3R - 390

GENERAL CORRESPONDENCE

YEAR(S):

2004 - 1967

Attn Wayne Price

Department of Energy
National Nuclear Security Administration
Nevada Site Office
P.O. Box 98518
Las Vegas, NV 89193-8518

June 8, 2004

Denny Faust
State of New Mexico
Oil Conservation Division, District 3
1000 Rio Brazos Road
Aztec, NM 87410

SUBMITTAL OF THE SUNDRY NOTICE FOR MUD PIT REMEDAITION ACTIVITIES AT THE GASBUGGY SITE, NEW MEXICO

Enclosed please find for your review and approval the sundry notice of the U.S. Department of Energy (DOE) National Nuclear Security Administration Nevada Site Office's intent to perform remedial work at the Gasbuggy Site located in the Carson National Forest.

The Stoller-Navarro Joint Venture as a contractor to DOE, will perform the remediation work.

Attached to the form C-103 is an executive summary of the remediation activities planned to start in mid-July of this year.

Additional copies have been provided for distribution within your organization.

For additional information, please contact me at (702) 295-1037.

Robert M. Bumgarter Jr.
for Monica L. Sanchez, Acting Director
Environmental Restoration Division

ERD:1096.PS

Enclosure:
As stated

cc w/encl.:
T. R. Echelard, SNJV, Las Vegas, NV
S. K. Doty, EM Records Center,
NNSA/NSO, Las Vegas, NV

-Submit 3 Copies To Appropriate District Office
District I
1625 N. French Dr., Hobbs, NM 88240
District II
1301 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
March 4, 2004

WELL API NO.

5. Indicate Type of Lease
STATE ☐ FEE X

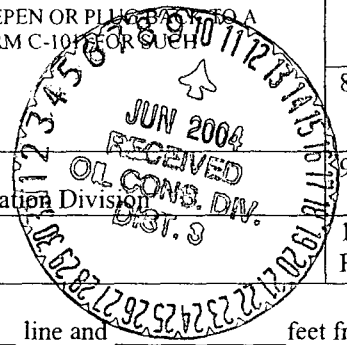
6. State Oil & Gas Lease No.
Not Applicable

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

1. Type of Well:
Oil Well ☐ Gas Well X Other

8. Well Number



2. Name of Operator
United States Department of Energy, Environmental Restoration Division

9. OGRID Number

3. Address of Operator
PO box 98518, Las Vegas, NV, 89193-8518

10. Pool name or Wildcat
Pictured Cliffs

4. Well Location
Unit Letter_____eet from the _____ line and _____feet from the _____line
Section Township Range County

11. Elevation *(Show whether DR, RKB, RT, GR, etc.)*
7160-7345

Pit or Below-grade Tank Application (For pit or below-grade tank closures, a form C-144 must be attached)

Pit Location: UL__Sect__36_ Twp__29N_ Rng__4W__ Pit type __drilling mud__ Depth to Groundwater _>50 ft bgs __ Distance from nearest fresh water well__> 5 miles___ Distance from nearest surface water > 2 miles___ Below-grade Tank Location UL _____Sect _____Twp _____Rng _____ ; _____feet from the _____line and _____feet from the _____line

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

NOTICE OF INTENTION TO:				SUBSEQUENT REPORT OF:			
PERFORM REMEDIAL WORK	X	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:			☐

13. 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 recompletion.

The Stoller-Navarro Joint Venture (SNJV), a US DOE contractor, intends to remediate four TPH-DRO contaminated mudpits associated with the Gasbuggy project located in the Carson National Forest. The remediation effort will involve the excavation and transportation of approximately 5000cy of contaminated soils to the OCD approved Envirotech land farm in the Bloomfield area. SNJV will provide general oversight which will be conducted with partners Weston Solutions providing equipment and manpower, and INTERA acting as construction management and New Mexico Professional Engineering. Anticipated start date is July 19, 2004 (pending Forest Service approval) and lasting approximately 6 weeks (weather dependent). SNJV shall notify the NM Oil Conservation Division (505-334-6178) at least 24 hours prior to mobilization.

I hereby certify that the information above is true and complete to the best of my knowledge and belief. **I further certify that any pit or below-grade tank has been/will be constructed or closed according to NMOCD guidelines ☐, a general permit ☐ or an (attached) alternative OCD-approved plan X.**

SIGNATURE Peter Sanders TITLE Acting Project Manager DATE 6/8/2004

Type or print name Peter Sanders E-mail address: sanders@nv.doe.gov Telephone No. 702-295-1037

(This space for State use)

APPPROVED BY_____ TITLE_____ DATE_____
Conditions of approval, if any:

Summary of Corrective Action Plan

This summary describes the corrective action that the National Nuclear Security Administration, Nevada Operations Office (NNSA/NV) proposes to be completed at the Gasbuggy Site. The primary objective of the corrective action is to remove approximately 5,000 cubic yards of drilling mud containing Total Petroleum Hydrocarbons (TPH) above the agreed upon limit of 100 milligrams per kilogram (mg/Kg), while minimizing impact to the surrounding environment.

The Gasbuggy Site is located approximately 55 air miles east of Farmington, New Mexico, in Rio Arriba County within the Carson National Forest. The corrective action site includes the previously disturbed areas consisting of the drilling mud pits in the surface ground zero (SGZ), and the Well GB-D areas. The use of these lands for Project Gasbuggy was established in a Memorandum of Understanding, dated March 23, 1967, between the U.S. Department of Agriculture's U.S. Forest Service (USFS) and the U.S. Atomic Energy Commission (AEC) (predecessors to the U.S. Department of Energy [DOE]). Additionally, by land withdrawal action of Public Order 4232, dated June 22, 1967, the U.S. Department of the Interior, Bureau of Land Management (BLM) withdrew from all forms of appropriation, including mining and mineral leasing laws, and reserved for use by the AEC the surface and subsurface of lands within Section 36, Township 29 north, Range 4 west, New Mexico Principal Meridian.

The remediation effort will consist of the following construction / excavation activities:

1. Mobilization of required equipment, materials, and personnel; and set-up of temporary office and storage areas in the SGZ previously established area.
2. Installation of temporary control fences, and erosion and sedimentation controls at SGZ and the Well GB-D Area, including straw bale check dams, and silt fences.
3. Construction of access roads, stabilized exits, and a temporary weigh scale, at Surface Ground Zero (SGZ) and the Well GB-D Area.
4. Removal of overburden material (clean soil) and storage at temporary stockpile location within the boundaries of the original site.
5. Excavate Total Petroleum Hydrocarbon (TPH) - Diesel Range Organics (DRO) contaminated drilling mud from 3 mud pits associated with well GBE in the SGZ area, and the Well GB-D Mud pit according to approved drawings.
6. Transport all (~5000 cy) TPH-DRO contaminated drilling mud to the Envirotech, Inc. land farm in Bloomfield, New Mexico.
7. Perform confirmatory sampling and additional excavation as needed.
8. Place gravel from temporary access road, and overburden material (clean soil) in mud pit excavations.
9. Place topsoil cover over overburden material.
10. Grade all disturbed areas.
11. Revegetate mud pits, and all disturbed areas.

Upon completion of field activities new as-built drawings and documents will be generated showing the new contours and drainage.

NEW MEXICO ENVIRONMENT DEPARTMENT TPH SCREENING GUIDELINES

Some sites with areas of soil contamination resulting from releases of petroleum products such as jet fuel and diesel wish to use total petroleum hydrocarbon (TPH) sampling results to delineate the extent of petroleum-related contamination at these sites and ascertain if the residual level of petroleum products does not represent an unacceptable risk to future users of the site. TPH results represent a complex mixture of compounds, some of which are regulated constituents and some compounds that are not regulated. In addition, the amount and types of the constituent compounds in TPH differ widely depending on which petroleum product was spilled and how the spill has weathered. This variability makes it difficult to determine the toxicity of weathered petroleum products in soil solely from TPH results. **Therefore, remediation of spills and corrective action sites cannot be based solely on results of TPH sampling; these TPH guidelines must be used in conjunction with the screening guidelines for individual petroleum-related contaminants in Table 3 and other contaminants as applicable.**

The screening levels for each petroleum carbon range from the Massachusetts Department of Environmental Protection (MADEP) Volatile Petroleum Hydrocarbons/Extractable Petroleum Hydrocarbons (VPH/EPH) approach and the percent composition table below were used to generate screening levels corresponding to total TPH. Except for waste oil, the information in the compositional assumptions table was obtained from Table 5-1 of the Massachusetts Department of Environmental Protection guidance document *Implementation of the MADEP VPH/EPH Approach Final Draft June 2001*. TPH toxicity was based only on the weighted sum of the toxicity of the hydrocarbon fractions listed in Table 1.

Table 1: TPH Compositional Assumptions in Soil

Petroleum Product	C11-C22 Aromatics	C9-C18 Aliphatics	C19-C36 Aliphatics
Diesel #2/ new crankcase oil	60%	40%	0%
#3 and #6 Fuel Oil	70%	30%	0%
Kerosene and jet fuel	30%	70%	0%
Mineral oil dielectric fluid	20%	40%	40%
Unknown oil [a]	100%	0%	0%
Waste Oil[b]	0%	0%	100%

[a] Sites with oil from unknown sources must be tested for VOCs, SVOCs, metals, and PCBs to determine if other potentially toxic constituents are present. The TPH guidelines in Table 2 are not designed to be protective of exposure to these constituents therefore they must be tested for, and compared to, their individual NMED soil screening guidelines.

[b] Compositional assumption for waste oil developed by NMED is based on review of chromatographs of several types of waste oil. Sites with waste oil must be tested for VOCs, SVOCs, metals, and PCBs to determine if other potentially toxic constituents are present. The TPH guidelines in Table 2 are not designed to be protective of exposure to these constituents therefore they must be tested for, and compared to, their individual NMED soil screening guidelines.

A TPH screening guideline was calculated for each of the types of petroleum product based on the assumed composition from the above table for petroleum products and the direct soil standards incorporating ceiling concentrations given in the MADEP VPH/EPH Excel spreadsheet for each of the carbon fractions. Ground water concentrations are based on the weighted sum of the noncarcinogenic toxicity of the petroleum fractions assuming the water is drinking water.

Table 2: TPH Screening Guidelines

	TPH		
Petroleum Product	Residential Direct Exposure (mg/kg)	Industrial Direct Exposure (mg/kg)	Concentration in Ground Water (mg/L)
Diesel #2/crankcase oil	880	2200	1.8
#3 and #6 Fuel Oil	860	2150	1.4
Kerosene and jet fuel	940	2350	3.0
Mineral oil dielectric fluid	1560	3400	3.7
Unknown oil [a]	800	2000	2.3
Waste Oil[b]	2500	5000	Petroleum-Related Contaminants
Gasoline	Not applicable	Not applicable	Petroleum-Related Contaminants

Mineral oil based hydraulic fluids can be evaluated for petroleum fraction toxicity using the screening guidelines from Table 2 specified for waste oil, because this type of hydraulic fluid is composed of approximately the same range of carbon fractions as waste oil. However, these hydraulic fluids often contain proprietary additives that may be significantly more toxic than the oil itself; these additives must be considered on a site- and product-specific basis (see ATSDR hydraulic fluids profile reference). **Use of alternate screening guideline values requires prior written approval from the New Mexico Environment Department.** TPH screening guidelines in Table 2 must be used in conjunction with the screening levels for petroleum-related contaminants given in Table 3 because the TPH screening levels are NOT designed to be protective of exposure to these individual petroleum-related contaminants. Table 3 petroleum-related contaminants screening levels are based on the New Mexico Environment Department soil screening levels (NMED SSLs) released in December of 2000.

The list of petroleum-related contaminants does not include PAHs with individual screening levels that would exceed the total TPH screening levels (acenaphthene, anthracene, flouranthene, flourene, and pyrene). In addition, these TPH screening guidelines are based solely on human health, not ecological risk considerations, protection of surface water, or potential indoor air impacts from soil vapors. Potential soil vapor impacts to structures or utilities are not addressed by these guidelines. Site-specific investigations for potential soil vapor impacts to structures or utilities must be done to assure that screenings are consistently protective of human health, welfare or use of the property. NMED believes that use of these screening guidelines will allow more efficient screenings of petroleum release sites at sites while protecting human health and

the environment. Copies of the references cited below are available on the MADEP website at http://www.state.ma.us/dep/bwsc/vph_eph.htm and the NMED website at http://www.nmenv.state.nm.us/HWB/guidance.html.

Table 3. Petroleum-Related Contaminants Screening Guidelines

Petroleum-Related Contaminants	Values for Direct Exposure to Soil		NMED DAF 20 GW protection (mg/kg in soil)	NMED DAF 1[f] GW protection (mg/kg in soil)
	NMED residential SSL (mg/kg)	NMED Indus. SSL (mg/kg)		
Benzene	6	14	0.06	0.003
Toluene	180	180	5	0.2
Ethyl benzene	68	68	8	0.4
Xylene	63	63	100	5
Naphthalene	53	180	0.2	0.01
2-methyl naphthalene	1000[e]	2500[e]	---[e]	---[e]
Benzo(a)anthracene	6.2	26	40	2
Benzo(b)fluoranthene	6.2	26	20	0.8
Benzo(k)fluoranthene	62	260	200	8
Benzo(a)pyrene	0.62	2.6	100	6
Chrysene	610	2500	1000	50
Dibenz(a,h) anthracene	0.62	2.6	9	0.5
Indeno(1,2,3-c,d) pyrene	6.2	26	40	2

[e] no NMED value available, value taken from MADEP paper

[f] for contaminated soil in contact with ground water

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1997. Toxicological Profile for Hydraulic fluids.

Massachusetts Department of Environmental Protection, Bureau of Waste Site Cleanup and Office of Research and Standards. 1994. "Background Documentation for the Development of the MCP Numerical Standards."

Massachusetts Department of Environmental Protection, Bureau of Waste Site Cleanup and Office of Research and Standards. 2001. "Characterizing Risks Posed by Petroleum

Contaminated Sites: Implementation of the MADEP VPH/EPH Approach Final Draft June 2001."

New Mexico Environment Department, Hazardous Waste Bureau and Ground Water Quality Bureau Voluntary Remediation Program. 2000. "Technical Background Document for Development of Soil Screening Levels." Document # NMED-00-008.

Price, Wayne

From: Sanders, Peter [sanders@nv.doe.gov]
Sent: Wednesday, September 10, 2003 10:30 AM
To: 'dfoust@state.nm.us'; 'FTCHAVEZ@state.nm.us.'; 'WPRICE@state.nm.us'
Cc: Sanchez, Monica L.
Subject: Gas Buggy EPNG 10-36 Well P&A

Please find attached for your review and approval the P&A plan for the EPNG 10-36 Well located at the DOE Gas Buggy Site. Our window of oppurtunity for A-Plus Service to P&A the well is Sept 15 to 18, 2003. Once the plan is accepted we will send the signed C-103 form by certified mail. Please contact Monica Sanchez, at (702) 295-1037 if you have any questions.

Peter A. Sanders
National Nuclear Security Administration
Nevada Site Office
U.S. Department of Energy
Las Vegas, Nevada
(702) 295-1037
pager (702) 794-1952
Fax (702) 657-7723

<<C103(Gasbuggy_EPNG10-36).doc>> <<EPNG #10-36 - procedure.doc>> <<EPNG #10-36 - plugged.ppt>> <<EPNG #10-36 - current.ppt>>

Submit 3 Copies To Appropriate District Office
District I
1625 N. French Dr., Hobbs, NM 88240
District II
1301 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 June 10, 2003

WELL API NO.
30-039-07488

5. Indicate Type of Lease
STATE ☐ FEE X

6. State Oil & Gas Lease No.
Not Applicable

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
San Juan 29-4

1. Type of Well:
Oil Well ☐ Gas Well X Other (Groundwater Monitoring Well)

8. Well Number
No. 10 (EPNG #10-36)

2. Name of Operator
United States Department of Energy, Environmental Restoration Division

9. OGRID Number

3. Address of Operator
P.O. Box 98518, Las Vegas, NV, 89193-8518

10. Pool name or Wildcat.
Pictured Cliffs

4. Well Location

Unit Letter K : 1650 feet from the South line and 1700 feet from the West line

Section 36 Township 29N Range 4W NMPM County Rio Arriba

11. Elevation *(Show whether DR, RKB, RT, GR, etc.)*
7184' GL

12. 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	X	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:			☐

13. 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 recompletion.

Shaw Environmental, Inc (US DOE Contractor) intends to Plug and Abandon the above referenced well for the US DOE, as per NM OCD Requirements.

Shaw shall oversee the P&A activities. A-Plus Well Service (Farmington, NM) shall perform plugging operations in accordance with the attached procedure.

The estimated start date (pending subcontractor approval) is anticipated to be September 15, 2003. Shaw shall notify the NM Oil Conservation Division (505-334-6178) at least 24 hours prior to mobilization.

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

SIGNATURE _____ TITLE Offistes Project Manager DATE September 9, 2003

Type or print name Monica L. Sanchez E-mail address: sanchezm@nv.doe.gov Telephone No. (702) 295-0160

(This space for State use)

APPPROVED BY _____ TITLE _____ DATE _____

Conditions of approval, if any:

PLUG AND ABANDONMENT PROCEDURE

August 13, 2003

EPNG #10-36

Chaco Mesa Pictured Cliffs
1650' FSL & 1700' FWL, Section 36, T29N, R4W
Rio Arriba County, New Mexico / API #30-39-07488

Note: All cement volumes use 100% excess outside pipe and 50' excess inside. The stabilizing wellbore fluid will be 8.3 ppg, sufficient to balance all exposed formation pressures. All cement is ASTM Type II, (15.6ppg and 1.18 cf/sx).

1. Install and test rig anchors. Prepare blow pit. Comply with all NMOCD and BLM safety rules and regulations. MOL and RU daylight pulling unit. Conduct safety meeting for all personnel on location. Blow well down; kill with water as necessary. ND wellhead and NU BOP and stripping head; test BOP.

2. Prepare a 2-3/8" tubing work string. Round trip 5-1/2" wireline gauge ring or casing scraper to 3521'.

3. **Plug #1 (Ojo Alamo perforations, 3611' – 3410'):** TIH and set 5-1/2" cement retainer at 3521'. Pressure test tubing to 1000#. Load casing and displace well surface to surface with fresh water, circulate returns into a steel pit. Transport waste fluid to an approved disposal facility. Pressure test casing to 500#. If casing does not test, then spot or tag subsequent plugs as appropriate. Mix and pump 40 sxs cement, squeeze 21 sxs cement below cement retainer and spot a 19 sxs above the CR to fill the Ojo Alamo perforations and to cover the top. LD tubing to 2260' and TOH.

4. **Plug #2 (Nacimiento top, 2260' - 2160'):** Perforate 3 HSC squeeze holes at 2260'. If casing pressure tested above, establish injection into squeeze holes. TIH and set 5-1/2" cement retainer at 2210'. Mix and pump 60 sxs cement, squeeze 43 sxs cement outside 5-1/2" casing and leave 17 sxs inside casing to cover the Nacimiento top. LD tubing to 174' and TOH.

5. **Plug #3 (9-5/8" Surface Casing, 174' - Surface):** Attempt to pressure test the bradenhead annulus to 300#. Note the volume required to fill the annulus before it pressures up.

   - If it tests, then perforate the 5-1/2" casing at 174'. Establish an injection rate into the squeeze holes. Mix and pump 42 sxs down the 5-1/2" casing, squeeze 22 sxs outside the 5-1/2" casing and leave 20 sxs inside the casing to surface. Shut in well and WOC.
   - If unable to establish an injection rate into the squeeze holes, then TIH to 224'. Establish circulation out casing valve with water. Mix approximately 25 sxs cement to fill the inside of the 5-1/2" casing or and spot a plug from 174' to surface, circulate good cement out casing valve. TOH and LD tubing. Shut in well and WOC.
   - If the bradenhead annulus does not pressure test, then perforate 174' and attempt to establish circulation to surface out the BH valve. Cement as appropriate. Need to set cement plugs across the surface casing shoe and from the perforations to surface, circulate good cement out bradenhead.

6. ND BOP and cut off well head below surface casing flange. Install P&A marker with cement to comply with regulations. RD, MOL and cut off anchors. Restore location per BLM stipulations.

EPNG #10-36

Proposed P&A

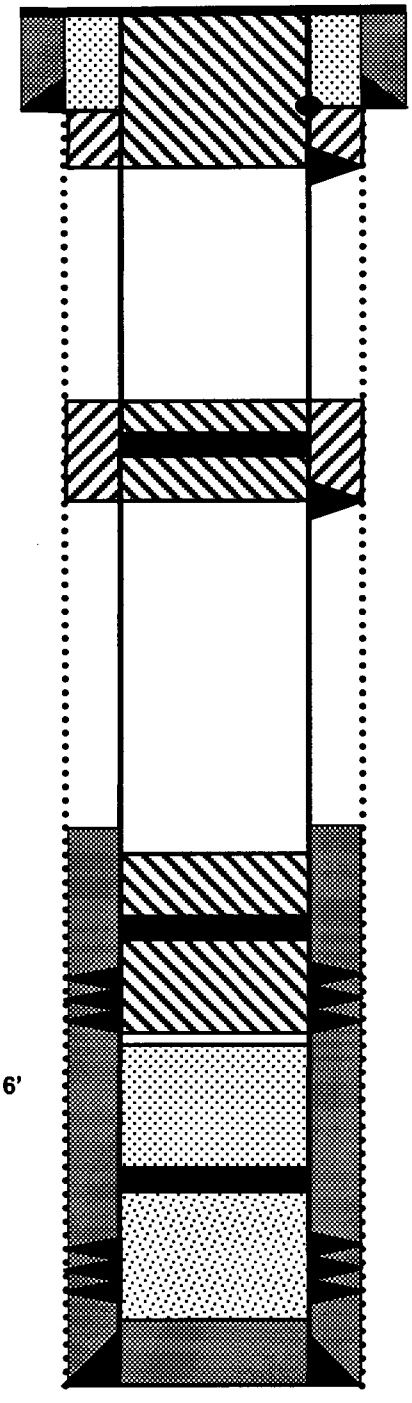
Chaco Mesa Pictured Cliffs

1650' FSL & 1700' FWL, Section 36, T-29-N, R-4-W

Rio Arriba County, NM / API # 30-039-07488

Today's Date: **8/12/03**
Spud: 7/6/56
PC Completed: 1956
PC P&A: 1967
OA Completed: 1968
Elevation: 7184' GL
7194' KB

13-3/8" hole



Bradenhead annuls cemented from 120' to surface. (1967)

9-5/8" 25.4#, S W Casing set @ 124'
Cement with 100 sxs, (Circulated to surface)

Perforate @ 174'

Plug #3 174' - Surface
Cement with 42 sxs.
22 sxs outside casing
and 20 sxs inside casing.

Nacimiento @ 2210'

Set CR @ 2210'

Perforate @ 2260'

Plug #2 2260' - 2160'
Cement with 60 sxs,
43 sxs outside casing,
17 sxs inside casing.

TOC @ 3055' (T.S.)

Plug #1 3611' - 3410'
Cement with 40 sxs,
21 sxs below CR
and 19 sxs above.

Ojo Alamo @ 3460'

Set CR @ 3521'

Ojo Alamo Perforations:
3571' – 3611'

PBTD 3616'

Kirtland @ 3650'

Fruitland @ 3760'

Pictured Cliffs @ 3896'

CIBP @ 3880' (1967)

Pictured Cliffs Perforations:
3901' – 4166'
Squeezed with 112 cf (1967)

8-3/4" Hole

5-1/2" 15.5#, J55 casing at 4203'
Cement with 300 sxs (407 cf)

TD 4210'
PBTD 3616'

EPNG #10-36

Current

Chaco Mesa Pictured Cliffs

1650' FSL & 1700' FWL, Section 36, T-29-N, R-4-W

Rio Arriba County, NM / API # 30-039-07488

Today's Date: **8/12/03**
Spud: 7/6/56
PC Completed: 1956
PC P&A: 1967
OA Completed: 1968
Elevation: 7184' GL
7194' KB

13-3/8" hole

Nacimiento @ 2210'

Ojo Alamo @ 3460'

Kirtland @ 3650'

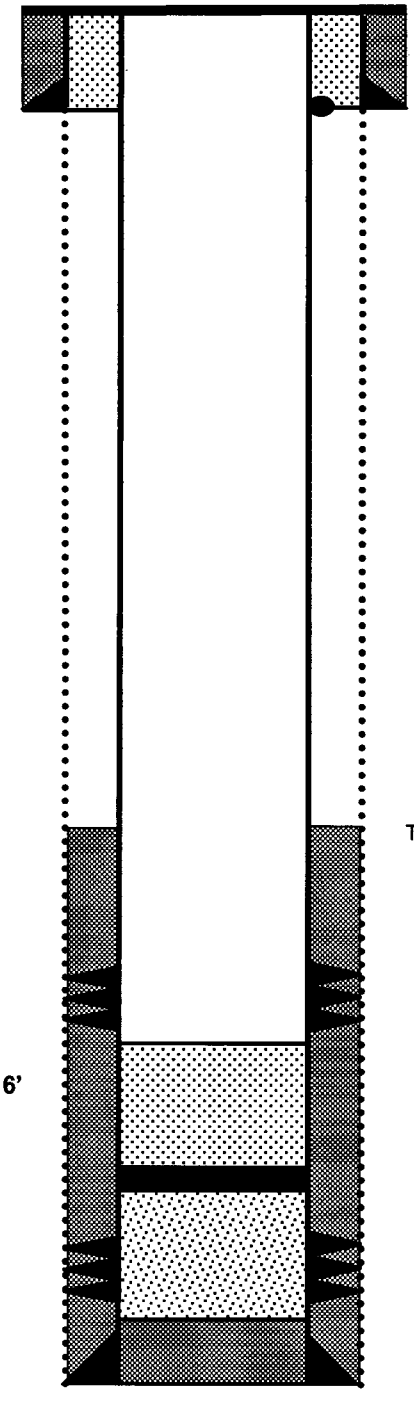
Fruitland @ 3760'

Pictured Cliffs @ 3896'

PBTD 3616'

8-3/4" Hole

TD 4210'



Bradenhead annuls cemented from 120' to surface. (1967)

9-5/8" 25.4#, S W Casing set @ 124'
Cement with 100 sxs, (Circulated to surface)

Well History

Oct '67: P&A PC: Pull tubing. Set CIBP at 3880' and spot 112 cf cement above up to 3205'. Tag cement and spot 40 cf from 3205' to 2941'. Perforate at 5-1/2" casing at 120'. Cement BH annulus with 56 cf, circulate cement to surface out bradenhead. Clean out well to 2941' and MOL.

Oct'68: Perforate OA: Change out tubing head to flanged. Drill out cement to 3616'. Perforate OA from 3571' to 3611'. Land tubing and swab well.

2002: Pull tubing. Conduct MIT of casing.

TOC @ 3055' (T.S.)

Ojo Alamo Perforations:
3571' – 3611'

CIBP @ 3880' (1967)
Capped with 112 cf cement, then 40 cf up to 2941'.

Pictured Cliffs Perforations:
3901' – 4166'
Covered with sand (1967)

5-1/2" 15.5#, J55 casing at 4203'
Cement with 300 sxs (407 cf)

Price, Wayne

From: Price, Wayne
Sent: Thursday, July 24, 2003 4:09 PM
To: 'sanchezm@nv.doe.gov'
Cc: Chavez, Frank; Perrin, Charlie; Foust, Denny
Subject: Gas Buggy EPNG 10-36 Well P&A and Gas Buggy Site Restoration

Contacts: Sanchez, monica

Dear Ms Sanchez:

The OCD is in receipt of your letter dated July 02, 2003 indicating the above subject well failed a MIT test last year and your intentions to plug and abandon this well. The OCD has rules concerning P&A of wells. Please submit your plugging plan for approval on a OCD form C-103 to Mr. Frank Chavez-District Supervisor (505-334-6178) of the OCD Aztec office by August 22, 2003 with a copy to this office. Mr. Chavez's E-mail is FTCHAVEZ@state.nm.us.

OCD is currently evaluating the complete DOE Gas Buggy file to determine a future course of action to be taken. OCD's last correspondence from DOE on this issue is dated January 30, 2002 (Transmittal of the Site Characterization Work Plan for Gasbuggy, New Mexico, Revision 1). If there is a later version please supply the OCD a copy. Once OCD has accomplished this task we will notify you of any further requirements or conditions, if any. As with all projects we may need to communicate concerning closure issues. Feel free to call or write concerning this issue.

Sincerely:

Wayne Price
New Mexico Oil Conservation Division
1220 S. Saint Francis Drive
Santa Fe, NM 87505
505-476-3487
fax: 505-476-3462
E-mail: WPRICE@state.nm.us

Department of Energy
National Nuclear Security Administration
Nevada Site Office
P.O. Box 98518
Las Vegas, NV 89193-8518

July 15, 2003

Mark Catron, U.S Forest Service, Jicarilla Ranger District, Bloomfield, NM
Christine Bynum, New Mexico Environment Department, Santa Fe, NM

MINUTES FROM JUNE 18, 2003, MEETING WITH THE U.S. DEPARTMENT OF AGRICULTURE, FOREST SERVICE JICARILLA RANGER DISTRICT REGARDING THE GASBUGGY SITE IN RIO ARRIBA COUNTY, NEW MEXICO

Please find enclosed a copy of the meeting minutes referenced above for your files. We have also included the following attachments for your information:

Attachment A:	Attendee List
Attachment B:	Minutes from the January 30, 2003, Meeting with the New Mexico Environment Department regarding the Gasbuggy and Gnome-Coach Sites.
Attachment C:	Various correspondences between the U.S. Department of Energy and New Mexico agencies concerning work at the Gasbuggy Site.

Thank you for taking the time to meet with the environmental consultant and working with us to achieve closure of the surface at the Gasbuggy Site.

If you have any questions or concerns please contact Monica Sanchez, of my staff, at (702) 295-0160.

Runore C. Wycoff, Director
Environmental Restoration Division

ERD:900.MS

Enclosure:
As stated

cc w/enclosures:
Steve Holmes, NMED HWB, Santa Fe, NM
Denny Foust, NM OCD, Aztec, NM
Ben Martinez, USDA FS, Albuquerque, NM
Marcia Miolano, USDA FS, Albuquerque, NM
John Reidinger, USDA FS, Bloomfield, NM

cc w/Minutes & Attachment A:
Paul Gretsky, Shaw, Las Vegas, NV
Dave Stahl, Shaw, Las Vegas, NV
Rob Boehlecke, SAIC, Las Vegas, NV
Jim Coburn, Shaw, Las Vegas, NV

Attachment A

List of Attendees at the Informational Meeting with the USDA FS
on the Gasbuggy Site - June 18, 2003

Information Meeting with USFS on Gasbuggy Site
June 18, 2003

NAME	ORGANIZATION	PHONE NO.	E-MAIL
Rob Boehlecke	SAIC (NNSA/NSO Contractor)	(702) 295-2099	
Jim Coburn	Shaw Environmental, Inc. (NNSA/NSO Contractor)	(702) 295-2124	
Dale Wirth	BLM Farmington	(505) 599-6320	
Bill Papich	BLM Farmington	(505) 599-6324	
Lisa Goodman	USDA FS, Taos	(505) 758-6372	
Denny Foust	New Mexico Oil Conservation Division (OCD)	(505) 334-6178 ext. 15	
Mark Catron	USDA FS, Jicarilla RD	(505) 632-2956	
Marcia Miolano	USDA FS ABQ	(505) 346-3848	
Ben Martinez	USDA FS ABQ	(505) 842-3854	
Randy Houtz	USDA FS Jicarilla RD	(505) 632-2956	
Dave Seery	USDA FS Jicarilla RD	(505) 632-2956	
Rachel Miller	USDA FS Jicarilla RD	(505) 632-2956	
Joe Hewitt	BLM Farmington	(505) 599-6365	
Rick Shean	NMED – VRP	(505) 476-3658	
Christine Bynum	NMED – VRP	(505) 827-2754	
John Reidinger	USDA FS, Jicarilla RD	(505) 632-2956	

Highlights of June 18, 2003, Meeting at the U.S. Department of Agriculture, Forest Service (USDA FS) Jicarilla Ranger District Office in Bloomfield, NM

List of Attendees: See Attachment A

The purpose of the meeting was to provide information to the USDA FS on the background, history, and ongoing activities involved with the investigation of potential contamination at the Gasbuggy Site surface.

Mr. Rob Boehlecke and Mr. Jim Coburn (contractors for the U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office [NNSA/NSO]) gave a Power Point presentation on the Gasbuggy Site. The presentation covered the following topics:

- History and background of the site
- Land use
- Regulatory history
- Contents of the *Site Characterization Work Plan for Gasbuggy Site, New Mexico* (February 2001)
- Field investigation activities and results
- Planned content of the *Corrective Action Investigation Report and Corrective Action Plan for the Gasbuggy Site, New Mexico* (planned for publication June 2003)
- Proposed schedule for corrective action fieldwork preparation, activities, and reporting

During the presentation the audience asked questions and/or provided comments. The following questions/comments were communicated:

- Additional archaeological clearance needs to be documented prior to any remedial work at the site.

- Upon completion of the surface remediation, the USDA FS may consider making the Gasbuggy location an archaeological site or point of interest. Interpretative information such as pamphlets for a walking tour may be provided for the site.

- Representatives of the USDA FS indicated that borrow material for filling excavations created during the remediation may be available within the Jicarilla Ranger District and that they would identify possible sources.

- Denny Foust of the New Mexico Oil Conservation Division (OCD) indicated that the OCD document, *Guidelines for Remediation of Leaks, Spills and Releases* (August 13, 1993), should be used to determine the cleanup levels for petroleum hydrocarbons. This guidance document states the cleanup levels are determined based on site-specific factors including depth to groundwater, distance to drinking

water source, and distance to any surface water body. He also indicated that the "cattle tanks" and intermittent stream (Leandro creek) near the Gasbuggy Site would be considered a surface water body (approximately 300 feet from mud pit).

Note: Based on the vertical distance between contamination and groundwater, and the distance to surface water at the Gasbuggy Site the action level for total petroleum hydrocarbons (TPH) would be 100 parts per million (ppm). It was communicated to Mr. Foust that the New Mexico Environment Department (NMED) Hazardous Waste Bureau and Voluntary Remediation Program (VRP) had agreed at a January 30, 2003, meeting with NNSA/NSO (see Attachment B) that the Gasbuggy Site should be regulated under the guidance provided in the draft *New Mexico Environment Department TPH Screening Guidelines*. The clean-up level for TPH-diesel in this document is 2,200 ppm. Chris Bynum of the NMED VRP indicated this document is in final review and may be published within the next month or two. The action level for diesel is 2,200 ppm and has remained unchanged.

- Ben Martinez of the USDA FS indicated he had specific questions on the historical information used to determine that tritium was the only radiological contaminant of potential concern (COPC). The presenters referred him to Appendix A of the Work Plan which is a summary of historical radiological monitoring and sampling results. It was also communicated that if he had additional questions he could forward those to Monica Sanchez, NNSA/NSO Offsites Project Manager, for the Gasbuggy Site. He could also request copies of documents referenced in the Work Plan.

- Ben Martinez, of the USDA FS and Denny Foust of the NM OCD both indicated that their organizations would not issue a letter releasing NNSA/NSO from further action at the close of remediation activities at the Gasbuggy Site surface.

- Ben Martinez, USDA FS, indicated he thought that a baseline environmental study needed to be documented by NNSA/NSO prior to the turnover of any lands to the USDA FS as required by an unspecified executive order. He was unsure if the Work Plan, the pending Corrective Action Investigation Report/Corrective Action Plan (CAIR/CAP), and the planned Closure Plan would meet the intent of the requirements.

- Ben Martinez, USDA FS, indicated that any remedial work at the site would need to meet the USDA FS land management requirements prior to the USDA FS accepting the land back from the NNSA/NSO. He indicated these requirements would be negotiated between NNSA/NSO and the Jicarilla District of the USDA FS.

- Lisa Goodman, of the USDA FS asked specifically how it was determined that the arsenic levels detected in the soil at the Gasbuggy Site were at background levels. The methodology used in the pending CAIR/CAP was explained.

- John Reidinger and Mark Catron (Jicarilla Ranger District) indicated that upon completion of remediation activities, they wanted to limit access to the Gasbuggy Site surface area. The USDA FS wants a gravel parking area (4 to 6 cars) located at the southeast corner of the site (adjacent to the existing Gasbuggy sign) and restricted access to the site. Ideas such as sandstone rocks or a ditch surrounding the site were proposed and could be negotiated.

- The point of contact for the USDA FS is Mark Catron, District Ranger, Carson National Forest, Jicarilla Ranger District.

- The point of contact for the New Mexico Oil Conservation Division is Wayne Price, State of New Mexico Energy, Minerals and Natural Resources Department.

SITE VISIT:

The following list of people were present at the Gasbuggy Site visit: Rob Boehlecke, Jim Coburn, Mark Catron, John Reidinger, Lisa Goodman, Marcia Miolano, Ben Martinez, Chris Bynum, and Rick Shean.

The site visit consisted of a tour of Surface Ground Zero (SGZ) area, Well GB-D Area, Control Point, and the Helicopter Pad. The proposed corrective action fieldwork activities were discussed at the SGZ area.

The following action items were accepted on behalf of NNSA/NSO:

- An e-mail would be issued to all participants listing the contact information for each participant as well as the contact information for the NNSA/NSO Offsites Project Manager, Monica Sanchez.

- NNSA/NSO would issue a letter to the applicable points of contact to document the highlights of the meeting.

The following materials, documents, and or letters were requested to be provided by NNSA/NSO:

- Mark Catron, District Forest Ranger for the Jicarilla District, requested copies of historical site pictures. The NNSA/NSO will provide these pictures as requested.

- Ben Martinez of the USDA FS requested copies of correspondence between the NMED and NNSA/NSO regarding the document review and comment by NMED on the *Site Characterization Work Plan for Gasbuggy Site, New Mexico* (February 2001). These are included here as Attachment C.

Attachment B

Minutes from January 30, 2003 Meeting with New Mexico Environment Department
Regarding the Gasbuggy and Gnome-Coach Sites

Department of Energy
National Nuclear Security Administration
Nevada Operations Office
P.O. Box 98518
Las Vegas, NV 89193-8518

FEB 0 7 2003

Christine Bynum, New Mexico Environmental Department, Santa Fe, NM
Steve Holmes, New Mexico Environmental Department, Santa Fe, NM

MINUTES FROM JANUARY 30, 2003, MEETING WITH NEW MEXICO ENVIRONMENTAL DEPARTMENT REGARDING THE GASBUGGY AND GNOME-COACH, NEW MEXICO SITES

Please find enclosed a copy of the above-referenced meeting minutes for your files.

Thank you again for making time to meet with my staff and working with us to receive closure of the surface at the Gasbuggy and Gnome-Coach sites.

If you have any questions or concerns, please contact Bill R. Wilborn, of my staff, at (702) 295-3188.

Runore C. Wycoff, Director
Environmental Restoration Division

ERD:WRW-040

Enclosure:
As stated

cc w/encl:
D. C. Stahl, IT, Las Vegas, NV
R. F. Boehlecke, IT, Las Vegas, NV
D. M. Arnold, IT, Las Vegas, NV
Jim Coburn, IT, Las Vegas, NV

Highlights of January 30 Meeting with NM Environment Department Representatives

Participants

Monica Sanchez (DOE)
Bill Wilborn (DOE)
Robert Boehlecke (ITLV)
Dawn Arnold (ITLV)
Jim Coburn (ITLV)
Steve Holmes (NMED Hazardous Waste Bureau)
Chris Bynum (NMED, Ground Water Quality Bureau)
Rick Shean (NMED, Ground Water Quality Bureau)

Prior to Chris Bynum and Rick Shean arriving, the following items were discussed:

- Steve stated he was now the NMED HWB contact for both the Gasbuggy and Gnome-Coach sites
- Steve stated he met with the Jicarillas in July and talked to them about surface at Gasbuggy. Specifically how there was no radioactive contamination at the surface, only chemical. He also explained to them the high quality of the sampling techniques being used at the site.
- Steve stated he had talked with a hydrologist employed by NM and that based on the hydrologist's knowledge there were no shallow groundwater issues at the Gasbuggy Site.
- Steve stated that the ranchers in the area were concerned about the groundwater.

Chris Bynum and Rick Shean arrived and introductions were made.

- Dawn provided a summary of the investigation and findings for the Gnome-Coach Site.
- Rob provided a summary of the investigation and findings for the Gasbuggy Site.
- Steve suggested that examples of calibration records be included in the final investigation report.
- Steve indicated that any public announcement or posting at either site should be bi-lingual (Spanish and English).
- There was some discussion as to whether it would be advantageous to put out two separate characterization/closure documents, one for technical review and one for public review. In the end it was agreed that one document would be best.
- Steve indicated that we should provide a copy of each document produced for the NM State library.
- There was a discussion on the time line for the Voluntary Remediation Program (VRP). It was determined that the applications should not be submitted for formal review until a draft investigation report and CADD were complete.

- Chris stated standards in any documented performance standard or [illegible] guideline could be used to demonstrate the site is clean as long as documentation indicating those standards had been met could be provided.
- There was a discussion of the new NM draft guidance on TPH remediation. Chris stated that the VRP was using the draft TPH guidance document as a regulatory document. She indicated the TPH level in the document was 2,200 mg/kg. When asked if this was a screening or cleanup level she indicated it was specified in the document as a screening level, but intended as a cleanup level.
- There followed a discussion on the requirements to get a closure letter for the Gasbuggy Site surface. Chris stated that if levels of TPH above 2,200 were left onsite, then only a conditional letter of closure could be issued. In other words even if a risk assessment showed there was no risk due to TPH levels above 2,200 there would need to be institutional controls and ongoing inspections, and therefore a closure letter could not be issued.
- Chris indicated that the requirement of the VRP program information on administrative and judicial enforcement action, permit revocations and suspension, and approved remediation plans in New Mexico and other states (20 3NMAC 6.3 202.A.3), could be met with a list of regulatory contacts in the other states where the Offsites Project has approved closure plans (e.g., Donna Stoner for Colorado).
- Chris stated that once a copy of the investigation report and CADD were made available they (the VRP) would distribute to other state agencies (e.g., NM Oil Conservation Division).
- Chris stated that the VRP requires the landowner to sign the VRP application. This will require approval from the USFS for Gasbuggy and the BLM for Gnome-Coach.

Attachment C

Various Correspondences between the U.S. Department of Energy and New Mexico Agencies Concerning Work at the Gasbuggy Site

The following correspondence is included:

- Highlights of March 7-8, 2000 Meeting. Runore C. Wycoff (DOE) to James P. Bearzi (New Mexico Environment Department [NMED]). March 29, 2000.

- Highlights of August 2-3, 2000 Meeting. Runore C. Wycoff (DOE) to James P. Bearzi (NMED). August 30. 2000.

- Scope of Work For FY 2000 Gasbuggy Field Work. Runore C. Wycoff (DOE) to Wayne Price New Mexico Oil Conservation Division [NMOCD]). August 21. 2000.

- Scope of Work for FY 2000 Preliminary Investigation of the Gasbuggy Site. Wayne Price (NMOCD) to Runore C. Wycoff (DOE). September 11, 2000.

- Transmittal of Site Characterization Work Plan for Gasbuggy, New Mexico, Revision 0, February 2001. Runore C. Wycoff (DOE) to James P. Bearzi (NMED) and Denny G. Foust (NMOCD). February 20, 2001

- Review and Comments on DOE's Site Characterization Work Plans for the Gnome-Coach and Gasbuggy Sites, New Mexico. Steve Zappe (NMED, Hazardous Waste Bureau) to William R. Wilborn (DOE). September 10, 2001.

  Note: Only the comments for the Gasbuggy Site are included in this Attachment. These comments were addressed in Revision 1 of the Work Plan. Individual comments and responses are provided in Appendix E of the Work Plan.

- Interest in Voluntary Remediation Program for New Mexico Sites. Runore C. Wycoff (DOE) to John E. Kieling (NMED). January 8. 2002.

- Voluntary Remediation Program Information. Christine D. Bynum (NMED, Ground Water Quality Bureau) to Runore C. Wycoff (DOE). April 16, 2002.

Department of Energy
Nevada Field Office
P.O. Box 98518
Las Vegas, NV 89193-8518

MAR 29 2000

James P. Bearzi, Chief
New Mexico Environment Department
Hazardous & Radioactive Materials Bureau
2044 A Galisteo, P.O. Box 26110
Sante Fe, NM 87502

HIGHLIGHTS OF MARCH 7-8, 2000 MEETING

On behalf of this office, I would like to thank you for allowing your staff to meet with my staff on March 7-8, 2000. The Gasbuggy site visit and discussions were very beneficial to all parties and served as our kick-off meeting for the Gasbuggy and Gnome Coach sites. Enclosure 1 contains highlights of this meeting. Enclosure 2 is a listing of documents provided to you as well as those enclosed with this letter.

Based on these meetings, we are proceeding forward with developing a strategy for characterizing both of these sites. Our initial step requires identification and approval of data quality objectives associated with these efforts. We expect to submit a draft copy for your review and comment by July 2000. Resolution of comments your staff had on the preliminary draft left at the March 8, 2000, meeting will be incorporated into the draft document.

There are several documents or references which will be very helpful in developing our characterization and remediation strategy. These documents may be used as the basis of decisions and comments made by your staff. We are interested in getting a copy or identifying a source for the following references.

- State of New Mexico voluntary closure regulatory drivers and guidelines
- State of New Mexico risk assessment regulatory drivers and guidelines
- State of New Mexico preliminary action levels and preliminary remediation goals
- State of New Mexico water control regulatory drivers and guidelines
- State of New Mexico data quality regulatory drivers and guidelines
- Aerial photo of Waste Isolation Pilot Plant (WIPP) facility which includes Gnome Coach site

Enclosure 2 are references which we feel may be beneficial to your organization in understanding both of these sites. However, if your staff is interested in getting other references from the lists provided at our meetings, please let us know.

Our next Gasbuggy site visit is tentatively scheduled for the week of June 12, 2000. Our next Gnome Coach site visit is scheduled for the following week, June 19, 2000. During these weeks, U.S. Environmental Protection Agency representatives will be collecting samples for our annual

off-site sampling report. There will also be some of my staff members and our contractor representatives observing this sampling and collecting site characterization information. Your staff is welcome to accompany us on either or both of these site visits. We are also available to meet with your staff to discuss any issues related to efforts at these sites.

For additional information, please contact Monica L. Sanchez or D. Scotty Afong, of my staff, at (702) 295-0160 or (702) 295-1050, respectively.

Runore C. Wycoff, Director
Environmental Restoration Division

ERD:DSA

Enclosures:
As stated

cc w/encls. (Encl. 1 & list of Encl.2):
J. E. Kieling, NMED, Santa Fe, NM
John Young, NMED, Santa Fe, NM

bcc w/encls.(Encl. 1 & list of Encl. 2):
Donald James, EPA, Las Vegas, NV
J. B. Chapman, DRI, Las Vegas, NV
P. J. Gretsky, IT, Las Vegas, NV
R. C. Furlow, ESHD, DOE/NV, Las Vegas, NV
M. L. Sanchez, ERD, DOE/NV, Las Vegas, NV

Highlights of March 7-8, 2000, Kick-Off Meeting With State of New Mexico Representatives

Attendees:

Monica Sanchez (DOE/NV)
Scotty Afong (DOE/NV)
Paul Gretsky (IT)
Dawn Arnold (IT)
John Young (NMED)
Don James (EPA)
Jenny Chapman (DRI)
Robert Boehlecke (IT)
John Kieling (NMED)

March 7, 2000

DOE/NV and New Mexico Environmental Department (NMED) representatives drove in two vehicles to the Gasbuggy site. During this trip, each group talked about Gasbuggy and Gnome Coach sites. The site's kick-off meeting presentation outline was used as the basis for discussions by the DOE/NV team and copies of these presentations were given to NMED representatives. There were discussions on general issues and concerns related to these sites.

DOE/NV representatives explained that our primary purpose of visiting New Mexico was to initiate meetings with state of New Mexico representatives concerning corrective action investigations at Gasbuggy and Gnome Coach sites. They emphasized that DOE/NV has the opportunity to accelerate remediation work at these sites and were interested in initiating dialogue with cognizant stakeholders.

DOE/NV representatives further explained that DOE/HQ has assigned responsibilities for all underground test areas, which includes the New Mexico sites, to DOE/NV. These sites have been the responsibility of DOE/NV Environmental Management for approximately 8 years. Since there is no on-site DOE presence, DOE/HQ is interested in closing out liability associated with these sites. They also explained that changes in priorities and availability of funds would allow the DOE/NV office to expedite investigation efforts at these sites.

The site visit consisted of identifying the markers present at the site including the ground zero plaque, concrete pads, and well markers for EPNG 10-36, GB-1, GB-2, GB-3, and GB-D. The general locations of past facilities including septic tanks, mudpits, and trailers were also identified. The group discussed general issues and concerns related to items identified.

March 8, 2000

General:

DOE/NV and NMED representatives had an opportunity to discuss issues related to each site. Monica Sanchez indicated that DOE/NV does not intend to prepare a Gasbuggy Preliminary Risk Assessment. Using U.S. Environmental Protection Agency (EPA) risk assessment guidance for Superfund sites, risk screening was performed on Gasbuggy and used to generate the Data

Quality Objective (DQO) Conceptual Site Model (CSM) and to identify data gaps. The Gnome Coach Preliminary Risk Assessment was used to generate this site's DQO CSM and to identify data gaps. However, this document will only be used as a reference source.

Robert Boehlecke and Dawn Arnold gave a DQO presentation for each site. NMED were provided a copy of each site preliminary DQO package and asked to provide any comments on this document. DOE/NV plans are to incorporate any state comments into its draft document and will submit it to the state by July 2000.

DOE/NV representatives gave a brief overview of the project schedule. They explained that historical information would be gathered and compiled this fiscal year. Surface sampling would probably take place next year once the state of New Mexico staff reviewed our DQOs and corrective action investigation plan. Although the DQOs would be submitted to the state during the same time frame, Gasbuggy fieldwork will take place ahead of Gnome Coach due to funding and higher project priorities. DOE/NV intends to streamline the surface closure process. Desert Research Institute (DRI) would complete the subsurface modeling within the next several years.

The current baseline schedule reflects 30-day review cycles. The NMED representatives agreed this was a reasonable schedule. They understood the interconnection of these schedules and funding and would like to enhance the process by allocating the necessary resources to meet baseline time frames.

The status of mud pit regulations was discussed. John Young stated that if the drilling mud pits were closed under gas and oil industry standards, then he does not have a concern as long as there is no potential contamination from the nuclear test.

NMED representatives would like to see both dose and risk data from any Residual Radiation (RESRAD) analysis. Ms. Sanchez indicated DOE/NV's desires to identify and agree on RESRAD parameters before doing any calculations. Ms. Sanchez indicated that land use scenarios would have to be agreed upon as part of the RESRAD calculation process. DOE/NV will have to coordinate land use and housekeeping issues with other federal entities (i.e., Bureau of Land Management, Forest Park Services, etc.).

Mr. Young stated that any assumptions proposed by DOE/NV should be reasonable and defensible. Mr. Young did not see any problems with combining surface and subsurface work plan for each site. However, surface and subsurface work related to each site's work plan will progress as independent activities.

Preliminary action levels were discussed. NMED stated that EPA Region 3 Preliminary Remediation Goals (PRG) are typically used as guidelines and that Region 6 has some radiological PRG levels that the state may follow. DOE/NV requested that these and other (i.e. risk assessment) guidelines and references used as a basis for NMED decisions be provided or its resource identified.

