plant seed mix at a rate of 20 - 25 PLS lbs/acre. Uniformly apply prescribed mix over area to be seeded as follows:

1. Accomplish seeding operations, where practical, by drilling in a direction across slope.

2. Plant seeds approximately 1/4 inch deep.

3. Do not exceed 4 inches distance between drilled furrows. If furrow openers on drill exceed 4 inches, drill area twice to obtain a 4-inch distance between furrows.

4. Seed with grass wheels, rate control attachments, seed boxes with agitators, and separate boxes for small seed.

C. Broadcast Seeding:

When broadcast seeding, plant seed mix at a rate of 32 - 37 PLS lbs/acre.

1. Where it is not practical to accomplish seeding by drilling, mechanically broadcast seed by use of a hydraulic mulch slurry blower, rotary spreader, or a seeder box with a gear feed mechanism. If seeding is done with a slurry blower, use highest pressure and smallest nozzle opening that will accommodate the seed.

2. Immediately following seeding operation, lightly rake seedbed or loosen with a chain harrow to provide approximately 1/4 inch of soil cover over most of the seed.

3. If hydraulically applying mulch as part of the broadcast seeding process, use a 2 step process. Apply seed with a tracer (200 – 300 lbs/ acre) amount of mulch across entire seeded area. Once seed is applied, apply full complement of mulch (to equal 2000 lbs/ acre). This shall allow seed to be in good contact with soil surface and not suspended in mulch matrix.

4. Prohibit vehicles and other equipment from traveling over the seeded areas.

3.3 STRAW MULCH: Slopes Flatter than 2:1, Non-Irrigated Projects

A. For locations that have not been hydraulically mulched, immediately following raking/chaining operation, add straw mulch to seeded areas.

1. Apply straw mulch at a minimum rate of 1.5 tons per acre of air-dry material. Spread straw mulch uniformly over area either by hand or with a mechanical mulch spreader to achieve 80 percent ground cover. When spread by hand, tear bales of straw apart and fluff before spreading. Depth of applied straw mulch shall not exceed 3 inches. Do not mulch when wind velocity exceeds 10 mph.

2. Wherever use of crimping equipment is practical, place mulch in manner noted above and anchor it into the soil to a minimum depth of 2 inches. Use a crimper or heavy disc such as a mulch tiller, with flat serrated discs at least 1/4 inch in thickness, having dull edges, and spaced no more than 9 inches apart. Provide discs of sufficient diameter to prevent frame of equipment from dragging the mulch. Where practical, perform crimping in 2 (opposite) directions. Do not use Sheep's Foot Rollers, heavy equipment tracks, and standard disc cultivators for crimping.

3. If straw mulched areas cannot be anchored by crimping, use hydraulic mulch wood fibers with tackifier. Mix slurry in a tank with an agitation system and spray under pressure uniformly over the soil surface. Keep all materials in uniform suspension throughout the mixing and suspension cycle when using hydraulic mulching equipment. Mix 100 lb. of wood fiber with 150 lbs. of tackifier to anchor straw mulch. Apply mixture at a rate of 250 lbs/acre.

4. Use both horizontal and vertical movements in the applicator to achieve an even application of the slurry material.

3.4 HYDRAULIC MULCHING/TACKIFIER: Slopes Flatter than 2:1, Irrigated Projects

A. Immediately following raking/chaining operation, apply hydraulic mulch fibers with tackifier to seeded areas. Mix slurry in a tank with an agitation system and spray, under pressure, uniformly over soil surface. Apply mulch evenly across landscape at a rate of 2000 lbs/ acre.

B. Use both horizontal and vertical movements in applicator to achieve an even application of slurry material. Keep all materials in uniform suspension throughout mixing and suspension cycle when using hydraulic mulching equipment.

C. When using plantago based tackifier as mulch, apply tackifier at a rate of 100 lbs/acre. When applied alone for dust control, apply tackifier at a rate of 150 lbs/acre.

D. Prohibit foot/vehicle traffic from hydraulically mulched areas.

3.5 EROSION CONTROL BLANKET: Slopes 3:1 and Steeper, Irrigated and Non-Irrigated Projects

A. Place blankets over native grass seeding immediately following the raking/chaining operation.

B. When using single netted products for 3:1 or flatter slopes, place blanket with netting on top and the wood/ straw fibers in contact with soil over entire seeded area.