Paul Gretsky mentioned that necessary background samples would be collected for different mediums (i.e., water, soil, etc). Regional data may be required. Mr. Gretsky asked about the state data quality requirements and guidelines. He mentioned that other current DOE/NV

remediation projects use complete Tier II validation of all data. Mr. Young stated they typically require complete Contract Laboratory Program packages for Resource Conservation and Recovery Act sites. However, NMED did not object to DOE/NV proposing quality levels with its rationalization for its use. The data quality level will be addressed in the DQO document. DOE/NV requested that any regulations or guidelines related to the data quality issue is provided or its resource identified.

Mr. Gretsky mentioned that DOE/NV is considering using on-site laboratories due to the remoteness of these sites. He asked if NMED had any issues with this approach. Mr. Young stated that as long as EPA guidelines were followed he did not foresee any problems.

Ms. Sanchez indicated that DOE/NV has had significant characterization experience. She recommended that NMED representatives consider contacting Donna Stoner, Colorado Department of Public Health and Environment. She is currently working with DOE/NV on the Colorado Rio Blanco investigation.

A list of references from a draft preliminary assessment done at each site was provided to NMED representatives. They will review this list and identify any documents, which they would like to get. DOE/NV will continue to keep stakeholders (i.e., NMED, Jicarilla Apache Tribe, Bureau of Land Management, etc.) informed on issues and upcoming events.

Gasbuggy

Parties discussed the "if-then" statements in the DQO packages. In particular, this issue focused on potential shallow groundwater investigations at Gasbuggy. These statements will determine the path to proceed on this investigation.

NMED voiced concern over tritium levels detected in soil moisture near the flare stack during the 1978 Gasbuggy sampling event. Mr. Young asked how much historical information was available for the on-site laboratories. Mr. Boehlecke indicated that little information exists but he is still researching the subject.

Mr. Young asked about the migration pathways of natural gas and if any scenarios and assumptions have been established. Jenny Chapman stated there is a lot of uncertainty in model parameters, and that this uncertainty will be incorporated in the modeling process. Potential contaminant migration will be evaluated both under current conditions and under stressed (gas development) conditions, in order to evaluate the effectiveness of the existing drilling restrictions. Ms. Chapman pointed out that there is no known remediation for underground nuclear cavities and that the goal of the subsurface investigation is to ensure protection of human health and the environment through adequate drilling restrictions.

Mr. Young recommended that DOE/NV check with the Jicarilla Apache for human health scenarios and to investigate such things as subsistence gathering from the Gasbuggy area. He indicated that the state could provide information on New Mexico water control regulations. DOE/NV would specifically look at ion levels to establish whether groundwater in the areas of this site and Gnome Coach are potable. Ms. Chapman described previous investigations of the Ojo Alamo aquifer in well 10-36 and why groundwater is not the primary pathway of concern.

There was a brief discussion on the Contaminant of Potential Concern list. Ms. Chapman stated that most of the radiological contaminants from the test would be tied up in the melt glass within the cavity. All parties agreed that this list was sufficient based on available information.

Gnome

In her DQO presentation, Ms. Arnold pointed out the areas of concern on aerial photos and differences between these DQO and the Gasbuggy site. She pointed out that there is no evidence of mud pit use at the site. Mr. Young stated that the rationale for eliminating the need for mud pit follow-up work must be documented. DOE/NV will incorporate its rationale in its DQO document. Mr. Gretsky pointed out that DOE/NV techniques used to investigate soil-contaminated sites might be used to characterize the vent plume.

Site surface erosion factors require that surface transport mechanisms be addressed at these historically contaminated areas. Mr. Young stated that contamination may reside inches below the surface due to downward migration and/or wind deposition and that surface radiological surveys may no longer adequately measure potential contamination. The loose sandy soil is conducive to downward percolation of contaminants.

Since DRI has the lead subsurface work associated with the cavities, drifts, and shaft, Ms. Chapman discussed subsurface and groundwater issues. Any potential leakage from the shot cavity, shaft, and drift complex would be due to a combination of salt creep and hypothesized borehole plugging failure as a release mechanism. She suggested that monitoring the situation might be more appropriate than characterization of subsurface contamination due to the possibility of creating migration pathways during characterization and to the hypothetical nature of the release scenario.

The group discussed tracer test and groundwater contamination issues associated with the Culebra aquifer. Ms. Chapman touched on the fact that there are no monitoring well downgradient of the tracer test wells. She mentioned that there was abundant and good data on the Culebra aquifer near the Waste Isolation Pilot Plant and Gnome area but nothing for the area downgradient between Gnome and the Pecos River. The risk from the tracer test would be due to migration outside the controlled area (i.e., current subsurface restrictions are in place for section 34). She mentioned that the issue has been evaluated in previous modeling work, available for NMED review, and that this would probably form the basis for a cost-benefit analysis regarding the wisdom of additional subsurface data collection.

Summary

The past two days provided both parties an opportunity to discuss issues associated with Gasbuggy and Gnome Coach sites. DOE/NV considers this a kick-off meeting and NMED representatives did not have a problem with this. Ms. Sanchez and John Kieling will serve as the lead for programmatic issues (i.e., agreement in principle funding, public participation requirements, funding, etc.). Scotty Afong and Mr. Young will serve as the lead on technical issues.

General Documents
for
The State of New Mexico Environmental Department

1. New Mexico kickoff briefing (hard copy of slides)
2. DQO briefing package for Gasbuggy
3. DQO briefing package for Gnome Coach
4. Reference list for Gasbuggy site (developed during the preparation of the draft preliminary assessment)
5. Reference list for Gnome Coach site (developed during the preparation of the preliminary assessment)
6. General DOE/NV Environmental Restoration Corrective Action Investigation Plan outline
7. Draft outline of the Colorado Rio Blanco Work Plan
8. Copy of old Agreement in Principle
9. Copy of the Gasbuggy Life-cycle Baseline Schedule
10. Copy of the Gnome Coach Life-cycle Baseline Schedule
11. Operational Area Monitoring Plan Long-Term Hydrological Monitoring Plan, 2000-2001, November 3, 1999
12. Annual Water Sampling and Analysis Calendar Year 1996, EPA-402-R-97-010, June 1997 (only sections for Gasbuggy and Gnome Test Site Areas)
13. Annual Water Sampling and Analysis Calendar Year 1997, EPA-402-R-98-005, June 1998 (only sections for Gasbuggy and Gnome Test Site Areas)
14. Annual Water Sampling and Analysis Calendar Year 1998, EPA-402-R-98-014, January 1999 (only sections for Gasbuggy and Gnome Test Site Areas)
15. Annual Water Sampling and Analysis Calendar Year 1999, EPA-402-R-99-012, December 1999 (only sections for Gasbuggy and Gnome Test Site Areas)
16. Project Gasbuggy and Gnome Coach Sampling Locations, Rev. Jan. 2000

NOTE: Documents 1-10 on this list were provided at the March 8, 2000, meeting.

Gasbuggy Site Specific Documents
for
The State of New Mexico Environmental Department

1. Project Gasbuggy Manager's Report, PNE-G-79, NVO-37, November 1971
2. Project Gasbuggy Site Restoration Final Report, PNE-G-90, NVO-211, July 1983
3. Project Gasbuggy Radiation Contamination Clearance Report, PNE-G-89, June 27, 1979
4. Surface Radioactivity at the Plowshare Gas-Stimulation Test Sites: Gasbuggy, Rulison, Rio Blanco, EPA 600/R-95/002, January 1995
5. An Aerial Radiological Survey of Project Gasbuggy and Surrounding Area, EGG 11265-1129, August 1995
6. Tritium Migration at the Gasbuggy Site, DOE/NV/11508-12, Publication # 45144, September 1996
7. Assessment of Hydrologic Transport of Radionuclides from the Gasbuggy Underground Nuclear Test Site, DOE/NV/11508-16, Publication No. 45148, September 1996
8. Tritium Results from Long-Term Monitoring Program at Gasbuggy Site (1972-1987)
9. Gasbuggy Sampling Results (1988 - 1991)
10. Video *The Resourceful Atom: Project Gasbuggy*

Gnome Coach Site Specific Documents
for
The State of New Mexico Environmental Department

1. Project Manager's Report, Project Gnome, Plowshare Program, October 1962
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AUG 30 2000

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HIGHLIGHTS OF AUGUST 2-3, 2000, MEETING

On behalf of this office, I would like to thank you for allowing your staff to meet with my staff on August 2-3, 2000. Discussions on issues related to your Gasbuggy and Gnome Coach data quality objective comments, work plans being developed for the characterization of both sites, FY 2000 Gasbuggy field work, and our New Mexico remediation efforts were very beneficial to my organization. Enclosure 1 contains highlights of this meeting. Enclosure 2 is our comment resolutions related to your comments on Gasbuggy and Gnome Coach data quality objectives.

Your representatives indicated that sites, which require a No Further Action (NFA) declaration, must be evaluated under the residential scenario. Your staff also stated that residential preliminary remediation goals must be used as the initial screening criteria to determine if a risk assessment evaluation is necessary. However, it is our understanding that if corrective measures, administrative controls, or monitoring controls are implemented, the NFA declaration does not apply and therefore, other land use scenarios can be considered. If a risk assessment evaluation is required, it is our intent to use land use scenarios which are consistent with potential future land use. For the Gasbuggy site, the Native American scenario will be addressed as the most sensitive receptor and we will work with cognizant stakeholders on establishing appropriate parameters. If the state does not agree with our interpretation, please let us know within the next 30 days so that we can have further discussions on this matter.

Our FY 2000 Gasbuggy preliminary characterization field work will continue through the end of September 2000. Your staff is welcome to visit this site and observe our preliminary characterization work.

For additional information, please contact Monica L. Sanchez or D. Scotty Afong, of my staff, at (702) 295-0160 or (702) 295-1050, respectively.

Runore C. Wycoff, Director
Environmental Restoration Division

ERD:DSA

Enclosures:
As stated

cc w/encls:
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Santa Fe, NM
D. C. Stahl, IT, Las Vegas, NV
J. B. Chapman, DRI, Las Vegas, NV

Highlights of August 2-3, 2000
DQO Comment Resolution/General Meeting
with State of New Mexico Representatives

Attendees - August 2, 2000

John Young (NMED)
Scotty Afong (DOE/NV)
Robert Boehlecke (DOE/NV)
Mike Nagy (DOE/NV)
Neelam Dhawan (NMED)
Bryan Cherry (DOE/NV)
Dawn Arnold (DOE/NV)
Jenny Chapman (DOE/NV)

Attendees - August 3, 2000

Wayne Price (NM OCD)
John Young (NMED)
Scotty Afong (DOE/NV)
Martyne Kieling (NM OCD)
Neelam Dhawan (NMED)
Robert Boehlecke (DOE/NV)

August 2, 2000, Meeting Highlights

1. Overview

Scotty Afong presented an overview of the work plan process to the New Mexico Environment Department (NMED) and provided a quick review of the acceleration of the Gasbuggy work. He explained the bifurcation of the surface and subsurface characterization components of each project and the reason behind DOE's decision to separate the two investigations. He clarified how DOE "closes" each component separately but the site does not get petitioned for closure until both components have been addressed.

NMED representatives initially expressed some concern on how a subsurface investigation impacts an "closed" surface (e.g., any sumps/mudpits resulting from subsurface drilling would be controlled and remediated under the subsurface component). Jenny Chapman clarified to NMED representatives on how a nuclear test typically affects the subsurface (i.e., rock fracturing) and that pathways to the surface are usually not present because of depth of test cavity, stemming of drill holes, hydraulic head, etc. This explanation helps support and clarify why DOE/NV can separate the surface and subsurface investigations into two components independent of each other.

2. Data Quality Objectives (DQO) Comment/Resolution

The DQO Gasbuggy comments were addressed by Rob and Jenny while Dawn and Jenny addressed the Gnome Coach DQO comments. In general, most of NMED's comments are being addressed in more details within the work plan. John and Neelam expressed the need to address compelling arguments for both surface and subsurface characterization decisions in the work plans.

Gasbuggy tritium sampling and shallow groundwater issues were discussed. DOE/NV stressed that the primary Contaminant of Promary Concern (COPCs) for the surface investigation are chemical COPCs because radiological characterization and remediation efforts had previously been done. NMED stressed their desires for confirmatory soil sampling for tritium. DOE/NV's initial strategy is not to collect these samples and that justification for not doing so would be presented in the work plan.

There were more detailed discussions on Gasbuggy's shallow groundwater. NMED indicated that sampling and chasing the shallow groundwater aquifer is dependent upon the alluvial system. If there is a notable decreasing surface contamination trend, one could argue for not chasing the shallow groundwater system if it was not reached within a reasonable distance from surface contamination. NMED agreed that the DQO for shallow groundwater was reasonable for the chemical COPCs but that it was still concerned about potential tritium in the shallow groundwater.

The Gnome Coach subsurface was discussed at length. DOE/NV explained the differences in the approaches to characterizing the underground workings versus the tracer test wells (i.e., whether or not contaminant modeling would be required). Based on these discussions, it was apparent that additional discussions are needed to determine whether the Culebra aquifer is considered a valuable water resource. NMED stated that the groundwater bureau has, in the past, protected water resources that currently are below drinking water standards. This philosophy has implications on the types of surface and subsurface risk scenarios. NMED suggested that all information should be provided that would make compelling arguments for all subsurface characterization techniques and decisions.

NMED indicated that all parameters and models used for risk assessments must be agreed upon, justified, and documented prior to going final with reports. NMED also stated that risk numbers are required in addition to any dose assessment performed. NMED indicated that all groundwater models should be calibrated and parameters documented and justified.

NMED restated their position that if pre-shot mudpits were closed under the oil and gas or potash industry accepted closure standards for the time being, then a No Further Action (NFA) will most likely be approved. DOE/NV has to demonstrate that the mudpits were closed prior to the test and not re-used during post-shot activities.

NMED stated they accept maximums and not data averaging over areas. Composite samples are also viewed as an averaging method. There are exceptions to this general rule in situations where volume requirements deem it necessary (e.g., two-inch diameter of direct push method requires the composting of several feet of soil core) but these situations must be explained in the report.

Current NMED policy (there is no written guidance) requires sites, for which a NFA declaration is desired, be evaluated under the residential scenario. Residential Preliminary Remediation Goals (PRGs) must be used and, if surface contamination is detected, a risk assessment using residential scenarios is required. However, if corrective measures, administrative controls, or monitoring controls are implemented, the NFA declaration does

not apply and therefore other land use scenarios can be considered. For the Gasbuggy site, NMED stated that the Native American scenario must be addressed as the most sensitive receptor.

3. Work Plan Issues

NMED agreed that the Resource Conservation and Recovery Act (RCRA) exclusion for waste under the oil and gas regulations could be applied to soil from borings. NMED stated that Method 5035 is preferred but not required. If Method 5035 is not used, a NMED approval is not required but DOE/NV must explain its rationale for using another method in the work plan. DOE/NV asked how NMED views estimated data due to missed hold times. It indicated that the data would be looked at and considered but is not useable in any risk assessments. A Total Petroleum Hydrocarbon (TPH) sampling guidance document was provided to DOE/NV and will be incorporated, where feasible, into the work plan.

DOE/NV informed NMED that preliminary dose assessments were run using Residual Radiation (RESRAD) for Gasbuggy and Gnome Coach to help guide the investigation strategy and will be presented in the work plan. Sample results from the most recent restoration effort at each site are being used in the assessment. NMED stated that risk numbers should be included.

NMED and DOE/NV agreed that only total metals would be acceptable for mudpit characterization but Toxicity Characteristics Leaching Procedure (TCLP) metals analysis is required for waste determination purposes. NMED stated that either total RCRA metals or the full Target Analyte List metals would be acceptable for site characterization.

DOE/NV led a discussion regarding common terms used for documents. In general, terminology of NMED reports is similar to those proposed by DOE/NV (i.e., work plan, investigation report). It was agreed that the scope of work would be explained at the front of each document to eliminate confusion over contents. Document titles would closely match those used by NMED (similar to RCRA report titles).

4. August/September 2000 Field Work

DOE/NV provided a brief overview of the preliminary characterization work being done in August and September. The work will include cultural and biological surveys, site geophysical work, sampling at various areas of concerns, and EPNG 10-36 initiatives. We are coordinating our work with the Jicarilla Ranger District and the Jicarilla Apache Tribe. NMED expressed an interest observing operations and would like a schedule of the upcoming work.

August 3, 2000, Meeting Highlights

General Topics of Interest

A meeting was held with the New Mexico Oil Conservation Division (OCD), NMED, and DOE/NV to discuss the Gasbuggy site in more detail. All representatives agreed that the

mudpits could be closed under the Water Quality Control Commission guidance. The focus of this commission is to protect groundwater and would require DOE/NV to comply with the New Mexico Water Quality Act. Since there are other areas of concerns, which do not fall under this jurisdiction, NMED would be the primary point of contact and bring in the OCD when necessary. OCD is interested in getting a copy of the NMED letter requesting the RCRA exclusion for mudpit materials.

The risk assessment and PRGs issues were clarified. NMED stated that because the surface and subsurface components of the sites are decoupled DOE/NV might be able to get a NFA for the surface. NMED also stated that sampling results for non-carcinogenic chemical COPCs should be compared to 1/10 of the published PRG. This would account for potential additive effects of these chemicals when performing risk screening. If/Then Statements for the subsurface investigations (both sites) were reviewed. NMED concurred with the DQO investigation strategy. NMED informed DOE/NV that there is a policy in production that addresses radiological PRGs.

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AUG 22 2000

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SCOPE OF WORK FOR FY 2000 GASBUGGY FIELD WORK

The DOE Nevada Operations Office will be conducting preliminary site characterization work at our Gasbuggy test site in Rio Arriba County, New Mexico, during August/September 2000. Although these efforts were not originally planned for this fiscal year, our office will be able to conduct them as a result of significant cost-savings achieved from our other remedial activities.

Enclosed is our scope of work related to actions being performed under the jurisdiction of the New Mexico Oil Conservation Division Environmental Bureau for your review and comment. Since the geophysical survey, described in the enclosure, does not involve any ground disturbance, the survey will help us to identify the mud pit locations. Our plans are to start this work on August 21, 2000. However, no ground disturbing activities will be started until we receive your approval and any conditional requirements are met.

Also enclosed is the additional information you requested relating to potential radiological contamination at the Gasbuggy site.

Your assistance and support on issues related to our upcoming field work is appreciated. For additional information, please contact D. Scotty Afong, of my staff, at (702) 295-1050.

for Runore C. Wycoff, Director
Environmental Restoration Division

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Scope of Work
Fiscal Year 2000 Gasbuggy Field Work

This scope of work addresses areas of concern (AOCs) that are regulated by the New Mexico Oil Conservation Division (OCD) at the U. S. Department of Energy, (DOE) Gasbuggy site in New Mexico. DOE will be conducting a preliminary field investigation at the Gasbuggy site during August/September 2000. The activities described in this Scope of Work have also been communicated to the United States Forest Service Jicarilla Ranger District, the New Mexico Environment Department, and the Jicarilla Apache Tribe. DOE will provide OCD weekly reports on site activities during the course of this investigation.

Background

Project Gasbuggy was a joint government-industry experiment conducted under the Plowshare program to test the effectiveness of nuclear explosives to fracture low-permeability natural gas reservoirs to stimulate production. Project Gasbuggy consisted of one 29-kiloton nuclear device emplaced in a boring at a depth of 1,292 meters (4,240 feet [ft]) below ground surface (bgs) in the Pictured Cliffs sandstone formation and detonated on December 10, 1967. The Gasbuggy site is located approximately 55 air miles east of Farmington, New Mexico, in Rio Arriba County within the Carson National Forest (see Figure 1). Investigations will be conducted in two operational areas; the surface ground zero (SGZ) area and the Well GB-D area (see Figure 2). At this time, there are no known OCD regulated AOCs at the other Gasbuggy operational areas (i.e., Recording Trailer Park, Control Point, or Helicopter Pad).

Six major natural gas production tests were conducted after reentry drilling was completed in January 1968. Long-term production testing was completed in November 1973 and pressure monitoring activities were completed in late 1976. During production testing, tritium-contaminated water was brought to the surface with the natural gas. The majority of this water was injected into the gas flare to be vaporized into the atmosphere. Some of this water then condensed and was deposited on the site surface, contributing to low levels of tritium contamination in the SGZ vicinity.

Site restoration activities including well plugging and abandonment, decontamination and disposal of equipment, and soil sampling and analysis were conducted in August and September 1978. No soil moisture samples collected during the 1978 restoration exceeded established release criteria for radioactivity; therefore, no soil was remediated. There is a potential for residual chemical and tritium contamination in the soil.

Objective of Investigation

The goal of this preliminary investigation is to collect data that will allow DOE to focus future investigations to specific contaminants of potential concern (COPCs) and AOCs. This field

effort will aid in the planning and refinement of the scope for future field investigations at the Gasbuggy site. This will be accomplished by completing the following objectives:

- Perform geophysical surveys to identify and define subsurface AOCs such as mud pits.
- Collect soil and groundwater samples that will allow investigation-derived waste from this and future investigations to be characterized and refine the list of COPCs for future investigations.
- Determine depth to shallow groundwater and collect shallow groundwater samples, if possible, using the direct-push method.
- Purge and sample El Paso Natural Gas (EPNG) Well 10-36, if feasible, to refine COPCs for future subsurface investigations.

Scope of Investigation

Intrusive activities will be limited to the SGZ area. Depending on time restrictions, results of the investigation, and limits of the direct-push technology, this investigation may or may not include determination of shallow groundwater depth and shallow groundwater sampling. All activities will be done in accordance with approved procedures and the DOE New Mexico Sites Quality Assurance Project Plan.

Geophysical Surveys

Geophysical surveys will be conducted to accomplish the following objectives:

- Locate and delineate the drilling mud pits in the SGZ area.
- Locate and delineate the landfills used to dispose of the drilling fluids generated during well abandonment in the SGZ area.
- Locate and delineate the drilling mud pit in the Well GB-D area.

The results of the geophysical investigation will be used to more accurately define the boundaries of each suspect area and determine areas to be sampled. Historical and geophysical data will be compared to make a determination as to what the geophysical anomaly represents.

Soil Sampling

Soil sampling will be conducted for the purpose of site characterization, quality control, and waste characterization. The primary objective of the soil sampling effort is to define the nature of potential contamination. Defining the vertical extent of contamination will be a secondary objective. In most instances, only a single boring will be advanced within each subsurface feature to be characterized (e.g., mud pit).

Boring locations will be established when the results from the geophysical investigation are available. The Site Supervisor, in conjunction with the Site Geologist, will choose the boring and sampling locations based on historical site records, field observations, and the results of the geophysical surveys. The total number of borings and samples will depend on field conditions. Upon completion of sampling activities, all boreholes will be grouted to the surface in accordance with applicable New Mexico regulations.

Mud Pits

During the 1978 site restoration, the mud pits were covered over and graded to the approximate contours of the site prior to disturbance. The base of the mud pits are estimated to be no more than 15 ft bgs. Based on the historical documentation available, it is possible that several of the mud pits overlap or are on top of one another. The results of the geophysical survey, together with the historical documentation, will be used to determine the locations of each of the subsurface features in the survey area. A single boring will be advanced in the approximate center of each of the mud pits. At a minimum, one sample will be collected from each distinct layer of mud. Additional samples may be collected from thick layers in order to determine if COPCs are concentrated in the top or bottom of layers. Samples will also be collected below the base of each mud pit to approximately 10 ft below the mud/native soil interface or until refusal is met.

Mud Landfills

Based on documentation, there are three landfills which were used exclusively for disposal of previously containerized drilling fluids used during various milling and plugging operations during the 1978 restoration effort. According to documentation, trenches were excavated and used to dispose of a mixture of water, mud, and paraffin. These landfills will be located based on documented knowledge and the results of the geophysical surveys. The landfills will be sampled in the same manner as the mud pits.

Drilling Pads

The exact locations of drill pads, shaker tables, and mud tanks used during drilling of wells in the SGZ area are not known. Therefore, in order to further refine the location of possible contamination resulting from drilling operations, three boreholes will be advanced within approximately a 20 ft diameter of each well. The exact location of these borings will be determined in the field based on field conditions and the judgment of the Site Supervisor and Site Geologist.

Sampling Methods

The direct-push method penetrates the soil with minimal disturbance using an advancing decontaminated 4 ft core barrel. Acetate, cellulose, or polyvinyl chloride liner sleeves will be used to contain the cores. In the event that an additional volume of soil is required to complete the sample, additional cores will be obtained at a radius of not greater than 1 ft from the original boring.

The contents of the liner sleeve will be documented by the Site Geologist. Soil samples will be analyzed for the following parameters:

- Total Volatile Organic Compounds (VOCs)
- Total Semi-Volatile Organic Compounds (SVOCs)
- Total *Resource Conservation and Recovery Act* (RCRA) Metals
- Total Petroleum Hydrocarbons

In addition, some of the samples will be analyzed for the following parameters for waste characterization purposes:

- TCLP VOCs
- TCLP SVOCs
- TCLP Metals
- Tritium

Shallow Groundwater

The depth to shallow groundwater at the Gasbuggy site is not known. The objective of identifying the depth to shallow groundwater and collecting samples is to provide information to refine the scope of further investigations. As time permits, and based on site conditions, an attempt will be made to identify the depth to shallow groundwater at the SGZ. The exact locations of these attempts will be determined based on conditions encountered in the field and the judgment of the Site Geologist. Using direct-push, a continuous core sample will be collected to either the maximum depth of the technology or until shallow groundwater is encountered, whichever comes first. If sufficient water enters the boring, a sample will be collected. Shallow groundwater samples will be analyzed for the following parameters:

- Total VOCs
- Total SVOCs
- Total RCRA metals
- Tritium

Well EPNG 10-36 Purging and Sampling

As part of the ongoing investigation of the subsurface at the Gasbuggy site, water samples may be obtained from Well EPNG 10-36. This well was originally completed by EPNG in 1956 and served as a natural gas producing well until 1967. In 1967, in preparation for the Gasbuggy test, the well was stemmed. Efforts to recomplete the well in 1968 to reach the natural gas producing formation were not successful, and the well was converted to a groundwater monitoring well. Samples collected annually by the U.S. Environmental Protection Agency (EPA) have indicated levels of tritium between 100 and 560 picocuries per liter (pCi/L) in the well since 1984. Samples collected in June of 1999 indicated a tritium concentration in the well water of 93 +/- 4.6 pCi/L.

Well EPNG 10-36 historically has very low recharge, therefore, only one well casing will be purged. Upon purging, a groundwater sample will be collected from the well if, based on field observation, it is believed the water in the casing is representative of the Ojo Alamo aquifer. In any case, a sample will be collected from the purged water for waste characterization purposes. Both samples will be analyzed for the following parameters:

- Total VOCs
- Total SVOCs
- Total RCRA Metals
- Total Petroleum Hydrocarbon
- Total Dissolved Solids
- Tritium
- Gamma Spectroscopy
- Gross Alpha/Beta

Waste Management and Disposal

The DOE intends to manage and dispose of the wastes associated with the investigation of the AOCs described above (e.g., mud pits, mud landfills, drill pads, and Well EPNG 10-36), under New Mexico OCD regulation as RCRA-exempt exploration and production waste. It is DOE's interpretation that these wastes qualify for the oil and natural gas industry-specific exclusion found at 40 CFR 261.4(b)(5). This regulatory citation excludes "drilling fluids, produced waters, and other wastes associated with the exploration, development, or production of crude oil, natural gas, or geothermal energy" from the definition of hazardous waste. EPA further defined these excluded wastes in their "Regulatory Determination for Oil and Gas and Geothermal Exploration, Development and Production Wastes," published in 1988 (53 FR 25447). The Determination lists several wastes that are included in the exemption, such as drill cuttings, well completion, treatment, and stimulation fluids, and pit sludges and contaminated bottoms from storage or disposal of exempt wastes. DOE contends that the waste that resulted from the drilling of the emplacement well and other test-related wells and the wells themselves are "uniquely associated with exploration, development, and production of crude oil and natural gas" and, therefore, meet the criteria for exclusion from hazardous waste regulation. Wastes generated during investigation activities at locations not directly associated with the Gasbuggy test, such as septic waste systems, will not be managed under this exclusion. These wastes, such as personal protective equipment/gear, disposable sampling equipment and decontamination rinsate, will be characterized, managed, and disposed of in accordance with applicable New Mexico Environment Department regulations.

Soil sampling activities will result in the generation of a soil waste stream that will require off-site disposal. It is estimated that the volume of soil that will be generated in sampling activities will fill a total of five to eight, 55-gallon drums. This material will be managed temporarily on site in Department of Transportation (DOT) certified steel drums or DOT-certified plastic buckets (for smaller volumes of waste). Drums and buckets will be labeled as non-regulated/non-hazardous waste and marked with a unique tracking number. An inventory of drums/buckets and their contents will be tracked through use of a Waste Management Logbook.

Waste containers will be stored on site in a locked transportainer (e.g., SeaLand container or Conex box) prior to off-site disposal.

The DOE has tentatively identified the following landfarm facilities for the disposal of the soil waste: (1) Tierra Environmental Company, Inc., Farmington, New Mexico, and (2) Envirotech, Inc., Farmington, New Mexico. Waste characterization analytical data will be forwarded to the OCD for their review prior to final selection of a disposal facility. Once a facility is selected, the DOE will have the waste transported for disposal.

Sampling of Well EPNG 10-36 will necessitate the purging of approximately 3,000 gallons of groundwater that will require off-site disposal. This water will be contained in an above-ground storage tank (e.g., frac tank) and managed under New Mexico Oil Conservation Division regulation as RCRA-exempt exploration and production waste. A sample of the purge water will be collected and analyzed as described above.

The DOE has tentatively identified the following underground injection facilities for the disposal of the purged groundwater: (1) Key Energy, Farmington, New Mexico, and (2) Basin Disposal, Inc., Aztec, New Mexico. Waste characterization analytical data will be forwarded to the OCD for their review prior to final selection of a disposal facility. Once a facility is selected, the DOE will have the waste transported for disposal.

Questions and Answers on Radiological Contamination at Gasbuggy for the New Mexico Oil Conservation Division (08/16/00)

1. How did the surface and subsurface at the Gasbuggy site get contaminated with radioactive material? What are the radiochemicals of concern?

First, what do we mean by surface and subsurface. The surface includes topsoil and shallow subsurface soils (approximately <20 feet). The subsurface includes the detonation cavity (approximately 4,238 feet below the ground surface) and chimney, and potential contaminant migration in the Ojo Alamo aquifer and the Pictured Cliffs natural gas bearing formation.

Surface

Radiological contamination in the surface at the Gasbuggy site is associated with gas production operations. Post-detonation operations in the main drilling area included gas production from the chimney. The chimney is the broken rock directly above the nuclear cavity formed by the force of the explosion. There is typically not a direct connection between the cavity and the ground surface. However, some radioactive gases including tritium can be found in the chimney. Other radionuclides are captured in the melt glass formed by the detonation. Radioactive gases including tritium (a radioactive form of hydrogen) were brought to the surface along with water as a by-product of the natural gas production after the detonation. The radioactive gases other than tritium would have quickly dissipated and decayed due to their gaseous form and a very short half-life.

During gas production, the tritium contaminated water was injected into the gas flare. Some tritium condensed out of its gaseous form and was deposited on the ground surface. Thus, the gas flaring operation is known to have impacted the surface soil in the surface ground zero area with low-levels of tritium moisture (AEC, 1971). Based on extensive monitoring and sampling during the detonation, and subsequent drilling operations, no other radiological contaminants are suspected at the site surface.

Surface and near surface soil sampling were performed at 165 locations in 1978, during the environmental restoration phase of Project Gasbuggy. Sets of subsurface soil samples were collected at 32 locations at depths down to eight feet below the ground surface. Forty-six additional operational soil samples were collected during the decontamination and environmental restoration phase.

All of the soil samples were analyzed for tritium. In addition, eight samples were also analyzed by gamma spectroscopy and for plutonium-239/240, plutonium-238, and strontium-90. Only tritium was detected in any of the soil samples. Therefore, tritium is the only radionuclide contaminant of potential concern in the surface soil at the Gasbuggy site.

Subsurface

Radiological contamination in the subsurface at the Gasbuggy site is associated with the underground nuclear test cavity in the deep subsurface. The radioactive contamination from the detonation is believed to be sealed within this underground cavity. The cavity was not drilled into. Low levels of tritium (which would have escaped the cavity as gas) have been detected in the groundwater monitoring well at the site, Well EPNG 10-36. Previous investigations have failed to conclude the source or pathway of this tritium.

2. *What are the radiological risks from tritium?*

Tritium is a pure beta particle emitter and emits no gamma ray radiation. Beta particles emitted from tritium outside of the body do not have sufficient energy to reach cells of skins and, therefore, would not cause any radiological risk.

Beta particles emitted by tritium can damage humans when tritium is taken into the body. The U.S. Environmental Protection Agency (EPA) has promulgated in their Safe Drinking Water regulations a maximum contaminant level for tritium of 20,000 pico curies per liter (pCi/L) (EPA, 1976). The dose from drinking water with a tritium concentration of 20,00 pCi/L is <1 millirem a year. Whereas the dose from natural background radiation is approximately 80 millirem a year. None of the well samples collected from Well EPNG 10-36 have exceeded this level. Therefore, the low levels of tritium in the soil moisture and groundwater would not cause any radiological risk.

3. *What are the levels of tritium in groundwater?*

Subsequent to the Gasbuggy test, Well EPNG 10-36 was converted to a groundwater monitoring well. It is now sampled annually by the EPA as part of the long-term hydrological monitoring program. Tritium was initially detected above background in Well EPNG 10-36 in 1984. This well is the closest sampling well to the Project Gasbuggy site ground zero and is located approximately 430 feet northwest. Annual groundwater samples taken from Well EPGN 10-36 from 1995 through 1999 have had tritium concentrations ranging from 130 pCi/L to 92 pCi/L, respectively. This is less than 0.5 percent of the EPA Safe Drinking Water Standard (EPA, 1976). The radiological risk from drinking this groundwater is not significantly different from zero (Adams, 2000).

4. *What are the levels of tritium in soil?*

Surface-soil samples (zero to one foot depth) collected during the 1978 restoration had tritium concentrations in the soil moisture that ranged from less than the minimum detectable concentration to a maximum of 154 pCi/mL. Samples taken from the subsurface (>1 foot depth) had tritium concentration in the soil moisture that ranged from less than minimum detectable concentration (<2 pCi/mL) to a maximum of 1,303 pCi/mL. The depth at which the maximum tritium concentration was observed was 4 feet below the ground surface (USDOE, 1983). Tritium which has a half-life of approximately 12.7 years would have decayed to less than 500 pCi/mL by now, not accounting for diffusion and evaporation.

5. Have the concentrations for radioactive material in groundwater at Gasbuggy site exceeded any of the human health standards in 20NMAC6.2 Subpart III paragraph 3103 - Standards for Groundwater?

No. The only standard for radioactive material in 20NMAC6.2 is 30 pCi/L for Combined Radium-226 & 228 (New Mexico Water Quality Control Commission Regulations, 20NMAC). Historical records indicate that no radionuclides, other than tritium, were measured in groundwater above minimum detectable concentrations.

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NEW MEXICO ENERGY, MINERALS and NATURAL RESOURCES DEPARTMENT

GARY E. JOHNSON
Governor
Jennifer A. Salisbury
Cabinet Secretary

Lori Wrotenbery
Director
Oil Conservation Division

September 11, 2000

CERTIFIED MAIL
RETURN RECEIPT NO. 5051 5024

Mr. Runore C. Wycoff
Department of Energy
Nevada Field Office
P.O. Box 98518
Las Vegas, NV 89193-8518

Re: Scope of Work For FY 2000 Preliminary Investigation of the GasBuggy Site.

Dear Mr. Wycoff:

The New Mexico Oil Conservation Division (OCD) is in receipt of the Department of Energy's (DOE) Scope of Work dated August 21, 2000 for the Preliminary Investigation of the GasBuggy site located in SW/4 of Section 36-Ts 29N-R 4W NMPM of Rio Arriba County, New Mexico.

The plan is hereby approved subject to the following additional conditions:

1. DOE will collect representative soil samples, and groundwater samples where applicable, from each area of investigation to properly characterize the waste. All samples will be collected and analyzed for the parameters listed in the plan and any Water Quality Control Commission (WQCC) Regulation "water contaminant" as listed in WQCC 20 NMAC.6.2.3103. All samples shall be collected and analyzed pursuant to EPA methods.

2. DOE will determine the extent of any WQCC "water contaminant" found on-site in the vadose zone and/or groundwater including the parameters listed in the plan.

3. All wastes generated during the investigation shall be disposed of at an OCD approved facility.

4. DOE shall submit the results of the investigation to the OCD Santa Fe Office by **December 15, 2000** with a copy provided to the OCD Aztec District Office and shall include the following investigative information:

   a. A description of all investigation, remediation and monitoring activities which have occurred including conclusions and recommendations.

   b. A geologic/lithologic log and well completion diagram for each bore hole or monitor well.

   c. A current site plot plan showing the extent and location of any on-site contamination found. Please include location of all pits, landfills, buried material, excavated areas, monitor wells, and any other pertinent site features, as well as the depth, direction and magnitude of the groundwater hydraulic gradient, if known.

   d. Isopleth maps for contaminants of concern which were observed during the investigations.

   e. Summary tables of all soil and ground water quality sampling results and copies of all laboratory analytical data sheets and associated QA/QC data taken within the past year.

   f. The quantity and disposition of all recovered product and/or wastes generated.

5. DOE will notify the OCD Santa Fe office and the OCD District office at least 48 hours in advance of all scheduled activities such that the OCD has the opportunity to witness the events and/or split samples during OCD's normal business hours.

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

If you have any questions, please contact me at (505) 827-7155.

Sincerely,

Wayne Price-Pet. Engr. Spec.

cc: OCD Aztec Office
Martyne Kieling-OCD Santa Fe
John Kieling-NMED HWB

Department of Energy
Nevada Field Office
P.O. Box 98518
Las Vegas, NV 89193-8518

FEB 20 2001

James P. Bearzi, Hazardous & Radioactive Materials Bureau, NMED, Sante Fe, NM
Denny G. Foust, Oil Conservation Division, State of New Mexico Energy Minerals, and Natural, Resources Department, Aztec, NM

TRANSMITTAL OF *SITE CHARACTERIZATION WORK PLAN FOR GASBUGGY, NEW MEXICO*, REVISION 0, FEBRUARY 2001

Please find enclosed for your review and comment a copy(s) of the Site Characterization Work Plan for Gasbuggy, New Mexico. As indicated on the proposed schedule in the Work Plan, the DOE Nevada Operations Office (DOE/NV) plans on continuing sampling and characterization studies at the site this summer. In order to begin and complete site characterization activities as currently scheduled, DOE/NV requests your comment response to this work plan by **March 29, 2001**. Your cooperation in this characterization effort is greatly appreciated.

If you have any questions or concerns, please contact Bill R. Wilborn, DOE/NV task manager for New Mexico sites, at (702) 295-3188.

Runore C. Wycoff, Director
Environmental Restoration Division

ERD:BRW

Enclosures:
As stated

ccw/encls:
OSTI, DOE/OR, Oak Ridge, TN
TIRC, DOE/NV, Las Vegas, NV
Public Reading Room, DOE/NV,
Las Vegas, NV

cc w/o encls:
J. E. Kieling, NMED, Santa Fe, NM
John Young, NMED, Santa Fe, NM
D. C. Stahl, IT, Las Vegas, NV
→R. F. Boehlecke, IT, Las Vegas, NV
J. B. Chapman, DRI, Las Vegas, NV
M. L. Sanchez, ERD, DOE/NV, Las Vegas, NV
B. R. Wilborn, ERD, DOE/NV, Las Vegas, NV

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GARY E. JOHNSON
GOVERNOR

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SECRETARY

PAUL R. RITZMA
DEPUTY SECRETARY

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

September 10, 2001

Mr. William R. Wilborn
Environmental Restoration Division
DOE/Nevada Operations Office
P. O. Box 98518, M/S 505
Las Vegas, Nevada 89193-8518

SUBJECT: REVIEW AND COMMENTS ON DOE'S SITE CHARACTERIZATION WORK PLANS FOR THE GNOME-COACH AND GASBUGGY SITES, NEW MEXICO

Dear Mr. Wilborn:

The New Mexico Environmental Department (**NMED**) Hazardous Waste Bureau and DOE Oversight Bureau have completed the review of two Work Plan documents for two Plowshare Program sites located in the state of New Mexico. The Work Plans are titled "Site Characterization Work Plan for the Gnome-Coach Site, New Mexico" (hereafter referred to as **Gnome**) and "Site Characterization Work Plan for the Gasbuggy Site, New Mexico" (hereafter referred to as **Gasbuggy**). Both Work Plans, dated February 2001, were prepared by the United States Department of Energy Nevada Operations Office (**DOE/NV**) and were submitted for NMED's review on February 14, 2001 (received by NMED February 15, 2001). The Gnome site is located approximately 25 miles southeast of Carlsbad, Eddy County; the Gasbuggy site is located within the Carson National Forest, approximately 55 miles east of Farmington, Rio Arriba County.

NMED has found both documents to be well written and, in general, sufficiently complete to proceed with the proposed investigations. However, in the interest of improving the technical adequacy of the documents, NMED offers the attached comments for your consideration. Comments on the Gnome project are contained in Attachment 1 and Gasbuggy comments are in Attachment 2. Each attachment is divided in two parts in order to separate general comments

(Part 1) from specific comments related to sections of the Work Plans (Part 2). While some of the comments (general and/or specific comments) are for informational purposes only, others are more of a technical nature and should warrant your serious consideration when preparing the final Work Plans. Please note that NMED personnel from both the Hazardous Waste Bureau and DOE Oversight Bureau reviewed the Work Plans and therefore comment format will differ within the attachments.

As you are aware from a telephone conversation with Will Fetner of my staff on August 16, 2001, NMED has no clear regulatory authority over the Gnome and Gasbuggy sites because neither of them is subject to the Federal Resource Conservation and Recovery Act (RCRA) or the New Mexico Hazardous Waste Act. NMED is providing the attached comments on behalf of the State which should be construed only as recommendations upon which NMED cannot take enforcement action(s). Moreover, DOE/NV should be aware that because NMED lacks regulatory authority over these sites, these Work Plans, future interim and/or final reports, and ultimately any closure/no further action proposals for these sites, cannot be approved or granted by NMED. NMED requests, however, to be kept informed on the progress of these two sites and to receive copies of the final Work Plans prior to initiating any field characterization activities.

If you have any questions or require further clarification on the attached comments, please contact William Fetner at (505) 428-2520 for comments associated with the Gnome site and Steve Holmes at (505) 428-2521 for comments associated with the Gasbuggy site.

Sincerely,

Steve Zappe
Hydrologist, Hazardous Waste Bureau
New Mexico Environment Department

SOZ/whf

Attachments:
Attachment 1 – NMED Gnome-Coach Comments
Attachment 2 – NMED Gasbuggy Comments

cc: James Bearzi, Chief, HWB
John Kieling, Manager, Permits Management Program, HWB
John Parker, Chief, DOE OB
Bob Weeks, DOE OB
William Fetner, HWB
Steve Holmes, HWB
File: Reading

ATTACHMENT 2

"Site Characterization Work Plan for Gasbuggy, New Mexico," by the DOE's Nevada Field Office dated February 2001, received by NMED on February 15, 2001

The above-referenced report is a Work Plan for additional assessment at the Gasbuggy site, located on Section 36, Township 29 north, Range 4 west, New Mexico Principal Meridian. Gasbuggy is also located in the United Sates Carson National Forest, Jicarilla District and is adjacent to the sovereign Jicarilla Apache Tribal Nation. This is located approximately 55 miles east of Farmington, New Mexico.

The Gasbuggy Project was the first of three joint government-private industry experiments conducted under the AEC's Plowshare Program to test the effectiveness of nuclear explosives to fracture low-permeability natural gas reservoirs to stimulate natural gas production. The experiment involved the use of one 29-kiloton nuclear device emplaced in a boring at a depth of 4,240 feet below ground surface. The device was detonated on December 10, 1967. Neither AEC nor DOE has ever stated the source (radioisotope or material) of the mass of the device.

AEC took ownership and responsibility for the protection and stewardship of the Gasbuggy site beginning in 1966.There were several major natural gas production tests conducted at Gasbuggy from January of 1968 to November of 1976. In turn, DOE assumed responsibilities of the Gasbuggy site upon its creation.

There were several site decontamination and decommissioning activities conducted through September 1978, with all the surface waste being shipped off site to the Nevada Test Site.

The Site Characterization Work Plan for Gasbuggy, New Mexico is technically adequate. The NMED has a few questions and comments, as follows.

PART 1 – GENERAL COMMENTS

Notification to Native American Tribe - A primary concern is associated with DOE Order 0451.1B 5. (Responsibilities) d (10) (c), whereby DOE must notify any sovereign Indian Tribe neighboring any environmental restoration site of any intent for activity. Because DOE/NV is contemplating closure of the Gasbuggy site, and because the Jicarilla Apache Reservation borders the site, it appears necessary that the tribe receive a copy of the Work Plan. The tribe was not listed or mentioned on the distribution list of the Work Plan. NMED also believes it would be appropriate for DOE/NV to solicit comments from the Jicarilla Apache Tribe on the Work Plan.

Notification to the Public - A secondary concern is that of a more severe posting of contamination than the Work Plan indicates is currently being implemented. At present, significant gas and oil exploration is occurring near the Gasbuggy site. The Work Plan has apparent deficiencies for warnings of subsurface drilling. For example, a trifoil warning on the existing plaque may be considered prudent. DOE posts trifoil symbols at all contaminated laboratory sites and should consider consistency in this practice.

PART 2 – SPECIFIC COMMENTS

1. **Section 1.3 (4th paragraph, 1st sentence, pg. 8 of 97)** - A plaque at Surface Ground Zero (SGZ) states the current subsurface intrusion (drilling) restrictions as: no intrusion is allowed from surface to 1,500 ft total vertical depth (TVD) within 100-ft radius, and no intrusion is allowed from 1,500 to 4,500 ft TVD within 1,600-ft radius (DOE/NV, 1978). NMED believes the plaque should indicate the reason for restricted intrusion. The plaque should indicate the potential of radioactive contamination existing within the intrusion restrictions and possibly include a trifoil. The plaque should be inspected periodically (e.g., annually) for the integrity of the materials from which it is composed.

2. **Section 2.1.3 (2nd sentence, pg. 9 of 97)** - Four artificially created seasonal ponds: Are any radioactive species present in ponds or their sediment? NMED suggests sampling of pond sediment and analysis for radionuclides (plutonium, uranium, fission products [specifically ^{137}Cs and ^{90}Sr], and tritium). All results should indicate levels of radioactive contamination as 'releasable to the public', as indicated in DOE Order 5480.11. DOE/NV should also declare a 'releasable to public' limit for tritium, as several of the DOE national laboratories have designated a limit of 1000 dpm for tritium.

3. **Section 2.2 (3rd paragraph, 3rd sentence, pg. 10 of 97)** - Short-lived radioactive gases and tritium: If "process knowledge" stated that there were radiological releases at the site surface and these consisted of short-lived radioactive gases and tritium, it follows that there may well have been other non-gaseous radionuclides released at the surface simply by mechanical entrainment with the "short-lived radioactive gases and tritium." There are references in Appendix A (Page A-1 of A-24), but there are no comments relating to the laboratory methodology and Quality Assurance documentation. The Eberline Instrument Corporation 1979 Report, *Project Gasbuggy Radiation Contamination Clearance Report, PNE-G-89,* was cited as containing the information dealing with the non-existence or non-delectability of radionuclides other than "short-lived radioactive gases and tritium." Because the PNE-G-89 Report did not report items such as limit of detection for those radionuclides other than tritium, it is of limited value. Appropriate action would be to take soil samples at the Gasbuggy site and have them analyzed for the isotopes of concern and use MARSSIM criteria for clearance and sampling where appropriate.

4. **Section 2.2.1 (13th paragraph, 5th sentence, pg. 21 of 97)** - This process contaminated the soil in the SGZ area with low-levels of tritium. If there was contamination by tritium from the water that was injected into the gas flare, there was certainly the opportunity for the contamination of this soil by other radionuclides. Analyze for the presence of radionuclides in the soil near the SGZ.

5. **Section 2.2.1 (17th paragraph, 2nd sentence, pg. 21 of 97)** - Septic Tank B has no documentation of actually existence. If it did exist and was not located, it could be a matter of concern. A site survey with Ground Penetrating Radar (GPR) may be of use in determining whether or not this tank was present and also may identify the presence of other underground items at the site.

6. **Section 2.2.3 (1st paragraph, 2nd sentence, pg. 24 of 97)** - Septic tank or underground storage tank existence is of concern. The absence of these tanks is based solely upon "historical documents." If the actual site construction is different than as-built drawings, there may be a case for the presence of septic tanks and/or underground storage tanks. A site survey with GPR may be of use in determining whether or not tanks are present and also may identify the presence of other underground items at the site.

7. **Section 2.3, Table 2-1 (pg. 30 of 97)** - The table has a reference to the determination of ^{137}Cs, but not ^{90}Sr. If ^{137}Cs is present, there should have been a report on the presence of ^{90}Sr. The fact that it was present in 1990-1994, and not present after 1994 is not consistent with its half-life of 30 years. Does this mean that any ^{137}Cs originally present has been swept into surrounding aquifers? There should be a determination of both ^{137}Cs and ^{90}Sr in surrounding aquifers and groundwater.

8. **Section 2.3, Table 2-1, (pg. 31 of 97)** - A beta/gamma survey was also conducted (DOE/NV, 1983): NMED needs to review this document to determine exactly how the survey was performed in order to determine its sensitivity. Were MARSSIM criteria followed? If the document cannot be located, gamma flyovers could be conducted. Los Alamos National Laboratory, ESH-17, regularly conducts such surveys.

9. **Section 3.2.2 (3rd paragraph, 3rd sentence, pg. 42 of 97)** - ^{137}Cs at concentrations up to 16 pCi/L: In the monitoring of Well EPMG 10-36, why was only ^{137}Cs analyzed and reported and not ^{90}Sr, another fusion product of potential concern to human health? There should be a review of Boehleche, 2001 to determine if the ^{90}Sr was an analyte in these studies.

10. **Section 4.2.3.2 (2nd paragraph, 2nd sentence, pg. 60 of 97)** - The anomaly warrants further investigation: In Table 4-4, the Contaminants of Potential Concern do not include any radiological species. At the very least, screen the samples with survey meters for alpha and beta/gamma and include these results in the report. If these examinations give positive results, proceed with laboratory determinations of suspect radionuclides.

11. **Section 4.2.3.4 (1st paragraph, 1st sentence, pg. 62 of 97)** - Search for the septic tank with exploratory excavation: Samples should be made of any contents. Would it not be more productive to search with GPR than via exploratory excavation? Evaluate GPR capabilities and employ this technique if appropriate. If found, the sampling could be simple survey meter

for alpha and beta/gamma screening. *Note: Later in this report, GPR was employed and a statement was made that future work will include a more extensive search for the missing septic tank.*

12. **Section 4.3.1 (2nd paragraph, 3rd sentence, pg. 63 of 97)** - Discussion with NMED: Which bureau or bureaus will this involve? There are three entities that could be contacted. The Hazardous waste Bureau (**HWB**), Ground Water Bureau (**GWB**), and the DOE Oversight Bureau (**DOE-OB**) should be involved with this study prior to the wells are drilled.

13. **Section 5.1.1 (3rd paragraph, 7th sentence, pg. 71 of 97)** - Although randomly oriented joints present throughout the San Juan basin may influence some groundwater flow, pore flow is believed to dominate in the Ojo Alamo. However, the migration of radionuclides via groundwater flow through these "randomly oriented joints" is possible. There should be a determination of the presence of radionuclides as measured by appropriate monitoring wells.

14. **Section 5.1.2 (5th paragraph, 3rd sentence, pg. 73 of 97)** - 4.5×10^4 Curies of tritium: What about *tritiated* sandstone? Hydroxyls in rock should become tritiated. What about "higher hydrocarbon fractions"? How was this determined? Was there anything like a Soxhlet extraction performed on the rock samples? Conduct chemical extractions of samples of rock/rubble that are suspect, and follow with liquid scintillation determination of tritium. Ascertain that the statement "4.5×10^4 Curies of tritium" is the correct order of magnitude.

15. **Section 5.1.4 (1st paragraph, 2nd sentence, pg. 74 of 97)** - Evidence for a connection between Ojo Alamo and the Gasbuggy cavity: If there is a connection, then there is a potential for longer lived radionuclides to ultimately find their way into the Ojo Alamo and even through its water would not be used for drinking, perhaps there would be a pathway for these to get into a groundwater source used for human or animal consumption. Hydrological testing for radionuclides should be conducted if there is a reasonable location for such sampling.

16. **Section 5.1.4 (4th paragraph, 1st sentence, pg. 75 of 97)** - Water uncharacteristic of the Ojo Alamo: If not Ojo Alamo, then what is the source of the water? Could these also be pathways for radionuclides to migrate? A more extensive investigation, which gives the ultimate determination of the source of the "uncharacteristic" water, should be conducted.

17. **Section 5.3 (2nd paragraph, 1st sentence, pg. 80 of 97)** - Fracture permeability in the subsurface: Radionuclide migration through fractures and faults could be occurring. Employ those geophysical tools/methods which best determine whatever state-of-the-art will allow for determining the nature of fractures throughout the subsurface.

18. **Section 5.6 (3rd paragraph, 4th sentence, pg. 84 of 97)** - A C-14 and Carbon-13 (C-13) sample will also be collected: Will fission product ^{13}C or ^{14}C obscure these age results?

Particularly, would this be the case if there were the same uncertainty regarding their source of origin, as was the case for tritium and ^{137}Cs as detected in Well EPNG 10-36 and as mentioned on page 77 of 97 of this report? If not classified information, examine the technical literature to determine the presence of ^{13}C and ^{14}C resulting from nuclear detonations.

19. **Section 6.0 (1st paragraph, 1st sentence, pg. 86 of 97)** - The schedule is not current and should be revised.

20. **Appendix A.1.0 (2nd paragraph, 2nd bullet, pg. A-1 of A-24)** - No radionuclides other than tritium and naturally occurring radioisotopes were found in the soil samples collected during 1978 Gasbuggy restoration effort. Analytical methodology employed in the analysis of these soil samples could be conducted. There should be an examination of the reference EIC, 1979 to assure the veracity of the above statement.

21. **Appendix A 2.2 (2nd paragraph, 3rd sentence, pg. A-4 of A-24)** - The mean plus or minus one standard deviation for the pre- and post-detonation TLD sets were 0.37 ± 0.47: The values of the standard deviation appear to be large relative to the mean. An examination of these numbers and a determination of the standard deviations appear warranted. Also, deploy TLDs at appropriate locations near and at some distances from SGZ and exchange them on a quarterly basis. Continue this for several years. Compare the results from the TLDs around the site with other TLDs placed some distance away and which would serve as background dosimeters. This would be a cost effective method to obtain valuable information.

22. **Appendix A.2.5 (1st paragraph, 2nd sentence, pg. A-4 of A-24)** - None of the gas samples collected during the posttest contained radioactive material except for the noble gases of xenon and krypton: What about the presence of tritium? There should be an examination of the reference AEC, 1971 to assure the veracity of the above statement.

23. **Appendix 3.0 (7th paragraph, 2nd sentence, pg. A-7 of A-24)** - Have condensed and infiltrated the soil would have dissipated due to evapotranspiration: Tritium certainly could have associated with the sandstone of the reservoir and therefore not have dissipated. Perform a sampling of the sandstone rubble from around the cavity and conduct analysis for tritium.

24. **Appendix 5.1 (1st paragraph, 3rd sentence, pg. A-21 of A-24)** - The total gamma-ray flux was measured with a portable pressurized ion chamber system for comparison with the *in situ* spectrometry results: Is this comparison appropriate and relevant? There should be an examination of EPA, 1995 to determine the validity of the quote from the text.

25. **Appendix B-NM QAPP B.5.1.3 (1st paragraph, 2nd sentence, pg. B-25 of B-69)** - Contractors and other agency participants shall have a system in place for the storage and retrieval of quality records that is consistent with environmental regulations and DOE Order

200.1 (DOE, 1996a): Some of the citations associated with these comments mentioned herein have not been readily available for review. Compile a list of those documents cited and which are necessary for review and provide NMED copies of them so they can be evaluated. If the documents are available electronically, transmit electronic copies. Otherwise, provide hard copies.

26. **Appendix B-NM QAPP B.6.2 (1st paragraph, 3rd sentence, pg. B-26 of B-69)** - To the extent possible, contractors and project participant's hardware and software should be compatible with that of DOE/NV Environmental Restoration Program: Has appropriate action been taken such that information from this project will be easily retrievable in the future? The information technology specialists concerned with this project must address this concern. There certainly are numerous examples of data collected in the past not being retrievable because of hardware or software problems or incompatibilities.

27. **Appendix B-NM QAPP B.6.3.4.1 (1st paragraph, 3rd sentence, pg. B-35 of B-69)** - Pre-analysis Storage/Data reduction, Verification, and Validation shall be documented: There is a need to address specific storage vessel compositions in the context desired analytes, i.e., radiologicals, metals, organics, etc. The reason is that there is some tendency for various analytes to chemisorb to the surface of the storage vessel. If this happens, low analytical results will occur for the analyte under consideration. An example of this is the loss of polonium during storage in certain container types awaiting analysis. There must be documentation of storage vessel type showing that the vessel is satisfactory for the analyte of concern and that it will not be "lost" during storage.

28. **Appendix B-NM QAPP B.6.4.3 (2nd paragraph, 2nd sentence, pg. B-37 of B-69)** - Data reduction, Verification, and Validation: This section does not refer to the need for independent audits of the laboratories performing analytical work. An independent audit should be performed for those laboratories analyzing samples under the present program. The person(s) performing the audit must know what they are doing. There have been instances in which "auditors" were essentially clueless regarding the work they were supposed to be auditing. The concept of audit either may or may not be addressed in B.11.0, Criteria 10-Independent Assessments.

29. **Appendix C (3rd paragraph, 5th sentence, pg. C-2 of C-80)** - The septic tank was not located. See above Section 4.0 reference to septic tank.

30. **Appendix C.4.3 (1st paragraph, 3rd sentence, pg. C-17 of C-80)** - "The core was screened for alpha and beta contamination with...and gamma...": There was no apparent reporting of the levels of either background or elevated readings for alpha, beta, or gamma radiation. An examination of the field notes to obtain this information. Then include it in another report. A

simple statement that was no evidence of radiation above background would be informative if this were the case.

31. **Appendix C.6.2 (1st paragraph, 1st sentence, pg. C-64 of C-80)** - The problem with the existence and location of the septic tank as mentioned above.

32. **Appendix D.3.2.3 (3rd paragraph, 2nd sentence, pg. D-19 of D-21)** - The site does not pose a potential risk to human health based on exposure to tritium in the soil: Radioisotopes other than tritium may be of concern. Their absence based solely on the Eberline document (EIC, 1979) may be problematic as mentioned above. It may be worthwhile to include radioisotopes other than tritium in this statement, and this would make the statement a bit more clear.

Department of Energy
Nevada Operations Office
P.O. Box 98518
Las Vegas, NV 89193-8518

JAN 8 2002

John E. Kieling
New Mexico Environment Department
Hazardous Waste Bureau
P.O. Box 26110
Santa Fe, NM 87502

INTEREST IN VOLUNTARY REMEDIATION PROGRAM FOR NEW MEXICO SITES

The National Nuclear Security Administration Nevada Operations Office (NNSA/NV) has scheduled site investigation field work in 2002 at two Department of Energy sites in New Mexico. These sites, Gasbuggy and Gnome-Coach, were associated with historical underground testing activities and are located in Rio Arriba and Eddy counties, respectively.

The NNSA/NV has been coordinating the review of pertinent project planning documents with the NMED Hazardous Waste Bureau. However, a recent letter from the Hazardous Waste Bureau (Reference: Ltr, Zappe to Wilborn, dtd 9/10/01), states that the Bureau does not have "clear regulatory authority" at the two subject sites. The letter further states that the Bureau cannot approve associated project documents or site closure. The NNSA/NV understands the Bureau's jurisdictional limitations, but also recognizes the benefits of independent regulatory oversight.

The NNSA/NV is interested in discussing the NMED Voluntary Remediation Program (VRP) with your office and it's potential applicability to the subject sites. It appears that the Program offers its participants a clear path to site closure, including regulatory oversight and public participation, which is consistent with the NNSA/NV objectives for these sites. The NNSA/NV has chosen not to submit a VRP application at this time, but the NNSA/NV will apply to the VRP if, after discussion with your office, it is determined that participation in the Program is feasible.

Should you have any questions, please do not hesitate to call Bill R. Wilborn, of my staff, at (702) 295-3188.

Robert M. Bangerter Jr.

for Runore C. Wycoff, Director
Environmental Restoration Division

ERD:WRW

cc:
D. C. Stahl, IT, Las Vegas, NV
P. L. Gallo, IT, Las Vegas, NV

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Ground Water Quality Bureau
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GARY E. JOHNSON
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April 16, 2002

Runore C. Wycoff, Director
Environmental Restoration Division
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P.O. Box 98518
Las Vegas, NV 89193-8518

ACTION ERD
INFO
MGR ✓
AMBFS
AMTS
AMNS
AMEM ✓
AMPIA

Re: Voluntary Remediation Program Information

Dear Ms. Wycoff:

I am writing this letter to acknowledge and respond to your letter dated January 8, 2002. That letter was addressed to John Kieling of the New Mexico Environment Department (NMED) Hazardous Waste Bureau (HWB). The purpose of your January 8 letter was to express potential interest in NMED's Voluntary Remediation Program specifically for the Gasbuggy and Gnome Coach sites in New Mexico. We understand that the environmental assessments at these two sites are being administered by the National Nuclear Security Administration Nevada Operations Office (NNSA/NV), with some oversight and review by NMED/HWB.

The January 8 letter indicates that it is the understanding of NMED and NNSA/NV that NMED/HWB does not have "clear regulatory authority" over these two sites and thus NNSA/NV has expressed interest in obtaining closure for these two sites via the NMED VRP. Since this letter was received and reviewed by the VRP, I have been in contact with both Bill Wilborn and Monica Sanchez of your staff. These discussions have indicated that the goal of the site assessment and restoration at these sites is to allow the withdrawn land to be returned to the U.S. Forest Service and the Bureau of Land Management, although DOE will retain control of all subsurface rights at these sites.

This type of environmental project, where there is a clean-up and return to beneficial use, is appropriate for application to the VRP. Based upon this, NNSA/NV is welcome to make an application to the VRP for these sites. The VRP application takes about 30 days to review and approve, after which a 30-day public comment period is required. If the level of public comment indicates that a public meeting is necessary to satisfy concerns from the public, then a public meeting must be held.

At the present time, the NMED/HWB is continuing to provide oversight and support to these two projects as necessary. If the sites are accepted into the VRP, then VRP staff will continue to work closely with HWB staff to ensure consistent oversight of these projects. When the site meets VRP requirements for closure, then VRP will issue appropriate Completion Certificate documents.

Thank you for your interest in the NMED VRP. We look forward to the receipt of your application. I would urge your staff to be in contact with me prior to submitting the application so that all supporting documentation is in place with the application. There are likely to be some special requirements due to the size and nature of these sites relative to most VRP sites. I can be reached at (505) 827-2754.

Sincerely,

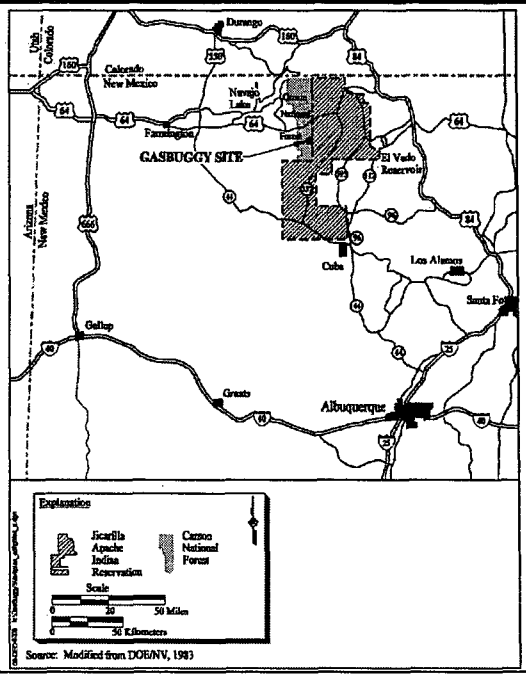
Christine D. Bynum

Christine D. Bynum, R.G.
Program Manager
Remediation Oversight Section

cc: John Kieling, NMED/HWB
Greg Lewis, Division Director, Water and Waste Management Division

Gasbuggy Site Surface Investigation/Closure

Presentation to the USFS - June 18, 2003



Gasbuggy Site Location Map

Gasbuggy Site

- Site Background
- Regulatory History
- Preliminary Field Investigation – 2000
- *Site Characterization Work Plan for Gasbuggy, New Mexico* (Work Plan), January 2002
- Surface Corrective Action Investigation (Field Work), Summer 2002
- *Surface Corrective Action Investigation Report with Surface Corrective Action Plan for the Gasbuggy Site, New Mexico* (planned submittal of June 2003)
- Path Forward and Proposed Schedule

Site Background

- Gasbuggy Project Background
- Site Setting and Description
- Pre-U.S. Department of Energy (DOE)
- Land Use
- Drilling and Detonation
- Post–Detonation (Production Testing and Gas Flaring)
- Restoration (1978)
- Current Status

Gasbuggy Project Background

- First of three joint government/industry experiments conducted under the Plowshare Program to test the effectiveness of nuclear explosives to fracture low-permeability natural gas reservoirs to stimulate production

Gasbuggy Project Background (cont.)

- Gasbuggy consisted of one 29-kiloton device emplaced in a boring at a depth of 4,240 ft in the Pictured Cliffs Sandstone
- Detonated on December 10, 1967
- Six major natural gas production tests were conducted after re-entry drilling was completed in January 1968
- Long-term production testing completed in 1973
- Pressure monitoring activities completed in 1976

Gasbuggy Project Background (cont.)

- Site restoration conducted in 1978
- No formal closure and restoration efforts
  - Did not address potential chemical contamination

Site Setting and Description

- Carson National Forest, Jicarilla Ranger District
- Five operational areas
  - Surface Ground Zero (SGZ)
  - Well GB-D
  - Recording Trailer Park (RTP)
  - Control Point (CP)
  - Helicopter Pad

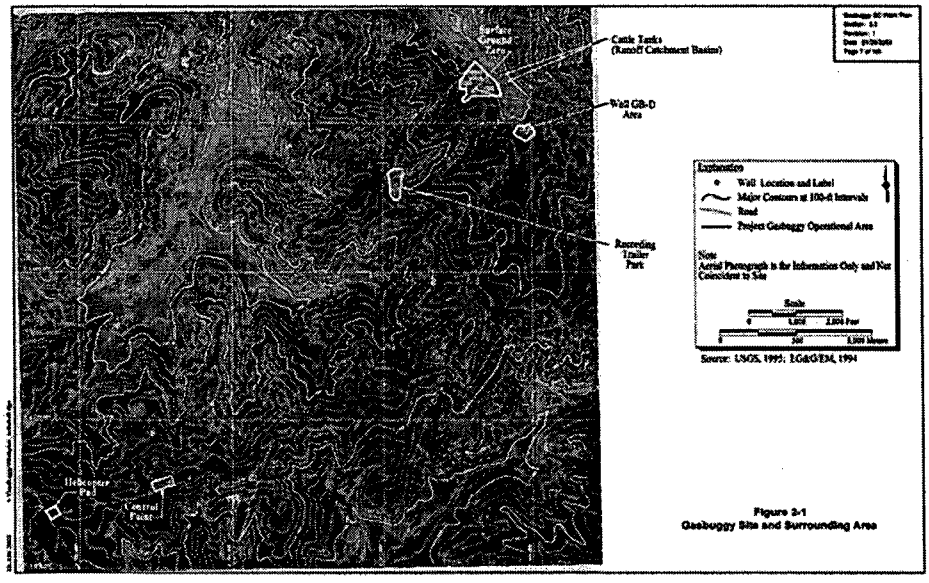
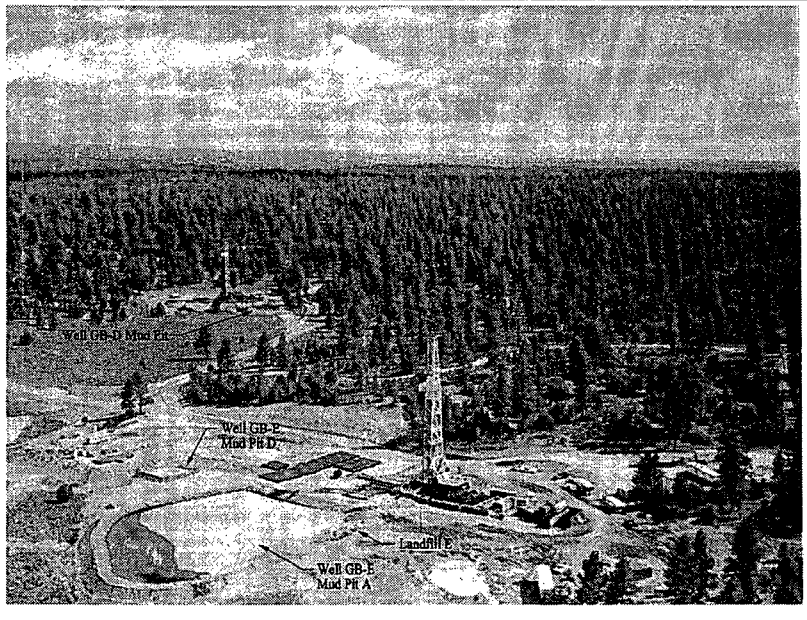
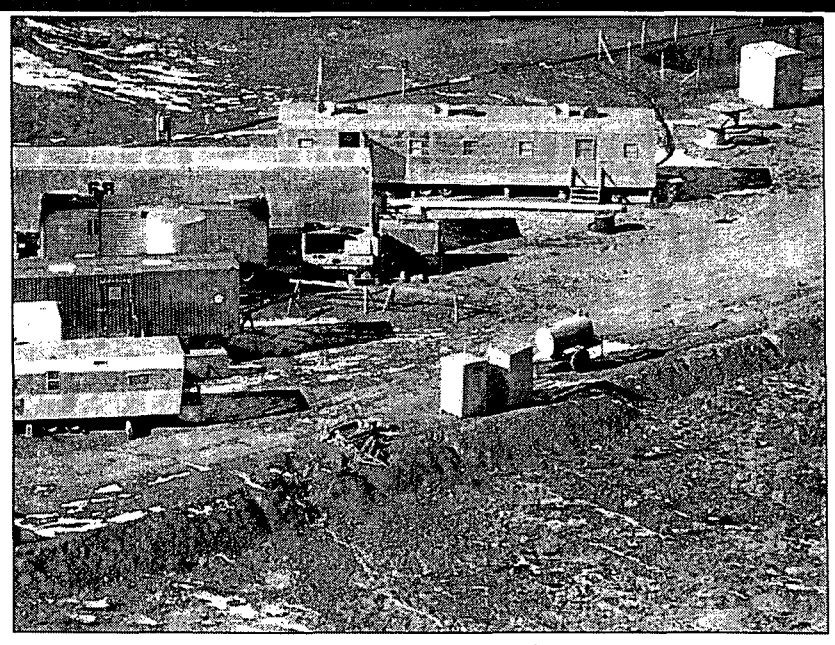


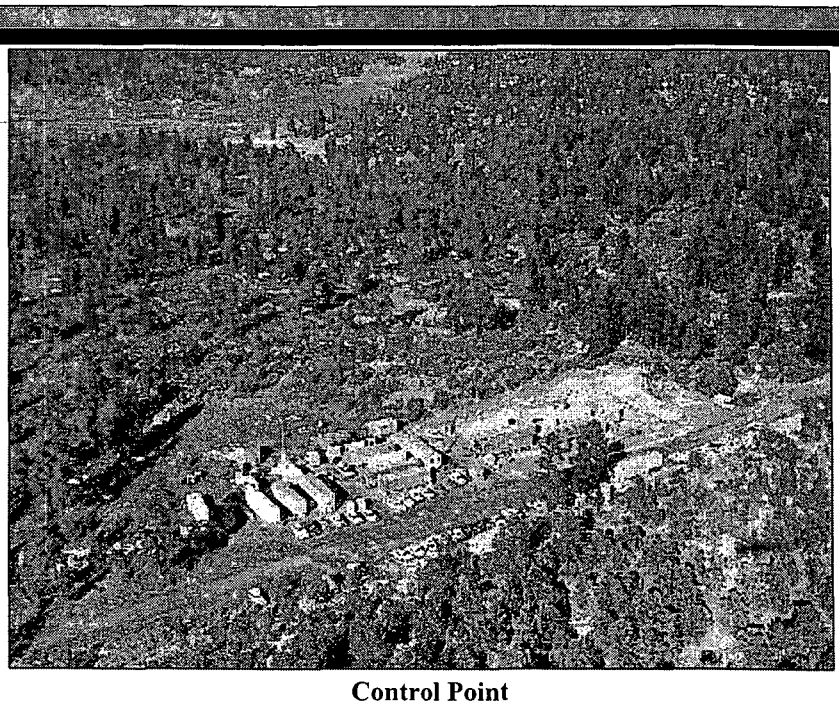
Figure 2-1
Gasbuggy Site and Surrounding Area



Gasbuggy Site during drilling of GB-ER and Well GB-D (1967)



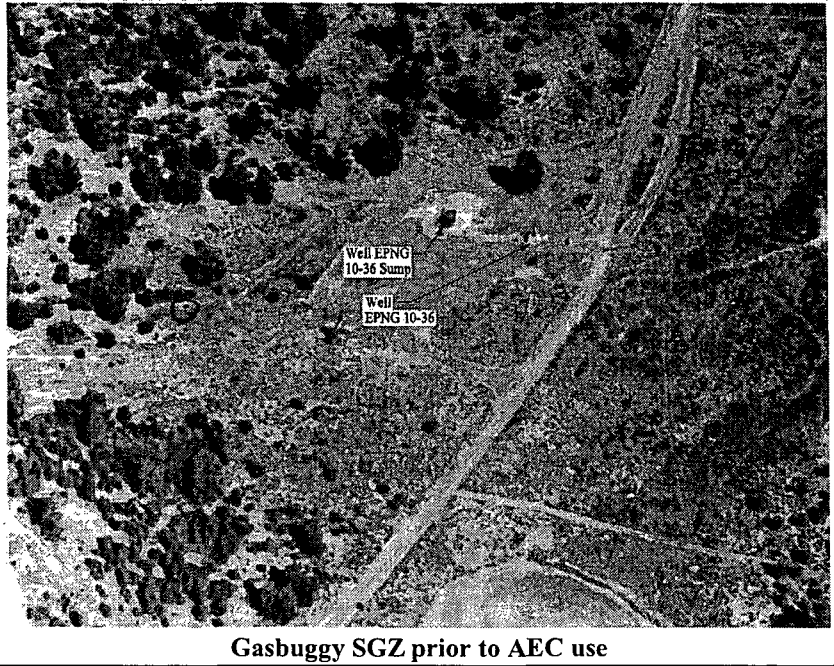
Recording Trailer Park



Control Point

Pre-DOE

- Natural gas wells were operated at the site prior to DOE use of the site
  - SGZ (Well EPNG 10-36)
  - Recording Trailer Park



Gasbuggy SGZ prior to AEC use

Land Use

- January 1967 - Surface and subsurface rights of SW ¼ Section of Section 36 reserved for use by the U.S. Atomic Energy Commission (AEC) as prescribed by contract AT (04-3)-711. Signed by AEC, U.S. Department of the Interior (USDOI) and El Paso Natural Gas (EPNG). Only SGZ in this area.
- March 1967 - Memorandum of Understanding (MOU) signed by U.S. Department of Agriculture's, U.S. Forest Service (USFS) and AEC allowed for the use of lands for Project Gasbuggy
- June 1967 - Section 36, Township 29 north, Range 4 west withdrawn by Public Land Order 4232 dated June 22, 1967 (SGZ and Well GB-D Areas only)

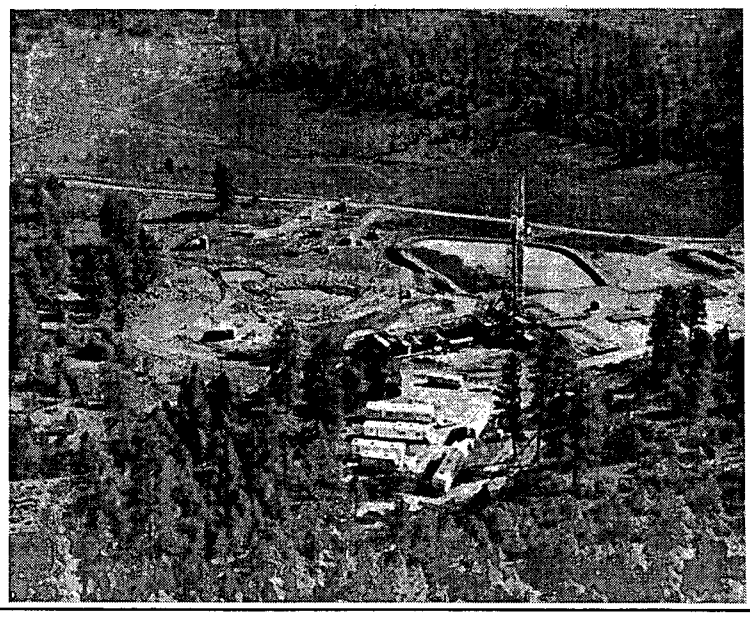
Drilling

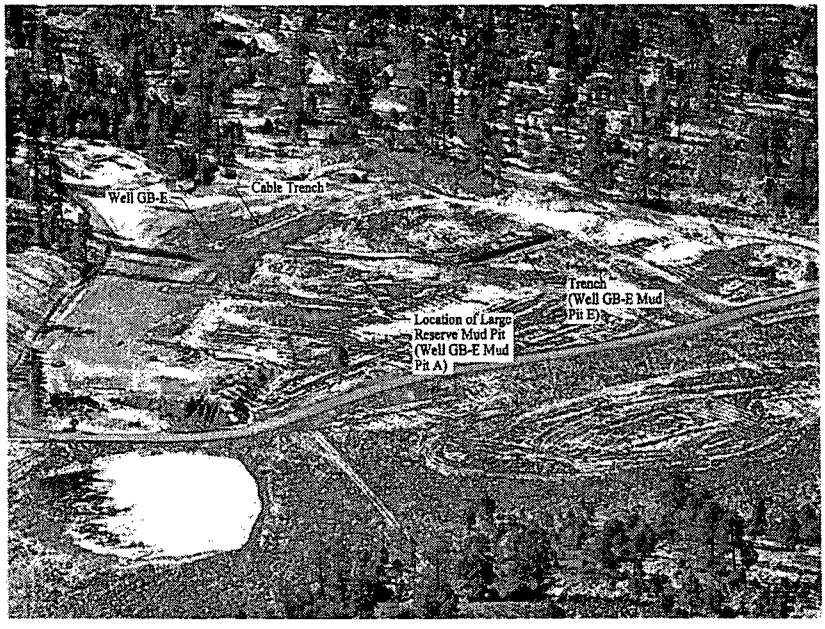
- Drilling at the SGZ area began in 1967
- Two wells drilled to complete geologic investigation (GB-1 and GB-2)
- Emplacement Well (GB-E), completed November 1967
- Mud pits used to contain drilling fluid
- Trailers staged at SW portion of site

Drilling (cont.)

- Potential sources of contamination from drilling include
  - Mud pits/drilling fluids (diesel, chromium)
  - Construction landfill
  - Septic tanks
  - Drilling pads
  - Product storage areas

Drill Rig Set Up Over Emplacement Hole





Gasbuggy SGZ December 10, 1967

Post-Detonation Operations

- Re-entry Drilling at GB-ER, GB-2, and EPNG 10-36
- New well drilled (GB-3)
- Six major natural gas production tests from 1968 to 1973
  - Brought water, natural gas, and small amount of oil to surface
  - Tritium and krypton-85 (Kr-85 is an inert noble gas and would not contribute to soil contamination)

Post-Detonation Operations (cont.)

- Flaring Operations
  - Early production test water shipped to NTS
  - During the larger production tests, the water separated out, turned to steam, and injected in the flare
  - Process contaminated the soil in the SGZ area with tritium
- Well EPNG 10-36 bought by DOE and converted to groundwater monitoring well
  - Annual Sampling by EPA

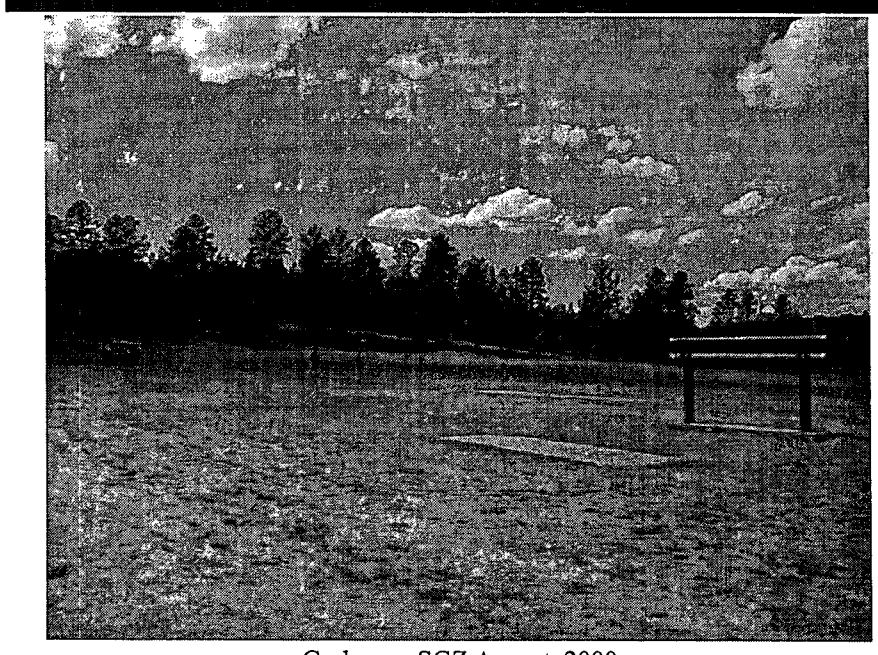
Gasbuggy SGZ during natural gas production activities

Restoration

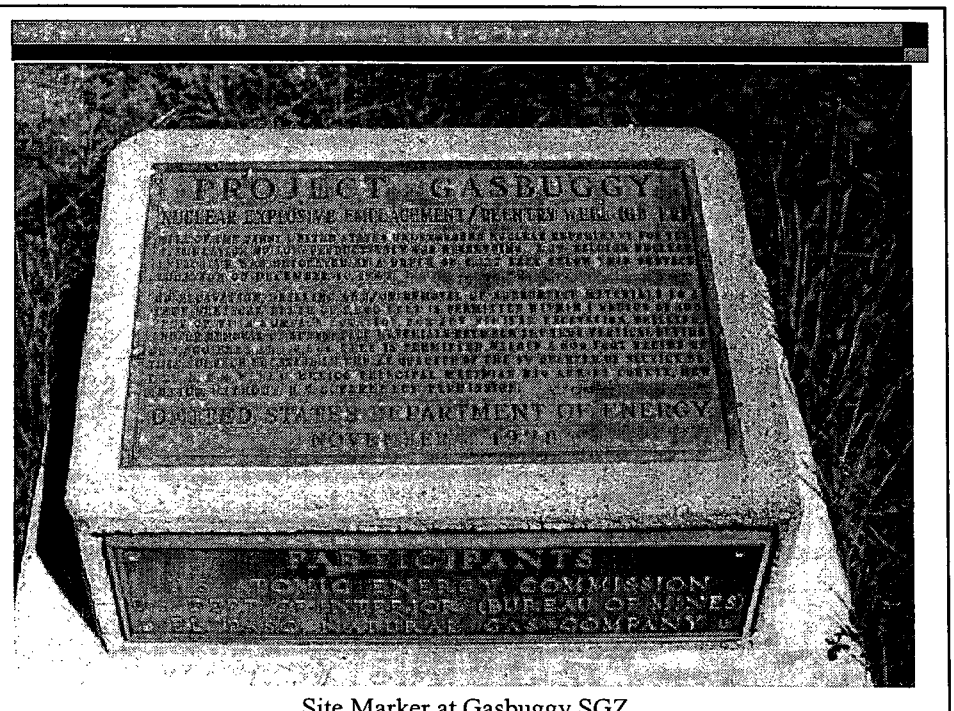
- Restoration conducted in Aug./Sept. 1978
  - Well plugging and abandonment
  - Decontamination and disposal of equipment
  - One small construction landfill used
  - Several mud disposal trenches
  - Soil sampling and analysis (radiological only)
  - No soil samples exceeded established release criteria
    - No soil remediation required

Current Status

- No access control
- Site is currently used for recreation, grazing
- Remaining surface features from the Project
  - Earthen berms (mud pits)
  - Well markers
  - Concrete pads, pipe stanchion
  - SGZ plaque
  - Groundwater monitoring - Well EPNG 10-36



Gasbuggy SGZ August, 2000



Site Marker at Gasbuggy SGZ

Regulatory History

- 3/2000 - Meeting with New Mexico Environment Department (NMED) Hazardous Waste Bureau (HWB) and site visit
- 5/2000 - DQOs submitted to NMED HWB for review
- 8/2000 - Additional meetings held with NMED HWB and New Mexico Oil Conservation Division (NMOCD)
- 8-9/2000 - Preliminary Field Investigation conducted, results incorporated into the Work Plan

Regulatory History (cont.)

- 2/2001 - Revision 0 of Work Plan submitted to NMED HWB for review and comment
  - Found to be "sufficiently complete to proceed with proposed investigations"
  - NMED comments offered as recommendations "because NMED lacks regulatory authority over these sites...closure...proposals cannot be approved or granted by NMED"
- 1/2002 - Revision 1 of Work Plan submitted to NMED

Regulatory History (cont.)

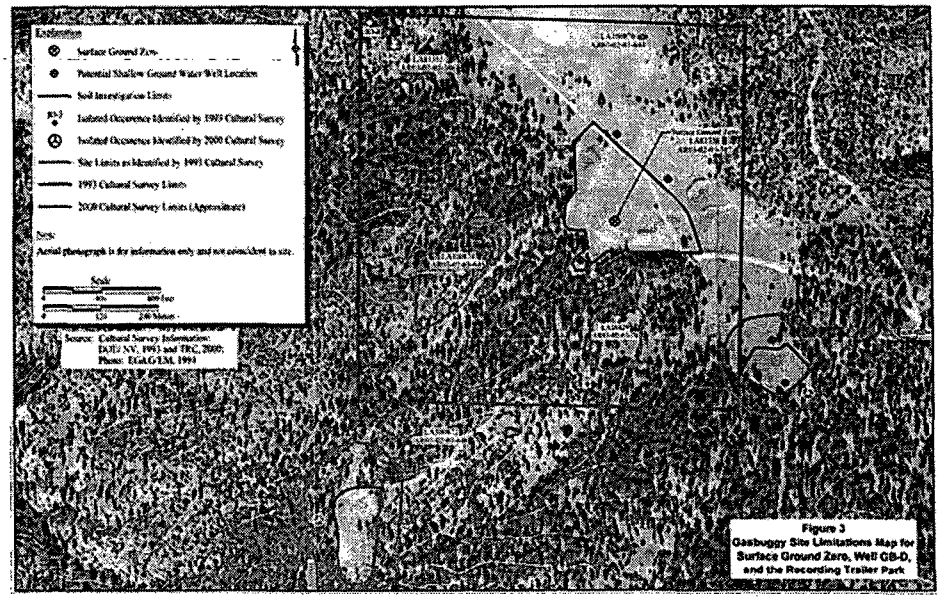
- 1/2002 – Interest in NM Voluntary Remediation Programs (VRP) expressed in letter to NMED
- 3/2002 – NMED indicates the NM VRP is appropriate for the Gasbuggy Site
- 7-10/2002 – Corrective Action Investigation conducted at Gasbuggy
- 1/2003 – Meetings held with NMED HWB and VRP to discuss initial findings and VRP schedule
- 6/2003 – Submittal of VRP application and closure document planned

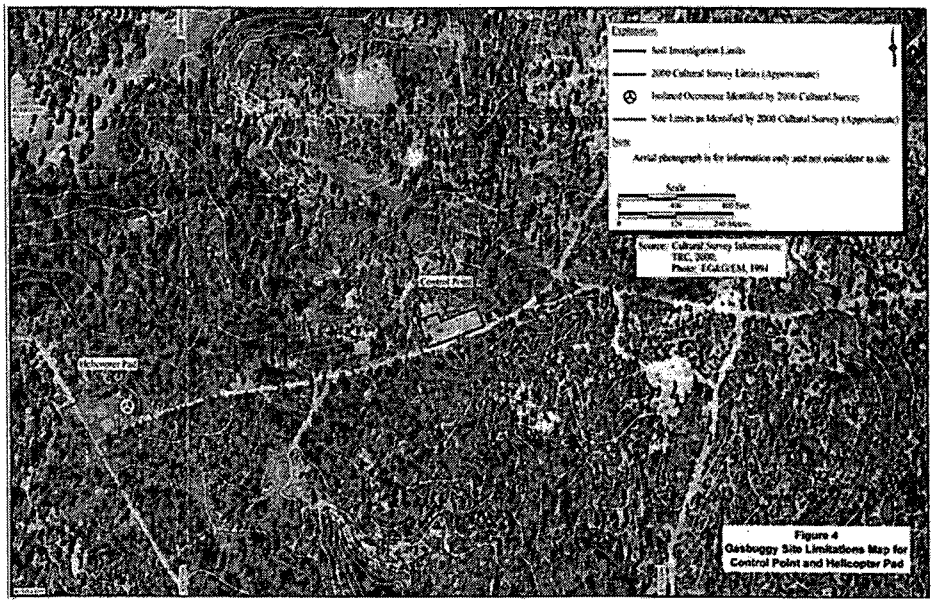
Preliminary Field Investigation

- Availability of funding allowed for acceleration of field work in FY 2000
- Field work conducted in Aug./Sept. 2000
- Activities
  - Biological and cultural resources surveys
  - Surface geophysical survey
  - Soil sampling
- Results

Bio. and Cultural Resources Surveys

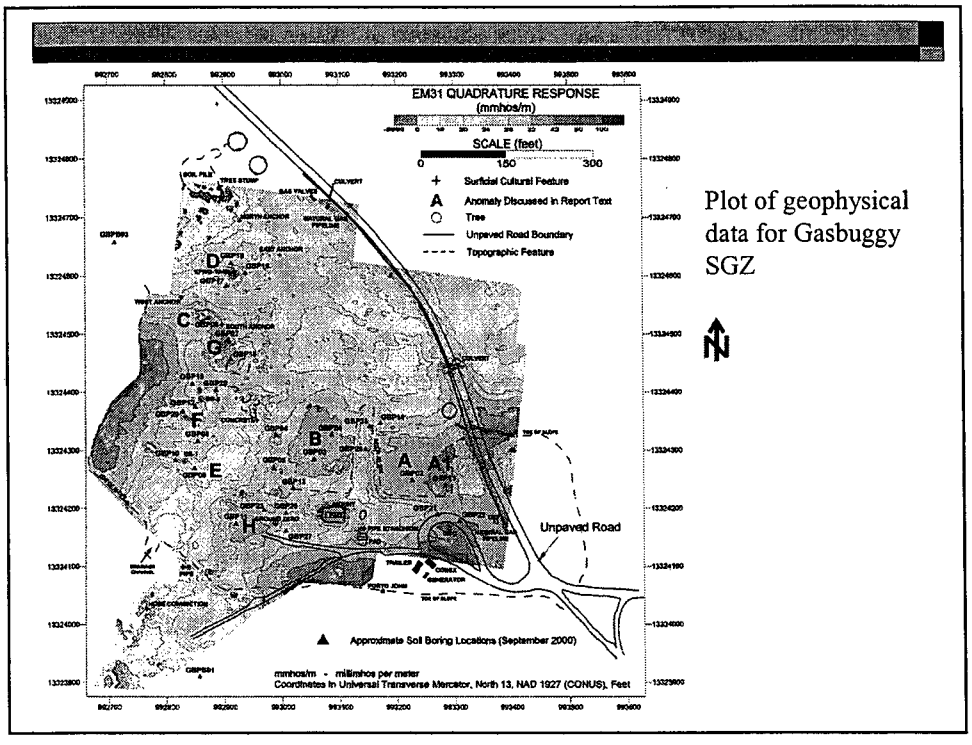
- Initial surveys (1993) did not cover all areas
- Surveys conducted by TRC with reports issued
- Biological Survey
  - "No affect will occur to any USFWS threatened, endangered proposed candidate or species of concern"
- Cultural Resources Survey
  - Several isolated occurrences and one site documented
  - Monitoring recommended should ground-disturbing work occur south of the road at the CP
    - No such activities planned





Surface Geophysical Surveys

- Used to accurately identify/locate subsurface features
  - Mud pits, landfills, trenches, objects
  - All of SGZ, Well GB-D, RTP, and CP covered
- Maps generated with data were used to determine sampling points



Plot of geophysical data for Gasbuggy SGZ

Soil Sampling

- Conducted only in the SGZ Area
- Conducted with by Geoprobe® (direct-push)
- 29 investigative boreholes
- 2 background boreholes
- 73 soil samples collected
- Samples analyzed for total VOCs, SVOCs, TAL metals, TPH (gas and diesel), tritium, and TCLP (for waste disposal purposes)

Results of Preliminary Field Investigation

- Results available in Appendix C of the Work Plan
- Geophysics identified most of the anticipated features
- Septic tanks at SGZ not positively identified

Results of Preliminary Field Investigation

- Main contaminants of potential concern (COPCs):
  - TPH (diesel)
  - Arsenic (also identified in background samples)
- Depth to contamination, 4 to 10 ft below ground surface (bgs)
- Contamination confined to mud layer
- Results used to refine strategy for characterization

Work Plan - Outline

- 1.0 Purpose and Scope
- 2.0 Facility Description
- 3.0 DQOs
- 4.0 Surface and Shallow Subsurface Strategy
- 5.0 Subsurface Strategy (not part of this presentation)
- Appendix A: Historical Radiological Monitoring and Sampling Results
- Appendix B: New Mexico Quality Assurance Project Plan
- Appendix C: Results of Preliminary Field Investigation
- Appendix D: Surface Radiological Dose/Risk Assessment

Purpose and Scope

- Purpose of the Work Plan is to document current site knowledge/detail the activities and methods to characterize the site

- Scope of Surface Work Plan:
  - Define the nature and extent of contamination
  - Determine if shallow groundwater is a potential contaminant pathway
  - Determine nature and extent of potential contamination in the groundwater, if applicable
  - Limited to the surface and shallow subsurface

Data Quality Objectives (DQOs)

- Conceptual site model
  - Percolation of precipitation through impacted soil/mud and transport of contamination
  - Potential shallow groundwater contamination

DQOs (cont.)

- Contaminants of Potential Concern
  - TPH, VOCs, SVOCs, Metals
  - Tritium not a COPC based on historical data, new samples, and Human Health Risk Assessment
- Preliminary Action Levels (PALs)
  - Region IX Preliminary Remediation Goals (PRGs) for chemical COPCs
  - New Mexico TPH Guidance (2,200 mg/kg diesel)

Surface/Shallow Subsurface Strategy

- Use existing knowledge/data to define and mark areas of concern
- Drill/excavate to collect samples
- Extend area of investigation (lateral, vertical), if contamination exists
- Define depth to shallow groundwater and sample if necessary (e.g., if pathway to contamination)

Surface/Shallow Subsurface Strategy (cont.)

- If contamination is detected above PALs, complete risk assessment, as applicable
- Determine if corrective action is necessary

Surface/Shallow Subsurface Strategy (cont.)

- Each feature or Area of Concern is specified in the Work Plan along with the characterization strategy

Table 4-3
Investigation Strategy for Surface Ground Zero Area Known and Suspect AOCs
(Page 1 of 2)

Unique Identifier	Approximate Size (feet)	Summary of Proposed Investigation Strategy	Contaminants of Potential Concern
Well EPNG 10-36 Sump	50 X 25	Further investigation will include excavation and/or direct-push sampling to refine nature and extent of potential contamination.	TPH (DRO, GRO), VOCs, SVOCs, Total RCRA metals
Well GB-1 Mud Pit	100 X 50	Based on available historical documentation and the results of the geophysical investigation, these three mud pits can not be distinguished from each other. Therefore, for the purposes of further investigation, these three mud pits will be treated as one unit. Further investigation will include additional direct-push sampling to refine nature and extent of potential contamination.	TPH (DRO, GRO), VOCs, SVOCs, Total RCRA metals
Well GB-E Mud Pit B	NA		
Well GB-E Mud Pit C	NA		
Well GB-2 Mud Pit	150 X 125	Further investigation will include additional direct-push sampling to refine nature and extent of potential contamination.	TPH (DRO, GRO), VOCs, SVOCs, Total RCRA metals
Well GB-E Mud Pit A	150 X 175	Further investigation will include additional direct-push sampling to refine nature and extent of potential contamination.	TPH (DRO, GRO), VOCs, SVOCs, Total RCRA metals
Well GB-E Mud Pit D	75 X 50	Well GB-E Mud Pit D is located entirely within the lateral bounds of the Well GB-2 Mud Pit, but consists of a distinct mud layer. Further investigation will include additional direct-push sampling to refine nature and extent of potential contamination.	TPH (DRO, GRO), VOCs, SVOCs, Total RCRA metals
Well GB-E Mud Pit E	100 X 75	Further investigation will include additional direct-push sampling to refine nature and extent of potential contamination.	TPH (DRO, GRO), VOCs, SVOCs, Total RCRA metals
Landfill A	20 X 10	Further investigation will include excavation and/or direct-push sampling to refine nature and extent of potential contamination.	TPH (DRO, GRO), VOCs, SVOCs, Total RCRA metals
Landfill C	50 X 10		
Landfill D	30 X 10		
Landfill B	50 X 50	No further investigation is proposed.	No further sampling proposed.
Landfill E	50 X 20	No further investigation is proposed.	No further sampling proposed.