C. For slope installations, the following guidelines shall be used:

1. Begin at top of slope and anchor its blanket in a 6 inch deep by 6-inch wide trench. Backfill trench and tamp earth firmly.

2. Unroll blanket downslope in direction of water flow.

3. Overlap edges of adjacent parallel rolls 2 to 3 inches and staple every 3 feet.

4. When blankets are spliced, place blankets end over end (shingle style) with 6-inch overlap. Staple through overlapped area, approximately 12 inches apart.

5. Lay blankets loosely and maintain direct contact with soil – do not stretch.

6. Staple blankets sufficiently to anchor blanket and maintain contact with soil. Place staples down the center and staggered with the staples placed along the edges. Steep slopes (1:1 – 2:1) require 2 staples per square yard. Moderate slopes (2:1 – 3:1) require 1 to 2 staples per square yard. Gentle slopes require 1 staple per square yard. Use a common row of staples on adjoining blankets.

D. Use wood stakes on tuff slopes, in place of wire staples. Use same installation rate as for staples. Drive stakes in perpendicular to slope and leave 2 inches exposed above soil grade.

3.6 BONDED FIBER MATRIX (BFM): Slopes 2:1 and Steeper, Irrigated and Non-Irrigated Projects

A. Hydraulically apply BFM over seeded area (or apply seed with a tracer amount, 200-300 lbs/ acre) immediately following raking/chaining operations and in accordance with manufacturer's specified procedures. Hydraulically apply BFM as a viscous mixture. Upon drying, it shall form a continuous, porous and erosion resistant mat. Upon drying, matrix shall not inhibit germination and growth of plants in and beneath the layer. Matrix shall retain its form despite re-wetting.

B. Apply matrix uniformly across area and apply in multiple directions to ensure a 100 percent soil surface coverage.

C. Apply at a rate of approximately 3,500-lbs/ acre in a manner that achieves uniform coverage of all exposed soils.

D. Prohibit vehicle traffic on hydraulic BFM applications.

3.7 WATERING

A. Where temporary watering is required for seeded areas, provide temporary water system which may be a sprinkler system, or a water truck with a spray boom or any other method satisfactory to distribute a uniform coverage of clean water (free or oil, acid, salt or other substances harmful to plants) to previously seeded and mulched areas.

B. If a temporary sprinkler system is used, keep all pipe connections tight to avoid leakage and loss of water, and to prevent washing or erosion of growing areas. Maintain sprinklers in proper working order during watering.

C. Do not drive trucks with spray systems on seeded areas and ensure water force does not cause movement of mulch or seed on the ground.

D. Water revegetated areas only if areas were planted between April 15 and July 31.

E. Apply water at a maximum of 1/2 inch/hour for 2 hours. Additional applications of water may be made as designated by LANL Construction Inspector. Water source will be approved by LANL, prior to use.

3.8 MAINTENANCE

A. Begin maintenance immediately after planting.

B. Maintain seeded areas for not less than 60 days after final acceptance of work and longer as required to achieve final stabilization as described in Section 3.10 ACCEPTANCE.

C. Reseed void areas greater than 6 square feet or repetitive voids greater than 2 square feet amounting to more than 10 percent of any area that appears the growing season following installation.

D. Keep revegetated areas free of noxious weeds until acceptance by LANL. Contact LANL Construction Inspector prior to application of any control measure.

3.9 CLEANUP AND PROTECTION

A. After completion of work, clear site of excess soil, waste material, debris and objects that may hinder maintenance and detract from neat appearance of site.

B. Protect work and materials from damage due to seeding operations, operations by other contractors and trades, and trespassers. Maintain protection during installation and maintenance periods. Treat, repair or replace damaged work as directed.

3.10 ACCEPTANCE

A. Seeded areas will be reviewed for acceptance by LANL when final stabilization has been achieved. Final stabilization is defined as "All soil disturbing activities at the site have been completed and a uniform (e.g., evenly distributed, without large bare areas) perennial vegetative cover with a density of 70 percent of the native background vegetative cover for the area has been established on all unpaved areas and areas not covered by permanent structures, or equivalent permanent stabilization measures (such as the use of riprap, gabions, or geotextiles) have been employed."

B. In the event that all other work required by the Contract is completed before final stabilization is achieved or because seasonal limitations prevent seeding, partial acceptance of the work shall be made with final acceptance delayed until satisfactory vegetative growth has been established.

END OF SECTION