Table 4-3
Investigation Strategy for Surface Ground Zero Area Known and Suspect AOCs
(Page 2 of 2)

Unique Identifier	Approximate Size (feet)	Summary of Proposed Investigation Strategy	Contaminants of Potential Concern
Septic Tank A Septic Tank B	NA	Search for septic tank with exploratory excavation. If tank is located, verify it has been closed in place (filled). If tank has not been filled, sample any contents, and close in accordance with State of New Mexico regulations (NMAC, 1997).	Tritium and other COPCs as required for waste disposal (tank contents only)
Well EPNG 10-36 Drill Pad	50 X 50	No further investigation is proposed.	No further sampling proposed.
Well GB-1 Drill Pad	50 X 50	No further investigation is proposed.	No further sampling proposed.
Well GB-2 Drill Pad	50 X 50	No further investigation is proposed.	No further sampling proposed.
Well GB-E Drill Pad	100 X 100	No further investigation is proposed.	No further sampling proposed.
Well GB-3 Drill Pad	50 X 50	No further investigation is proposed.	No further sampling proposed.
Soil Pile	75 X 50	Excavate and sample based on field observations.	TPH (DRO, GRO), VOCs, SVOCs, Total RCRA metals
Gas-Flaring System	Unknown	Further investigation will include additional direct-push sampling to refine nature and extent of potential contamination.	TPH (DRO, GRO), VOCs, SVOCs, Total RCRA metals

DRO = Diesel-range organics
GRO = Gasoline-range organics
NA = Not applicable

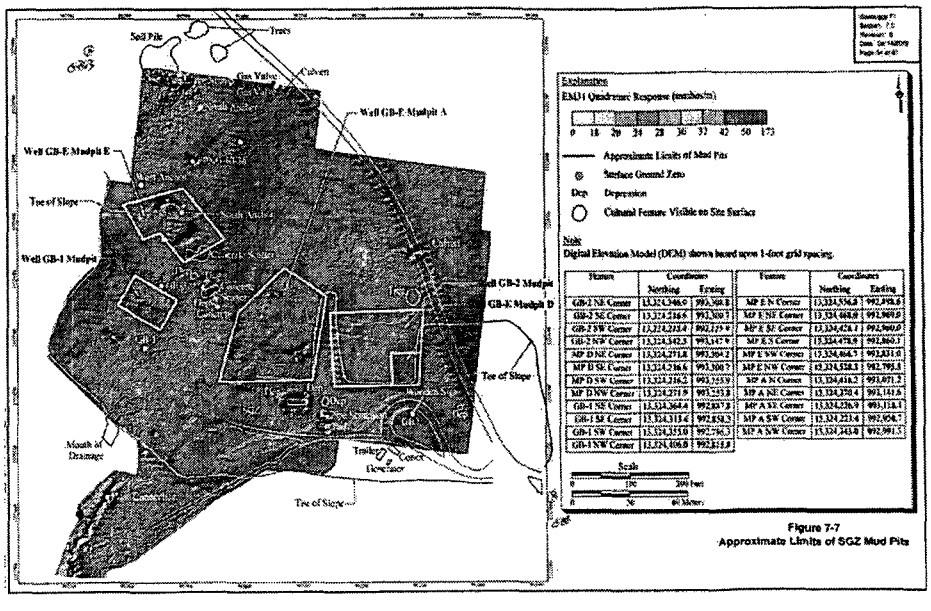


Figure 7-7
Approximate Limits of SGZ Mud Pits

Work Plan – Appendix A

- Summary of historical radiological monitoring and sampling results
  - Detonation and post-test drilling
  - Aerial surveys
  - Effluent monitoring during gas production
  - Sampling (soil, waste, equipment) during 1978 restoration
- Conclusion: Tritium only radionuclide of concern at the site

Work Plan – Appendix D

- Gasbuggy Site Surface Human Health Radiological Dose/Risk Assessment
  - RESRAD model with conservative assumptions
  - Potential exposure to tritium
  - Specified scenarios (recreation, rancher, and Native American)
  - Specified pathways (soil ingestion, groundwater ingestion)
- Conclusion: The site does not pose a risk to human health based on exposure to tritium

Gasbuggy Site Surface Investigation/Closure

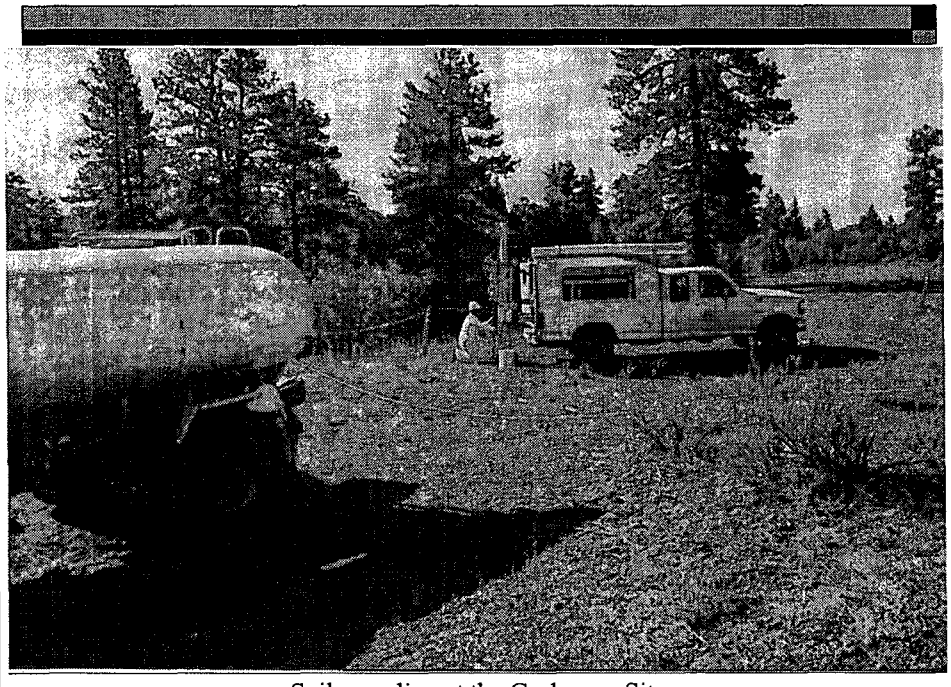
BREAK

Corrective Action Investigation (CAI), Summer 2002

- Field Work Preparation
- Field Methods
- Background Sample Collection
- Control Point Investigation
- Recording Trailer Park Investigation
- Well GB-D Investigation
- Surface Ground Zero Investigation
- Wrap-Up Activities

Site Preparation - USFS Special Use Permit Conditions

- Fire Restrictions – Level III Conditions (no smoking on site, fire extinguishers)
- Fire Equipment – water truck on site, 300 ft of hose, fire watch, and additional handtools on site
- Revegetation – grade/reseed disturbed areas
- Cultural Resources – Archeologically sensitive areas based on 1993 and 2000 Cultural Survey



Soil sampling at the Gasbuggy Site

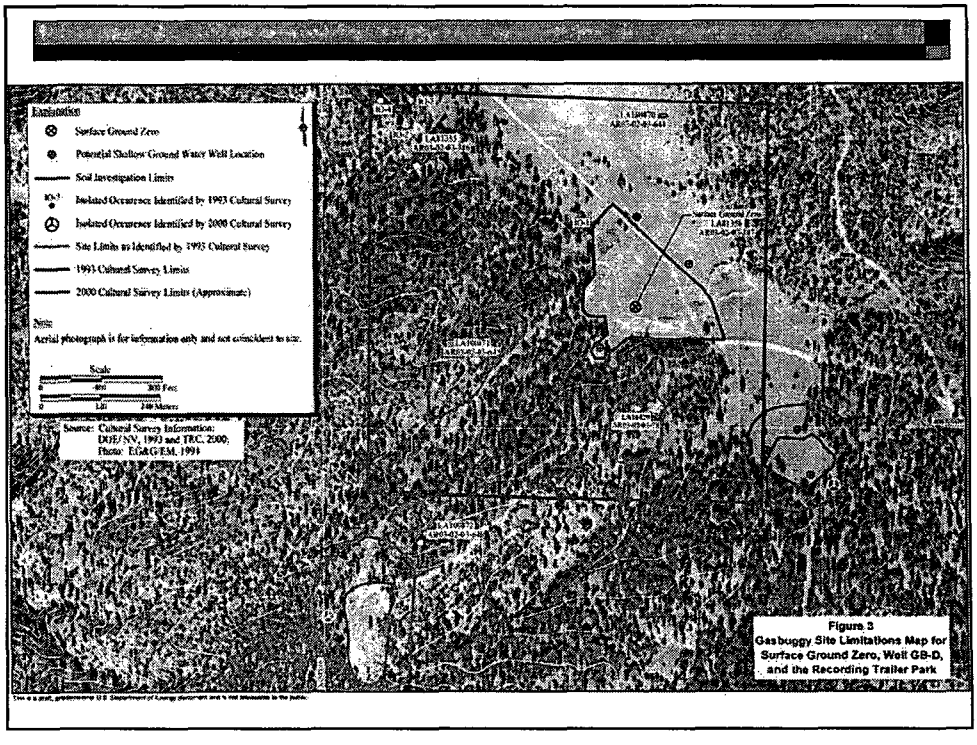


Figure 3
Gasbuggy Site Limitations Map for Surface Ground Zero, Well GB-D, and the Recording Trailer Park

Field Methods

- Excavation
- Soil Borings conducted by direct-push (Geoprobe®)
- Rotosonic drilling
- Samples analyzed for VOC, SVOCs, TPH (DRO and GRO), and Total RCRA Metals

Soil sampling at the Gasbuggy Site

Soil core samples

CAI - Background Sample Collection

- 8 undisturbed sample locations
  - RPT (1 location), Well GB-D Area (3 locations), and SGZ (4 locations)
- Soil samples analyzed for RCRA Metals
  - arsenic, barium, cadmium, chromium, lead, selenium, silver, mercury
- Arsenic only COPC at background locations equal to or above PAL (2.7 mg/kg)

Corrective Action Investigation - Control Point

- Geophysical Anomaly
- Septic Tank

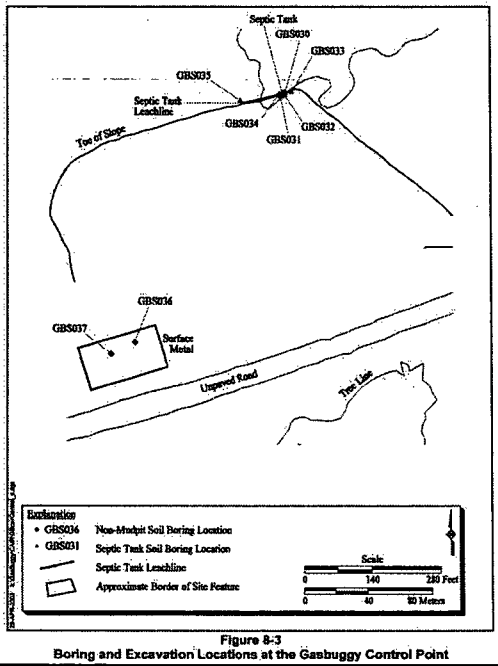


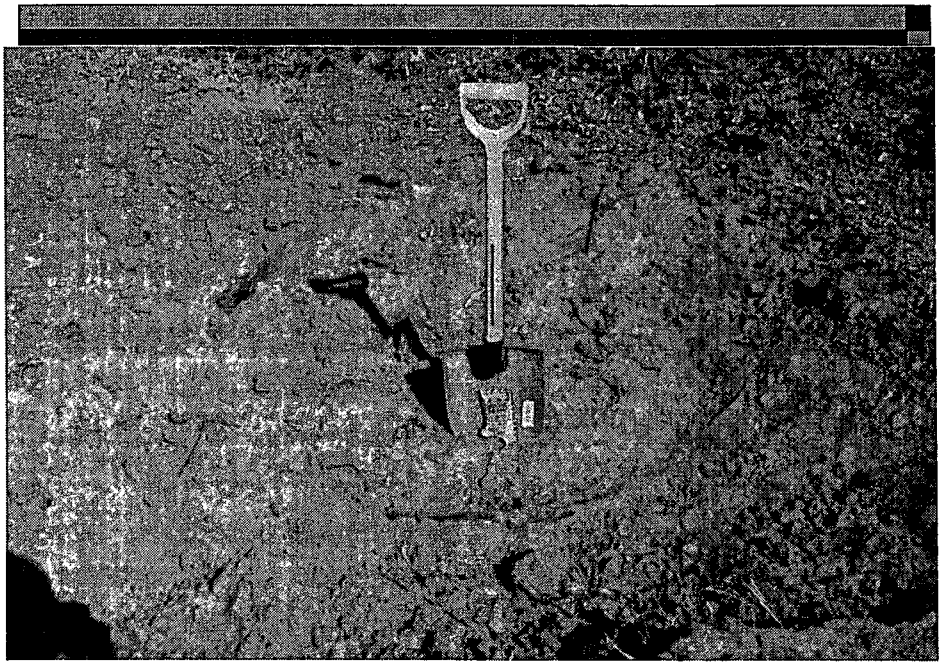
Figure 8-3
Boring and Excavation Locations at the Gasbuggy Control Point

Control Point – Geophysical Anomaly

- Unknown origin but in vicinity of former on-site laboratory
- 2 borings, no biasing factors (e.g., odor, soil staining)
- Samples collected at preselected intervals generated by random number tables
- Geophysical signature may have been result of instruments picking up truck
- Soil sample results below PALs

Control Point – Septic Tank

- Septic tank and leach line located by excavation
  - Septic tank: 48-inch diameter metal tank, 6 inches below ground surface. Tank was backfilled with native soil, bottom approximately 4 feet deep
  - Leach line: 4-inch diameter pipe, surrounded with leach rock, 18 inches below ground surface
- No PALs were exceeded in the soil samples collected in association with the CP septic system



· Septic Tank at the Gasbuggy CP

Leach line and leach rock at the Gasbuggy CP

Corrective Action Investigation – Recording Trailer Park

- Geophysical Anomaly
- Soil Pile

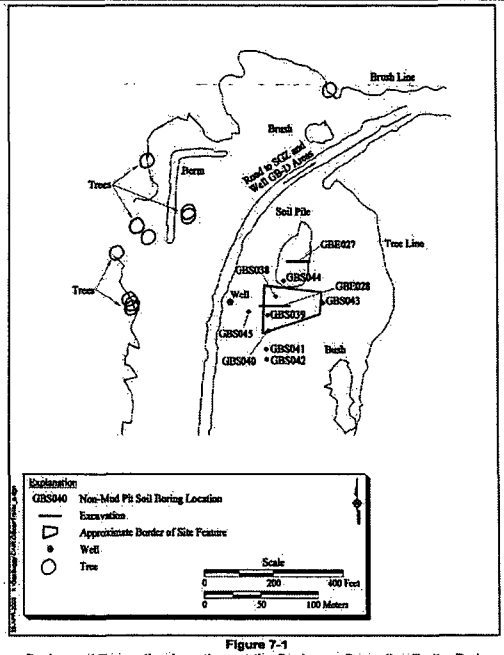


Figure 7-1
Boring and Excavation Locations at the Gasbuggy Recording Trailer Park

RTP – Geophysical Anomaly

- 1 Excavation and 8 borings conducted by direct-push method
- Based on visual observations, appeared to be small construction debris pit
- No PALs exceeded

RTP – Soil Pile

- 1 excavation through soil pile
- No biasing factors (e.g., odor or stained soil); therefore, no soil samples were collected

Corrective Action Investigation – Well GB-D

- Well GB-D Drill Pad
- Mud Pit
- Geophysical Anomaly

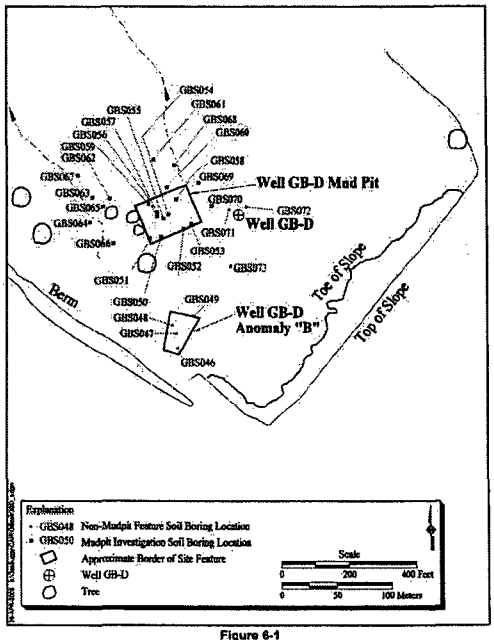


Figure 6-1
Boring Locations at the Gasbuggy Well GB-D Area

Well GB

- Drill pad
  - 3 boreholes drilled by direct-push method
  - No biasing factors were observed (e.g., odor or stained soils); therefore, soil samples collected at randomly selected depths
- Geophysical Anomaly
  - 4 boreholes drilled by direct-push method
  - No biasing factors were observed (e.g., odor or stained soils); therefore, soil samples collected at randomly selected depths

Well GB-D (cont.)

- Mud Pit
  - 21 boreholes drilled by direct-push method
  - Drilling mud was generally found 5 to 7 ft bgs
  - Arsenic only PAL exceeded
- Arsenic identified in site characterization samples from Well GB-D area above the EPA Region IX PRGs and is representative of background conditions at the site

Corrective Action Investigation – Surface Ground Zero

- Septic Tanks
- Miscellaneous Features
- Mud Pits

SGZ – Septic Tanks

- 2 Septic Tanks
  - Multiple exploratory trenches and "potholes"
  - Magnetometer located copper pipes
  - Tanks were not identified - assumed removed during initial site restoration or never installed

Exploratory trenching at the Gasbuggy SGZ

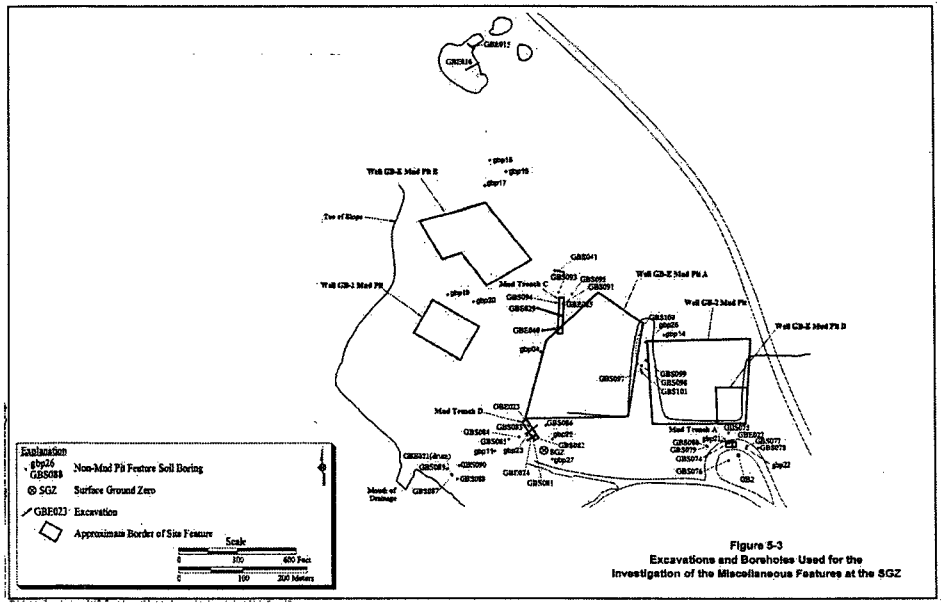


Figure 5-3
Excavations and Boreholes Used for the Investigation of the Miscellaneous Features at the SGZ

SGZ – Misc. Features

- Mud Trenches (well closure activities)
  - 3 trenches identified by excavation
  - Soil samples collected by direct-push method
  - No PALs exceeded
- EPNG 10-36 Sump
  - 2 borings
  - No PALs exceeded

SGZ – Misc. Features (cont.)

- Soil pile
  - 2 excavations through soil pile
  - No biasing factors observed – no samples
- Gas-flaring system
  - Soil samples collected by direct-push method
  - PALs exceeded for 1,2,4-trimethylbenzene (TMB)
  - TMB is a component of crude oil

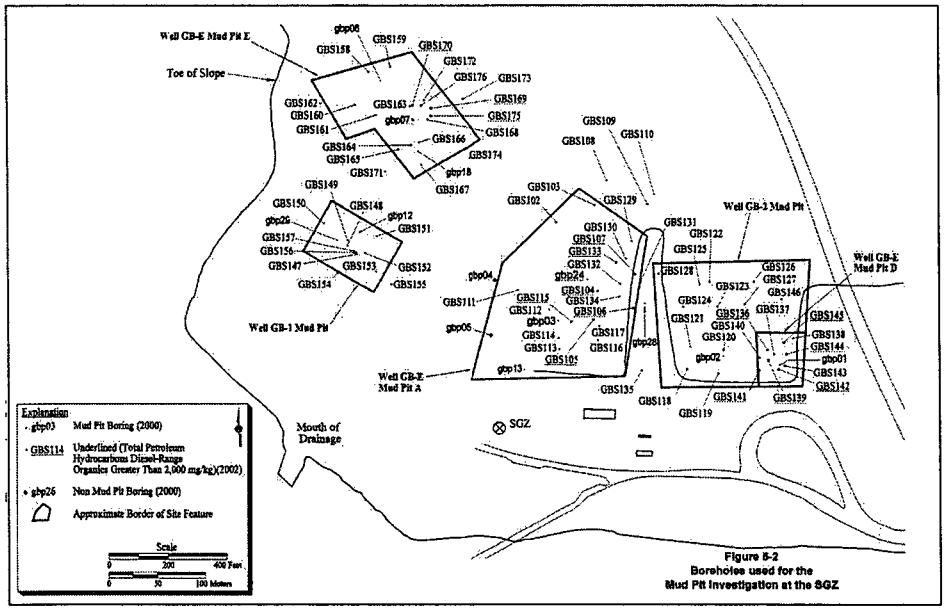


Figure 5-2
Boreholes used for the
Mud Pit Investigation at the SGZ

SGZ – Mud Pits

- 78 boring locations, 35 identified with drilling mud
- Soil samples collected by direct-push
- PALs exceeded for TPH-DRO and TMB in 3 mud pits
  - GB-E Mud Pit A
  - GB-E Mud Pit D
  - GB-E Mud Pit E

SGZ – Mud Pits (cont.)

- TMB PAL (1999 PRG) = 5,700 µg/kg exceeded in 8 soil samples
- TPH-DRO PAL = 2,200 mg/kg exceeded in 15 soil samples

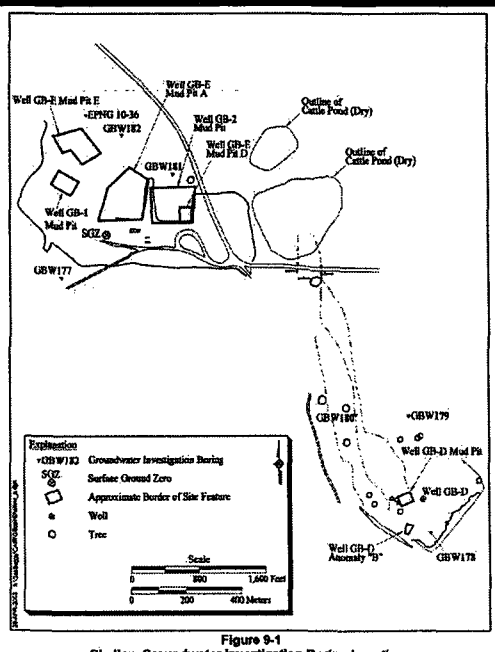


Figure 9-1
Shallow Groundwater Investigation Boring Locations

Ground Water Investigation

- Work Plan methodology: if groundwater (saturated conditions) encountered within 10 ft of contamination, collect groundwater samples
  - Contamination in SGZ mud pits generally 5 to 16 ft bgs
  - Contamination in Well GB-D mud pit 5 to 7 ft bgs
  - Groundwater was not encountered within 10 ft of contamination in either operational area

Ground Water Investigation (cont.)

- Best Management Practice, 6 boreholes were drilled on the fringes of the disturbed areas
- Limited to the SGZ area and the Well GB-D area based on observations of potential contamination
- Rotosonic drilling rig used to minimize waste
  - 6-inch diameter, 10-ft core barrel, with cores ranging in length from 2 to 5 ft

Ground Water Investigation (cont.)

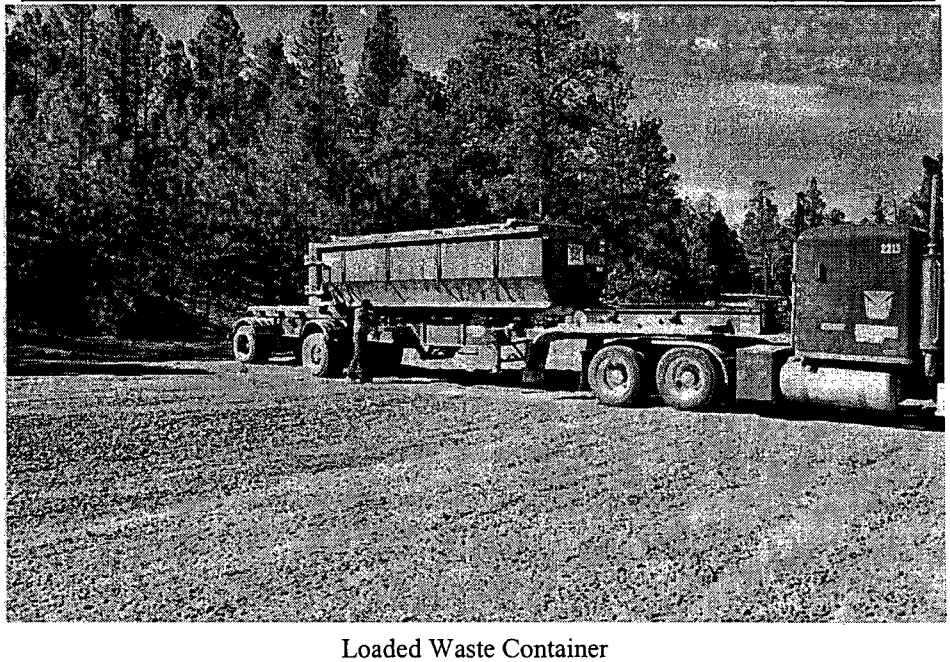
- Borings ranged in depth of 45 to 74 ft
- Groundwater detected at 52 to 58 ft bgs at Well GB-D area
- Groundwater not encountered at SGZ
- Minimum separation between bottom of drilling mud layer and groundwater is 30 ft

CAI – Wrap-Up Activities

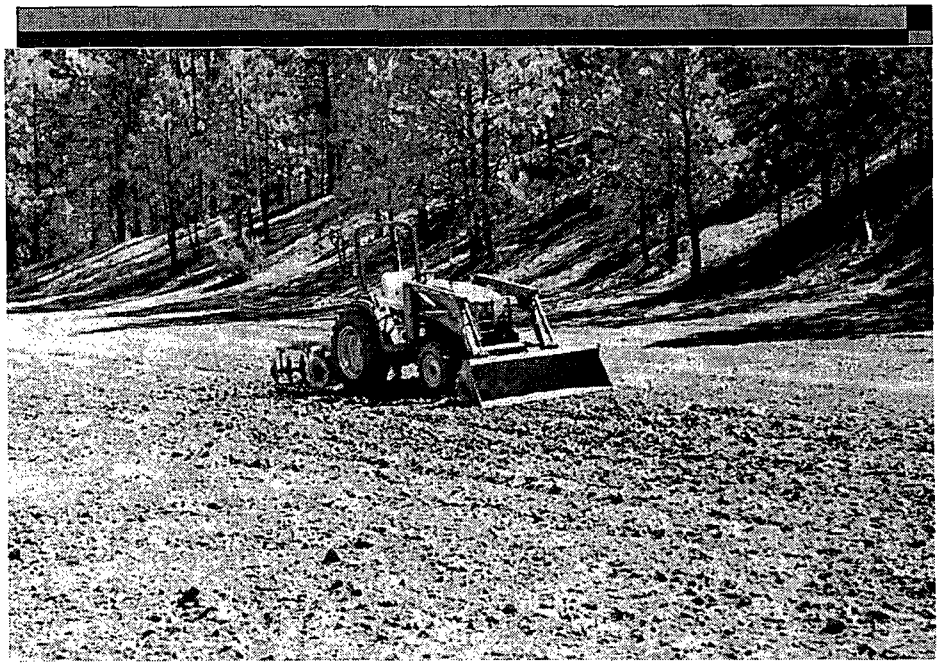
- Waste Disposal – ship all waste off site as nonhazardous
  - Drums of decontamination rinsate
  - 20 cubic yards roll-off container of solid waste (PPE, Soil)
- Site Survey
  - Conducted by New Mexico Licensed Professional Surveyor (NM LPS)
  - Topographic survey of all areas (2-ft contours)
  - Boreholes/sample point horizontal coordinates and elevations collected

CAI – Wrap-Up Activities (cont.)

- Site Restoration – disturbed areas bladed and reseeded
- Demobilization – all equipment removed from site by end of October 2002



Loaded Waste Container



Restoring disturbed area at SGZ (October, 2002)

Corrective Action Investigation Report and Corrective Action Plan (CAIR/CAP)

- Title: *Surface Corrective Action Investigation Report with Surface Corrective Action Plan for the Gasbuggy Site, New Mexico (CAIR/CAP)*
- Planned submittal to NMED VRP – June 2003

CAIR/CAP - Outline

- 1.0 Purpose and Scope
- 2.0 Summary of Field Methods
- 3.0 to 10.0 Summary of Activities and Results
- 11.0 Wrap-Up Activities
- 12.0 Conclusions
- 13.0 Recommendations
- Appendix A – Corrective Action Plan (CAP)
- Appendix B to E – Survey Results and Data

CAIR/CAP – Purpose and Scope

- Purpose is to provide information and data to support the recommendations that the Gasbuggy Site be clean closed and provide details on how the closure will be achieved
- Scope
  - Corrective Action Investigation for site surface
  - Closure recommendation for site surface
  - Corrective Action Plan for site surface

CAIR/CAP - Conclusions

- Control Point
  - Septic tank and leach line were identified at the CP
  - No COPCs were identified above the PALs
  - Tank was closed in accordance with NM regulations
- Recording Trailer Park
  - No COPCs were identified above PALs
  - Well GB-D Area
  - Arsenic was only COPC identified above the PAL

CAIR/CAP – Conclusions (cont.)

- Surface Ground Zero
  - Two suspected septic tanks at SGZ not located
  - Only COPCs that exceeded PALs at the SGZ area are arsenic, TMB, and TPH-DRO

CAIR/CAP – Conclusions (cont.)

- Arsenic was not considered a contaminant of concern (same as background)
- Based on the Human Health Risk Assessment, the levels of TMB at the site are not likely to impact potential receptors at the site
- All diesel "hits" above the PAL of 2,200 mg/kg were located in areas known to be mud pits

CAIR/CAP – Conclusions (cont.)

- Shallow Groundwater Investigation
  - Minimum separation of groundwater and drilling mud is 30 ft
  - Groundwater is not considered an exposure pathway

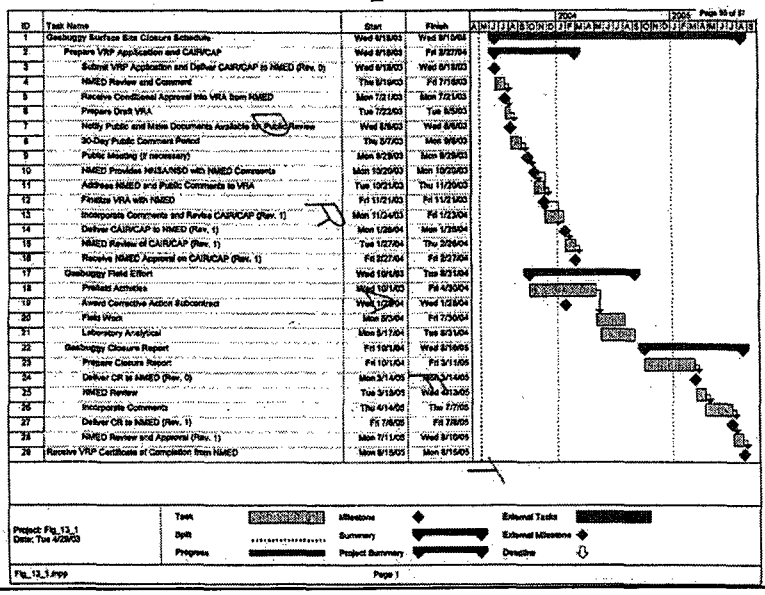
CAIR/CAP - Recommendations

- Complete the application process for admission of the site into the New Mexico VRP
- Work with the New Mexico VRP to complete all required public participation activities once accepted into the VRP

CAIR/CAP – Recommendations (cont.)

- Remove soil contaminated with TPH-DRO above 2,200 mg/kg
- Although TMB is not considered to pose a threat to human health, soil containing TMB above the PAL will be removed and transported off site for disposal as a best management practice
- Upon completing of closure activities, a closure report will be prepared and submitted to the NMED/VRP

CAIR/CAP – Proposed Schedule



Appendix A – Corrective Action Plan

- Objective: Primary objective of the corrective action is to remove drilling mud containing TPH-DRO and TMB contamination above the regulatory limits of 2,200 mg/kg and 5,700 µg/kg, respectively, while minimizing impact to the surrounding environment

Proposed Project Organization

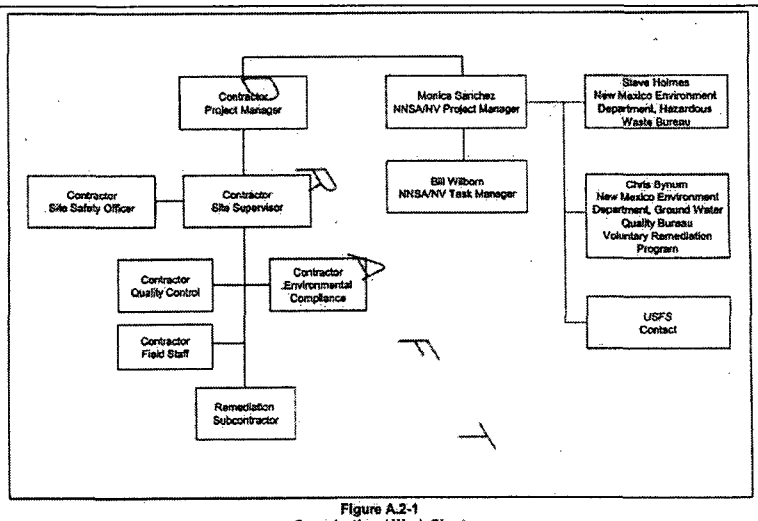


Figure A.2-1
Organizational Work Chart

Appendix A – Corrective Action Plan (cont.)

- Permits
  - *National Environmental Policy Act* (NEPA) Compliance
  - Site Access Authorization (USFS Special-Use Permit)
  - CWA and Storm Water Pollution Prevention Plan
  - Fuel storage (spill prevention, control, and countermeasures plan) may be required

Appendix A – Corrective Action Plan (cont.)

- Scope of Work
  - Mobilization of personnel and equipment
  - Site setup
  - Contamination control zone delineation
  - Installation of temporary construction fence
  - Site clearing
  - Establishment of field office and laboratory

Appendix A – Corrective Action Plan (cont.)

- Scope of Work (cont.)
  - Installation of erosion and sedimentation control structures
  - Access road construction
  - Installation of stabilized construction exit
  - Temporary scale installation
  - Construction of decontamination pad

Appendix A – Corrective Action Plan (cont.)

- Scope of Work (cont.)
  - Removal and stockpiling of overburden material
  - Excavation of contaminated drilling mud
  - Confirmatory sampling and analysis of the excavated mud pits
  - Waste transportation and disposal

Appendix A – Corrective Action Plan (cont.)

- Scope of Work (cont.)
  - Road maintenance
  - Backfill of excavated areas
  - Site restoration including regarding and revegetation
  - Demobilization

Gasbuggy Site - Path Forward

- 6/2003 - Submit CAIR/CAP for review (NMED, USFS) with VRP application
- 7/2003 - Receive Conditional Approval from VRP
- 7/2003 - Prepare Draft Voluntary Remediation Agreement (VRA)
- 8-9/2003 - Public Notification, Comment, Meeting
- 11/2003 - Finalize VRA and CAIR/CAP
- 5/2004 - Conduct Field Work
- 3/2005 - Submit Closure Report for review (NMED, USFS)
- Receive Certificate of Completion from NMED VRP
- Turn over Gasbuggy Site surface unit to USFS

Figure References

- EG&G Energy Measurements. 1994. Aerial Photograph of Gasbuggy Site, EG&G 7992-57. Nellis Air Force Base, NV: Remote sensing Laboratory Photo Library.
- TRC. 2000. *Cultural Resources Survey of Four Operational Areas for the Gasbuggy Site Carson National Forest Rio Arriba County, New Mexico*, 1993-02-64C. Prepared by J.C. Acklen. Albuquerque, NM.
- U.S. Department of Energy, Nevada Operations Office. 1983. *Project Gasbuggy Site Restoration Final Report*, PNE-G-90, NVO-211. Prepared by Holmes & Narver, Inc. Las Vegas, NV.
- U.S. Department of Energy, Nevada Operations Office. 1993. *A Class III Cultural Resources Survey of the U.S. Department of Energy Gasbuggy Stimulation Test Site, Rio Arriba County, New Mexico*, DOE/NV/10972—66. Prepared by IT Corporation and Mariah Associates. Las Vegas, NV.
- U.S. Geological Survey. 1995. "Leandro Canyon Quadrangle, New Mexico – Rio Arriba County," 7.5 minute series (Topographic). Denver, Colorado

Gasbuggy Site Surface Investigation/Closure

BREAK

Well EPNG 10-36 Investigation

- Part of subsurface investigation
- Historical activities of the 1980 & 90s
- Subsurface DQOs involving Well EPNG 10-36
- Key investigative action
- Recent field activities
- Preliminary findings

1980s & 90s Activity at EPNG 10-36

- EPA sampling detected erratic tritium and ^{137}Cs between 1984 and present, all far below drinking water standards
- Request by USFS for casing integrity log prompts removal of 2" tubing from well in May 1994
- Logging and discrete sampling in May 1994
- Logging and discrete sampling in May 1995 – both this and the 1994 study only found tritium higher in borehole, not at Ojo Alamo perforations
- Modeling assessment of Ojo Alamo transport potential published in September 1996

Well EPNG 10-36 DQOs

Determine if contaminants are entering from Ojo Alamo

- Should the Ojo Alamo be included as a viable transport pathway from the Gasbuggy cavity? (previous analysis said no)
- What is the appropriate disposition of the well? (continue as monitoring point, or P&A)

Work plan page 82 & 89

Key action: Purge the borehole fluid from EPNG 10-36

Activity	Decision Action
Video log to determine casing integrity	If poor, design plugging and sealing program per BLM and State regulations
Determine if contamination is entering from Ojo Alamo	If yes, expand modeling effort to liquid-phase transport
Collect hydraulic data	If different than other site data, reanalyze Ojo Alamo pathway

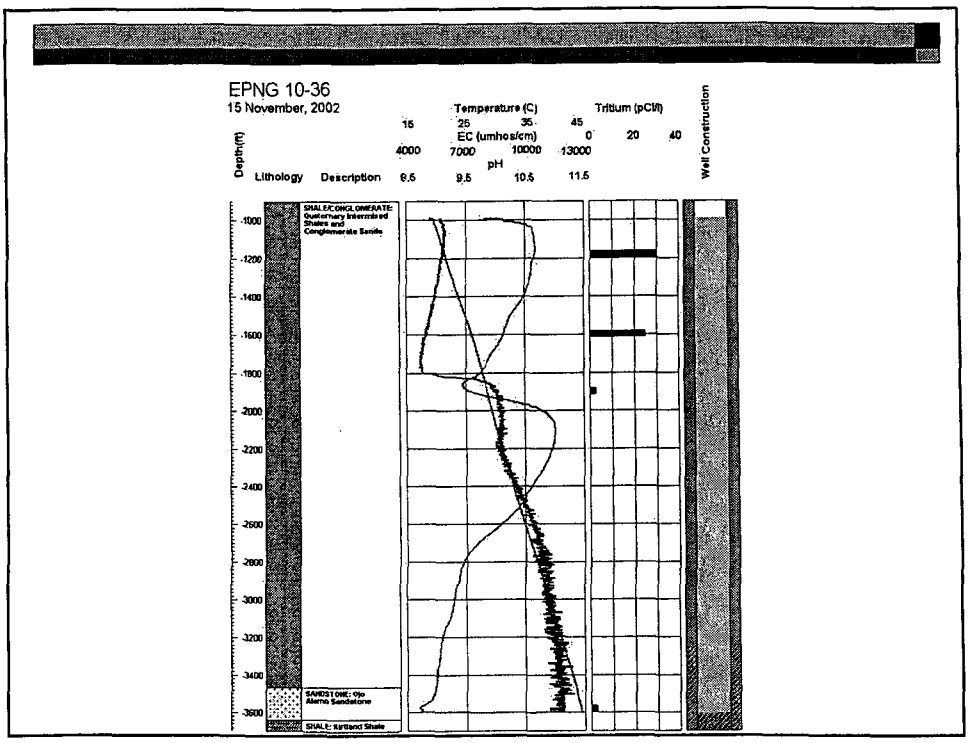
Work plan p.82, 84, 87-88

Recent Activity

- Well purged September 26 & 27, 2002
- Hydrologic logging and discrete sampling conducted November 13-15, 2002
- Hydrologic logging and discrete sampling conducted June 11-13, 2003

Preliminary Findings

- Purged water had no rad requiring management, did have benzene (5 ppm), acetone (1.3 ppm), toluene (2.1 ppm)
- Salinity stratification immediately recurred
- No detectable tritium (< 3 pCi/L) at 1900 and 3585 ft
- 30 ± 8 pCi/L @ 1180ft, 25 ± 9 pCi/L @ 1600 ft [drinking water std = 20,000 pCi/L]


EPNG 10-36
15 November, 2002
Temperature (C)
15
25
35
45
EC (umhos/cm)
4000
7000
10000
13000
pH
6.5
9.5
10.5
11.5
Tritium (pCi/l)
0
20
40
Depth(ft)
Lithology
Description
Well Construction
-1000
-1200
-1400
-1600
-1800
-2000
-2200
-2400
-2600
-2800
-3000
-3200
-3400
-3600
SHALE/CONGLOMERATE: Quaternary Interbedded Shales and Conglomerate Sands
SANDSTONE: Ojo Alamo Sandstone
SHALE: Kirtland Shale

Department of Energy
National Nuclear Security Administration
Nevada Site Office
P.O. Box 98518
Las Vegas, NV 89193-8518

JUL 0 2 2003

Wayne Price
State of New Mexico
Energy, Minerals and Natural Resource Department
Oil Conservation Division
Environmental Bureau
2040 South Pacheco
Santa Fe, New Mexico 87505

GASBUGGY EPNG 10-36 WELL LOGS AND CORRESPONDENCE

As you requested, please find enclosed one copy of the cement bond log and ultrasonic imaging tool results for the casing evaluations conducted by Schlumberger (September 1994) and Century Geophysical Corporation (September 1999). Also enclosed, for your information, are copies of correspondence regarding well integrity testing activities on the EPNG 10-36 Well. The well failed a pressure test conducted in September 2002. We are currently planning to plug and abandon this well during fiscal year 2004 (i.e., October 2003 to September 2004).

If you have any questions or concerns, please contact Monica L. Sanchez of my staff at (702) 295-0160.

Robert M. Bangerter Jr.
for Runore C. Wycoff, Director
Environmental Restoration Division

ERD:MLS-187

Enclosures:
As stated

cc w/o encls:
Chris Bynum, NMED VRP, Santa Fe, NM
Steve Holmes, NMED HWB, Santa Fe, NM
P. J. Gretsky, Shaw Environmental, Inc.,
Las Vegas, NV
D. C. Stahl, Shaw Environmental, Inc.,
Las Vegas, NV
Jim Coburn, Shaw Environmental, Inc.,
Las Vegas, NV

Rick-
FYI
Rox

ERD (R)
ERD (RF)
AMEM (RF)
MGR (RF)

FILE CODE #

ERD
Danz
8/18/95

ERD
Mellington
8/18/95

ERD
Sandy
/ /95

Ken Townsend, Chief
ATTN: Stephen Mason
Branch of Drilling and Production
Farmington District Office
Bureau of Land Management
1235 La Plata Highway
Farmington, NM 87401

GASBUGGY WELL CASING INTEGRITY

Reference: NMSF-079761 (WC), 3162.3-2 (07337)

This letter is concerning our well No. 10 San Juan 29-4 Unit (PROJECT GASBUGGY), located 1650' FSL and 1700' FWL of Sec. 36, T. 29 N., R. 4 W., Rio Arriba County, New Mexico, Lease NMSF-079761. An ultrasonic imaging log was performed for the referenced well on September 22, 1994. A copy of this log was previously forwarded to your office. As discussed with Stephen Mason on August 15, 1995, the log shows the casing integrity to be more than adequate. In light of this, no further action is required for the well at this time. Per your regulations, the intergity of the casing will be rechecked at five-year intervals.

Any questions on this matter may be directed to Roxanne Danz, of my staff, at (702) 295-7723.

ORIGINAL SIGNED BY

Steven J. Kuncel

for Stephen A. Mellington, Director
Environmental Restoration Division

ERD:RD

Department of Energy
Nevada Operations Office
P. O. Box 98518
Las Vegas, NV 89193-8518

AUG 27 1999

Steve Mason
U.S. Department of the Interior
Bureau of Land Management
Farmington District Office
1235 La Plata Highway, Suite A
Farmington, NM 87401-8731

CASING INSPECTION OF GASBUGGY SITE WELL EPNG 10-36

The DOE Nevada Operations Office has scheduled casing integrity testing of Well EPNG 10-36 at the Gasbuggy Site. The Bureau of Land Management (BLM) originally requested that the casing in Well EPNG 10-36 be tested if tritium were ever detected at above background levels. In a letter from Ken Townsend dated May 24, 1993, BLM further stipulated that Well EPNG 10-36 casing be rechecked every five years. The first casing test was conducted on September 22, 1994, and consisted of a cement bond log with a gamma ray tool and an ultrasonic imaging tool. The 1994 log results indicated that the casing integrity was more than adequate and the condition of the cement grout was acceptable. To fulfill the five-year requirement and document that the well casing and cement grout are still intact, Well EPNG 10-36 will be re-logged on September 13, 1999. It is anticipated that the geophysical logging of Well EPNG 10-36 can be completed in one day.

In order for a side-by-side comparison to be made with the 1994 well logs, the 1999 casing integrity testing will run the same logs. However, the new well logging technology being employed will still meet the objective of determining the current condition of the casing and cement grout in well EPNG 10-36. The geophysical logs to be run include a cement bond/gamma ray log (944 to 3,604 ft. depth), ultrasonic imaging or acoustic televiewer (944 to 3,590 ft. depth) and a tool Quality Assurance rerun section (one per log at 100 feet).

If you have any questions or comments concerning the planned field activities, please call either myself at (702) 295-0160 or Michael O. Giblin at (702) 295-2011.

for Monica L. Sanchez, Project Manager
Off-Sites Project

ERD:MLS

cc:
P. J. Gretsky, IT, Las Vegas, NV
L. E. Wille, IT, Las Vegas, NV

Department of Energy
Nevada Field Office
P.O. Box 98518
Las Vegas, NV 89193-8518

DEC 27 2000

James P. Bearzi, New Mexico Environment Department, Sante Fe, NM
Wayne Price, New Mexico Oil Conservation Division, Santa Fe, NM

TRANSMITTAL OF RESULTS OF GASBUGGY PRELIMINARY FIELD INVESTIGATION (AUGUST - SEPTEMBER 2000)

Reference: Ltr, Wycoff to Price, dtd 10/25/00

As stated in the above-referenced letter, the DOE Nevada Operations Office (DOE/NV) is committed to sending results of our preliminary field investigation as an appendix to the Corrective Action Investigation Plan (CAIP) by December 31, 2000. Currently the CAIP is in draft form and submitted for internal review.

In trying to keep with the deadline of December 31, 2000, I have enclosed the draft Appendix C of the CAIP, stating the results of the Gasbuggy preliminary investigation, along with figures which the Appendix C references to in the text. This Appendix is still under internal review along with the CAIP, once internal review is completed the finalized CAIP, Revision 0, will be sent to you for your complete review and official comment.

If you have any questions or comments, please contact Bill R. Wilborn, of my staff, at (702) 295-3188.

for E. Frank DiSanza

Runore C. Wycoff, Director
Environmental Restoration Division

ERD:BRW

Enclosures:
As stated

cc: w/o encls:
J. E. Kieling, NMED, Sante Fe, NM
John Young, NMED, Sante Fe, NM

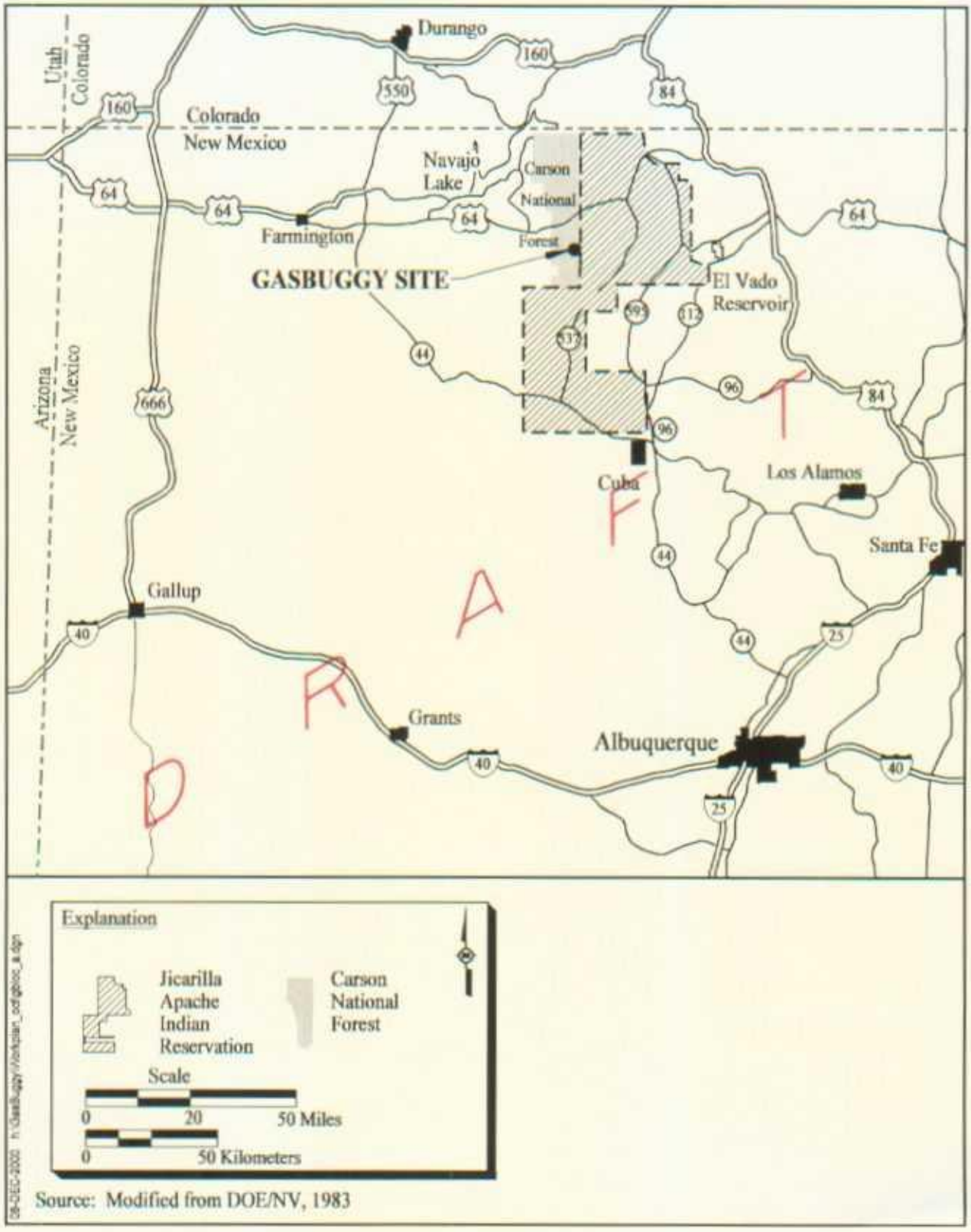
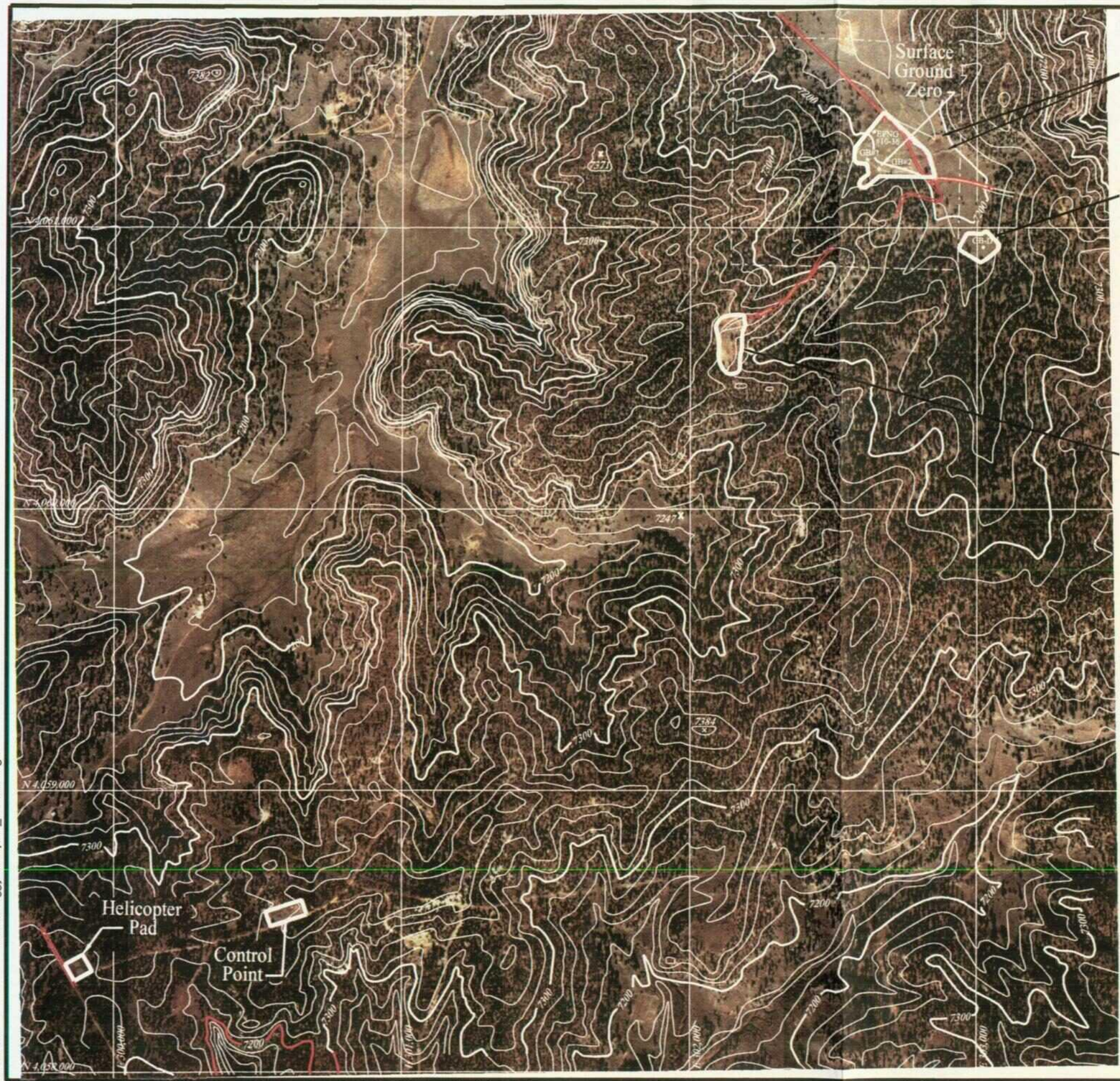


Figure 1-1
Gasbuggy Site Location Map



Explanation

- Well Location and Label
- Major Contours at 100-ft Intervals
- Road
- Project Gasbuggy Operational Area

Note

Aerial Photograph is for Information Only and Not Coincident to Site

Scale

0 1,000 2,000 Feet

0 500 1,000 Meters

Source: USGS, 1995; BN, 1994

Figure 2-1
Gasbuggy Site and Surrounding Area

h:\GasBuggy\Workplan_oct\shaft.dgn
12/20/00

C.2.0 Biological and Cultural Resources Surveys

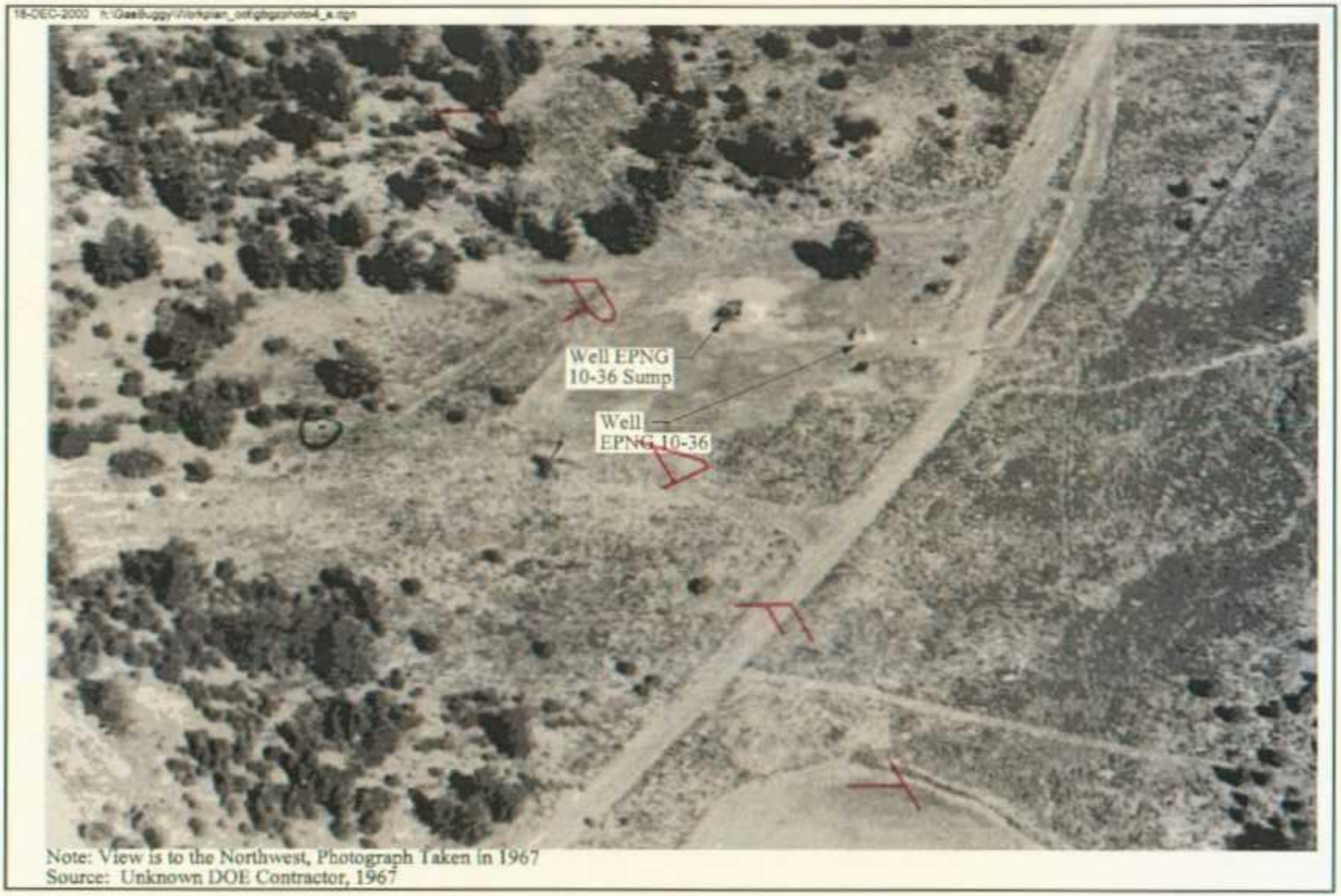
Biological and cultural resource surveys were completed for all operational areas excluding the SGZ area. Surveys for the SGZ area were completed in 1993 (DOE/NV, 1993a and b). These surveys were performed to ensure that future planned site characterization activities would not disturb sensitive species or sites of historical significance. Copies of the final reports for both surveys (TRC, 2000a and b) will be sent to the Jicarilla Ranger District of the Carson National Forest.

C.2.1 Biological Survey

The biological survey was completed on September 7, 2000. A detailed report on the findings of the survey was prepared and will be kept in the project files. The report concluded that "no affect will occur to any U.S. Fish and Wildlife Service (USFWS) threatened, endangered, proposed candidate, or species of concern as a result of environmental studies taking place at the Gasbuggy Site. No affect will occur to State of New Mexico threatened, endangered, or species of concern, or USFS sensitive species as a result of environmental studies at the Gasbuggy Site" (TRC, 2000a).

C.2.2 Cultural Resources Survey

The cultural resources survey was completed on September 22, 2000, by a contractor on the USFS Jicarilla Ranger district list of archeological permittees. A detailed report on the findings of the survey was prepared and will be kept in the project files. The survey identified three "isolated occurrences" (IOs) and one newly recorded "site". Isolated occurrences are archaeological manifestations offering limited information because they lack identifiable cultural context. Sites, generally speaking, are larger in size and extent. One IO was recorded at each of the following areas: Well GB-D area, RTP, and the HP. The "site" was recorded on the ridge to the south of the CP area. The report concluded that cultural resource monitoring is recommended should any future ground-disturbing work occur south of the road (TRC, 2000b). Although the documented boundaries of the "site" overlap the CP boundaries, no ground-disturbing work is planned within the specified "site" boundaries at the current time.



Note: View is to the Northwest, Photograph Taken in 1967
Source: Unknown DOE Contractor, 1967

Figure 2-2
Oblique Photograph of Surface Ground Zero Area
Prior to AEC/DOE Use of Site (1967)

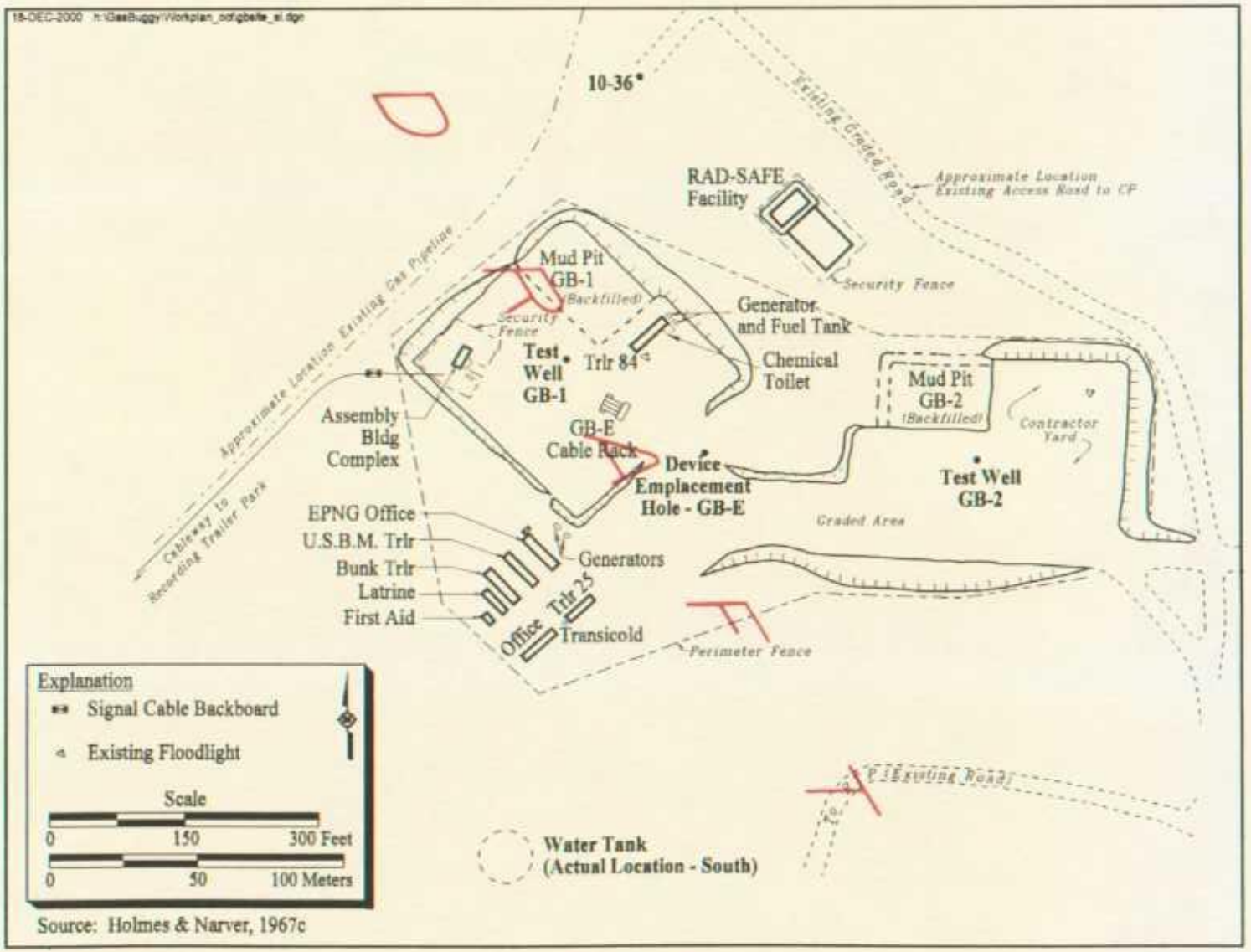
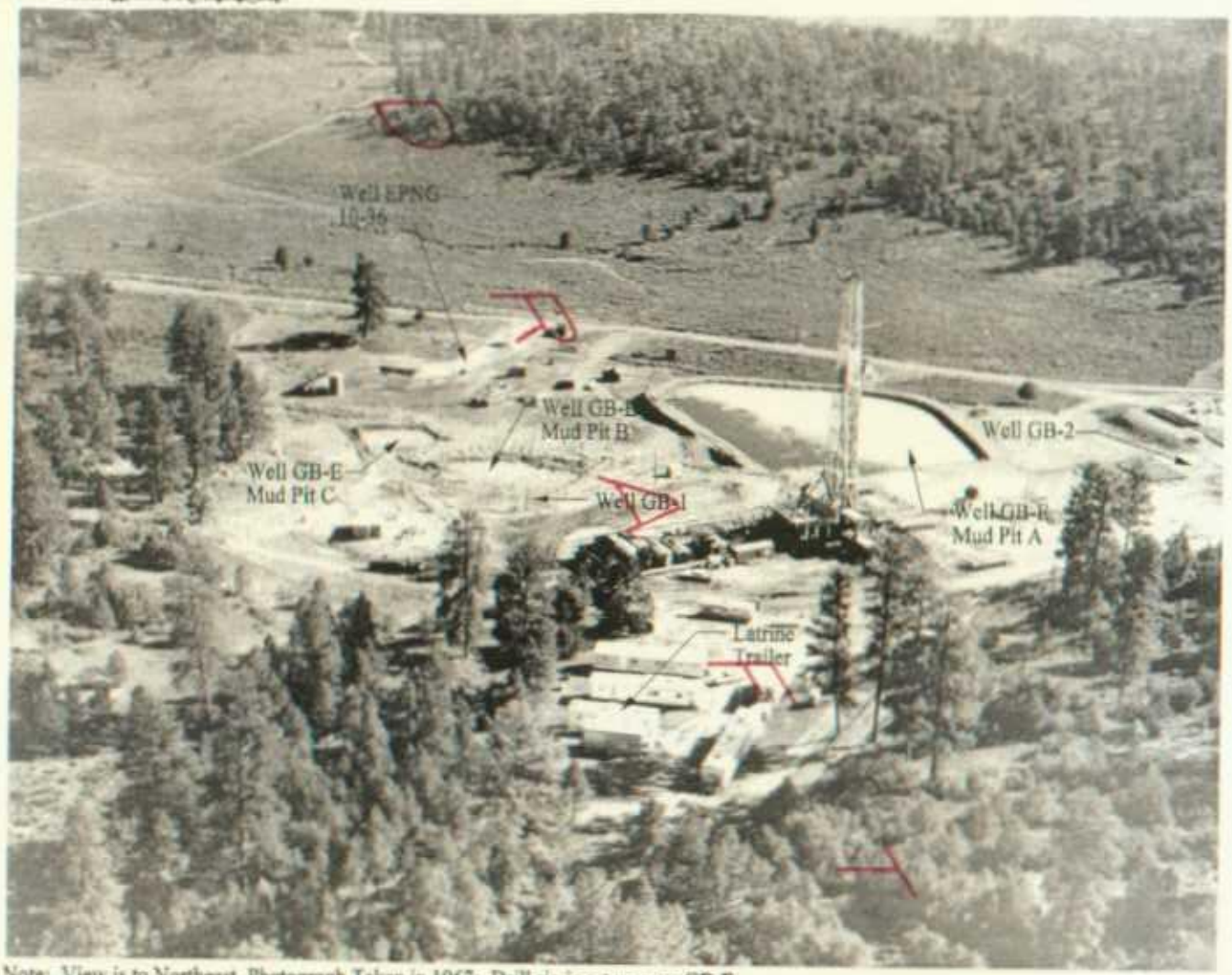


Figure 2-3
Surface Ground Zero Site Plan Gasbuggy, New Mexico



Note: View is to Northeast, Photograph Taken in 1967; Drill rig is set up over GB-E.
Source: LRL, 1967b

Figure 2-4
Oblique Photograph of Surface Ground Zero Area During Drilling of Well GB-E

Note: View is to the Southeast, Photograph Taken in 1967
Source: Wofford, 2000a

Figure 2-5
Oblique Photograph of Surface Ground Zero Area with Well GB-D in Background

Note: View is to the West, Photograph Taken December 10, 1967
Source: Wofford, 2000b

Figure 2-6
Oblique Photograph of Surface Ground Zero Area December 10, 1967

Note: View is to the North, Date of Photograph is Unknown
Source: Wofford, 2000a

Figure 2-7
Oblique Photograph of Surface Ground Zero Area Prior to Restoration

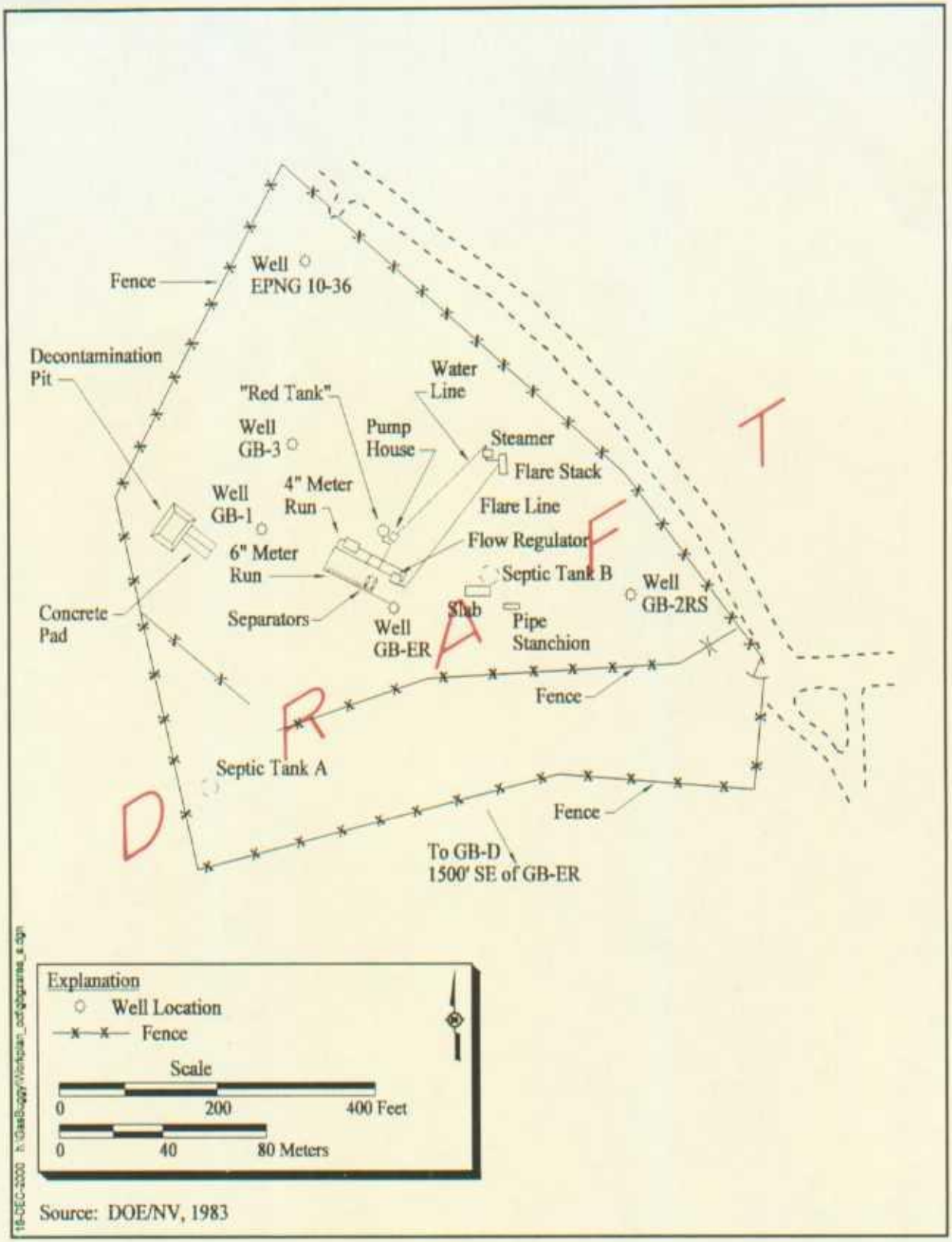


Figure 2-8
Surface Ground Zero Area Status as of December 1976

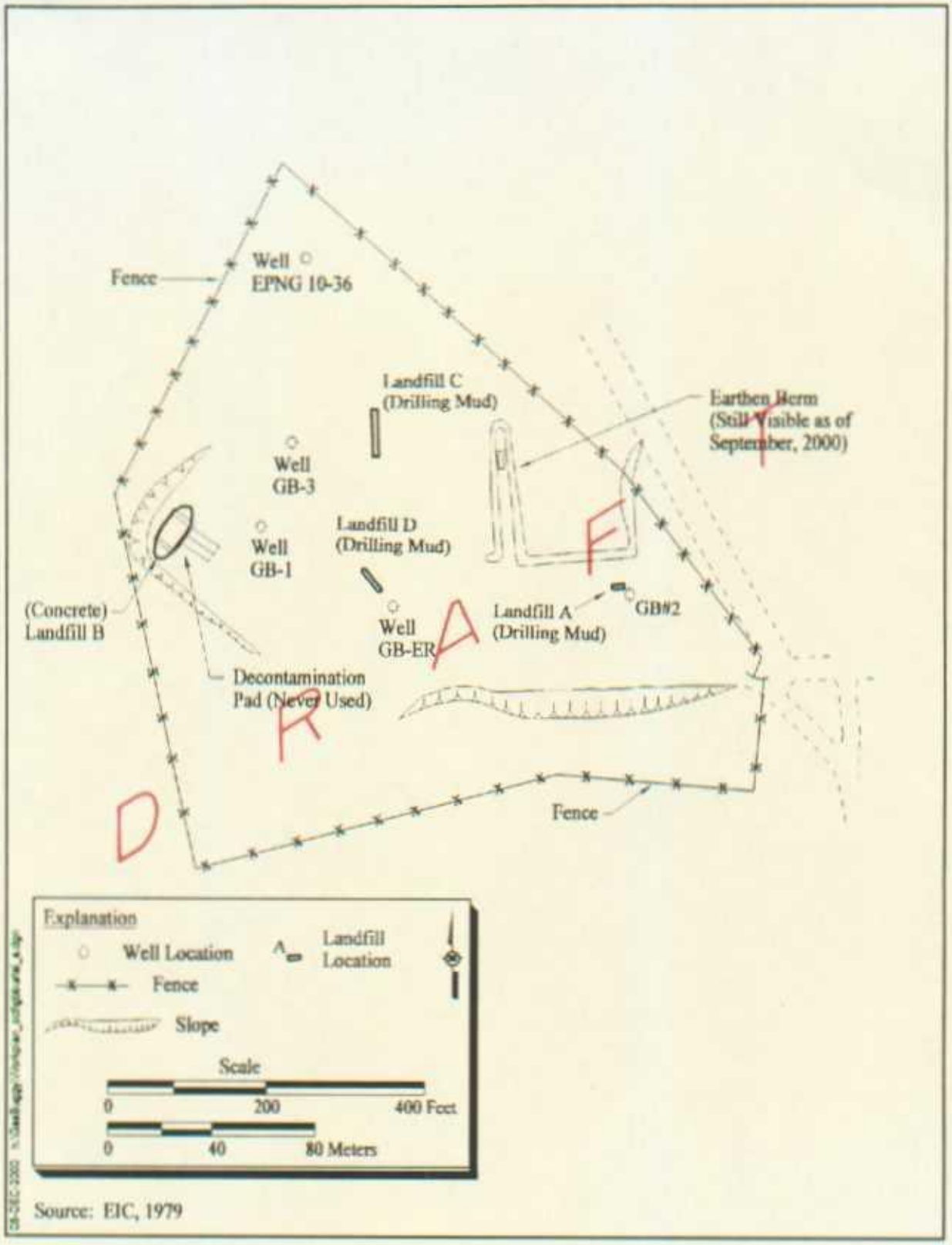


Figure 2-9
Surface Ground Zero Area Location of On-Site Burials

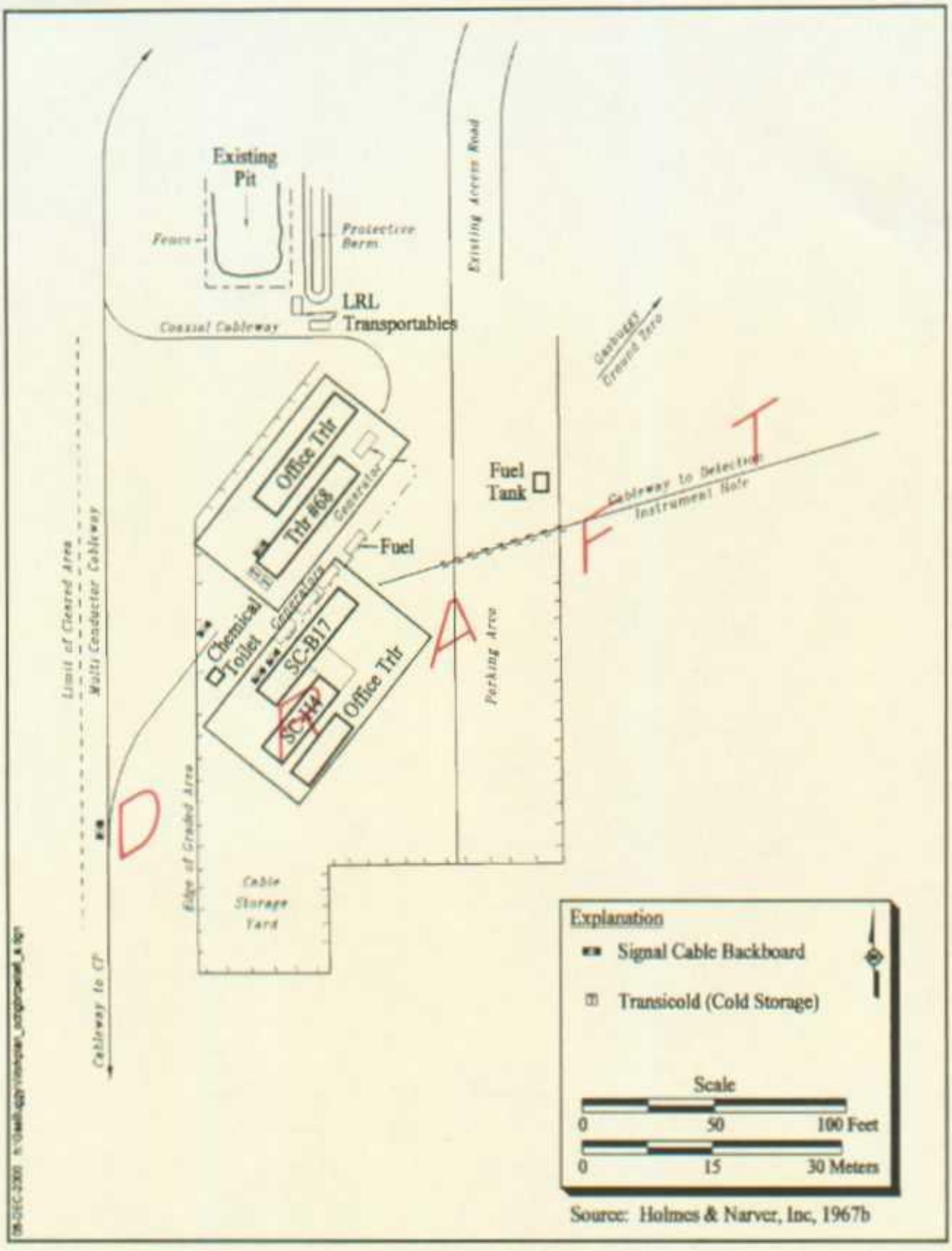


Figure 2-10
Recording Trailer Park Site Plan Gasbuggy, New Mexico

Source: Wofford, 2000a

Note: View is to the Northwest,
Photograph Taken December 10, 1967

Figure 2-11
Oblique Photograph of the Recording Trailer Park

Source: Wofford, 2000a

Note: View is to the North,
Date of Photograph is Unknown

Figure 2-12
Oblique Photograph of the Control Point

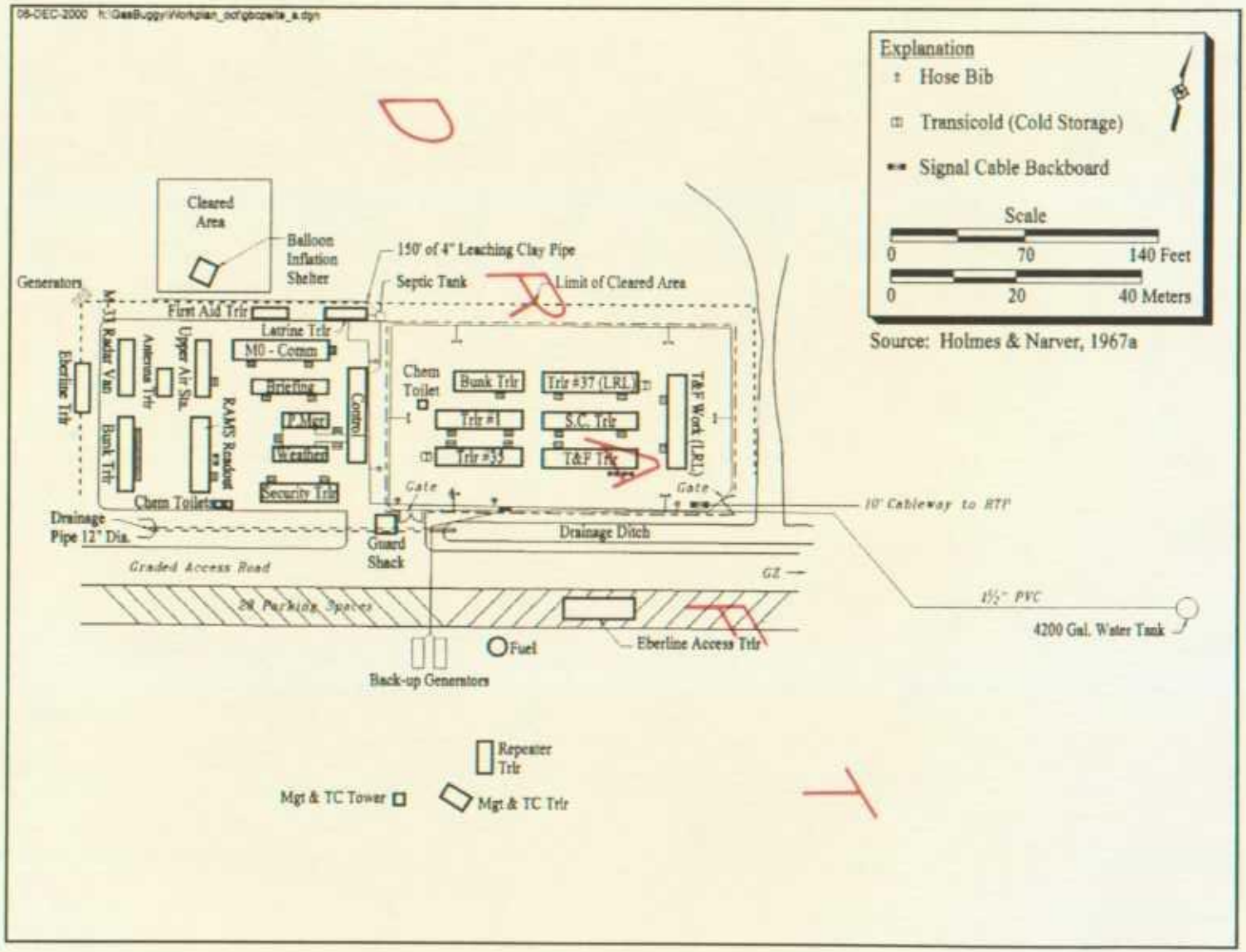


Figure 2-13
Control Point Site Plan Gasbuggy, New Mexico

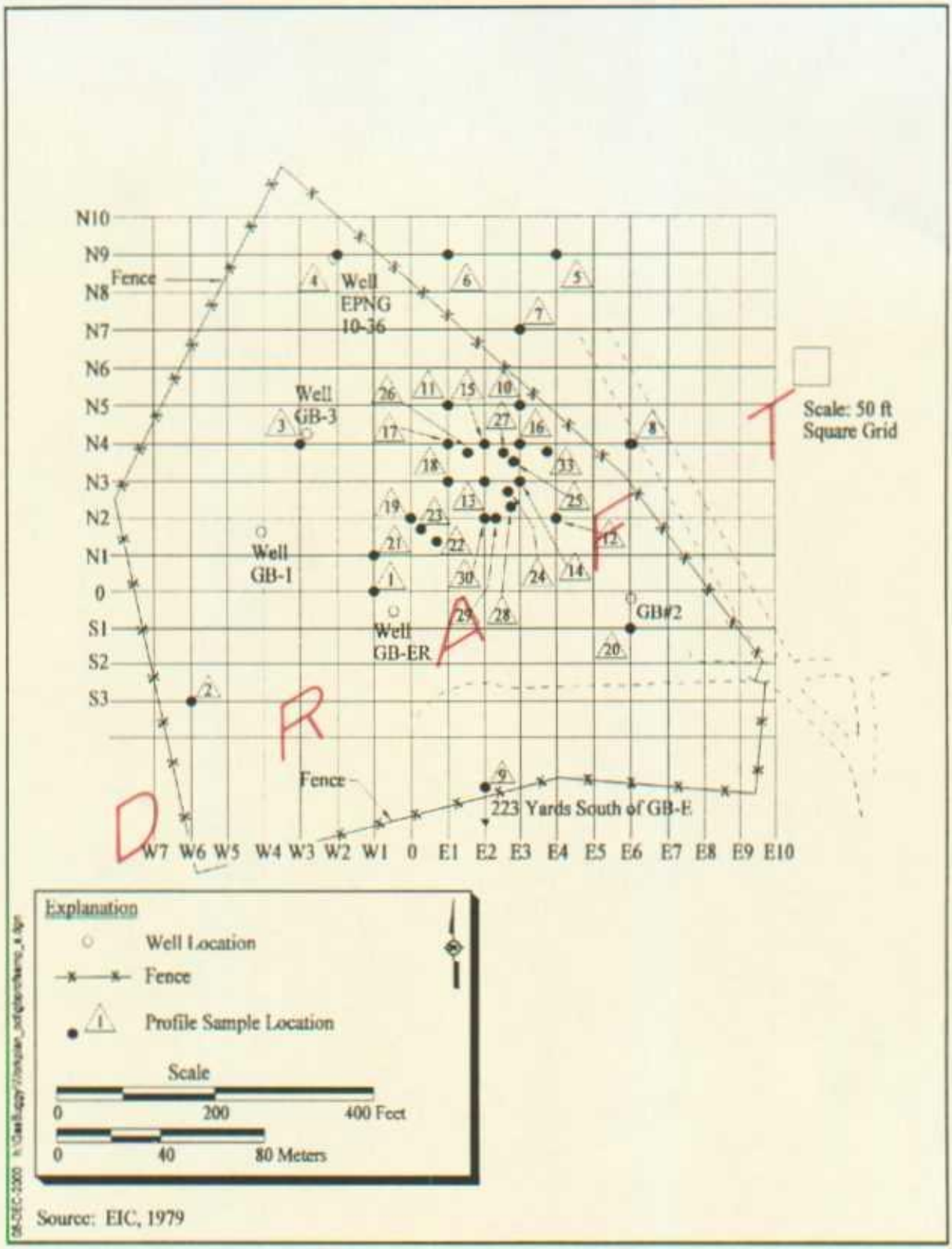


Figure A.4-2
Location of Profile Sample Sets

Appendix C

Results of Gasbuggy Preliminary Field Investigation (August - September, 2000)

DRAFT

C.1.0 Introduction

This appendix presents the investigation activities and analytical results from the preliminary field investigation conducted at the Gasbuggy Site in Rio Arriba County, New Mexico, during August and September of 2000. The Gasbuggy Site is located approximately 55 air miles east of Farmington, New Mexico, in the Carson National Forest. The site is made up of five operational areas (i.e., Surface Ground Zero area, the Well GB-D area, the Recording Trailer Park, the Control Point, and the Helicopter Pad) (Figure 2-1). Additional information on the site history is presented in the main body of the Site Characterization Work Plan (see Section 2.0) and will not be presented here.

C.1.1 Preliminary Field Investigation Objectives

The seven primary objectives for the preliminary field investigation of the surface/shallow subsurface were to:

- Complete necessary biological and cultural resource surveys for operational areas not previously surveyed (all except the SGZ area), so that a Special Use Permit may be obtained from the CNF, Jicarilla Ranger District for future work in these areas.
- Complete surface geophysical investigations for all operational areas where shallow subsurface contamination is suspected to identify suspect AOCs and refine sampling locations.
- Collect soil samples to identify the presence and nature of COPCs at the SGZ area.
- Locate the shallow groundwater table in the SGZ area with planned equipment (direct-push), if possible.
- Collect shallow groundwater samples in the SGZ area, if shallow groundwater is found.
- Verify location of septic tanks in the SGZ.
- Verify septic tanks in SGZ area were closed.

Biological and cultural resource surveys were completed by a contractor approved by the CNF. Surface geophysical investigations were carried out using several electromagnetic (EM) techniques (e.g., EM31 and EM61) and ground-penetrating radar (GPR). Soil samples were collected from within the SGZ area and analyzed as planned.

- Section C.8.0 summarizes the significant results pertaining to the Gasbuggy preliminary field investigation.
- Section C.9.0 cites references used to prepare this appendix.

To make this report a concise summary, the complete field documentation and laboratory data (e.g., Field Activity Daily Logs, Sample Collection Logs, Analysis Request/Chain of Custody Forms, Visual Classification of Soils Forms, laboratory certificates of analyses, and analytical results) are not contained in this report. These documents are retained in project files as both hard copy files and electronic media.

C.3.0 Geophysical Investigations

Geophysical surveys were completed during August 2000 at all operational areas excluding the helicopter pad. Surveys were completed to locate and delineate shallow subsurface features.

C.3.1 Scope and Objectives of Geophysical Investigation

All shallow subsurface AOCs could not be accurately located exclusively through historical research and current site features. Therefore, a geophysical investigation was conducted to more accurately locate and delineate the known suspect shallow subsurface AOCs identified through the document search; locate other suspect areas; and map mud pits and subsurface features containing buried metal objects and/or debris such as landfills and septic tanks.

The geophysical surveys were conducted to accomplish the following objectives within each identified operational area:

Ground Zero Area

- Locate and delineate the drilling mud pits in the SGZ area associated with wells EPNG 10-36, GB-1, GB-2(R), GB-E(R), and GB-3.
- Locate the two septic tanks and potential associated influent and effluent lines (Figure 2-8).
- Locate and delineate undocumented landfills including the potential landfill identified along the western edge of the large mud pit (Landfill E) (Figure 2-5).
- Locate and delineate the landfills used to dispose of the drilling fluids and paraffin generated during the 1978 site restoration and well abandonment (Landfills A, C, and D) (Figure 2-9).
- Locate and delineate the "unused" decontamination pad and other concrete pads buried during the 1978 site restoration (Landfill B) (Figure 2-9).
- Locate and delineate undocumented subsurface features.

Well GB-D Area

- Locate and delineate the drilling mud pit.
- Locate and delineate undocumented subsurface features.

C.3.3.1 EM31

The EM31 technology collects data on the electric and magnetic properties of subsurface materials. The "quadrature phase" measures differences in the conductivity of subsurface materials. The "inphase" reacts well to metal but not the natural conductivity of the earth. The technology measures to approximately 18 ft bgs. Data was collected every 2 seconds or approximately every 2.5 ft to 3 ft while carrying the EM31 antenna over the surface while walking. The GPS antenna was also carried and positioning data was collected once every second while walking.

Prior to each survey, the lateral limits of the area to be surveyed were marked and base grids were established for each site. Using the base grids as a reference survey lanes were flagged. These lanes ensured that transects were evenly spaced. Survey control was maintained by using GPS technology (SAIC, 2000).

C.3.3.2 EM61

The EM61 is a high-resolution metal detection survey that uses an antenna to transmit an electromagnetic pulse into the subsurface and then uses a second antenna to measure the decay rate of the electromagnetic field. The magnitude of the remnant electromagnetic field provides a measurement of the metallic presence in the subsurface and the difference in the fields. The antenna are pulled across the surface on a frame supported by wheels. The EM61 data was collected over areas where landfills or other potential subsurface features which are suspected to contain metal. Survey lanes were established on 5-ft transects over the area of interest. Survey control was maintained by using GPS technology (SAIC, 2000).

C.3.3.3 Ground-Penetrating Radar

Ground-penetrating radar data is collected by pulling an antenna along the ground surface. An electromagnetic pulse (much higher in frequency then is used in the EM61) is sent into the subsurface. When there is a contrast in the dielectric permeativity of the subsurface materials, some of the energy is reflected back to the ground surface, where it is recorded. The GPR surveys were conducted to investigate anomalies detected during the EM31 survey and to attempt to identify the location of several septic tanks documented in historical reports (SAIC, 2000).

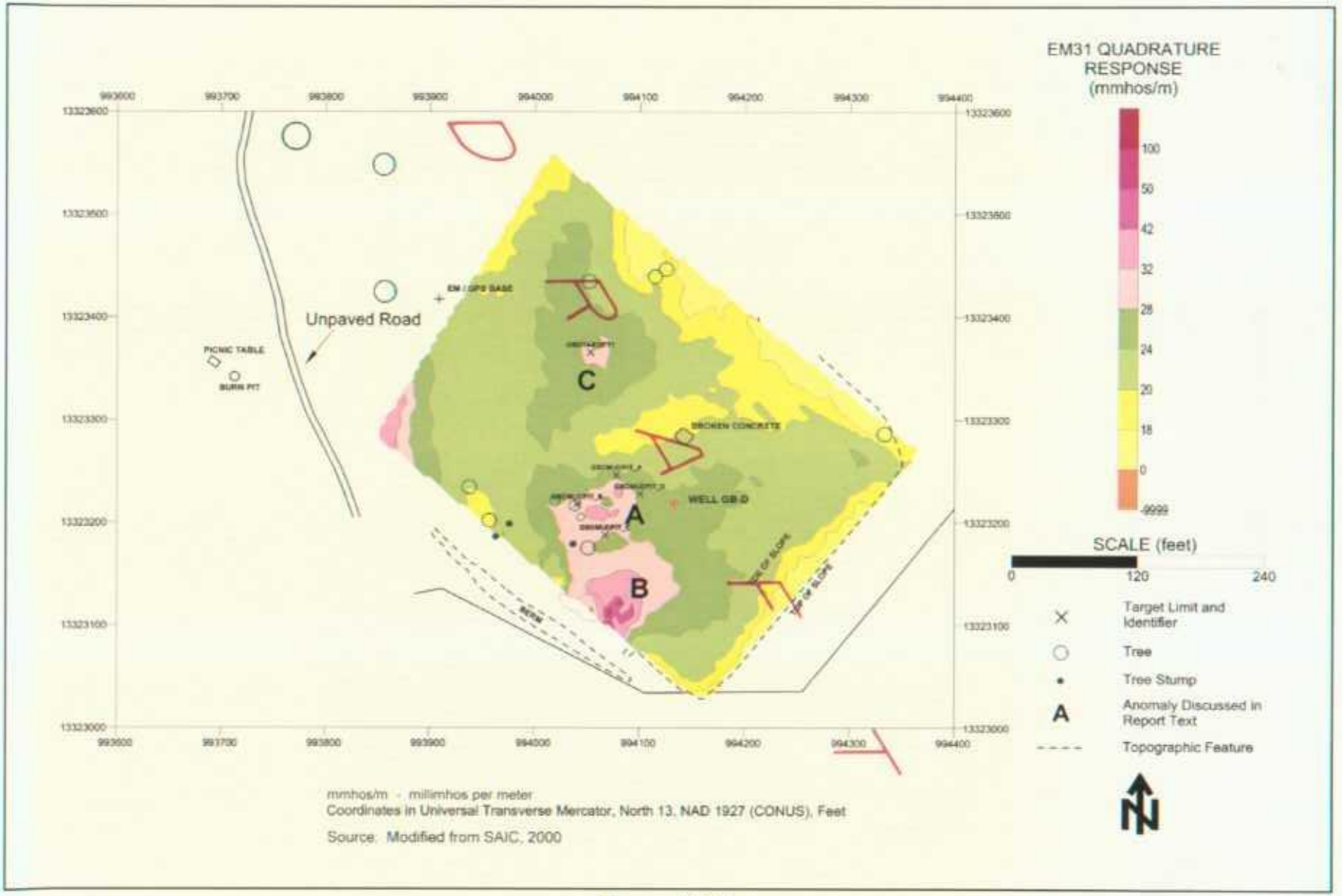


Figure C.3-1
Location of Anomalies Identified by EM31 Survey Quadrature Phase Response at the Well GB-D Area

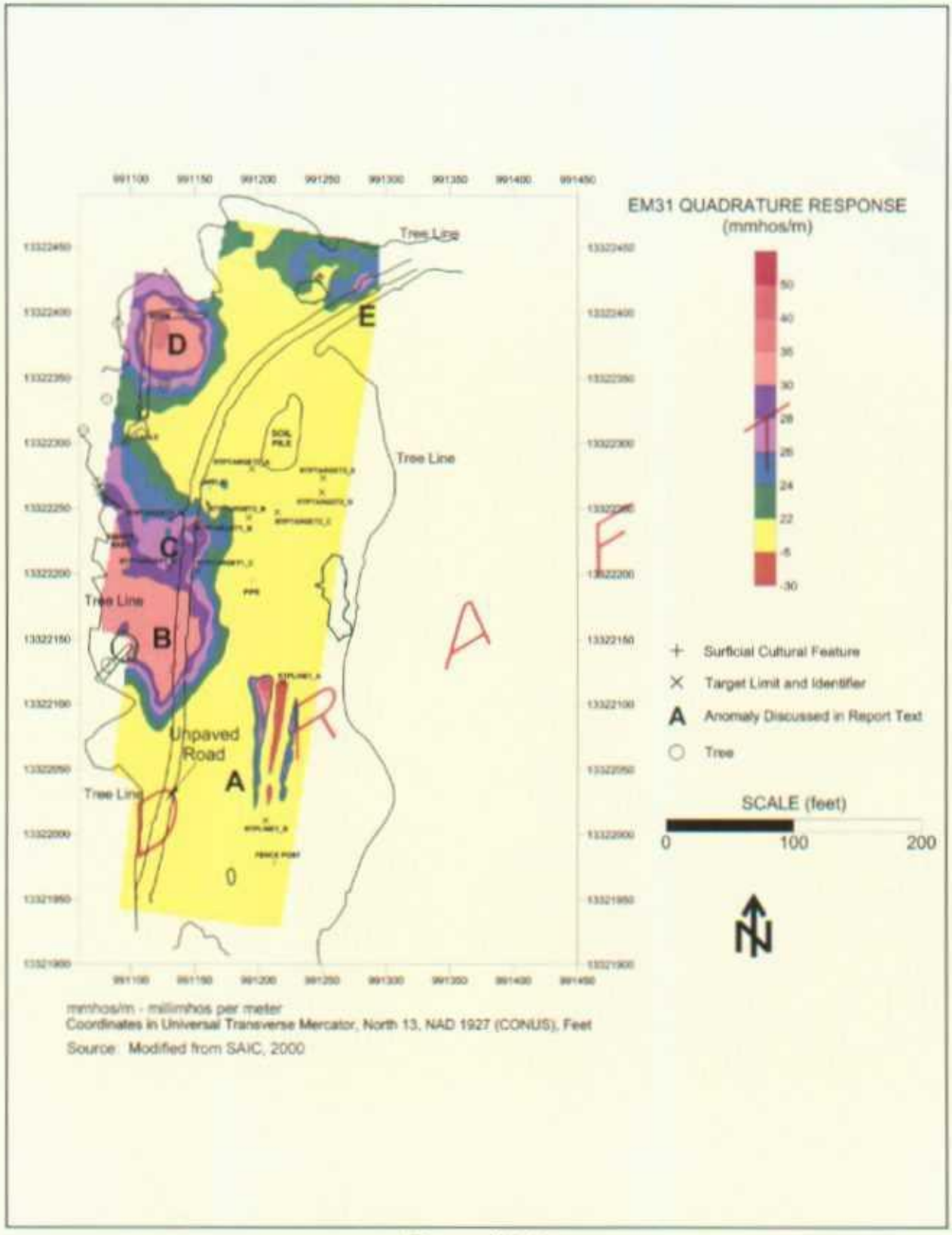


Figure C.3-2
Location of Anomalies Identified by EM31 Quadrature Phase Response at the Recording Trailer Park

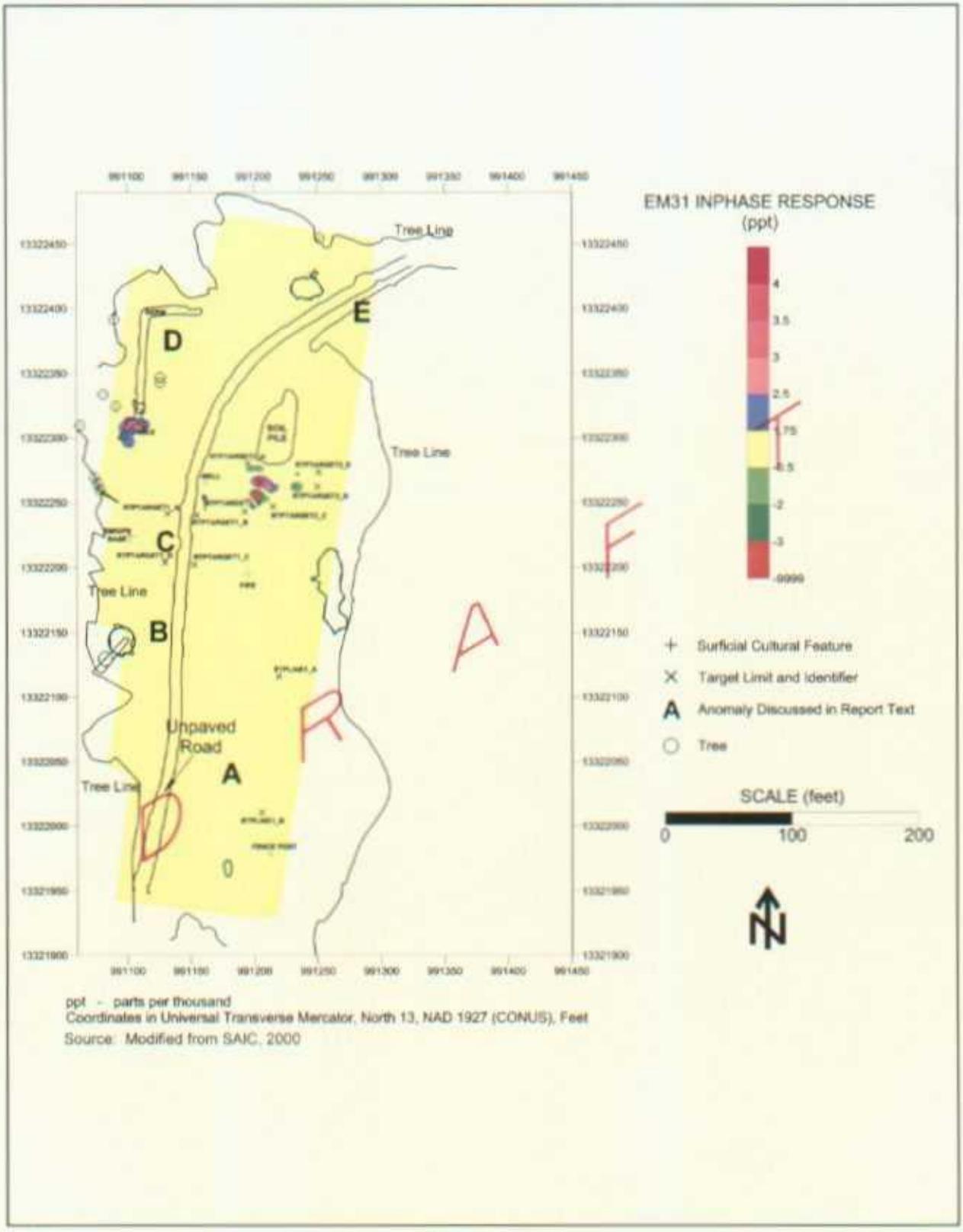


Figure C.3-3
Location of Anomalies Identified by EM31 Inphase Response at the Recording Trailer Park

Based on the data from the geophysical investigations, process knowledge, and field observations, the following interpretations and conclusions were made:

- Anomaly A is linear and trends north to south. Based on the historical aerial photos of the RTP, this anomaly appears to be in the vicinity of the edge of the compacted earthen pad and driveway constructed at the site during the DOE presence (Figure 2-11). The anomaly may represent the edge of the pad. The GPR traverses perpendicular to this anomaly indicated no evidence of a subsurface pipe or cable. Neither historical information nor field observation indicate any reason to suspect contamination due to DOE activities in this specific area. Therefore, this anomaly will not be further investigated.

- Anomaly B is located along the western edge of the surveyed area in an area of higher elevation. The EM31 data are indicative of a natural feature associated with changes in soil electric properties and increased soil moisture (SAIC, 2000). Therefore, this anomaly will not be further investigated.

- Anomaly C is located due south of the abandoned natural gas well located on site. As indicated on the pipe marking the well, the well was operated by Meridian Oil and is referred to as San Juan 28-4. A search of the New Mexico Department of Natural Resources records indicates the well was completed in 1955. No abandonment date was found. An "existing" open pit is indicated on historic site drawings (Figure 2-10), and is visible in a historic photograph of the area (Figure 2-11). The GPR did not indicate any anomalies. The anomaly and the "existing" pit in the drawing are assumed to be the same feature (i.e, the sump associated with the on site well). Therefore, this anomaly will not be further investigated.

- Anomaly D is located near an L-shaped berm in the northwest corner of the area. The anomaly appears to represent a gradual change in conductivity as would a natural feature. The DOE activities at the RTP were concentrated in the southern portion of the cleared area (see Figure 2-10). The berm may be related to the natural gas well located approximately 100 ft southeast of the berm. Neither historical information nor field observation indicate any reason to suspect contamination due to DOE activities in this specific area. Therefore, this anomaly will not be further investigated.

- Anomaly E is located adjacent to the dirt road at the entrance to the RTP. Based on interpretation of the geophysical results Anomaly E appears to be a natural feature of the area (SAIC, 2000). Therefore, this anomaly will not be further investigated.

- Anomaly F is located where steel cables are visible on the surface and is attributed to a response to these cables. The cables are likely related to the natural gas well located approximately 100 ft southeast of the cables. Therefore, this anomaly will not be further investigated.

- Anomaly G is located near a soil pile suggesting the anomaly may represent an excavation and fill event. EM31 data indicated a strong metallic response and GPR traverses across this

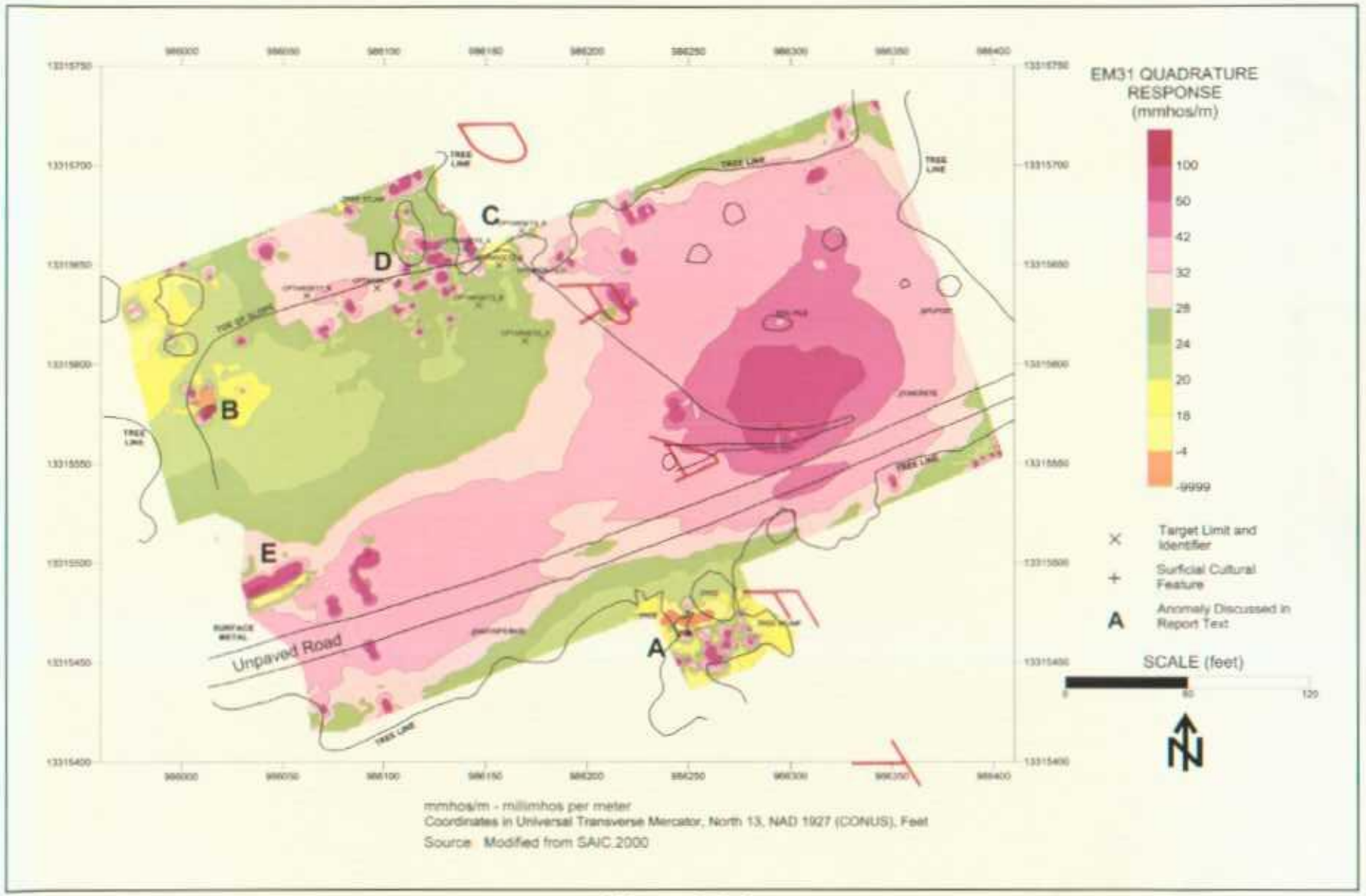


Figure C.3-4
Location of Anomalies Identified by EM31 Quadrature Phase Response at the Control Point

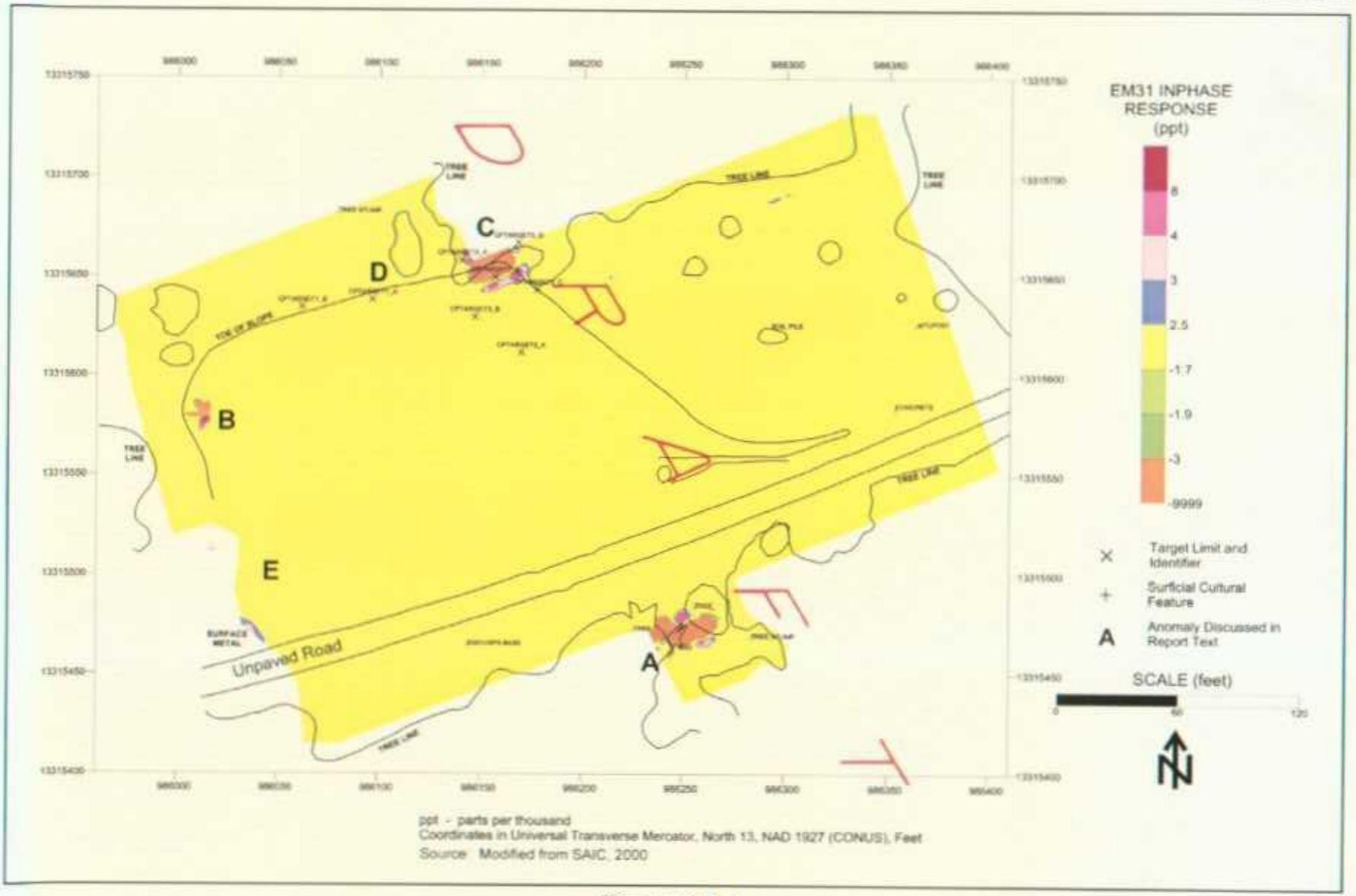


Figure C.3-5
Location of Anomalies Identified by EM31 Inphase Response at the Control Point

C.4.0 Sampling Activities

Soil samples were collected exclusively from the SGZ area. Soil sampling was conducted in accordance with the NM QAPP presented in Appendix B. The samples were collected and documented by following approved sampling, chain of custody, and shipping procedures. Quality control samples (e.g., field blanks, equipment rinsate blanks, trip blanks, and sample duplicates) were collected as required by the NM QAPP and approved procedures.

C.4.1 Site Description and Conditions

The SGZ area is approximately 8 to10 acres in size. There are no buildings within the area. The only utility within the area is a underground gas pipeline that runs along the west side of USFS Road 357. Remaining surface features include four well markers, a ground water monitoring well (Well EPNG 10-36), a pipe stanchion, several concrete pads, and miscellaneous drilling rig anchors, fence posts, and other small historical features. Some soil berms and other surface contours from historical site activities are also still visible. There is a moderate amount of surface debris from historical site activities and recreational usage of the site.

C.4.2 Direct-Push Operation

Shallow subsurface soil samples were collected at 29 site characterization locations and 2 background locations by the direct-push method. All locations were biased based on the conceptual site model, historical knowledge, site features, and results of the geophysical investigation. The direct-push method works by mechanically pushing and/or hammering a core barrel into the soil to the desired depth. The core barrel used at the Gasbuggy Site was 48 in. long with an outside diameter of 2 in. The core barrel was lined with Lexan™ sleeves. Once brought to the surface, these sleeves were cut open along the length to allow for logging of soil type to the full depth of the borehole.

C.4.3 Sample Collection

The Lexan™ sleeve containing the recovered soil was removed from the direct-push equipment, the sleeve was capped, and the bottom cap was marked with the total depth. The sleeve was then brought to the sampling area and cut open. The core was screened for alpha and beta contamination with a NT

Technologies Electra and gamma exposure rate measurements were collected with a Bicron microroentgen meter. The core was also screened for VOCs with a PID. Samples to be analyzed for volatile parameters were collected first using decontaminated stainless steel utensils to place soil directly into sample bottles from the specified depth. Samples to be analyzed for nonvolatile parameters were then collected by placing soil into decontaminated mixing bowls for homogenization prior to filling the required sample bottles.

The assigned sample numbers indicate the location and depth at which the sample was collected as indicated in Table C.4-1. Samples were generally collected from a 2-ft interval to obtain the required volume to fill the necessary sample bottles. Sample intervals were decreased in several cases to collect the sample in a desired interval based on soil characteristics. Sample intervals were also increased in several cases to obtain the required volume. Samples were collected at the depths specified in Table C.4-2.

Table C.4-1
Sample Identification Examples

Sample Type	Example of Identification Number	Description
Soil	GBPS010406 or GBPB010406	GBP = Gasbuggy Preliminary Investigation
		S = Soil sample; or B = Background sample
		01 = Sequential boring number
		0406 = Depth interval sample obtained (e.g., 4-6 feet below ground surface)
Duplicate Soil Sample	GBPS01	01 = Sequential number for duplicate sample
Source Blank	GBP001	001 = Sequential number for QA/QC samples
Equipment Rinsate Blank		
Trip Blank		
Field Blank		

Table C.4-2
Sample Locations, Types, and Analyses
(Page 1 of 5)

Borehole Number[a]	Site Feature (soil samples) or Sample Type[b]	Sample Number[c]	Sample Matrix	Analyses[d]
GBP01	Well GB-2 Mud Pit and Well GB-E Mud Pit D*	**GBPS010609**[f]	Soil	SC, WQCC, WC
		GBPS010911[f]	Soil	SC, WQCC, WC
		GBPS011214	Soil	SC
		GBPS011921	Soil	SC
GBP02	Well GB-2 Mud Pit	**GBPS020610**[f]	Soil	SC, WQCC, WC
		GBPS021719	Soil	SC
GBP03	Well GB-E Mud Pit A	**GBPS030406**[f]	Soil	SC, WQCC, WC
		GBPS030911	Soil	SC
		GBPS031416	Soil	SC
GBP04	Landfill E	GBPS040406	Soil	SC, WQCC, WC
		GBPS040911	Soil	SC
		GBPS041416	Soil	SC
GBP05	Landfill E	GBPS050408	Soil	SC, WQCC, WC
		GBPS051012	Soil	SC
		GBPS051820	Soil	SC
		GBPS01	Soil	Duplicate of above
GBP06	Well EPNG 10-36 Sump	GBPS060608	Soil	SC, WQCC, WC
		GBPS061012	Soil	SC
		GBPS061618	Soil	SC
GBP07	Well GB-E Mud Pit E	**GBPS070608**[f]	Soil	SC, WQCC, WC
		GBPS071012	Soil	SC
		GBPS071618	Soil	SC
GBP08	Well GB-1 Drill Pad	GBPS080204	Soil	SC
		GBPS081416	Soil	SC
GBP09	Well GB-1 Drill Pad	GBPS090204	Soil	SC
		GBPS091416	Soil	SC
GBP10	Well GB-1 Drill Pad	GBPS100204	Soil	SC, WQCC, WC
		GBPS101416	Soil	SC
GBP11	Well GB-E Drill Pad	GBPS110204	Soil	SC, WQCC, WC
		GBPS111416	Soil	SC

Table C.4-2
Sample Locations, Types, and Analyses
(Page 2 of 5)

Borehole Number[a]	Site Feature (soil samples) or Sample Type[b]	Sample Number[c]	Sample Matrix	Analyses[d]
GBP12	Well GB-1 Mud Pit	**GBPS120204**[f]	Soil	SC, WQCC, WC
		GBPS120608	Soil	SC
		GBPS121719	Soil	SC
GBP13	Well GB-E Mud Pit A[g]	GBPS131920	Soil	SC
GBP14	flare stack area	GBPS140304	Soil	Tritium
		GBPS140708	Soil	Tritium
		GBPS141112	Soil	Tritium
		GBPS141516	Soil	Tritium
		GBPS141920	Soil	Tritium
GBP15	Well EPNG 10-36 Drill Pad	GBPS150204	Soil	SC
		GBPS151416	Soil	SC
GBP16	Well EPNG 10-36 Drill Pad	GBPS160204	Soil	SC
		GBPS02	Soil	Duplicate of above
		GBPS161416	Soil	SC
GBP17	Well EPNG 10-36 Drill Pad	GBPS170204	Soil	SC, WQCC, WC
		GBPS171314	Soil	SC
		GBPS172123	Soil	SC
GBP18	Well GB-E Mud Pit E	GBPS180608	Soil	SC
		GBPS180911[f]	Soil	SC, WQCC, WC
		GBPS181416	Soil	SC
		GBPS182122	Soil	SC
GBP19	Well GB-3 Drill Pad	GBPS190204	Soil	SC
		GBPS191416	Soil	SC
GBP20	Well GB-3 Drill Pad	GBPS200204	Soil	SC
		GBPS201416	Soil	SC
GBP21	Well GB-2 Drill Pad	GBPS210204	Soil	SC, WQCC, WC
		GBPS210608	Soil	SC
		GBPS211416	Soil	SC
GBP22	Well GB-2 Drill Pad	GBPS220204	Soil	SC
		GBPS221416	Soil	SC
		GBPS03	Soil	Duplicate of above
		GBPS222021	Soil	SC

Table C.4-2
Sample Locations, Types, and Analyses
(Page 3 of 5)

Borehole Number[a]	Site Feature (soil samples) or Sample Type[b]	Sample Number[c]	Sample Matrix	Analyses[d]
GBP23	water/gas separator area	GBPS230304	Soil	Tritium
		GBPS230708	Soil	Tritium
		GBPS231112	Soil	Tritium
		GBPS231516	Soil	Tritium
		GBPS231920	Soil	Tritium
GBP24	Well GB-E Mud Pit A	GBPS240304	Soil	Tritium
		GBPS240506[f]	Soil	SC, Tritium
		GBPS241112	Soil	Tritium
		GBPS241416	Soil	SC, Tritium
GBP25	flare stack area	GBPS250304	Soil	Tritium
		GBPS250507	Soil	SC
		GBPS250708	Soil	Tritium
		GBPS251012	Soil	SC, Tritium
GBP26	Well GB-E Drill Pad	GBPS260204	Soil	SC
		GBPS261416	Soil	SC
		GBPS04	Soil	Duplicate of above
GBP27	Well GB-E Drill Pad	GBPS270204	Soil	SC
		GBPS271416	Soil	SC
GBP28	berm that separates the Well GB-E Mud Pit A and the Well GB-2 Mud Pit	GBPS280608	Soil	SC
		GBPS281012	Soil	SC
		GBPS282224	Soil	SC
		GBPS283032	Soil	SC
		GBPS283436	Soil	SC
GBP29	Well GB-1 Mud Pit	**GBPS290103[f]**	Soil	SC
		GBPS291416	Soil	SC
GBPB01	background	GBPB010204	Soil	BG, VOCs
		GBPB010912	Soil	BG, VOCs
GBPB03	background	GBPB030407	Soil	BG
		GBPB031012	Soil	BG
		GBPB031416	Soil	BG
NA	trip blank	GBP001	Water	VOCs
NA	trip blank	GBP002	Water	VOCs

Table C.4-2
Sample Locations, Types, and Analyses
(Page 4 of 5)

Borehole Number[a]	Site Feature (soil samples) or Sample Type[b]	Sample Number[c]	Sample Matrix	Analyses[d]
NA	trip blank	GBP003	Water	VOCs
NA	trip blank	GBP004	Water	VOCs
NA	trip blank	GBP005	Water	VOCs
NA	trip blank	GBP006	Water	VOCs
NA	trip blank	GBP007	Water	VOCs
NA	trip blank	GBP008	Water	VOCs
NA	trip blank	GBP009	Water	VOCs
NA	field blank	GBP010	Water	SC, WQCC (except for NO_3, Br, Cl, F, and SO_4), tritium[h]
NA	trip blank	GBP011	Water	VOCs
NA	equipment rinsate blank	GBP012	Water	SC, WQCC (except for NO_3, Br, Cl, F, and SO_4), tritium[h]
NA	trip blank	GBP013	Water	VOCs
NA	trip blank	GBP014	Water	VOCs
NA	source blank for decontamination water	GBP015	Water	SC, WQCC, tritium
NA	trip blank	GBP016	Water	VOCs
NA	source blank for Lexan™ tube[i]	GBP017	Water	SC, WQCC, tritium
NA	trip blank	GBP018	Water	VOCs
NA	equipment rinsate blank	GBP019	Water	NO_3, Br, Cl, F, and SO_4[j]
NA	trip blank	GBP020	Water	VOCs
NA	trip blank	GBP021	Water	VOCs
NA	trip blank	GBP022	Water	VOCs
NA	field blank	GBP023	Water	VOCs, WQCC, Tritium
NA	trip blank	GBP024	Water	VOCs
NA	field blank	GBP025	Water	SC, WQCC, tritium
NA	trip blank	GBP026	Water	VOCs
NA	trip blank	GBP027	Water	VOCs
NA	field blank	GBP028	Water	SC, WQCC, tritium
NA	trip blank	GBP029	Water	VOCs
NA	source blank for Lexan™ tube[i]	GBP030	Water	SC, WQCC, tritium

Table C.4-2
Sample Locations, Types, and Analyses
(Page 5 of 5)

Borehole Number[a]	Site Feature (soil samples) or Sample Type[b]	Sample Number[c]	Sample Matrix	Analyses[d]
NA	trip blank	GBP031	Water	VOCs
NA	trip blank	GBP032	Water	VOCs

[a]The alphanumerical characters indicated that the borehole was drilled during the Gasbuggy preliminary investigation (GBP) which occurred in August-September of 2000, if it is a background borehole (GBPB), and the sequential boring number.
[b]If sample matrix is soil, the description in this column describes the site features (e.g., mud pit, landfill) that the samples from the borehole were intended to capture.
[c]See Table C.4-1 for an explanation of the sample nomenclature.
[d]See explanation of abbreviations below for the specific analysis.
[e]The Well GB-E Mud Pit D is located within the bounds of the Well GB-2 Mud Pit and appears to overlay the Well GB-2 Mud Pit.
[f]Visual observation of the soil core indicates this sample was collected from a suspect drilling mud layer.
[g]Visual observation of the soil core did not indicate a layer of drilling mud within this borehole.
[h]NO_3, Br, Cl, F, and SO_4 were not collected because the hold time for NO_3 is 48 hours, and since the sample was collected on Saturday it would not have been analyzed on time.
[i]Two different types of Lexan™ tubes were used to line the sample core. Samples were collected by pouring deionized water through the tube.
[j]NO_3, Br, Cl, F, and SO_4 were the only parameters collected in order to make up for them not being collected for sample GBP012.

SC = Site Characterization parameters are: total VOCs, total SVOCs, TAL metals, boron, molybdenum, uranium, TPH (diesel-range organics [DRO] and gasoline-range organics [GRO]).
WQCC = New Mexico Water Quality Control Commission parameters are: nitrates (NO_3), cyanide, bromide (Br), chloride (Cl), fluoride (F), sulfate (SO_4), radium-226 and radium-228
WC = Waste Characterization parameters are: TCLP metals, TCLP VOCs, TCLP SVOCS, and Tritium.
NO_3 = Nitrates
Br = Bromide
Cl = Chloride
F = Fluoride
SO_4 = Sulfate
BG = Background parameters are: TAL metals, boron, molybdenum, uranium, total SVOCs, cyanide, Br, Cl, F, SO_4, NO_3, and radium-226/-228
NA = Not applicable

C.4.4 Waste Management

Eight drums of investigation-derived waste were generated during the investigation. The waste was characterized as sanitary (i.e., nonhazardous and nonradioactive). All waste was shipped to a licensed disposal facility.

C.4.5 Geology

The natural contour of the site slopes northeast into Leandro Canyon. Leandro Canyon is an ephemeral drainage and tributary of the ephemeral La Jara Creek.

Field descriptions performed by the field geologist for each boring were recorded on a Visual Classification of Soil Log. The stratigraphy is dominated by poorly graded red-brown to brown silty sand, poorly graded sand, and silt to a minimum of 30 ft bgs. The maximum depth of any boring was 36 ft bgs. Occasional clay layers exist at depths varying from 2 to 20 ft bgs. Bentonite chips were discovered interspersed in some of the borings. These chips are likely a product of the historic drilling operations at the site. Weathered sandstone bedrock was encountered between 14 to 24 ft bgs in a few of the borings in the northwest portion of the site.

C.4.6 Hydrology

No groundwater was encountered during the preliminary field investigation. Maximum depth of boreholes was 36 ft bgs.

C.5.0 Gasbuggy Preliminary Investigation Soil Sample Results

The analytical results of samples collected during the Gasbuggy preliminary field investigation have been compiled and summarized in the following subsections. The parameters analyzed for in this investigation are presented in Table C.4-2. The laboratory analytical methods utilized for this investigation are presented in Appendix B.

Samples were analyzed at Paragon Analytics in Fort Collins, Colorado. Complete analytical results are retained in project files as both hard copy files and electronic media.

C.5.1 Site Characterization Parameters

The site characterization parameters (i.e., TPH [DRO, GRO], VOCs, SVOCs, RCRA metals, and tritium) were selected through the application of site knowledge using the EPA's *Guidance for the Data Quality Objectives Process* (EPA, 1994a). The PALs for these parameters (i.e., the Region IX Industrial Soil PRGs [EPA, 1999a]) are presented in association with the results for these analyses. The results will be used as necessary to formulate corrective action decisions and/or as part of a risk assessment, if necessary.

C.5.1.1 Total Petroleum Hydrocarbon Analytical Results

The TPH analytical results are provided in Table C.5-1. Analytical results show that seven samples have TPH values greater than 100 milligrams per kilogram (mg/kg) indicating a significant detection. All of the samples in which TPH was detected above 100 mg/kg, except for two, were collected from a layer of drilling mud identified by visual observation within the mud pits. The exceptions (i.e., GBPS250507 and GBPS280608) were both collected from the berm that separates the Well GB-2 Mud Pit from Well GB-E Mud Pit A. The flare stack was located at the northern end of this berm. Based on visual observation, this berm appears to have been constructed at least partially by pushing up drill cuttings and drilling mud from the mud pits. These two samples were also the only two in which gasoline was detected at concentrations greater than 100 mg/kg. The source of the gasoline is not known. In all cases where TPH was detected at levels greater than 100 mg/kg, a sample collected at a lower depth in the same borehole indicated a TPH concentration of less than 100 mg/kg and/or a nondetect.

Table C.5-1
Soil Sample Results for TPH
(Page 1 of 3)

Borehole Location	Sample Number	Contaminants of Potential Concern (mg/kg)	
		Diesel	Gasoline
Well GB-2 Mud Pit and Well GB-E Mud Pit D[a]	**GBPS010609[b]**	**2,100 (J)**	3.1
	GBPS010911[a]	**270**	1.6
	GBPS011214	5.9 (U)	0.59 (U)
	GBPS011921	27	0.57 (U)
Well GB-2 Mud Pit	**GBPS020610[b]**	**300**	0.041(J)
	GBPS021719	5.9 (U)	0.59 (U)
Well GB-E Mud Pit A	**GBPS030406[a]**	**720 (J)**	0.58 (U)
	GBPS030911	5.6 (U)	0.56 (U)
	GBPS031416	5.6 (U)	0.56 (U)
Landfill E	GBPS040406	5.7 (U)	0.57 (U)
	GBPS040911	5.5 (U)	0.55 (U)
	GBPS041416	5.6 (U)	0.56 (UJ)
Landfill E	GBPS050408	5.8 (U)	0.58 (U)
	GBPS051012	5.3 (U)	0.53 (U)
	GBPS051820	5.5 (U)	0.55 (U)
	GBPS01[c]	5.5 (U)	0.55 (U)
Well EPNG 10436 Sump	GBPS060608	8.2	0.52 (U)
	GBPS061012	6.4 (U)	0.53 (U)
	GBPS061618	6.3 (U)	0.58 (U)
Well GB-E Mud Pit E	**GBPS070608[a]**	5.7 (U)	0.57 (U)
	GBPS071012	7.6 (U)	0.57 (U)
	GBPS071618	5.6 (U)	0.56 (U)
Well GB-1 Drill Pad	GBPS080204	5.2 (U)	0.52 (U)
	GBPS081416	5.5 (U)	0.55 (U)
Well GB-1 Drill Pad	GBPS090204	5.4 (U)	0.54 (U)
	GBPS091416	5.3 (U)	0.53 (U)
Well GB-1 Drill Pad	GBPS100204	5.6 (U)	0.56 (U)
	GBPS101416	5.7 (U)	0.57 (U)

Table C.5-1
Soil Sample Results for TPH
(Page 2 of 3)

Borehole Location	Sample Number	Contaminants of Potential Concern (mg/kg)	
		Diesel	Gasoline
Well GB-E Drill Pad	GBPS110204	5.5 (U)	0.55 (U)
	GBPS111416	5.7 (U)	0.57 (U)
Well GB-1 Mud Pit	**GBPS120204**[b]	5.5 (U)	0.55 (U)
	GBPS120608	6.1 (U)	0.54 (U)
	GBPS121719	6.3 (U)	0.58 (U)
Well GB-E Mud Pit A	GBPS131920	5.6 (U)	0.56 (U)
Well EPNG 10-36 Drill Pad	GBPS150204	5.2 (U)	0.52 (U)
	GBPS151416	5.8 (U)	0.58 (U)
Well EPNG 10-36 Drill Pad	GBPS160204	5.2 (U)	0.52 (UJ)
	GBPS02[c]	5.2 (U)	0.52 (U)
	GBPS161416	6.3 (U)	0.58 (U)
Well EPNG 10-36 Drill Pad	GBPS170204	5.3 (U)	0.53 (U)
	GBPS171314	5.4 (U)	0.54 (U)
	GBPS172128	5.6 (U)	0.56 (U)
Well GB-E Mud Pit B	GBPS180608	14 (U)	0.55 (U)
	GBPS180911[b]	10	0.68 (U)
	GBPS181416	5.4 (U)	0.54 (U)
	GBPS182122	5.9 (U)	0.59 (U)
Well GB-3 Drill Pad	GBPS190204	5.4 (U)	0.54 (UJ)
	GBPS191416	5.9 (U)	0.53 (U)
Well GB-3 Drill Pad	GBPS200204	7.5 (U)	0.53 (U)
	GBPS201416	5.6 (U)	0.56 (U)
Well GB-2 Drill Pad	GBPS210204	5.5 (U)	0.55 (U)
	GBPS210608	5.3 (U)	0.53 (U)
	GBPS211416	6.4 (U)	0.58 (U)

Table C.5-1
Soil Sample Results for TPH
(Page 3 of 3)

Borehole Location	Sample Number	Contaminants of Potential Concern (mg/kg)	
		Diesel	Gasoline
Well GB-2 Drill Pad	GBPS220204	5.6 (U)	0.56 (U)
	GBPS221416	6.1 (U)	0.56 (U)
	GBPS03[c]	6.8 (U)	0.56 (U)
	GBPS222021	5.6 (U)	0.55 (U)
Well GB-E Mud Pit A	**GBPS240506[b]**	**2,600 (J)**	6.2 (J)
	GBPS241416	9.9 (UJ)	0.59 (U)
Flare stack area	GBPS250507	**250 (J)**	**340**
	GBPS251012	6.5 (UJ)	0.58 (U)
Well GB-E Drill Pad	GBPS260204	11 (J)	0.52 (U)
	GBPS261416	8.6 (UJ)	0.54 (U)
	GBPS04[c]	5.4 (U)	0.54 (U)
Well GB-E Drill Pad	GBPS270204	5.3 (U)	0.53 (U)
	GBPS271416	5.3 (U)	0.53 (U)
Berm that separates the Well GB-E Mud Pit A and the Well GB-2 Mud Pit	GBPS280608	**360**	**3,300**
	GBPS281012	10 (U)	0.57 (U)
	GBPS282224	5.6 (U)	0.56 (U)
	GBPS283032	5.9 (U)	0.59 (U)
	GBPS283436	6 (U)	0.6 (U)
Well GB-1 Mud Pit	**GBPS290103[b]**	5.5 (U)	0.55 (U)
	GBPS291416	5.8 (U)	0.58 (U)

[a]The Well GB-E Mud Pit D is located within the bounds of the Well GB-2 Mud Pit and appears to overlay the Well GB-2 Mud Pit.
[b]Visual observation of the soil core indicates this sample was collected in a suspect drilling mud layer.
[c]Sample is field duplicate of above sample

Darker shaded area = Indicates analytical result exceeds 100 mg/kg
J = Estimated value
U = Undetected

C.5.1.2 Total Volatile Organic Compound Results

The total VOC analytical results above the minimum reporting limits, along with the associated PALs, are presented in Table C.5-2. Nondetects were not reported to limit the length of the report. 1,2,4-Trimethylbezene was detected in sample GBPS250507 at a concentration of 40,000 micrograms per kilogram (µg/kg) (PAL is 5,700 µg/kg). This sample was collected from a depth of 5 to 7 ft bgs from the borehole located at the historic location of the flare stack. This compound is known to be found in many petroleums (Merck, 1976). This sample also contained levels of diesel over 100 mg/kg, and is one of the two samples in which gasoline was detected over 100 mg/kg. The source of the contamination is not known but believed to be associated with production and flaring of natural petroleum hydrocarbons. The contamination is believed to be localized to this location. Further investigation will be conducted in the flare stack area to determine the nature and extent of this potential contamination. No other VOCs were detected at levels which exceeded PALs.

Other VOCs that were detected are either in samples in which TPH was detected above 100 mg/kg or are common laboratory contaminants (i.e., acetone and methylene chloride). The nonlaboratory contaminants are likely present as part of the TPH formulation. The only exceptions to this are contaminants (i.e., 1,2,4-trimethylbenzene; carbon tetrachloride, and chloroform) detected at concentrations less than 1 percent of the associated PAL, in samples collected from borehole GBP28.

C.5.1.3 Total Semivolatile Organic Compound Results

The total SVOC analytical results above the minimum reporting limits, along with the associated PALs, are presented in Table C.5-3. Nondetects were not reported to limit length of report. Concentrations of TPH above 100 mg/kg were detected in seven of the eight samples in which SVOCs were detected. These SVOCs are likely present as part of the TPH formulation. The one sample in which SVOCs were detected but TPH was not detected above 100 mg/kg was sample GBPS270204. The only SVOC detected above minimum reporting limits in this sample was Bis(2-ethylhexyl) phthalate, which is a common laboratory contaminant. No SVOCs were detected at levels which exceeded PALs.

Table C.5-2
Soil Sample Results for VOCs (Detects Only)
(Page 1 of 4)

Sample No.	Contaminants of Potential Concern (µg/kg)																
	1,2,4-Trimethylbenzene	1,3,5-Trimethylbenzene	Acetone	Benzene	Carbon Disulfide	Carbon Tetrachloride	Chloroform	Ethylbenzene	Isopropylbenzene (Cumene)	Total Xylenes*	Methylene Chloride	Naphthalene	N-Butylbenzene	N-Propylbenzene	P-Isopropyltoluene	Sec-Butylbenzene	Toluene
Preliminary Action Levels*	5,700	70,000	6,200,000	1,500	720,000	530	520	230,000	520,000	210,000	21,000	190,000	240,000	240,000	NA	220,000	520,000
GBPS010609	780	220	--	5.3 (J)	--	--	--	14 (J)	15 (J)	200	--	1,200	57 (J)	35 (J)	160	39 (J)	--
GBPS010911	260	72	--	--	--	--	--	4.1 (J)	5.1 (J)	60	--	260	16 (J)	13	31	13	--
GBPS020610	44	78	--	--	--	--	--	--	--	--	--	280	--	3.6 (J)	34	6.8 (J)	--
GBPS021719	--	--	24	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GBPS030406	--	--	--	--	--	--	--	--	--	--	--	4.4 (J)	--	--	--	--	--
GBPS031416	--	--	19 (J)	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GBPS031416	--	--	65	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GBPS040406	--	--	26	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GBPS040911	--	--	73	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GBPS041416	--	--	180	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GBPS050408	--	--	190	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GBPS051012	--	--	46	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GBPS01'	--	--	31	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GBPS061618	--	--	160	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GBPS071012	--	--	110	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Table C.5-2
Soil Sample Results for VOCs (Detects Only)
(Page 2 of 4)

Sample No.	Contaminants of Potential Concern (µg/kg)																
	1,2,4-Trimethylbenzene	1,3,5-Trimethylbenzene	Acetone	Benzene	Carbon Disulfide	Carbon Tetrachloride	Chloroform	Ethylbenzene	Isopropylbenzene (Cumene)	Total Xylenes[a]	Methylene Chloride	Naphthalene	N-Butylbenzene	N-Propylbenzene	P-Isopropyltoluene	Sec-Butylbenzene	Toluene
Preliminary Action Levels[b]	5,700	70,000	6,200,000	1,500	720,000	530	520	230,000	520,000	210,000	21,000	190,000	240,000	240,000	NA	220,000	520,000
GBPS071618	--	--	97	--	--	--	--	--	--	--	110 (B)	--	--	--	--	--	--
GBPS080204	--	--	--	--	--	--	--	--	--	--	88 (B)	--	--	--	--	--	--
GBPS081416	--	--	130 (B)	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GBPS101416	--	--	85	--	--	--	--	--	--	--	54 (B)	--	--	--	--	--	--
GBPS111416	--	--	--	--	--	--	--	--	--	--	66 (B)	--	--	--	--	--	--
GBPS120204	--	--	99	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GBPS121719	--	--	190	--	--	--	--	--	--	--	70 (B)	--	--	--	--	--	--
GBPS131920	--	--	150	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GBPS150204	--	--	130	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GBPS151416	--	--	170	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GBPS160204	--	--	52	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GBPS161416	--	--	30	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GBPS170204	--	--	14 (J)	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GBPS171314 RR1	--	--	1,600	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Table C.5-3
Soil Sample Results for SVOC (Detects Only)

Sample No.	Contaminants of Potential Concern (µg/kg)				
	2-Methylnaphthalene	Fluorene	Naphthalene	Phenanthrene	Bis(2-ethylhexyl) phthalate
Preliminary Action Levels*	**NA**	**33,000,000**	**190,000**	**NA**	**180,000**
GBPS010609	3,100	570	1,000	660	--
GBPS010911	610	--	190 (J)	--	--
GBPS020610	1,400	--	--	200 (J)	--
GBPS030406	1,400	--	440	490	--
GBPS240506	15,000	990 (J)	6,600	1,300 (J)	--
GBPS250507	1,100	--	440	--	--
GBPS270204	--	--	--	--	67
GBPS280608	310	--	--	--	92

*Environmental Protection Agency Region IX, Industrial Preliminary Remediation Goal (EPA, 1999a)

NA = Not applicable (There is no Region IX, Industrial Preliminary Remediation Goal for this constituent.)
-- = Analyte not detected above minimum reporting limits.
J = Estimated value

C.5.1.4 Total RCRA Metals

The total RCRA metals analytical results, along with the associated PALs, are presented in Table C.5-4. Background sample results are located at the bottom of the table. Only arsenic was found in concentrations which exceeded the PAL. Statistical comparison of the arsenic results for the background samples and site characterization samples indicate the two sets of results are not "significantly different."

Table C.5-2
Soil Sample Results for VOCs (Detects Only)
(Page 4 of 4)

Sample No.	Contaminants of Potential Concern (µg/kg)																
	1,2,4-Trimethylbenzene	1,3,5-Trimethylbenzene	Acetone	Benzene	Carbon Disulfide	Carbon Tetrachloride	Chloroform	Ethylbenzene	Isopropylbenzene (Cumene)	Total Xylenes[a]	Methylene Chloride	Naphthalene	N-Butylbenzene	N-Propylbenzene	P-Isopropyltoluene	Sec-Butylbenzene	Toluene
Preliminary Action Levels[b]	5,700	70,000	6,200,000	1,500	720,000	530	520	230,000	520,000	210,000	21,000	190,000	240,000	240,000	NA	220,000	520,000
GBPS280608	520	210	980	--	--	--	--	72	36	920	31 (J)	130	37	75	29	--	150
GBPS281012	3.4 (J)	--	--	--	--	--	--	--	--	--	--	11	--	--	--	--	--
GBPS282224	--	--	49	--	--	--	--	--	--	--	--	--	--	--	--	--	--
GBPS283032	--	--	18 (J)	--	--	1.7 (J)	--	--	--	--	--	--	--	--	--	--	--
GBPS283436	--	--	--	--	--	--	1.1 (J)	--	--	--	--	--	--	--	--	--	--
GBPS291416	--	--	160	--	--	--	--	--	--	--	--	--	--	--	--	--	--

[a]Xylene results were reported as concentrations of m+p-xylene and o-xylene. The reported values were added to get total xylene.
[b]Environmental Protection Agency Region IX, Industrial Preliminary Remediation Goal (EPA, 1999a).
[c]Sample GBPS01 is a field duplicate of GBPS051820. There were no VOC detects for GBPS051820.
[d]Sample is field duplicate of above sample.

-- = Analyte not detected above minimum reporting limits.
J = Estimated value
B = Analyte found in associated blank
Darker shaded area = Indicates analytical result exceeds PAL

Table C.5-4
Soil Sample Results for RCRA Metals
(Page 1 of 4)

Sample Number	Contaminants of Potential Concern (mg/kg)							
	Arsenic	Barium	Cadmium	Chromium	Lead	Mercury	Selenium	Silver
Preliminary Action Level[a]	2.7	100,000	810	450	1,000	610	10,000	10,000
GBPS010609	7	270	1.2 (U)	15	15	0.009 (UJ)	1.2 (U)	1.2 (U)
GBPS010911	1.7	260	0.59 (U)	9.7	62	0.015 (UJ)	0.59 (U)	1.2 (U)
GBPS011214	2.1	320	1.2 (UJ)	17	14	0.02 (UJ)	1.1 (B)	1.2 (U)
GBPS011921	1.4	88	0.57 (UJ)	11	12	0.081 (B)	0.42 (B)	1.1 (U)
GBPS020610	2.7	190	0.57 (U)	13	27	0.017 (UJ)	0.55 (B)	1.1 (U)
GBPS021719	1.5	380	0.59 (U)	9.9	11	0.088 (UJ)	0.59 (U)	1.2 (UJ)
GBPS030406	2.2	190	0.58 (U)	22	9.9	0.012 (UJ)	0.53 (B)	1.2 (U)
GBPS030911	3	220	0.56 (U)	13	7.7	0.112 (UJ)	0.48 (B)	1.1 (UJ)
GBPS031416	3	220	0.56 (U)	12	7.6	0.113 (UJ)	0.56 (U)	1.1 (UJ)
GBPS040406	3.1	220	0.57 (U)	14	7.4	0.011 (UJ)	0.53 (B)	1.1 (U)
GBPS040911	2.9	200	0.55 (U)	10	6.2	0.109 (UJ)	0.55 (U)	1.1 (UJ)
GBPS041416	3.1	230	0.56 (U)	13	8.2	0.113 (UJ)	0.56 (U)	1.1 (UJ)
GBPS050408	3.3	220	0.58 (U)	15	8.5	0.011 (UJ)	0.39 (B)	1.2 (U)
GBPS051012	2.7	160	0.53 (U)	8.8	5.8	0.106 (UJ)	0.53 (U)	1.1 (UJ)
GBPS051820	2.5	150	0.55 (U)	9.4	6.4	0.11 (UJ)	0.55 (U)	1.1 (UJ)
GBPS01[b]	2.9	190	0.55 (U)	10	7	0.11 (UJ)	0.55 (U)	1.1 (UJ)
GBPS060608	2.9	130	0.52 (U)	26	6.5	0.012 (UJ)	0.52 (U)	1 (U)
GBPS061012	2.2	140	0.53 (U)	11	5.4	0.005 (U)	0.57	1.1 (U)
GBPS061618	2	340	0.58 (U)	13	10	0.12 (U)	0.4 (B)	1.2 (U)
GBPS070608	2.7	310	0.57 (U)	12	14	0.006 (UJ)	0.41 (B)	1.1 (U)
GBPS071012	2.4	190	0.57 (U)	10	6.8	0.005 (U)	0.32 (B)	1.1 (U)
GBPS071618	2.3	290	0.56 (U)	10	6.1	0.003 (U)	0.56 (U)	1.1 (U)
GBPS080204	1.8	120	0.52 (U)	8.2	6	0.1 (U)	0.52 (U)	1 (U)
GBPS081416	2.3	150	0.55 (U)	8.8	6.1	0.11 (U)	0.55 (U)	1.1 (U)

Table C.5-4
Soil Sample Results for RCRA Metals
(Page 2 of 4)

Sample Number	Contaminants of Potential Concern (mg/kg)							
	Arsenic	Barium	Cadmium	Chromium	Lead	Mercury	Selenium	Silver
Preliminary Action Level*	2.7	100,000	810	450	1,000	610	10,000	10,000
GBPS090204	2.8	210	0.54 (U)	13	8.3	0.007 (U)	0.49 (B)	1.1 (U)
GBPS091416	2.1	140	0.53 (U)	8.6	6.9	0.11 (U)	0.53 (U)	1.1 (U)
GBPS100204	3.3	230	0.56 (U)	16	11	0.023 (UJ)	0.75	1.1 (U)
GBPS101416	3.5	240	0.57 (U)	12	9.5	0.11 (U)	0.57 (U)	1.1 (U)
GBPS110204	3.1	240	0.55 (U)	13	7.3	0.007 (UJ)	0.43 (B)	1.1 (U)
GBPS111416	3.3	240	0.57 (U)	11	9	0.005 (U)	0.57 (U)	1.1 (U)
GBPS120204	1.9	430	0.033 (U)	15	17	0.088 (B)	0.54 (B)	1.1 (U)
GBPS120608	2.4	2,300	0.54 (U)	12	31	0.012 (U)	0.42 (B)	1.1 (U)
GBPS121719	2.2	180	0.58 (U)	12	9.6	0.12 (U)	0.58 (U)	1.2 (U)
GBPS131920	3	150	0.56 (UJ)	10	6.9	0.11 (UJ)	0.47 (B)	1.1 (U)
GBPS150204	2.3	180	0.52 (UJ)	11	6.3	0.1 (UJ)	0.58	1 (U)
GBPS151416	2.4	210	0.58 (UJ)	13	8.4	0.12 (UJ)	0.86	1.2 (U)
GBPS160204	2.6	180	0.52 (UJ)	13	7.2	0.002 (UJ)	0.72	1 (U)
GBPS02*	2.7	190	0.52 (U)	13	7.7	0.004 (UJ)	0.72	1 (U)
GBPS161416	1.8	160	0.58 (UJ)	12	7.4	0.12 (UJ)	0.58 (U)	1.2 (U)
GBPS170204	2.5	170	0.53 (U)	12	8.1	0.005 (UJ)	0.54	1.1 (U)
GBPS171314	2.8	160	0.54 (UJ)	10	6.5	0.11 (UJ)	0.37 (B)	1.1 (U)
GBPS172123	0.62 (B)	110	0.56 (UJ)	11	5	0.11 (UJ)	0.56 (U)	1.1 (U)
GBPS180608	2.7	210	0.55 (UJ)	14	14	0.005 (UJ)	0.67	1.1 (U)
GBPS180911	2.9	230	0.68 (U)	13	63	0.012 (UJ)	0.45 (B)	1.4 (U)
GBPS181416	3	160	0.54 (UJ)	11	6.8	0.11 (UJ)	0.54 (U)	1.1 (U)
GBPS182122	2.7	580	1.2 (UJ)	16	12	0.082 (UJ)	1.2 (U)	1.2 (U)
GBPS190204	3.3	290	1.1 (UJ)	14	13	0.014 (UJ)	1.1 (U)	1.1 (U)
GBPS191416	2.6	140	0.53 (U)	8.1	4.5	0.11 (UJ)	0.71	1.1 (U)

Table C.5-4
Soil Sample Results for RCRA Metals
(Page 3 of 4)

Sample Number	Contaminants of Potential Concern (mg/kg)							
	Arsenic	Barium	Cadmium	Chromium	Lead	Mercury	Selenium	Silver
Preliminary Action Level[a]	2.7	100,000	810	450	1,000	610	10,000	10,000
GBPS200204	2.3	290	1.1	12	26	0.021 (UJ)	0.43 (B)	1.1 (U)
GBPS201416	2.7	170	0.56 (UJ)	10	6.2	0.11 (UJ)	0.59	1.1 (U)
GBPS210204	1.8	380	0.37 (B)	11	12	0.052 (B)	0.34 (B)	1.1 (U)
GBPS210608	2.7	170	0.53 (U)	9.5	5.6	0.11 (UJ)	0.54	1.1 (U)
GBPS211416	2.7	220	0.58 (U)	13	8.1	0.12 (UJ)	0.68	1.2 (U)
GBPS220204	2.5	1,500	1.1 (U)	20	13	0.029 (UJ)	1.1 (U)	1.1 (U)
GBPS221416	1.6	180	1.1 (U)	20	12	0.028 (UJ)	1.1 (U)	1.1 (U)
GBPS03[b]	1.6	150	1.1 (U)	19	12	0.028 (UJ)	1.1 (U)	1.1 (U)
GBPS222021	1.1	330	0.071 (B)	15	6.5	0.11 (UJ)	0.76	1.1 (U)
GBPS240506	3	210	0.6 (UJ)	30	19 (J)	0.01 (UJ)	1.1	1.2 (U)
GBPS241416	3.8	280	0.59 (UJ)	17	10 (J)	0.002 (UJ)	1.3	1.2 (U)
GBPS250507	2.7	290	0.56 (UJ)	39	13 (J)	0.11 (UJ)	0.85	1.1 (U)
GBPS251012	3.5	370	0.58 (UJ)	16	10 (J)	0.12 (UJ)	1	1.2 (U)
GBPS260204	2.1	120	0.52 (U)	8.3	5	0.1 (UJ)	0.52 (U)	1 (U)
GBPS261416	2.5	140	0.54 (U)	8.7	6.3	0.11 (UJ)	0.54 (U)	1.1 (U)
GBPS04[b]	3.2	200	0.54 (U)	11	7.1	0.11 (U)	0.54 (U)	1.1 (U)
GBPS270204	2.4	140	0.53 (U)	10	7	0.11 (U)	0.53 (U)	1.1 (U)
GBPS271416	2.9	190	0.53 (U)	10	6.5	0.11 (U)	0.3 (B)	1.1 (U)
GBPS280608	3	330	0.57 (U)	66	17	0.11 (U)	0.57 (U)	1.1 (U)
GBPS281012	3.3	390	0.57 (U)	15	9	0.11 (U)	0.57 (U)	1.1 (U)
GBPS282224	2.3	170	0.56 (U)	9.7	6.8	0.11 (U)	0.56 (U)	1.1 (U)
GBPS283032	2.6	240	0.59 (U)	12	9.3	0.12 (U)	0.39 (B)	1.2 (U)
GBPS283436	2.5	280	0.6 (U)	11	9.2	0.005 (UJ)	0.41 (B)	1.2 (U)
GBPS290103	2.3	410	1.1 (U)	16	12	0.018 (UJ)	1.1 (U)	1.1 (U)

Table C.5-4
Soil Sample Results for RCRA Metals
(Page 4 of 4)

Sample Number	Contaminants of Potential Concern (mg/kg)							
	Arsenic	Barium	Cadmium	Chromium	Lead	Mercury	Selenium	Silver
Preliminary Action Level[a]	**2.7**	**100,000**	**810**	**450**	**1,000**	**610**	**10,000**	**10,000**
GBPS291416	1.6	320	0.58 (U)	14	8.1	0.12 (U)	0.58 (U)	1.2 (U)
GBPB010204[c]	1.8	310	0.53 (U)	11	5.6	0.11 (UJ)	0.53 (U)	1.1 (U)
GBPB010912[c]	1.6	250	1.1 (U)	15	7.2	0.008 (UJ)	1.1 (U)	1.1 (U)
GBPB030407[c]	3.2	280	0.54 (U)	13	8.5	0.11 (UJ)	0.54 (U)	1.1 (U)
GBPB031012[c]	2.5	240	0.56 (U)	13	9.9	0.003 (UJ)	0.31 (B)	1.1 (U)
GBPB031416[c]	1.5	290	1.1 (U)	9.7	11	0.11 (UJ)	1.1 (U)	1.1 (U)

[a] Environmental Protection Agency Region IX, Industrial Preliminary Remediation Goal (EPA, 1999a)
[b] Sample is field duplicate of above sample.
[c] Sample collected at background location

Darker shaded area = Indicates analytical result exceeds PAL
U = Undetected
J = Estimated value
B = Analyte found in associated blank

C.5.1.5 Tritium Results

The radioanalytical results for tritium are presented in Table C.5-5. There is no PAL for tritium. Samples were analyzed for tritium for two purposes, waste characterization and site characterization. The waste characterization samples were generally collected from a layer within the borehole in which drilling mud or other disturbed media could be identified. The site characterization samples were collected at arbitrary 4-ft intervals from four Boreholes, GBP14, GBP23, GBP24, and GBP25.

Boreholes GBP14, GBP23, and GBP25 were completed at locations where some of the highest levels of tritium were detected during the 1978 sampling event. Borehole GBP14 was located approximately 25 ft east of the historic flare stack location. This is also the approximate location of profile set #14 from the 1978 sampling event. Borehole GBP23 was located at the approximate

Table C.5-5
Soil Sample Results for Tritium

Purpose	Sample Number	Tritium (pCi/g)	Purpose	Sample Number	Tritium (pCi/g)
WC	GBPS010609	0.033 (UJ)	WC	GBPS170204	0.001 (UJ)
WC	GBPS010911	0.039 (UJ)	WC	GBPS180911	1.6 (J)
WC	GBPS020610	0.038 (UJ)	WC	GBPS210204	0 (UJ)
WC	GBPS030406	0.037 (UJ)	Profile samples from location of gas/water separator	GBPS230304	0.008 (U)
WC	GBPS040406	-0.004 (UJ)		GBPS230708	0.011 (U)
WC	GBPS050408	0.024 (UJ)		GBPS231112	0.072 (U)
WC	GBPS060608	0.028 (UJ)		GBPS231516	0.079 (U)
WC	GBPS070608	0.142 (J)		GBPS231920	0.261 (LT)
WC	GBPS100204	-0.01 (UJ)	Profile samples from location west of flare stack	GBPS240304	0.011 (U)
WC	GBPS110204	0.001 (UJ)		GBPS240506	0.07 (U)
WC	GBPS120204	-0.004 (UJ)		GBPS241112	0.007 (U)
Profile samples from location just east of flare stack	GBPS140304	0.263 (J)		GBPS241416	0.005 (U)
	GBPS140708	7.32 (J)	Profile samples from location of flare stack	GBPS250304	0.402 (LT)
	GBPS141112	3.36 (J)		GBPS250708	0.56 (LT)
	GBPS141516	1.73 (J)		GBPS251012	0.29 (LT)
	GBPS141920	2.5 (J)			

WC = Waste characterization
pCi/g = Picocuries per gram
U = Undetected
J = Estimated value
LT = Result is less than requested minimum detectable concentration (MDC) but greater than sample specific MDC

location of the gas/water separator used during flaring operations. This is also the approximate location of profile set #1 from the 1978 sampling event. Borehole GBP25 was located at the approximate historic location of the flare stack and at the approximate location of profile set #24 from the 1978 sampling event. The highest concentration of tritium in soil moisture (i.e., 1,303 pCi/mL) detected during the 1978 sampling was detected at this location. See Appendix A for results of the 1978 profile sampling. Borehole GBP24 was completed approximately 50 ft west of the historic location of the flare stack and within Well GB-E Mud Pit A.

Of the 31 soil samples analyzed for tritium, 5 samples produced results higher than 1.0 picocuries per gram (pCi/g). Four of these samples were collected from Borehole GBP14. The highest concentration of tritium detected was 7.32 pCi/g in sample GBPS140708 collected at 7 to 8 ft bgs. Samples taken in the same borehole below the depth of sample GBPS140708 indicate lower concentrations of tritium. Based on the preliminary dose/risk assessment provided in Appendix D, these levels do not pose a risk to human health.

C.5.2 New Mexico Oil Conservation Division Required Parameters

A second category of parameters were analyzed for indirect comparison to the NM WQCC action levels listed in Title 20 NMAC 6.2.3103 "Standards for Ground Water of 10,000 mg/L Total Dissolved Solids Concentration or Less" (NMAC, 1996b). These parameters (i.e., TAL metals, boron, molybdenum, uranium, bromide, chloride, cyanide, fluoride, nitrates, sulfates, and radium-226/-228) were specified by the NM OCD to show drilling fluids and drill cuttings were disposed of "in a manner to prevent contamination to surface or subsurface waters," as stated in 19 NMAC 15.C.105 (NMAC, 1996b). Sampling activities for these parameters were designed to collect samples at locations where the potential for contamination was highest (i.e., from layers of drilling mud).

All characterization samples collected during the preliminary field investigation were soil samples (i.e., no groundwater was encountered), thus the results can not be directly compared to the NM WQCC water quality standards in 20 NMAC 6.2.3103 (NMAC, 1996a). The Region IX Industrial soil PRGs (EPA, 1999a), are presented in association with the results for comparison. Further analysis of the data was not done at this time. This data may be used in the corrective action decision document to support decisions made on the closure of the mud pits.

C.5.2.1 Target Analyte List Metals, Boron, Molybdenum, and Uranium Results

The TAL metals (not including the RCRA metals) plus boron, molybdenum, and uranium analytical results above the minimum reporting limits, along with the associated Region IX PRGs (EPA, 1999a), as applicable, are presented in Table C.5-6. Nondetects were not reported to limit the length of the report. None of these COPCs were detected above the associated Region IX PRGs (EPA, 1999a).

Table C.5-6
Soil Sample Results for TAL Metals (Except RCRA Metals) and Molybdenum, Boron, and Uranium
(Page 1 of 6)

Sample No.	Contaminants of Potential Concern (mg/kg)																	
	Aluminium	Antimony	Beryllium	Boron	Calcium	Cobalt	Copper	Iron	Magnesium	Manganese	Molybdenum	Nickel	Potassium	Sodium	Thallium	Uranium	Vanadium	Zinc
PRG*	100,000	820	2,200	79,000	NA	100,000	76,000	100,000	NA	32,000	10,000	NA	NA	NA	NA	NA	14,000	100,000
GBPS010609	7,300	0.84 (J)	0.79	--	4,100	8.1	16	24,000	2,100	270	0.95 (B)	11	1,400 (J)	350 (J)	--	--	30	33
GBPS010911	6,700	--	0.81	--	4,900	5.7	13	12,000	1,900	230	--	9.3	1,300 (J)	1,000 (J)	--	--	18	30
GBPS011214	14,000	1.2 (B)	1.7	--	9,500	9.7	46	30,000	4,700	700	1 (B)	20	2,100	520	--	53	54	63
GBPS011921	12,000	0.59 (B)	1.3	--	6,700	5.5	55	17,000	3,200	160	0.87 (B)	11	2,400	990	--	20 (B)	47	51
GBPS020610	7,600	0.38 (J)	0.66	--	3,900	7.5	13	16,000	2,400	340	0.69 (B)	10	1,500 (J)	350 (J)	--	16 (B)	25	38
GBPS021719	11,000	0.72 (B)	1.2	--	7,100	4	36	18,000	2,900	150	--	10	1,500	320	--	--	39	41
GBPS030406	6,900	0.61 (J)	0.62	--	5,500	7	12	15,000	2,300	330	--	9.8	1,500 (J)	1,100 (J)	--	12 (B)	24	35
GBPS030911	7,800	0.44 (B)	0.7	--	3,300	8	11	16,000	2,500	440	--	11	1,100	100 (B)	--	--	25	35
GBPS031416	8,000	--	0.68	--	4,000	7.4	10	16,000	2,600	390	--	10	910	--	--	--	25	33
GBPS040406	9,000	0.41 (J)	0.74	--	3,100	7.7	12	18,000	2,500	420	0.64 (B)	11	1,600 (J)	190 (J)	--	34	28	38
GBPS040911	6,100	0.54 (B)	0.52 (B)	--	2,300	6.5	8.3	13,000	2,000	340	--	8.4	930	240	--	--	21	28
GBPS041416	8,600	0.81 (B)	0.74	--	3,400	7.9	11	17,000	2,700	430	--	11	1,100	130	--	--	27	37
GBPS050408	9,600	0.65 (J)	0.83	--	3,700	8.7	13	19,000	2,800	520	--	12	1,600 (J)	140 (J)	--	34	30	42
GBPS051012	5,400	0.43 (B)	0.49 (B)	--	2,300	5.9	7.8	12,000	1,900	300	--	8	690	--	--	--	19	26

Table C.5-6
Soil Sample Results for TAL Metals (Except RCRA Metals) and Molybdenum, Boron, and Uranium
(Page 2 of 6)

Sample No.	Contaminants of Potential Concern (mg/kg)																	
	Aluminium	Antimony	Beryllium	Boron	Calcium	Cobalt	Copper	Iron	Magnesium	Manganese	Molybdenum	Nickel	Potassium	Sodium	Thallium	Uranium	Vanadium	Zinc
PRG*	100,000	820	2,200	79,000	NA	100,000	76,000	100,000	NA	32,000	10,000	NA	NA	NA	NA	NA	14,000	100,000
GBPS051820	5,900	0.52 (B)	0.51 (B)	--	3,100	6.9	7.8	13,000	2,000	370	--	8.5	850	--	--	--	21	27
GBPS01[a]	6,700	0.31 (B)	0.57	--	3,300	7.6	8.6	14,000	2,300	400	--	9.7	950	--	--	16 (B)	23	32
GBPS060608	5,200	0.35 (J)	0.46 (B)	--	2,200	5.9	7.7	12,000	1,600	290	--	7.5	780 (J)	170 (J)	--	--	19	31
GBPS061012	4,700	--	0.42 (J)	--	1,700	6	6.2	10,000	1,600	320	0.64 (B)	7.1	550 (J)	470	--	--	16	23
GBPS061618	9,800	--	1.2 (J)	--	5,600	11	23	20,000	3,500	310	0.71 (B)	14	1,200 (J)	180	--	38	38	48
GBPS070608	7,800	--	0.71	--	4,500	6.5	13	17,000	2,500	240	--	10	1,300 (J)	410 (J)	--	20 (B)	27	35
GBPS071012	6,400	--	0.59 (J)	--	3,000	6.7	9.1	13,000	2,300	370	--	9	940 (J)	310	--	--	20	31
GBPS071618	5,700	--	0.51 (J)	--	3,000	6.5	7.8	12,000	2,100	340	--	8.3	730 (J)	98 (B)	--	--	19	27
GBPS080204	4,300	--	0.39 (J)	--	2,000	5.4	8.4	9,700	1,700	260	--	7.2	1,300 (J)	170	--	--	17	28
GBPS081416	5,300	--	0.51 (J)	--	2,400	7.2	7.9	13,000	1,900	350	--	8.2	750 (J)	--	--	--	20	28
GBPS090204	7,400	--	0.72 (J)	--	3,600	8.5	13	16,000	2,500	530	--	11	1,800 (J)	160	--	22	26	40
GBPS091416	5,100	--	0.44 (J)	--	2,600	5.7	6.9	11,000	1,800	310	--	7.4	780 (J)	--	--	--	17	24
GBPS100204	8,800	0.47 (J)	0.75	--	3,500	9.2	13	19,000	2,700	550	0.55 (B)	12	1,800 (J)	160 (J)	--	32	30	42
GBPS101416	8,500	--	0.71 (J)	--	3,200	8.7	11	17,000	2,800	420	--	11	1,200 (J)	--	--	14 (B)	28	36

Table C.5-6
Soil Sample Results for TAL Metals (Except RCRA Metals) and Molybdenum, Boron, and Uranium
(Page 3 of 6)

Sample No.	Contaminants of Potential Concern (mg/kg)																	
	Aluminium	Antimony	Beryllium	Boron	Calcium	Cobalt	Copper	Iron	Magnesium	Manganese	Molybdenum	Nickel	Potassium	Sodium	Thallium	Uranium	Vanadium	Zinc
PRG*	100,000	820	2,200	79,000	NA	100,000	76,000	100,000	NA	32,000	10,000	NA	NA	NA	NA	NA	14,000	100,000
GBPS110204	8,100	0.45 (J)	0.7	--	3,100	7.6	10	17,000	2,400	440	--	10	1,300 (J)	150 (J)	--	25	27	34
GBPS111416	8,200	--	0.77 (J)	--	4,400	7.5	11	15,000	2,700	460	--	11	1,200 (J)	--	--	18 (B)	23	36
GBPS120204	14,000	0.87 (J)	1.6	--	8,700	12	44	32,000	4,600	340	--	20	2,000 (J)	660 (J)	--	38	39	68
GBPS120608	7,900	--	0.78 (J)	--	17,000	7.8	15	16,000	2,900	380	--	11	1,300 (J)	770	--	14 (B)	22	40
GBPS121719	10,000	--	0.89 (J)	--	4,300	9	16	17,000	3,200	370	--	13	1,400 (J)	250	--	31	26	43
GBPS131920	7,400	--	0.53 (J)	--	2,700	7	8.8	14,000	2,200	380	0.85 (B)	9.1	1,100	68 (B)	--	14 (B)	23	30
GBPS150204	6,200	0.5 (J)	0.46 (J)	--	2,100	6.6	8.6	13,000	1,900	390	0.73 (B)	8.2	1,400	260	--	12 (B)	22	30
GBPS151416	11,000	0.66 (J)	1.1 (J)	--	5,300	7.4	20	20,000	3,200	730	0.58 (B)	19	1,400	88 (B)	--	20 (B)	35	42
GBPS160204	7,300	0.59 (J)	0.55 (J)	--	2,700	7.7	10	16,000	2,200	460	0.99 (B)	9.8	1,600	170	--	24	26	36
GBPS02[b]	7,600	0.44 (B)	0.57	--	3,000	7.7	11	16,000	2,500	470	0.61 (B)	9.8	1,700	180	--	14 (B)	26	37
GBPS161416	10,000	0.68 (J)	0.81 (J)	--	4,100	7.7	14	18,000	3,400	360	--	11	1,800	99 (B)	--	28	27	48
GBPS170204	7,500	0.38 (J)	0.66	--	2,600	8.4	14	16,000	2,300	450	0.48 (B)	11	1,600 (J)	130 (J)	--	26	28	37
GBPS171314	6,600	0.56 (J)	0.49 (J)	--	2,400	7.1	8.3	14,000	2,200	380	0.53 (B)	9	860	82 (B)	--	19 (B)	23	29
GBPS172123	10,000	--	0.76 (J)	--	14,000	8.2	19	15,000	4,100	230	--	13	1,300	200	--	--	22	50

Table C.5-6
Soil Sample Results for TAL Metals (Except RCRA Metals) and Molybdenum, Boron, and Uranium
(Page 4 of 6)

Sample No.	Contaminants of Potential Concern (mg/kg)																		
	Aluminium	Antimony	Beryllium	Boron	Calcium	Cobalt	Copper	Iron	Magnesium	Manganese	Molybdenum	Nickel	Potassium	Sodium	Thallium	Uranium	Vanadium	Zinc
PRG*	100,000	820	2,200	79,000	NA	100,000	76,000	100,000	NA	32,000	10,000	NA	NA	NA	NA	NA	14,000	100,000
GBPS180608	8,400	0.44 (J)	0.64 (J)	--	3,800	7.2	12	16,000	2,500	270	0.82 (B)	10	1,500	440	--	15 (B)	26	39
GBPS180911	8,400	0.42 (J)	0.72	--	21,000	7.4	15	15,000	2,600	370	0.74 (B)	11	1,600 (J)	1300 (J)	--	--	24	36
GBPS181416	7,600	--	0.55 (J)	--	3,100	7.4	8.8	15,000	2,400	410	0.98 (B)	9.6	910	210	--	16 (B)	25	32
GBPS182122	13,000	1.2 (J)	1.5 (J)	--	11,000	5.9	24	29,000	3,400	230	0.98 (B)	11	2,000	820	--	30 (B)	68	50
GBPS190204	9,600	0.84 (J)	0.88 (J)	--	4,400	8.9	19	21,000	3,100	390	1.6	13	1,800	200	--	--	33	46
GBPS191416	5,000	0.57 (B)	0.38 (B)	--	1,800	4.4	6.9	11,000	1,500	220	--	6.2	610	64 (B)	--	--	19	21
GBPS200204	7,600	0.33 (J)	0.7 (J)	--	5,900	7.2	15	16,000	2,500	360	--	10	1,700	390	--	14 (B)	23	39
GBPS201416	7,100	0.32 (J)	0.53 (J)	--	3,700	6.6	8.3	14,000	2,200	350	--	9	880	70 (B)	--	14 (B)	23	28
GBPS210204	11,000	--	1.3	--	13,000	8.1	36	17,000	3,500	200	--	15	1,700 (J)	230 (J)	--	--	31	51
GBPS210608	6,100	0.46 (B)	0.46 (B)	--	2,200	5.5	6.2	12,000	1,700	290	--	7.6	1,100	63 (B)	--	--	21	24
GBPS211416	11,000	0.63 (B)	0.89	--	4,300	9.4	15	20,000	3,200	370	--	12	1,400	330	--	28	35	39
GBPS220204	14,000	0.83 (B)	1.4	--	8,400	13	31	28,000	4,800	330	--	19	1,400	320	--	--	38	73
GBPS221416	14,000	0.91 (B)	1.4	--	6,700	17	49	32,000	6,900	410	--	27	2,600	720	--	48	49	96
GBPS503[a]	14,000	1.1 (B)	1.4	--	6,200	16	43	33,000	6,500	400	--	27	2,700	710	0.85 (B)	43 (B)	50	94
GBPS222021	11,000	0.9 (B)	0.93	--	5,100	12	24	22,000	5,100	280	--	19	2,200	610	--	54	31	70

Table C.5-6
Soil Sample Results for TAL Metals (Except RCRA Metals) and Molybdenum, Boron, and Uranium
(Page 5 of 6)

Sample No.	Contaminants of Potential Concern (mg/kg)																	
	Aluminium	Antimony	Beryllium	Boron	Calcium	Cobalt	Copper	Iron	Magnesium	Manganese	Molybdenum	Nickel	Potassium	Sodium	Thallium	Uranium	Vanadium	Zinc
PRG*	100,000	820	2,200	79,000	NA	100,000	76,000	100,000	NA	32,000	10,000	NA	NA	NA	NA	NA	14,000	100,000
GBPS240506	7,800	--	0.82	--	6,800	7.6 (J)	24	16,000	2,800	270	0.52 (B)	14	1,800	1,600	--	--	21 (J)	41
GBPS241416	13,000	--	0.96	--	4,600	9.6 (J)	14	23,000	3,800	510	--	14	1,700	96 (B)	--	34	33 (J)	48
GBPS250507	9,900	--	0.73	9.7 (J)	16,000	7.6 (J)	13	16,000	2,600	310	--	10	2,000	500	--	16 (B)	26 (J)	41
GBPS251012	12,000	--	0.97	--	4,700	9.9 (J)	15	22,000	3,500	560	0.92 (B)	14	2,000	100 (B)	--	25	32 (J)	48
GBPS260204	4,400	0.65 (B)	0.38 (B)	--	1,700	5	5.4	9,900	1,500	290	--	6.4	800	98 (B)	--	--	16	23
GBPS261416	5,700	--	0.5 (B)	--	2,800	6.5	7.9	12,000	2,000	350	--	8.4	760	--	--	--	18	26
GBPS04*	7,200	0.42 (J)	0.58 (J)	--	5,500	6.4	8.7	14,000	2,200	370	0.52 (B)	8.9	1,000 (J)	--	--	--	24	30
GBPS270204	5,500	0.61 (J)	0.47 (J)	--	2,300	5.8	7.2	12,000	1,800	340	--	7.4	1,100 (J)	120 (J)	--	16 (B)	20	34
GBPS271416	6,600	0.36 (J)	0.53 (J)	--	4,900	6	7.9	12,000	2,000	350	0.54 (B)	8.3	960 (J)	--	--	13 (B)	22	28
GBPS280608	9,300	0.68 (J)	0.83 (J)	13	15,000	8.2	17	17,000	2,900	460	1.1	11	1,800 (J)	690 (J)	--	17 (B)	25	47
GBPS281012	10,000	0.83 (J)	0.92 (J)	--	4,700	9.1	14	19,000	3,200	500	1.4 (B)	13	1,700 (J)	120 (J)	--	35	30	42
GBPS282224	6,100	0.55 (J)	0.55 (J)	--	2,600	7.1	8.7	13,000	2,100	420	0.64 (B)	8.9	950 (J)	--	--	12 (B)	21	33
GBPS283032	7,600	0.44 (J)	0.65 (J)	--	3,400	10	9.2	16,000	2,400	640	0.5 (B)	13	1,100 (J)	--	--	19 (B)	26	47
GBPS283436	8,500	0.66 (J)	0.89 (J)	--	4,700	15	15	19,000	2,800	370	--	14	1,000 (J)	170 (J)	--	29	30	39

Table C.5-6
Soil Sample Results for TAL Metals (Except RCRA Metals) and Molybdenum, Boron, and Uranium
(Page 6 of 6)

Sample No.	Contaminants of Potential Concern (mg/kg)																	
	Aluminium	Antimony	Beryllium	Boron	Calcium	Cobalt	Copper	Iron	Magnesium	Manganese	Molybdenum	Nickel	Potassium	Sodium	Thallium	Uranium	Vanadium	Zinc
PRG*	100,000	820	2,200	79,000	NA	100,000	76,000	100,000	NA	32,000	10,000	NA	NA	NA	NA	NA	14,000	100,000
GBPS290103	12,000	0.65 (J)	1 (J)	--	5,700	11	21	21,000	3,900	720	--	17	1,400 (J)	160 (J)	--	--	39	59
GBPS291416	12,000	0.66 (J)	1 (J)	--	5,200	8.2	20	21,000	3,600	220	--	13	1,100 (J)	160 (J)	--	47	38	47
GBPB010204'	7,300	0.52 (B)	0.56	--	3,200	6.2	6.9	14,000	2,700	370	--	8.9	780	--	--	--	21	31
GBPB010912"	12,000	0.54 (B)	0.83	--	6,400	9.6	13	21,000	5,200	460	--	14	1,100	390	--	--	28	48
GBPB030407'	8,200	0.51 (B)	0.77	--	3,900	8.1	11	16,000	2,700	390	--	11	1,100	85 (B)	--	--	24	35
GBPB031012"	10,000	0.45 (B)	0.93	--	5,100	8.8	15	18,000	3,300	390	--	13	1,400	310	--	--	30	45
GBPB031416'	9,600	0.95 (B)	1.4	--	7,200	5.8	20	22,000	2,700	230	--	14	1,600	420	--	--	47	45

*Environmental Protection Agency Region IX, Industrial Preliminary Remediation Goal (EPA, 1999a)
"Sample is field duplicate of above sample.
'Sample collected at background location.

J = Estimated value
B = Analyte found in associated blank

C.5.2.2 Bromide, Chloride, Fluoride, Nitrates, Sulfate, and Cyanide Results

The bromide, chloride, fluoride, nitrates, sulfate, and cyanide analytical results above the minimum reporting limits, along with the associated Region IX PRGs (EPA, 1999a), as applicable, are presented in Table C.5-7. Nondetects were not reported to limit the length of report. None of these COPCs were detected above the associated Region IX PRGs (EPA, 1999a).

C.5.2.3 Radium Results

The radioanalytical results for radium are presented in Table C.5-8. Radium is not a COPC associated with underground nuclear detonations or other DOE activities at the site.

C.5.3 Waste Characterization Parameters

Additional parameters including TCLP metals, TCLP VOCs, and TCLP SVOCs, were analyzed for use in characterization of investigation-derived waste. The EPA regulatory limits for hazardous waste (CFR, 1999) are presented in association with the results of these analyses.

C.5.3.1 Toxicity Characteristic Leaching Procedure Metal Results

The TCLP metals analytical results above the minimum reporting limits, along with the associated regulatory limit (CFR, 1999), are presented in Table C.5-9. Nondetects were not reported to limit the length of the report. No COPCs were detected above regulatory limits.

C.5.3.2 Toxicity Characteristic Leaching Procedure Volatile Organic Compound and Semivolatile Organic Compound Results

The TCLP VOCs and TCLP SVOCs analytical results above the minimum reporting limits, along with the associated regulatory limit (CFR, 1999), are presented in Table C.5-10. Nondetects were not reported to limit the length of the report. None of these COPCs were detected above the regulatory limits.

C.5.4 Rejected Data

The data presented in table Table C.5-11 was rejected (not usable for site characterization). These constituents were not detected in other site characterization samples. Rejected data did not impact the characterization.

Table C.5-7
Soil Sample Results for Bromide, Chloride, Fluoride, Nitrates, Sulfate, and Cyanide (Detects Only)

Sample Numbers	Contaminants of Potential Concern (mg/kg)					
	Bromide	Chloride	Fluoride	Nitrate	Sulfate	Cyanide
PRG[a]	NA	NA	53,000	NA	NA	NA
GBPS010609	--	5	5.3	1.8 (J)	39	--
GBPS010911	--	6.7	7.5	2.3 (J)	43	--
GBPS020610	1.2 (J)	4.3	2.4 (J)	11	150	0.5 (J)
GBPS030406	--	7	4.2 (J)	2.9	480	0.29 (J)
GBPS040406	--	2.2 (J)	3.9 (J)	2.6	16	0.41 (J)
GBPS050408	--	2.7	4.3 (J)	3.2	41	0.44 (J)
GBPS060608	--	1.2 (J)	2 (J)	1.3 (J)	41 (J)	--
GBPS070608	--	12 (J)	8.2 (J)	3.9 (J)	130 (J)	--
GBPS100204	--	1 (J)	3.7 (J)	2.3 (J)	53 (J)	--
GBPS110204	--	1.1 (J)	4.5 (J)	1.3 (J)	36 (J)	--
GBPS120204	--	3.6 (J)	13 (J)	1.8 (J)	110 (J)	--
GBPS170204	--	4.6	3.7	2.3	16	0.25 (J)
GBPS180911	1.4 (J)	120	6.9	3.8	380	0.42 (J)
GBPS210204	--	2 (J)	6.7 (J)	1.4 (J)	17 (J)	--
GBPS270204	--	1.7 (J)	1.5	2 (J)	70	--
GBPS271416	--	10	5.3	1.3 (J)	6.1 (J)	--
GBPB010204[b]	--	1.1 (J)	2.7 (J)	1.2 (J)	16	--
GBPB010912[b]	--	66	9.1 (J)	1.9 (J)	42	--
GBPB030407[b]	--	3.4	4.8 (J)	1.9 (J)	8.7 (J)	--
GBPB031012[b]	--	27	14 (J)	1.2 (J)	32	--
GBPB031416[b]	--	11	13 (J)	1.3 (J)	63	--

[a]Environmental Protection Agency Region IX, Industrial Preliminary Remediation Goal (EPA, 1999a)
[b]Sample collected at background location

NA = Not applicable (There is no Region IX, Industrial Preliminary Remediation Goal for this constituent)
-- = Analyte not detected above minimum reporting limits
J = Estimated value

Table C.5-8
Soil Sample Results for Radium-226 and Radium-228

Sample Number	Radium-226 (pCi/g)	Radium-228 (pCi/g)
GBPS010609	1.54	1.36
GBPS010911	1.5	1.3
GBPS020610	1.38	1.03
GBPS030406	1.4	1.29
GBPS040406	1.54	1.06
GBPS050408	1.62	1.43
GBPS060608	1.49	1.47
GBPS070608	2.4	1.93
GBPS100204	1.49	1.2
GBPS110204	1.77	0.96
GBPS120204	3.06	2.52
GBPS170204	1.44	1.13
GBPS180911	1.73	1.17
GBPS210204	2.49	2.29
GBPB010204*	1.32	1.26
GBPB010912*	1.66	1.69
GBPB030407*	1.83	1.25
GBPB031012*	1.99	1.33
GBPB031416*	2.86	2.15

*Sample collected at background location.

Table C.5-9
Soil Sample Results for TCLP Metals (Detects Only)

Sample Number	Constituents of Potential Concern (mg/L)		
	Barium	Chromium	Lead
Regulatory Limit[a]	100	5.0	5.0
GBPS010609	2.1	--	0.029 (B)
GBPS010911	1.9	--	0.07
GBPS020610	1.4	--	--
GBPS030406	0.89 (B)	--	--
GBPS040406	1	--	--
GBPS050408	0.97 (B)	--	--
GBPS060608	0.93 (B)	0.023 (B)	--
GBPS070608	1.2	--	--
GBPS100204	1.1	--	--
GBPS110204	0.92 (B)	--	--
GBPS120204	1.4	--	--
GBPS170204	0.9 (B)	--	--
GBPS180911	1.1	--	--
GBPS210204	2.1	--	--

[a]40 CFR 261.24, "Identification and Listing of Hazardous Waste" (CFR, 1999)

-- = Analyte not detected above minimum reporting limits.
B = Analyte found in associated blank

Table C.5-10
TCLP VOCs and SVOCs (Detects Only)

Sample Number	Contaminants of Potential Concern (mg/L)	
	Chloroform	2-Butanone (MEK)
Regulatory Limit*	6.0	200
GBPS020610	0.00099 (J)	--
GBPS060608	--	.0073 (J)
GBPS070608	.0067 (J)	0.00023 (J)
GBPS110204	.0064 (J)	--

*40 CFR 261.24, "Identification and Listing of Hazardous Waste" (CFR, 1999)

MEK = Methyl ethyl ketone
-- = Analyte not detected above minimum reporting limits.
J = Estimated value

Table C.5-11
Rejected Data for Soil Samples

Sample Number	Contaminants of Potential Concern (µg/kg)			
	2,4-Dinitrophenol	Benzoic Acid	Hexachlorocyclopentadiene	3-Nitroaniline
GBPB010204	1,800 (R)	1,800 (R)	350 (R)	--
GBPB010912	1,800 (R)	1,800 (R)	360 (R)	--
GBPB030407	--	1,800 (R)	360 (R)	--
GBPB031012	--	1,900 (R)	370 (R)	--
GBPB031416	--	1,900 (R)	370 (R)	--
GBPS030911	--	--	370 (R)	--
GBPS031416	--	--	380 (R)	--
GBPS041416	--	--	380 (R)	--
GBPS051012	--	--	350 (R)	--
GBPS051820	--	--	370 (R)	--
GBPS01*	--	--	370 (R)	--
GBPS210608	--	--	360 (R)	--
GBPS211416	--	--	390 (R)	--
GBPS220204	--	--	370 (R)	--
GBPS221416	--	--	370 (R)	--
GBPS03*	--	--	370 (R)	--
GBPS222021	--	--	370 (R)	--
GBPS240506	--	--	1,600 (R)	--
GBPS241416	--	2,000 (R)	390 (R)	--
GBPS250507	--	--	370 (R)	--
GBPS251012	--	--	390 (R)	--
GBPS260204	1,700 (R)	1,700 (R)	350 (R)	--
GBPS261416	1,800 (R)	1,800 (R)	360 (R)	--
GBPS283436	--	--	--	2,000 (R)
GBPS290103	--	--	--	1,800 (R)
GBPS291416	--	--	--	1,900 (R)

*Sample is field duplicate of above sample.

R = Rejected data. Value shown is the detection limit.
-- = Data for this constituent was not rejected.

C.6.0 Discussion of Investigation Results for the Surface Ground Zero Area

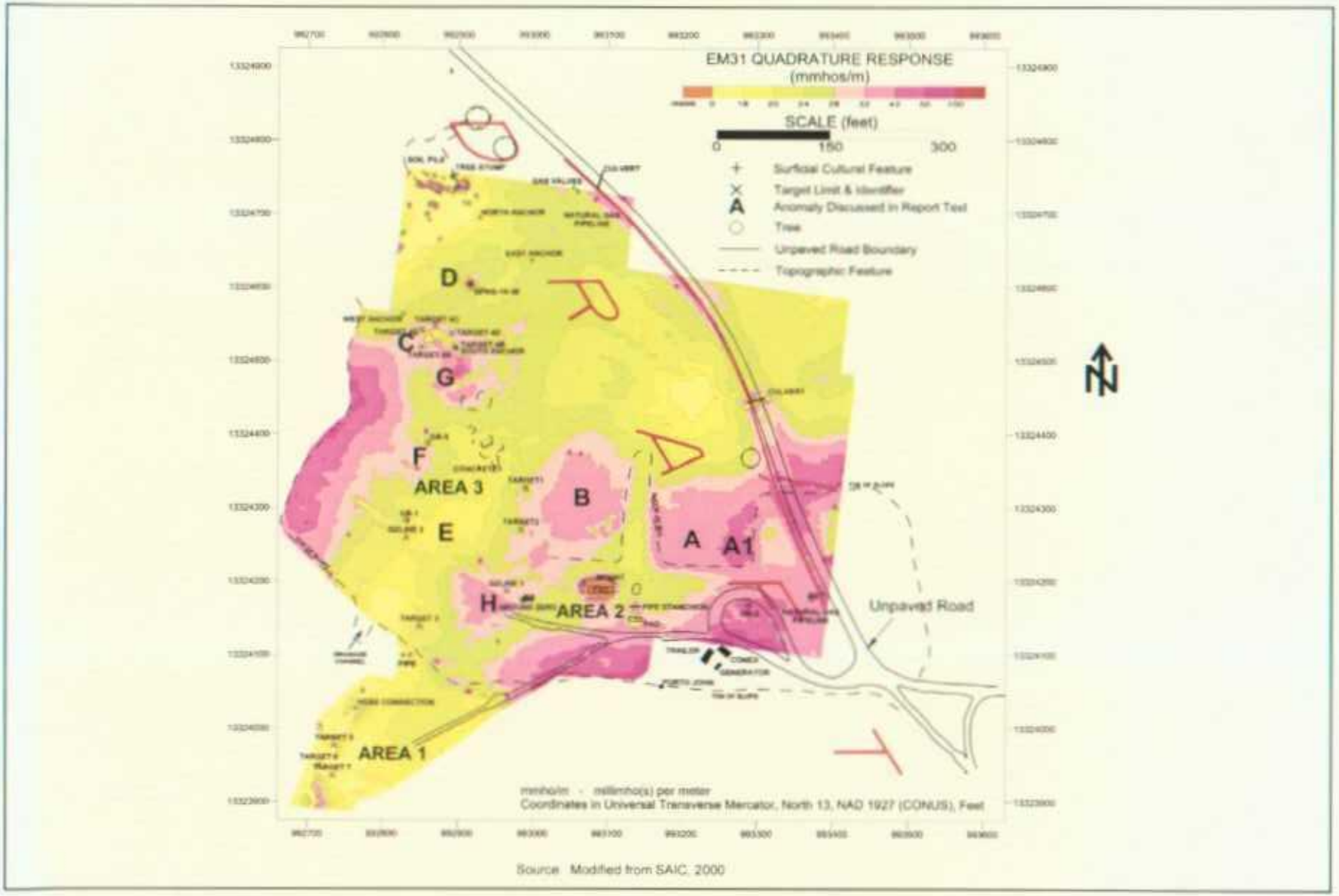
This section provides a summary of the geophysical and soil sampling findings of the preliminary field investigation in the SGZ area, and offers assumptions as to how the data can be interpreted. Conclusions presented in this portion of the document are meant only to provide direction for further investigation and not to draw final conclusions on the nature and extent of contamination.

The EM31 was used for an initial geophysical survey of the SGZ area. The EM31 data indicated numerous anomalies in both the quadrature phase and the inphase (Figure C.6-1 and Figure C.6-2). Additional data was collected using EM61 in Areas 1, 2, and 3, as indicated in Figure C.6-1 and Figure C.6-2. Data was also collected using GPR at the locations specified as Targets 1 through 8 on Figure C.6-1 and Figure C.6-2. Many of the targets identified could be recognized as specific site features based on historical site photos and plans. Many of these features were further investigated through soil boring and soil sampling (Figure C.6-3).

A summary of the SGZ area features identified during the investigation is provided in Table C.6-1.

C.6.1 Mud Pits

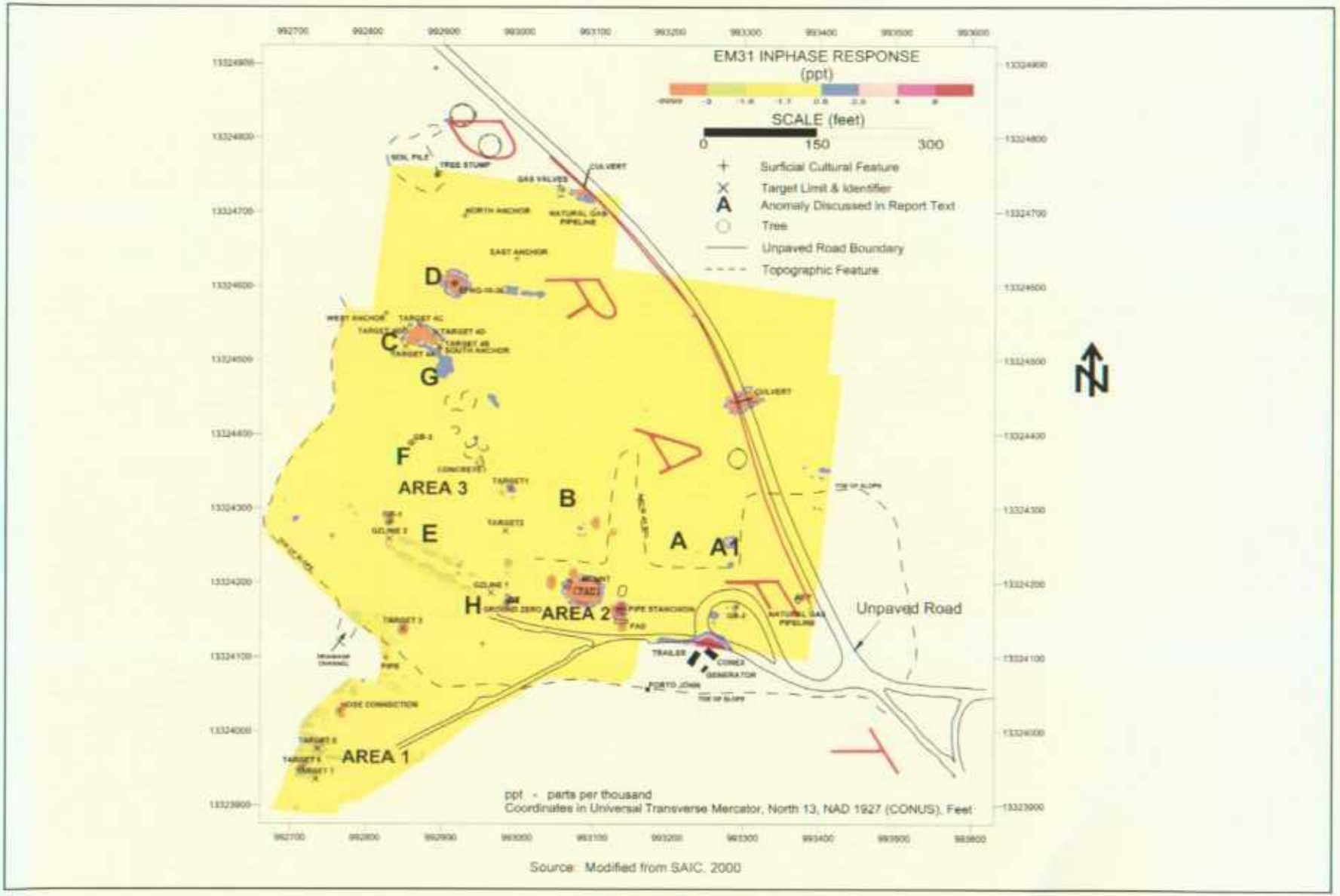
The geophysical survey was able to locate and roughly delineate the mud pits, approximately where historical documentation indicated they would be (Figure C.6-1). As indicated in Table C.6-1, several of the mud pits indicated in historical photos or assumed to exist were not found as distinct anomalies. It is assumed this is because these mud pits overlap others or did not alter the shallow subsurface enough to create a distinct geophysical anomaly. Further investigation of these mud pits (i.e., Well GB-E Mud Pits B and C, and Well GB-3 Mud Pit) will be covered by the investigation of known mud pits.



Source: Modified from SAIC, 2000

Figure C.6-1

Location of Anomalies Identified by EM31 Survey Quadrature Phase Response at Surface Ground Zero



Source: Modified from SAIC, 2000

Figure C.6-2
Location of Anomalies Identified by EM31 Survey Inphase Response at Surface Ground Zero

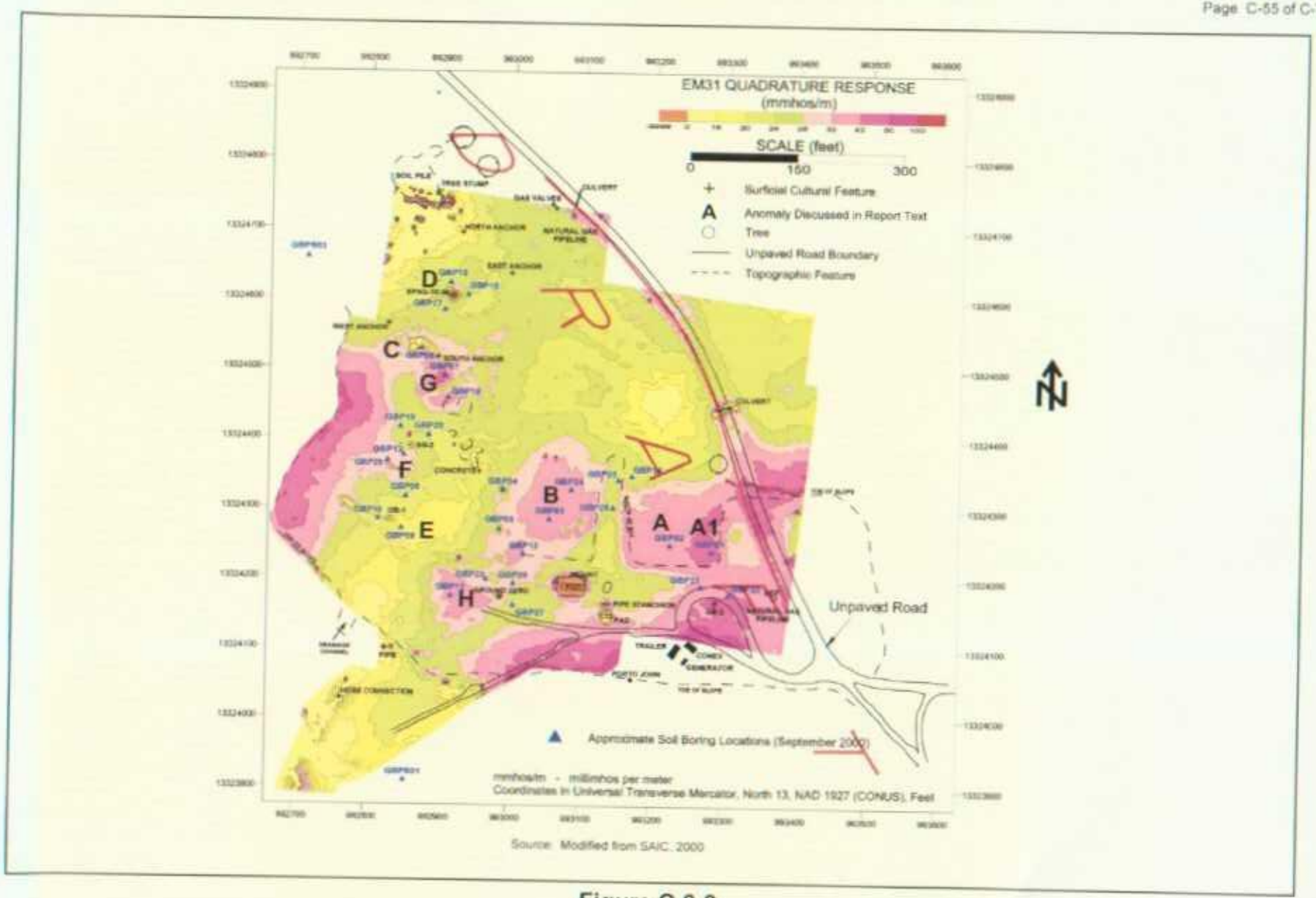


Figure C.6-3
Direct-Push Borehole Locations at Surface Ground Zero

Table C.6-1
Known and Suspect Site Features
(Page 1 of 5)

Unique Identifier	How Feature was Identified*	Summary of Geophysical Results	Summary of Borehole Observations	Summary of Analytical Results*	Discussion
Well EPNG 10-36 Sump	Historical photos (Figure 2-2) Geophysics - Anomaly C (Figure C.6-1 and Figure C.6-2)	EM31 data indicated an anomaly in area where sump is expected. EM61 data indicate buried metal in area.	One borehole (GBP06) drilled in approximate center of GP anomaly. No mud was evident in boring.	Diesel detected at levels < 100 mg/kg.	Further investigation planned to define nature and extent of potential contamination.
Well GB-1 Mud Pit	Historical plans (Figure 2-3) Geophysics - Anomaly F (Figure C.6-1)	EM31 data indicated an anomaly where mud pit is expected. Site drawings indicate mud pit should be centered approximately 100 ft NE of center of anomaly.	One borehole (GBP12) drilled where center of mud pit indicated by site drawing. One borehole (GBP29) drilled in center of GP anomaly. Evidence of mud observed in both boreholes within 4 ft bgs.	No COPCs detected above PALs.	Based on the results of the GP survey, it is likely these mud pits overlap or are not significant enough to give a distinct GP profile. For the purposes of further investigation, these mud pits will be characterized together. Further investigation is planned to define extent of this mud pit(s).
Well GB-E Mud Pit B Well GB-E Mud Pit C	Historical photos (Figure 2-4)	Not specifically identified by GP.	No boreholes specifically drilled for this feature.	No samples collected.	
Well GB-2 Mud Pit	Historical plans (Figure 2-3) Geophysics - Anomaly A (Figure C.6-1) Current site features (berms)	EM31 data indicate anomaly where mud pit expected.	One borehole (GBP02) drilled in approximate center of GP anomaly. Second borehole (GBP01) also intersected mud pit. Evidence of mud observed in both borings at approximately 9-10 ft bgs. Mud also observed at 6-9 ft in GBP01, believed to be layer associated with Well GB-E Mud Pit D.	Diesel detected at approximately 300 mg/kg in both samples collected within mud layer associated with Well GB-2 Mud Pit.	Further investigation planned to define extent of mud pit.
Well GB-E Mud Pit A	Historical photos (Figure 2-4) Geophysics - Anomaly B (Figure C.6-1) Current site features (berms)	EM31 data indicate an anomaly in the area where mud pit expected.	Two boreholes (GBP03 and GBP24) drilled in anomaly. Evidence of mud observed in both borings less than 6 ft bgs. Third borehole (GBP13) did not intersect mud pit.	Diesel detected at concentrations of 720 and 2,600 mg/kg at 4-6 ft bgs.	Further investigation planned to define extent of mud pit.

Table C.6-1
Known and Suspect Site Features
(Page 2 of 5)

Unique Identifier	How Feature was Identified*	Summary of Geophysical Results	Summary of Borehole Observations	Summary of Analytical Results*	Discussion
Well GB-E Mud Pit D	Historical photo (Figure 2-5) Geophysics - Anomaly A1 (Figure C 6-1) Current features (berms)	EM31 data indicate slight difference in conductivity at location where mud pit expected. This mud pit overlays the location of the Well GB-2 Mud Pit	One borehole (GBP01) drilled in approximate center of anomaly. Evidence of two distinct mud layers observed at approximately 8 ft bgs and 10 ft bgs. The second layer is likely from the Well GB-2 Mud Pit, as discussed above.	Highest incidence of arsenic (7 mg/kg) detected in layer of mud associated with this mud pit. Diesel detected at 2,100 mg/kg	Further investigation planned to define extent of mud pit.
Well GB-E Mud Pit E	Historical photo(Figure 2-6) Geophysics - Anomaly G (Figure C 6-1)	EM31 data indicated an anomaly where mud pit expected	Two boreholes (GBP07 and GBP18) drilled in anomalous area. Evidence of mud layer observed in GBP018 only, at approximately 10 ft bgs.	No COPCs were detected above PALs.	Further investigation planned to define extent of mud pit.
Well GB-3 Mud Pit	No historical references to this mud pit were found during the records search nor did any site observations indicate a mud pit.	Mud pit not detected by GP.	No boreholes specifically drilled for this feature.	No samples were collected.	Based on proximity, it is assumed that either the Well GB-1 Mud Pit or the Well GB-E Mud Pit E, was likely used during the drilling of Well GB-3. This mud pit will not be further investigated.
Landfill A Landfill C Landfill D	Historical diagram (Figure 2-9)	Landfill not detected by GP.	No boreholes specifically drilled for this feature.	No samples were collected.	Further investigation planned to determine nature and extent of potential contamination.
Landfill B	Historical diagram (Figure 2-9)	Landfill not detected by GP.	No boreholes specifically drilled for this feature.	No samples were collected.	Landfill contains only construction debris. No further investigation planned.
Landfill E	Historical photos (Figure 2-5) Geophysics - targets 1 and 2 (Figure C 6-2)	EM31 data indicate two small anomalies where landfill is expected. GP data indicate buried metal in area.	Two boreholes (GBP04 and GBP05) drilled in approximate center of each anomaly to 16 and 20 ft bgs, respectively. No evidence of contamination observed.	No COPCs were detected above PALs.	No further investigation planned.

Table C.6-1
Known and Suspect Site Features
(Page 3 of 5)

Unique Identifier	How Feature was Identified[a]	Summary of Geophysical Results	Summary of Borehole Observations	Summary of Analytical Results[b]	Discussion
Septic Tank A	Historical diagram (Figure 2-8) Historical photo (Figure 2-4) Current site features (tree line)	EM31 data indicated several anomalies in the general area. These were further investigated with EM61 and GPR. GPR indicated a subsurface feature that could represent a septic tank.	An excavation was dug to approximately 2.5 ft bgs in area where tank was indicated. No evidence of septic tank was found. Seven boreholes were drilled to 4 ft bgs and one to 8 ft bgs. No indication of septic tank was evident.	No samples were collected.	Further investigation planned to verify tank has been closed in accordance with NM regulations.
Septic Tank B	Historical diagram (Figure 2-9)	Interpretation of GP data collected by all three methods does not indicate a septic tank.	No boreholes specifically drilled for this feature.		
Well EPNG 10-36 Drill Pad	Current site features (wellhead) Wellhead shows as geophysics - Anomaly D (Figure C.6-2)	No anomalies other than that interpreted as the well were detected.	Two boreholes (GBP15 and GBP16) drilled approximately 20 ft from well to 16 ft bgs. No evidence of contamination observed. Third borehole (GBP17) approximately 25 ft from center of well advanced to 24 ft bgs. Possible evidence of staining observed between 14 to 15 ft bgs. Sample collected at this interval.	No COPCs were detected above PALs.	No further investigation planned.
Well GB-1 Drill Pad	Current site features (abandoned wellhead)	No anomalies other than that interpreted as the well were detected.	Two boreholes (GBP09 and GBP10) drilled approximately 20 ft from well to 16 ft bgs. One borehole (GBP08) located approximately 30 ft from well also advanced to 16 ft bgs. No evidence of contamination observed in any of the three boreholes.	No COPCs were detected above PALs.	No further investigation planned.

Table C.6-1
Known and Suspect Site Features
(Page 4 of 5)

Unique Identifier	How Feature was Identified*	Summary of Geophysical Results	Summary of Borehole Observations	Summary of Analytical Results*	Discussion
Well GB-2 Drill Pad	Current site features (abandoned wellhead)	No anomalies other than that interpreted as the well were detected.	Two boreholes (GBP21 and GBP22) drilled approximately 20-25 ft from well to depth of 16 ft and 22 ft bgs, respectively. Evidence of possible contamination observed in both holes from approximately 0-6 ft bgs. Samples collected in this interval.	No COPCs were detected above PALs.	No further investigation planned.
Well GB-E Drill Pad	Historical photos (Figure 2-4) Geophysics - Anomaly H (Figure C 6-1) Current site features (SGZ marker)	EM31 data indicate an anomaly to the south and west of Well GB-E. This is likely a compacted pad used to stabilize the ground for the drill rig.	One borehole (GBP11) drilled in approximate center of anomaly (approximately 90 ft west of Well GB-E) to 16 ft bgs. Two additional boreholes (GBP26 and GBP27) drilled approximately 20 ft from Well GB-E to 16 ft bgs. No evidence of contamination observed in any of the three holes.	No COPCs were detected above PALs.	No further investigation planned.
Well GB-3 Drill Pad	Current site features (abandoned wellhead)	No anomalies other than that interpreted as the well were detected.	Two boreholes (GBP19 and GBP20) drilled approximately 20 ft from well to 16 ft bgs. No evidence of contamination observed.	No COPCs were detected above PALs.	No further investigation planned.
SGZ Cable Trench	Historical site photos (Figure 2-6) Geophysics- Anomaly E (Figure C 6-2)	EM31 data indicates a linear anomaly trending northwest from Well GB-E. Anomaly is likely remnants of the cable trench visible in historical photographs.	No boreholes were specifically drilled for this feature.	No samples were collected.	No further investigation planned.
Water line	Historical photos (location of water tank) Geophysics (EM61 data not shown) Current site features (surface depression and hose bib visible on surface)	EM31 and EM61 data indicate a linear anomaly trending north from the southwest corner of the site. Based on site drawings and photographs this is likely a historical water line.	No boreholes were specifically drilled for this feature.	No samples were collected.	No further investigation is planned.

Table C.6-1
Known and Suspect Site Features
(Page 5 of 5)

Unique Identifier	How Feature was Identified*	Summary of Geophysical Results	Summary of Borehole Observations	Summary of Analytical Results*	Discussion
Gas flaring system	Historical photos (Figure 2-7) Historical diagram (Figure A.4-2) and documentation Current site features (berm)	NA	One borehole drilled at the historical location of the flarestack (GBP25). Two others were drilled in the vicinity of the flare stack (GBP14 and GBP24). Another borehole was drilled at the location of the gas/water separator (GBP23). Profile sets collected for tritium analysis in these boreholes.	Highest concentration of tritium (7.32 pCi/g) detected in sample collected from borehole just east of flare stack location (GBP14). The VOC (1,2,4-Trimethylbezene) was detected above the PAL at sample collected 5-7 ft bgs in borehole at former flare stack location. Diesel and gasoline were detected above 100 mg/kg in same sample.	VOC contaminants detected are likely from production and flaring of petroleum hydrocarbons. Contamination is assumed to be localized to the specific location of the flare stack. Further investigation is planned to define the extent of the contamination.
Berm that separates Well GB-2 Mud Pit and Well GB-E Mud Pit A	Current site features	NA	One borehole (GBP28) drilled through berm approximately midway along the length. Borehole drilled to total depth of 36 ft bgs. No groundwater was observed.	Diesel and gasoline were detected above 100 mg/kg.	Berm is assumed to be contaminated from Well GB-E Mud Pit A and Well GB-2 Mud Pit and will be further investigated along with these mud pits and the flare stack area investigation.

*Anomalies identified by geophysics are listed by the unique identifiers assigned to them in the report of the results of the geophysical survey (SAIC, 2000)
*COPCs not specifically discussed unless detected above the associated PAL. Arsenic hits above PALs not specifically called out. For the purposes of this table, 100 mg/kg will be assumed to be the PAL for TPH.

NE = Northeast
GP = Geophysics
NM = State of New Mexico

A minimum of one borehole was drilled within each identified mud pit. Samples were generally collected within the mud layer, if identifiable; 4 ft below this layer; and again 10 ft below the mud layer. Samples within the mud layer generally indicated levels of TPH diesel above 100 mg/kg. Gasoline was not detected in samples collected within the mud pits. In all cases, except in borehole GBP01, where two distinct layers of mud are evident, the samples collected below the mud layer did not indicate diesel above 100 mg/kg. Thus, it appears that contamination is not migrating. No other COPCs were identified above PALs in mud pits except arsenic. The values of arsenic detected in samples from mud layers or other intervals are not significantly different from those detected in background samples. The highest concentration of arsenic detected, 7 mg/kg, was from a sample collected in the mud layer associated of Well GB-E Mud Pit D. Samples collected at 2 and 3 ft below this sample had levels of arsenic of 1.7 and 2.1 mg/kg, respectively (below the PAL of 2.7 mg/kg). Further sampling is needed in this mud pit to ensure a representative value for arsenic is obtained. Further sampling is planned to more accurately define the nature and extent of potential contamination in the mud pits.

Landfills

The following sections discuss the results of the investigation with regard to the various types of landfills expected to be encountered.

Landfills A, C, and D (Mud Landfills)

These landfills were not identified by the geophysical survey; therefore, no boreholes were drilled in these features during the preliminary field investigation. Their general location is known through historical documentation and further investigations including sampling and analysis are planned.

Landfill B

The geophysical survey did not identify this landfill. The contents and location of this landfill are known through historical documentation as indicated in Section 2.2.1 of the Work Plan. Since no hazardous constituents are indicated, no further investigation of this feature is planned.

Landfill E

The EM31 and EM61 geophysical surveys indicate several anomalies in the general vicinity of where Landfill E was indicated in historical photos. Additional surveys with GPR identified numerous possible metal targets scattered throughout the suspected area. Boreholes GBP04 and GBP05 were drilled in the center of the two "highest" EM31 anomalies. Visual observation of the soil cores did not indicate any evidence of a landfill. Analytical results did not indicate any COPCs above PALs. It is believed this landfill contains metal and other construction debris. No further investigation of this feature is planned.

C.6.2 Septic Tanks

Geophysics surveys were unable to definitively locate either Septic Tank A (in the southwest portion of the site) or Septic Tank B (near Well GB-E). All three geophysical methods were employed. The EM31and EM61 both indicated several anomalies in the southwest portion of the site that were further investigated with GPR. The results of the GPR investigation indicated one likely target. One borehole was drilled to 8 ft bgs in the center of this target and seven boreholes were drilled to 4 ft bgs within a 3 ft radius of this target. Visual observation of the soil cores did not indicate any evidence of a septic tank.

No likely targets were identified by any of the three geophysical methods in the area where Septic Tank B is indicated by historical documentation. Further investigation of the septic tanks is planned.

C.6.3 Other Anomalies

Several other distinct anomalies which did not represent known features (e.g., wellhead, road, or culvert pipe) were identified by geophysical methods. A linear anomaly extending roughly from Well GB-E approximately 250 ft to the northwest was identified. Based on interpretation of historical photos, this feature is likely a trench used to run cables from Well GB-E during the experiment (see Figure 2-6.). No further investigation of this feature is planned.

A second linear anomaly was identified entering the southwest corner of the site. The anomaly extends approximately 50 ft to the north-northwest, then abruptly turns and extends approximately 250 ft to the northeast. Evidence of this linear anomaly can be seen on the site surface extending an

additional 240 ft, where it ends near the southeast corner of the large concrete pad east of Well GB-E. It is believed that both the geophysical anomaly and the surface depression represent a water line. The water storage tank used during the experiment was located on the hill to the southwest of the site. The path cleared through the trees to construct the water line is still visible. Portions of this water line likely remain in place. No further investigation of this feature is planned.

Numerous small anomalies were identified in the northwest corner of the site near a soil pile. It is possible these anomalies represent small pieces of concrete at or near the surface. The origin of the soil pile is not known. It is not visible in historical photographs taken prior to the original closure (covering) of the Well GB-E mud pits in November-December, 1967 (Figure 2-4). The pile appears to be visible in photographs taken on the day of the detonation (Wofford, 2000b). Further investigation of this soil pile is planned.

C.7.0 Quality Assurance

The results of the QA/QC activities for the Gasbuggy preliminary field investigation sampling events are summarized in the following text. Detailed information regarding the QA program is contained in the NM QAPP (Appendix B).

Quality control results are typically judged in terms of precision, accuracy, representativeness, completeness, and comparability and are described in the following sections.

C.7.1 Precision

Precision is a quantitative measure of the variability of a group of measurements from their average value. Precision is assessed for inorganic analysis by collecting and analyzing duplicate field samples and comparing the results with the original sample. Precision is also assessed by creating, preparing, analyzing, and comparing laboratory duplicates from one or more field samples in inorganic analyses and MS/MSD samples for organic analyses. Precision is reported as RPD, which is calculated as the difference between the measured concentrations of duplicate samples, divided by the average of the two concentrations, and multiplied by 100. Any deviation from these requirements has been documented, explained, and the related data qualified accordingly.

C.7.2 Accuracy

Analytical accuracy is defined as the nearness of a measurement to the true or accepted reference value. It is the composite of the random and systematic components of the measurement system and measures bias in the measurement system. The random component of accuracy is measured and documented through the analyses of spiked samples. Sampling accuracy is assessed by evaluating the results of spiked samples and laboratory control samples. Accuracy measurements are calculated as percent recovery by dividing the measured sample concentration by the true concentration and multiplying the quotient by 100.

Field accuracy is assessed by confirming that the documents of record track the sample from its origin, through transfer of custody, to disposal. The goal of field accuracy is for all samples to be collected from the correct locations at the correct time, placed in a correctly labeled container with the

correct preservative, and sealed with custody tape to prevent tampering. All samples in this sampling event were properly collected and forwarded to the laboratories as described above.

C.7.3 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition (EPA, 1987). Sample representativeness was achieved through the implementation of a sampling program designed to ensure proper sampling locations, number of samples, and the use of validated analytical methods. Representativeness was assessed through analysis of duplicate samples. Representativeness of the samples taken in this sampling event was assured by collecting the specified number of samples and by analyzing them by the approved analytical methods shown in the NM QAPP (Appendix B).

C.7.4 Completeness

Completeness is defined as a percentage of measurements made that are judged to be valid. A sampling and analytical requirement of 80 percent completeness was established and achieved for this project. This criteria was taken from the "EPA Guidance for Quality Assurance Project Plans" (EPA, 1998).

The specified sampling locations were utilized as planned. All samples were collected as planned. All sample containers reached the laboratory intact and properly preserved (when applicable). Sample temperatures were maintained during shipment to the laboratory and sample chain of custody was maintained during sample storage and/or shipment.

C.7.5 Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared to another (EPA, 1987). To ensure comparability, sampling activities were performed and documented in accordance with approved procedures, and all samples were collected in accordance with the NM QAPP (Appendix B). Approved standardized methods and procedures were also used to analyze and report the data (e.g., CLP and/or CLP-like data packages). This approach ensures that

the data from this project can be compared to other data sets. Based on the minimum comparability requirements specified in the NM QAPP (Appendix B), all requirements were met.

Field (i.e., sample handling) documentation, laboratory nonconformance reports, and the precision and accuracy of quality-control sample results were evaluated for their effect on the results of the associated environmental sediment samples. The environmental sample results were then qualified according to processes outlined in the following sections. Documentation of the data qualifications resulting from these reviews is retained in project files as both hard copy and electronic media.

C.7.6 Tier I and Tier II Data Evaluations

All laboratory data from samples collected during the Gasbuggy preliminary field investigation have been evaluated for data quality according to the EPA Functional Guidelines (EPA, 1994b and 1999b). These guidelines are implemented in a tiered process and are presented in the following text. No data rejected during the data evaluation process were used to draw the conclusions. Only valid data, whether estimated (i.e., J-qualified) or not, were used.

The adjustments to data and data qualifiers resulting from the data evaluation process were documented in the project files and were summarized in memoranda for each sample delivery group. These memoranda are maintained in the project files.

C.7.6.1 Tier I Evaluation

Tier I evaluation for both chemical and radiological analysis examines (but is not limited to):

- Sample count/type consistent with chain of custody
- Analysis count/type consistent with chain of custody
- Correct sample matrix
- Significant problems stated in cover letter or case narrative
- Completeness of certificates of analysis
- Completeness of CLP or CLP-like packages
- Completeness of signatures, dates, and times on chain of custody
- Condition-upon-receipt variance form included
- Requested analyses performed on all samples
- Date received/analyzed given for each sample
- Correct concentration units indicated
- Electronic data transfer supplied

- Results reported for field and laboratory QC samples
- Whether or not the deliverable met the overall objectives of the project

C.7.6.2 Tier II Evaluation

Tier II evaluation for both chemical and radiological analysis examines (but is not limited to):

Chemical:

- Sample date, preparation date, and analysis date for each sample
- Holding time criteria met
- QC batch association for each sample
- Cooler temperature upon receipt
- Sample pH for aqueous samples, as required
- Detection limits properly adjusted for dilution, as required
- Blank contamination evaluated and applied to sample results/qualifiers
- MS/MSD percent recoveries (%R) and RPDs evaluated and applied to laboratory results/qualifiers
- Field duplicate RPDs evaluated using professional judgement and applied to laboratory results/qualifiers
- Laboratory duplicate RPDs evaluated and applied to laboratory results/qualifiers
- Surrogate %R evaluated and applied to laboratory results/qualifiers
- Laboratory control sample %R evaluated and applied to laboratory results/qualifiers
- Initial and continuing calibration evaluated and applied to laboratory results/qualifiers
- Internal standard evaluated and applied to laboratory results/qualifiers
- Recalculation of 10 percent of laboratory results from raw data
- Mass spectrometer tuning criteria
- Initial and continuing calibration verification
- Internal standard evaluation
- Organic compound quantification
- Inductively coupled plasma (ICP) interference check sample evaluation
- Graphite furnace atomic absorption quality control
- ICP serial dilution effects

Radioanalytical:

- Blank contamination evaluated and validation data qualifier applied to sample results
- Certificate of Analysis consistent with data package documentation
- Quality control sample results (e.g., duplicates, laboratory control samples, MS/MSD) evaluated and validation data qualifiers applied to sample results
- Sample results, error, and minimum detectable activity evaluated and applied to laboratory result qualifiers
- Detector system calibrated to NIST-traceable sources
- Calibration sources preparation was documented, demonstrating proper preparation and appropriateness for sample matrix, emission energies, and concentrations
- Detector system response to daily, weekly, and monthly background and calibration checks for peak energy, peak centroid, peak full-width half-maximum, and peak efficiency
- Tracers NIST-traceable, appropriate for the analysis performed, and recoveries that met QC requirements
- Documentation of all QC sample preparation complete and properly performed
- Spectra lines, emissions, particle energies, peak areas, and background peak areas support the identified radionuclide and its concentration

C.7.6.3 Tier III Evaluation

Data quality considerations that are included in EPA data review functional guidelines (EPA, 1994b and 1999b) as a Tier III review include the additional evaluations:

Chemical:

- Recalculation of all laboratory results from raw data

Radioanalytical:

- QC sample results (e.g., calibration source concentration, percent recovery, and RPD) verified
- Radionuclides and their concentration appropriate considering their decay schemes, half-lives, and process knowledge and history of the facility and site
- Each identified line in spectra verified against emission libraries and calibration results
- Independent identification of spectra lines, area under the peaks, and quantification of radionuclide concentration in a random number of sample results

Tier III review of at least five percent of the sample analytical data is planned.

C.7.7 Field Quality Control Samples

There were 23 trip blanks, 4 field blanks, 2 equipment rinsate blanks, 3 source blanks, 4 field duplicates, and 4 MS/MSD collected and submitted for off-site laboratory analysis as shown in Table C.4-2. In addition, 19 laboratory duplicates were analyzed. The samples and duplicates were assigned individual sample numbers and sent to the laboratory "blind." The field blanks were taken by placing deionized water into appropriate sample bottles at the sampling location and preserving them according to the requirements specified in the NM QAPP (Appendix B). The equipment rinsate blank was obtained by collecting deionized water, which was poured over the decontaminated sampling equipment, into the appropriate sample bottles, and preserved as applicable. The field duplicates were taken at the same location as the environmental sample and MS/MSD. The trip blanks, which were received preserved and sealed from the laboratory, were placed in each shipping cooler containing samples for VOC analysis. The source blank for the rinsate water was obtained by collecting rinsate source water (Farmington municipal source) directly from the container used to store the water on site, into the appropriate sample bottles and preserved as applicable. The two source blanks for the Lexan™ tubes (liners for the sample collection core barrel) were collected in the same fashion as the equipment rinsate blank. The MS/MSD samples were collected as duplicate volumes of environmental samples. The results of the QC samples are discussed in the following sections.

C.7.7.1 Field Blank Analysis

Review of the field-collected blank analytical data for the Gasbuggy preliminary field investigation indicates that contamination from field methods may have occurred during sample collection. Samples were analyzed for the parameters listed in Table C.4-2. Acetone and chloroform were detected in several equipment rinsate and field blanks at concentrations that exceeded the Contract-Required Detection Limit (CRDL). Acetone was also detected in trip blank sample 25400547 at a concentration that was at the CRDL. An overall review of the data indicated that field and shipping cross-contamination may have occurred. Although concentrations were above the CRDL, the PALs were not exceeded and the results did not have an impact on the investigation.

C.7.7.2 Field Duplicate Analysis

During the sampling event, four field duplicate samples were sent as blind samples to the laboratory to be analyzed for the investigation parameters listed in Table C.4-2. For these samples, the precision of duplicate sample results (i.e., RPDs between the environmental sample results and their corresponding field duplicate sample results) were evaluated to the guidelines set forth in EPA Functional Guidelines (EPA, 1994b and 1999b). The EPA Functional Guidelines state that there are no required review criteria for field duplicate analyses comparability, but allow the data reviewer to exercise professional judgement in qualifying data based upon the results of the field duplicates. The RPD between the environmental samples results and their corresponding field duplicates exceeded the 20 percent criteria for water and the 35 percent for soil (EPA, 1994b).

C.7.7.3 Matrix Spike Analysis

A total of four field samples were selected for use as MS/MSD samples. The percent recoveries of these samples (a measure of accuracy) and the relative percent differences in these sample results (a measure of precision) were compared to EPA Functional Guidelines criteria (EPA, 1994b and 1999b). The results were used to qualify associated environmental sample results accordingly.

The EPA Functional Guidelines for review of organic data state that no data qualification action is taken on the basis of MS/MSD results alone. As allowed by EPA functional guidelines, the data reviewer exercises professional judgement in considering these results in conjunction with the results of laboratory control samples (LCSs) and other QC criteria in applying qualifications to the data.

Generally, if the spike recovery is greater than the upper acceptance limits (>125 percent), nondetections are acceptable for use. If the spike recovery is greater than the upper acceptance limits (>125 percent) or less than the lower acceptance limits (<75 percent), positive results are qualified as estimated (J). If spike recovery is within the range of 30-74 percent, nondetections are qualified as estimated (UJ). If spike recovery is less than 30 percent (grossly low), positive results are not qualified and nondetections were qualified as unusable (R).

C.7.8 Laboratory Quality Control Samples

Analysis of QC method blanks, LCSs, and surrogate spikes for organic analyses (and method blanks, preparation blanks, initial and continuing calibration blanks, and LCSs for metals) were performed for each sample delivery group by Paragon Analytics, Inc. The results of these analyses were used to qualify associated environmental sample results according to EPA Functional Guidelines (EPA, 1994b and 1999b).

The EPA Functional Guidelines (EPA, 1994b and 1999b) state that no qualification action is taken if a compound is found in a sample, but not in the associated blank. The action taken when a compound is detected in both the sample and the associated blank varies depending upon the analyte involved, and is described in the "The 5X/10X Rule."

For most VOCs, SVOCs, TPH (i.e., DRO and GRO), and radionuclides, if an analyte is detected in the sample and is also detected in an associated blank, the result is qualified as undetected (U), if the sample concentration is less than five times (5X) the blank concentration. However, for the common laboratory contaminants (e.g., methylene chloride, acetone, 2-butanone [methyl ethyl ketone], and phthalate esters [especially bis(2-ethylhexyl)phthalate]), the factor is raised to ten times (10X) the blank concentration. The sample result is elevated to the quantitation limit if it is less than the quantitation limit, or remains unaltered if the sample result is greater than or equal to the quantitation limit.

For inorganics (i.e., metals), sample results greater than the instrument detection limit, but less than five times (5X) the amount found in an associated blank, are qualified as undetected (U). There are no metallic common laboratory contaminants, so there is no "10X Rule" for metals, and the sample result is never altered. When applying the 5X criteria to soil sample data or calibration blank data, the raw data results are used to evaluate and qualify the reported results on the Certificate of Analysis. Preparation blanks (PB) are evaluated for each matrix, with every sample delivery group, or with each batch of samples digested, whichever is more frequent. The analyte concentration in the PB should be below the CRDL. If any analyte concentration in the PB is above the CRDL, the lowest concentration of that analyte in the associated samples must be ten times (10X) the PB concentration. Otherwise, all samples associated with the PB with the analyte's concentration less than 10X the PB

concentration, and above the CRDL, should be redigested and reanalyzed. If the concentration of the PB is less than or equal to the CRDL, no corrective action to the associated sample is required.

C.7.8.1 Laboratory Surrogate Spikes

Surrogate spikes (e.g., system monitoring compounds) are added to the environmental samples analyzed by chromatographic techniques for VOCs, SVOCs, TPH (i.e., DRO and GRO). Surrogate compounds are analytes that are not expected to be present in associated environmental samples, but behave the same as similar target compounds chromatographically. Known amounts of each surrogate are added prior to sample preparation and are carried throughout the preparation and analysis procedures. The percent recoveries of these surrogate compounds give some measure of the anticipated recoveries of the target compounds whose chromatographic behavior they mimic.

If any surrogate percent recoveries are out of the acceptable range (which differs for each surrogate in each method), laboratory protocol requires the sample to be reprepared and/or reanalyzed. When the surrogate recoveries are acceptable on the second run, only the second analysis results are reported. When both analyses yield the same unacceptable range, the results of both analyses are reported.

The evaluation of surrogate spike percent recovery results is not straightforward. The functional guidelines suggest several optional approaches, but require the data reviewer to exercise professional judgement in reviewing surrogate data and qualifying associated data as estimated (J or UJ for detections or nondetections, respectively) or unusable (R).

C.7.8.2 Laboratory Duplicate Analysis

The laboratory duplicate samples were compared to the criteria set forth in the EPA Functional Guidelines (EPA, 1994b and 1999b), and the associated sample results were qualified accordingly. Both detections and nondetections have been qualified as estimated (J and UJ, respectively), if the relative percent difference between an environmental sample and its laboratory duplicate fell outside established criteria.

One laboratory duplicate analysis for metals was performed for each sample delivery group and sample matrix that reported metals. The duplicate results were compared to the results of the original sample to give a measure of analytical laboratory precision. If the results from a duplicate analysis

for a particular analyte fall outside the control limits, the EPA Functional Guidelines for Inorganic Data Review (EPA, 1994b) call for all results for that analyte in all associated samples of the same matrix to be qualified as estimated (J).

Laboratory control samples, also known as blank spikes, consist of known quantities of target compounds added to purified sand or deionized, deionized water prepared and analyzed along with the environmental samples in the sample delivery group. The percent recoveries of the compounds in the LCS give a measure of laboratory accuracy. The functional guidelines call for the data reviewer to use professional judgement to qualify associated data according to established criteria.

C.7.9 Field Nonconformances

During the Gasbuggy preliminary field investigation, the DOE contractor QA representatives provided field guidance and oversight to verify that sampling activities were performed in accordance with applicable requirements. Quality assurance representatives did not observe findings, deficiencies, or nonconformances with sampling activities. There were no nonconformances found during data review and validation.

C.7.10 Laboratory Nonconformances

Laboratory nonconformances are generally due to inconsistencies in analytical instrumentation operation, sample preparations, extractions, and fluctuations in internal standard and calibration results. Several nonconformances were documented for this project. These nonconformances have been accounted for in the data qualification process. Documentation of these results is retained in the project files Gasbuggy preliminary field investigation.

C.8.0 Summary

Analysis of data and observations from the surface and shallow subsurface preliminary field investigation conducted at the Gasbuggy Site indicate the following:

- The report on the results of the biological survey concluded that "no affect will occur to any USFW threatened, endangered, proposed candidate, or species of concern as a result of environmental studies taking place at the Gasbuggy Site. No affect will occur to State of New Mexico threatened, endangered, or species of concern or USFS Sensitive Species as a result of environmental studies at the Gasbuggy Site" (TRC, 2000a).

- The cultural resources survey identified one site on the south side of the road through the CP that could potentially impact future investigations. The report on the survey findings concluded that cultural resource monitoring is recommended should any future ground-disturbing work occur south of the road (TRC, 2000b). Although the documented boundaries of the "site" overlap the CP boundaries, no ground-disturbing work is planned within the specified "site" boundaries at the current time.

- Geophysical surveys in the Well GB-D area identified two anomalies that will be further investigated. One is believed to be the mud pit used during drilling of Well GB-D. The second anomaly is believed to be associated with a nearby soil pile, and may be representative of an excavation and fill event. Further investigation at the Well GB-D area will be based on this information.

- Geophysical surveys at the RTP identified one anomaly that will be further investigated. This anomaly is believed to be associated with a nearby soil pile, and may be representative of an excavation and fill event. Further investigation at the RTP will be based on this information.

- Geophysical surveys at the CP identified several anomalies believed to be associated with the septic system located at this site. Further investigation will be conducted to determine if the septic tank was closed (filled) in accordance with State of New Mexico regulations. Geophysical surveys also identified an anomaly near the historic location of the mobile radiological trailer. This anomaly will be further investigated by sampling and analysis.

- Geophysical surveys in the SGZ area identified and defined most of the predicted mud pits. Those not identified by geophysics are believed either to have not existed (e.g., no mud pit was specifically constructed during the drilling of Well GB-3, but instead existing mud pits such as Well GB-E Mud Pit E, were used) or the mud pits were not significant enough to produce an identifiable EM signature. Geophysical data will be used, where applicable, to delineate the lateral extent of the mud pits.

- Samples collected from observed mud layers within several of the mud pits indicated potential diesel contamination. Further sampling and analysis is planned to further refine the nature and extent of contamination in the mud pits.

- Geophysical surveys in the SGZ area did not identify the Landfills (A, C, and D) used to dispose of the drilling fluids generated during the abandonment of site wells in 1978. These landfills were not sampled during the preliminary field investigation. Sampling and analysis to define the nature and extent of potential contamination within these landfills is planned.

- Geophysical surveys in the SGZ area did not identify Landfill B used to dispose of concrete and asphalt pads. No further investigation of this landfill is proposed.

- Geophysical surveys identified two small anomalous areas where Landfill E was predicted. Samples from boreholes in these areas did not detect and COPCs above PALs. No further investigation of this landfill is proposed.

- Geophysical surveys in the SGZ area did not definitively define or eliminate from consideration the septic tanks indicated by historical documentation to be located in this area. Further investigation will be conducted to determine if the septic tanks were closed (filled) in accordance with State of New Mexico regulations.

- Concentrations of TPH were detected above 100 mg/kg in seven samples. Five of these seven samples were collected from a layer of drilling mud identified by visual observation within the mud pits. TPH diesel was detected above 100 mg/kg in all of these samples. Gasoline was not detected above 100 mg/kg in these samples. The remaining two of seven were collected from the berm that separates the Well GB-2 Mud Pit from Well GB-E Mud Pit A. One of these from the northern end of the berm at the historic location of the flare stack. Each of these two samples had detections of TPH, both in the diesel and gasoline range, over 100 mg/kg. In all cases where TPH was detected at levels greater than 100 mg/kg, a sample collected at a lower depth in the same borehole indicated a TPH concentration of less than 100 mg/kg and/or a nondetect. The diesel contamination will be further investigated as part of the investigations of the mud pits. The gasoline contamination will be further investigated as part of the flare stack area investigation.

- The only VOC detected above PALs was 1,2,4-Trimethylbenzene. This contaminant was detected at the 5 to 7 ft bgs interval in a borehole drilled at the historic location of the flare stack. The contamination is believed to be localized to this location. The source of the contamination is not known but believed to be associated with production and flaring of natural petroleum hydrocarbons. Further investigation will be conducted in the flare stack area to determine the nature and extent of this potential contamination.

- No SVOCs were detected at levels which exceeded PALs.

- Arsenic was the only metal detected above PALs. Based on statistical analysis, arsenic levels in background and site characterization samples appear to be not significantly different from each other. Additional site characterization and background samples will be collected.

- Tritium levels, detected in samples collected from locations where the highest levels of tritium were detected in 1978, indicate a range of less than the minimum detectable concentration to 7.32 pCi/g of tritium. Based on the preliminary dose/risk assessment provided in Appendix D, these levels do not pose a risk to human health.

- The COPCs requested to be analyzed for by NM OCD were compared against Region IX PRGs, if applicable. None of these COPCs exceeded its corresponding PRG. Further analysis of the data was not done at this time. This data may be used in the corrective action decision document to support decisions made on the closure of the mud pits.

- Analysis of samples by TCLP did not detect any COPCs which exceeded RCRA regulatory limits (CFR, 1999).

- Rejected data did not impact the characterization. Analytes for which data was rejected were not detected in other samples analyzed.

C.9.0 References

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DRAFT

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UPDATE ON GASBUGGY PRELIMINARY CHARACTERIZATION WORK

Reference: Ltr, Price to Wycoff, dtd 9/11/00

The DOE Nevada Operations Office has completed preliminary site characterization work at our Gasbuggy test site in Rio Arriba County, New Mexico. Our efforts included geophysical surveys, cultural surveys, and soil sampling at various operational areas within this site. We were not able to identify the depth to shallow groundwater since there was no groundwater within our sampling boundaries. There was also no Well EPNG 10-36 work accomplished since we were unable to hire a contractor to purge this well.

Per your request, outlined in your above-referenced letter, our office was able to analyze samples as discussed in paragraph one. Our work efforts and sampling schedule and a weekly field status report were provided to you. Disposal of waste streams generated as part of our efforts was also coordinated through your office. It should be noted that our office also complied with the requirements identified by the Jicarilla Ranger District letter dated August 4, 2000.

Our only outstanding action item is providing you with a field investigation report by December 15, 2000. Since results of our FY 2000 work efforts will be used in the development of our strategy to characterize the Gasbuggy site, our plan is to include this information as an appendix to our corrective action investigation plan (CAIP). Our goal is to submit a draft plan to various state agencies by December 31, 2000. In order to be more efficient, request that your requirement for receiving this information be changed to December 31, 2000, with the understanding that it will be included in the CAIP.

This letter is also being written to inform you that our New Mexico task manager, D. Scotty Afong, has accepted a promotion within our office and will no longer be working on New Mexico issues. Our new task manager is Bill R. Wilborn.

For additional information, please contact Mr. Wilborn, of my staff, at (702) 295-3188.

Runore C. Wycoff, Director
Environmental Restoration Division

ERD:DSA

OCT 25 2000

cc:
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President Jicarilla Apache Tribe, Dulce, NM
J. B. Chapman, DRI, Las Vegas, NV
D. C. Stahl, IT, Las Vegas, NV
M. L. Sanchez, ERD, DOE/NV, Las Vegas, NV

Price, Wayne

From: Afong, Scotty[SMTP:afong@nv.doe.gov]
Sent: Friday, September 08, 2000 1:44 PM
To: 'Ketterman, Lorri'; 'Young, John'; Price, Wayne; 'Catron, Mark'; 'Hooley, Camela'
Cc: Stahl, David(IT); Arnold, Dawn(IT); Sanchez, Monica L.; Boehlecke, Robert F.(IT); Wycoff, Runore C.; 'Chapman,Jenny'
Subject: Week of September 4 Gasbuggy Project Update

The following is subject matter:

Sensitive species surveys were completed at five areas within the site. On September 7, three representatives from New Mexico Oil and Conservation visited the site. Since sections of this site are former oil and gas areas and come under the jurisdiction of this agency, we are required to obtain state approval on ground disturbing activities (i.e. sampling of site). We anticipate receiving OCD approval during the week of September 11. As requested by OCD, we will provide you with a copy of our historical photo. Since the photo is being used in our ongoing fieldwork, we anticipate getting this copy to OCD by early November. In the interim, we are initiating actions to sample several other non-OCD areas this week and will proceed with sampling OCD areas once approval is received.

For additional information, please contact me. FYI.....I will be out of the office for most of the September 11 week and return on September 15. I will be New Mexico (12-14 September) and will be doing an assessment on our contractor's work at Gasbuggy.

Scotty Afong

August 21, 2000

From: Scotty Afong
To: Wayne Price

Subj: Gasbuggy Work Permit

Encl: (1) DOE Ltr Dated Aug 21 2000

1. Enclosed is a faxed copy of our request related to subject matter. Our contractor, IT, will FEDEX the original copy of this enclosure and I expect you should be getting it by COB Wednesday (8/23/00).

2. We appreciate all your assistance on this issue. As you may know from reading our e-mail related to our schedule, we are planning to start soil sampling on September 6, 2000. However, there is some preliminary "prep work" and coordination related to this effort. Given this, it would be very beneficial if we can get your verbal approval (with any conditions) no later than COB August 29, 2000 with follow-up written approval.

3. Once again, thank you for all your assistance and feel free to contact me. For additional information, please contact me at (702) 295-1050.

Scotty Afong

Total 12 pages faxed

Department of Energy
Nevada Field Office
P.O. Box 98518
Las Vegas, NV 89193-8518

AUG 21 2000

Wayne Price
New Mexico Oil Conservation Division
Environmental Bureau
2040 S. Pachaeco
Santa Fe, NM 87505

SCOPE OF WORK FOR FY 2000 GASBUGGY FIELD WORK

The DOE Nevada Operations Office will be conducting preliminary site characterization work at our Gasbuggy test site in Rio Arriba County, New Mexico, during August/September 2000. Although these efforts were not originally planned for this fiscal year, our office will be able to conduct them as a result of significant cost-savings achieved from our other remedial activities.

Enclosed is our scope of work related to actions being performed under the jurisdiction of the New Mexico Oil Conservation Division Environmental Bureau for your review and comment. Since the geophysical survey, described in the enclosure, does not involve any ground disturbance, the survey will help us to identify the mud pit locations. Our plans are to start this work on August 21, 2000. However, no ground disturbing activities will be started until we receive your approval and any conditional requirements are met.

Also enclosed is the additional information you requested relating to potential radiological contamination at the Gasbuggy site.

Your assistance and support on issues related to our upcoming field work is appreciated. For additional information, please contact D. Scotty Afong, of my staff, at (702) 295-1050.

Monica Sanchez
for Runore C. Wycoff, Director
Environmental Restoration Division

ERD:DSA

Enclosures:
As stated

cc w/encls:
J. E. Kieling, NMED, Santa Fe, NM
J. B. Chapman, DRI, Las Vegas, NV
D. C. Stahl, IT, Las Vegas, NV

Scope of Work
Fiscal Year 2000 Gasbuggy Field Work

This scope of work addresses areas of concern (AOCs) that are regulated by the New Mexico Oil Conservation Division (OCD) at the U. S. Department of Energy, (DOE) Gasbuggy site in New Mexico. DOE will be conducting a preliminary field investigation at the Gasbuggy site during August/September 2000. The activities described in this Scope of Work have also been communicated to the United States Forest Service Jicarilla Ranger District, the New Mexico Environment Department, and the Jicarilla Apache Tribe. DOE will provide OCD weekly reports on site activities during the course of this investigation.

Background

Project Gasbuggy was a joint government-industry experiment conducted under the Plowshare program to test the effectiveness of nuclear explosives to fracture low-permeability natural gas reservoirs to stimulate production. Project Gasbuggy consisted of one 29-kiloton nuclear device emplaced in a boring at a depth of 1,292 meters (4,240 feet [ft]) below ground surface (bgs) in the Pictured Cliffs sandstone formation and detonated on December 10, 1967. The Gasbuggy site is located approximately 55 air miles east of Farmington, New Mexico, in Rio Arriba County within the Carson National Forest (see Figure 1). Investigations will be conducted in two operational areas; the surface ground zero (SGZ) area and the Well GB-D area (see Figure 2). At this time, there are no known OCD regulated AOCs at the other Gasbuggy operational areas (i.e., Recording Trailer Park, Control Point, or Helicopter Pad).

Six major natural gas production tests were conducted after reentry drilling was completed in January 1968. Long-term production testing was completed in November 1973 and pressure monitoring activities were completed in late 1976. During production testing, tritium-contaminated water was brought to the surface with the natural gas. The majority of this water was injected into the gas flare to be vaporized into the atmosphere. Some of this water then condensed and was deposited on the site surface, contributing to low levels of tritium contamination in the SGZ vicinity.

Site restoration activities including well plugging and abandonment, decontamination and disposal of equipment, and soil sampling and analysis were conducted in August and September 1978. No soil moisture samples collected during the 1978 restoration exceeded established release criteria for radioactivity; therefore, no soil was remediated. There is a potential for residual chemical and tritium contamination in the soil.

Objective of Investigation

The goal of this preliminary investigation is to collect data that will allow DOE to focus future investigations to specific contaminants of potential concern (COPCs) and AOCs. This field

effort will aid in the planning and refinement of the scope for future field investigations at the Gasbuggy site. This will be accomplished by completing the following objectives:

- Perform geophysical surveys to identify and define subsurface AOCs such as mud pits.
- Collect soil and groundwater samples that will allow investigation-derived waste from this and future investigations to be characterized and refine the list of COPCs for future investigations.
- Determine depth to shallow groundwater and collect shallow groundwater samples, if possible, using the direct-push method.
- Purge and sample El Paso Natural Gas (EPNG) Well 10-36, if feasible, to refine COPCs for future subsurface investigations.

Scope of Investigation

Intrusive activities will be limited to the SGZ area. Depending on time restrictions, results of the investigation, and limits of the direct-push technology, this investigation may or may not include determination of shallow groundwater depth and shallow groundwater sampling. All activities will be done in accordance with approved procedures and the DOE New Mexico Sites Quality Assurance Project Plan.

Geophysical Surveys

Geophysical surveys will be conducted to accomplish the following objectives:

- Locate and delineate the drilling mud pits in the SGZ area.
- Locate and delineate the landfills used to dispose of the drilling fluids generated during well abandonment in the SGZ area.
- Locate and delineate the drilling mud pit in the Well GB-D area.

The results of the geophysical investigation will be used to more accurately define the boundaries of each suspect area and determine areas to be sampled. Historical and geophysical data will be compared to make a determination as to what the geophysical anomaly represents.

Soil Sampling

Soil sampling will be conducted for the purpose of site characterization, quality control, and waste characterization. The primary objective of the soil sampling effort is to define the nature of potential contamination. Defining the vertical extent of contamination will be a secondary objective. In most instances, only a single boring will be advanced within each subsurface feature to be characterized (e.g., mud pit).

Boring locations will be established when the results from the geophysical investigation are available. The Site Supervisor, in conjunction with the Site Geologist, will choose the boring and sampling locations based on historical site records, field observations, and the results of the geophysical surveys. The total number of borings and samples will depend on field conditions. Upon completion of sampling activities, all boreholes will be grouted to the surface in accordance with applicable New Mexico regulations.

Mud Pits

During the 1978 site restoration, the mud pits were covered over and graded to the approximate contours of the site prior to disturbance. The base of the mud pits are estimated to be no more than 15 ft bgs. Based on the historical documentation available, it is possible that several of the mud pits overlap or are on top of one another. The results of the geophysical survey, together with the historical documentation, will be used to determine the locations of each of the subsurface features in the survey area. A single boring will be advanced in the approximate center of each of the mud pits. At a minimum, one sample will be collected from each distinct layer of mud. Additional samples may be collected from thick layers in order to determine if COPCs are concentrated in the top or bottom of layers. Samples will also be collected below the base of each mud pit to approximately 10 ft below the mud/native soil interface or until refusal is met.

Mud Landfills

Based on documentation, there are three landfills which were used exclusively for disposal of previously containerized drilling fluids used during various milling and plugging operations during the 1978 restoration effort. According to documentation, trenches were excavated and used to dispose of a mixture of water, mud, and paraffin. These landfills will be located based on documented knowledge and the results of the geophysical surveys. The landfills will be sampled in the same manner as the mud pits.

Drilling Pads

The exact locations of drill pads, shaker tables, and mud tanks used during drilling of wells in the SGZ area are not known. Therefore, in order to further refine the location of possible contamination resulting from drilling operations, three boreholes will be advanced within approximately a 20 ft diameter of each well. The exact location of these borings will be determined in the field based on field conditions and the judgment of the Site Supervisor and Site Geologist.

Sampling Methods

The direct-push method penetrates the soil with minimal disturbance using an advancing decontaminated 4 ft core barrel. Acetate, cellulose, or polyvinyl chloride liner sleeves will be used to contain the cores. In the event that an additional volume of soil is required to complete the sample, additional cores will be obtained at a radius of not greater than 1 ft from the original boring.

The contents of the liner sleeve will be documented by the Site Geologist. Soil samples will be analyzed for the following parameters:

- Total Volatile Organic Compounds (VOCs)
- Total Semi-Volatile Organic Compounds (SVOCs)
- Total *Resource Conservation and Recovery Act* (RCRA) Metals
- Total Petroleum Hydrocarbons

In addition, some of the samples will be analyzed for the following parameters for waste characterization purposes:

- TCLP VOCs
- TCLP SVOCs
- TCLP Metals
- Tritium

Shallow Groundwater

The depth to shallow groundwater at the Gasbuggy site is not known. The objective of identifying the depth to shallow groundwater and collecting samples is to provide information to refine the scope of further investigations. As time permits, and based on site conditions, an attempt will be made to identify the depth to shallow groundwater at the SGZ. The exact locations of these attempts will be determined based on conditions encountered in the field and the judgment of the Site Geologist. Using direct-push, a continuous core sample will be collected to either the maximum depth of the technology or until shallow groundwater is encountered, whichever comes first. If sufficient water enters the boring, a sample will be collected. Shallow groundwater samples will be analyzed for the following parameters:

- Total VOCs
- Total SVOCs
- Total RCRA metals
- Tritium

Well EPNG 10-36 Purging and Sampling

As part of the ongoing investigation of the subsurface at the Gasbuggy site, water samples may be obtained from Well EPNG 10-36. This well was originally completed by EPNG in 1956 and served as a natural gas producing well until 1967. In 1967, in preparation for the Gasbuggy test, the well was stemmed. Efforts to recomplete the well in 1968 to reach the natural gas producing formation were not successful, and the well was converted to a groundwater monitoring well. Samples collected annually by the U.S. Environmental Protection Agency (EPA) have indicated levels of tritium between 100 and 560 picocuries per liter (pCi/L) in the well since 1984. Samples collected in June of 1999 indicated a tritium concentration in the well water of 93 +/- 4.6 pCi/L.

Well EPNG 10-36 historically has very low recharge, therefore, only one well casing will be purged. Upon purging, a groundwater sample will be collected from the well if, based on field observation, it is believed the water in the casing is representative of the Ojo Alamo aquifer. In any case, a sample will be collected from the purged water for waste characterization purposes. Both samples will be analyzed for the following parameters:

- Total VOCs
- Total SVOCs
- Total RCRA Metals
- Total Petroleum Hydrocarbon
- Total Dissolved Solids
- Tritium
- Gamma Spectroscopy
- Gross Alpha/Beta

Waste Management and Disposal

The DOE intends to manage and dispose of the wastes associated with the investigation of the AOCs described above (e.g., mud pits, mud landfills, drill pads, and Well EPNG 10-36), under New Mexico OCD regulation as RCRA-exempt exploration and production waste. It is DOE's interpretation that these wastes qualify for the oil and natural gas industry-specific exclusion found at 40 CFR 261.4(b)(5). This regulatory citation excludes "drilling fluids, produced waters, and other wastes associated with the exploration, development, or production of crude oil, natural gas, or geothermal energy" from the definition of hazardous waste. EPA further defined these excluded wastes in their "Regulatory Determination for Oil and Gas and Geothermal Exploration, Development and Production Wastes," published in 1988 (53 FR 25447). The Determination lists several wastes that are included in the exemption, such as drill cuttings, well completion, treatment, and stimulation fluids, and pit sludges and contaminated bottoms from storage or disposal of exempt wastes. DOE contends that the waste that resulted from the drilling of the emplacement well and other test-related wells and the wells themselves are "uniquely associated with exploration, development, and production of crude oil and natural gas" and, therefore, meet the criteria for exclusion from hazardous waste regulation. Wastes generated during investigation activities at locations not directly associated with the Gasbuggy test, such as septic waste systems, will not be managed under this exclusion. These wastes, such as personal protective equipment/gear, disposable sampling equipment and decontamination rinsate, will be characterized, managed, and disposed of in accordance with applicable New Mexico Environment Department regulations.

Soil sampling activities will result in the generation of a soil waste stream that will require off-site disposal. It is estimated that the volume of soil that will be generated in sampling activities will fill a total of five to eight, 55-gallon drums. This material will be managed temporarily on site in Department of Transportation (DOT) certified steel drums or DOT-certified plastic buckets (for smaller volumes of waste). Drums and buckets will be labeled as non-regulated/non-hazardous waste and marked with a unique tracking number. An inventory of drums/buckets and their contents will be tracked through use of a Waste Management Logbook.

Waste containers will be stored on site in a locked transportainer (e.g., SeaLand container or Conex box) prior to off-site disposal.

The DOE has tentatively identified the following landfarm facilities for the disposal of the soil waste: (1) Tierra Environmental Company, Inc., Farmington, New Mexico, and (2) Envirotech, Inc., Farmington, New Mexico. Waste characterization analytical data will be forwarded to the OCD for their review prior to final selection of a disposal facility. Once a facility is selected, the DOE will have the waste transported for disposal.

Sampling of Well EPNG 10-36 will necessitate the purging of approximately 3,000 gallons of groundwater that will require off-site disposal. This water will be contained in an above-ground storage tank (e.g., frac tank) and managed under New Mexico Oil Conservation Division regulation as RCRA-exempt exploration and production waste. A sample of the purge water will be collected and analyzed as described above.

The DOE has tentatively identified the following underground injection facilities for the disposal of the purged groundwater: (1) Key Energy, Farmington, New Mexico, and (2) Basin Disposal, Inc., Aztec, New Mexico. Waste characterization analytical data will be forwarded to the OCD for their review prior to final selection of a disposal facility. Once a facility is selected, the DOE will have the waste transported for disposal.

Questions and Answers on Radiological Contamination at Gasbuggy for the New Mexico Oil Conservation Division (08/16/00)

1. How did the surface and subsurface at the Gasbuggy site get contaminated with radioactive material? What are the radiochemicals of concern?

First, what do we mean by surface and subsurface. The surface includes topsoil and shallow subsurface soils (approximately <20 feet). The subsurface includes the detonation cavity (approximately 4,238 feet below the ground surface) and chimney, and potential contaminant migration in the Ojo Alamo aquifer and the Pictured Cliffs natural gas bearing formation.

Surface

Radiological contamination in the surface at the Gasbuggy site is associated with gas production operations. Post-detonation operations in the main drilling area included gas production from the chimney. The chimney is the broken rock directly above the nuclear cavity formed by the force of the explosion. There is typically not a direct connection between the cavity and the ground surface. However, some radioactive gases including tritium can be found in the chimney. Other radionuclides are captured in the melt glass formed by the detonation. Radioactive gases including tritium (a radioactive form of hydrogen) were brought to the surface along with water as a by-product of the natural gas production after the detonation. The radioactive gases other than tritium would have quickly dissipated and decayed due to their gaseous form and a very short half-life.

During gas production, the tritium contaminated water was injected into the gas flare. Some tritium condensed out of its gaseous form and was deposited on the ground surface. Thus, the gas flaring operation is known to have impacted the surface soil in the surface ground zero area with low-levels of tritium moisture (AEC, 1971). Based on extensive monitoring and sampling during the detonation, and subsequent drilling operations, no other radiological contaminants are suspected at the site surface.

Surface and near surface soil sampling were performed at 165 locations in 1978, during the environmental restoration phase of Project Gasbuggy. Sets of subsurface soil samples were collected at 32 locations at depths down to eight feet below the ground surface. Forty-six additional operational soil samples were collected during the decontamination and environmental restoration phase.

All of the soil samples were analyzed for tritium. In addition, eight samples were also analyzed by gamma spectroscopy and for plutonium-239/240, plutonium-238, and strontium-90. Only tritium was detected in any of the soil samples. Therefore, tritium is the only radionuclide contaminant of potential concern in the surface soil at the Gasbuggy site.

Subsurface

Radiological contamination in the subsurface at the Gasbuggy site is associated with the underground nuclear test cavity in the deep subsurface. The radioactive contamination from the detonation is believed to be sealed within this underground cavity. The cavity was not drilled into. Low levels of tritium (which would have escaped the cavity as gas) have been detected in the groundwater monitoring well at the site, Well EPNG 10-36. Previous investigations have failed to conclude the source or pathway of this tritium.

2. What are the radiological risks from tritium?

Tritium is a pure beta particle emitter and emits no gamma ray radiation. Beta particles emitted from tritium outside of the body do not have sufficient energy to reach cells of skins and, therefore, would not cause any radiological risk.

Beta particles emitted by tritium can damage humans when tritium is taken into the body. The U.S. Environmental Protection Agency (EPA) has promulgated in their Safe Drinking Water regulations a maximum contaminant level for tritium of 20,000 pico curies per liter (pCi/L) (EPA, 1976). The dose from drinking water with a tritium concentration of 20,00 pCi/L is <1 millirem a year. Whereas the dose from natural background radiation is approximately 80 millirem a year. None of the well samples collected from Well EPNG 10-36 have exceeded this level. Therefore, the low levels of tritium in the soil moisture and groundwater would not cause any radiological risk.

3. What are the levels of tritium in groundwater?

Subsequent to the Gasbuggy test, Well EPNG 10-36 was converted to a groundwater monitoring well. It is now sampled annually by the EPA as part of the long-term hydrological monitoring program. Tritium was initially detected above background in Well EPNG 10-36 in 1984. This well is the closest sampling well to the Project Gasbuggy site ground zero and is located approximately 430 feet northwest. Annual groundwater samples taken from Well EPGN 10-36 from 1995 through 1999 have had tritium concentrations ranging from 130 pCi/L to 92 pCi/L, respectively. This is less than 0.5 percent of the EPA Safe Drinking Water Standard (EPA, 1976). The radiological risk from drinking this groundwater is not significantly different from zero (Adams, 2000).

4. What are the levels of tritium in soil?

Surface soil samples (zero to one foot depth) collected during the 1978 restoration had tritium concentrations in the soil moisture that ranged from less than the minimum detectable concentration to a maximum of 154 pCi/mL. Samples taken from the subsurface (>1 foot depth) had tritium concentration in the soil moisture that ranged from less than minimum detectable concentration (<2 pCi/mL) to a maximum of 1,303 pCi/mL. The depth at which the maximum tritium concentration was observed was 4 feet below the ground surface (USDOE, 1983). Tritium which has a half-life of approximately 12.7 years would have decayed to less than 500 pCi/mL by now, not accounting for diffusion and evaporation.

5. Have the concentrations for radioactive material in groundwater at Gasbuggy site exceeded any of the human health standards in 20NMAC6.2 Subpart III paragraph 3103 - Standards for Groundwater?

No. The only standard for radioactive material in 20NMAC6.2 is 30 pCi/L for Combined Radium-226 & 228 (New Mexico Water Quality Control Commission Regulations, 20NMAC). Historical records indicate that no radionuclides, other than tritium, were measured in groundwater above minimum detectable concentrations.

References

New Mexico Water Quality Control Commission Regulations, 1995. 20NMAC 6.2, Title 20 Environmental Protection, Chapter 6 Water Quality, Part 2 Ground and Surface Water Protection. Santa Fe, NM.

U.S. Environmental Protection Agency. 1999. *Annual Water Sampling and Analysis Calendar Year 1999*, EPA-402-R-99-012. Washington, DC.

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U.S. Department of Energy, Nevada Operations Office. 1983. *Project Gasbuggy Site Restoration Final Report*, PNE-G-90, NVO-211. Las Vegas, NV.

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AUG 1 1 2000

John E. Kieling
Hazardous and Radioactive Materials Bureau
New Mexico Environment Department
2044-A Galisteo
Santa Fe, NM 87502

RESOURCE CONSERVATION AND RECOVERY ACT (RCRA) EXCLUSION FOR GASBUGGY MUDPIT MATERIAL COLLECTED DURING SEPTEMBER 2000 FIELD WORK

This letter is being written to follow-up on a August 3, 2000, meeting attended by representatives from your staff, my staff, and the New Mexico Oil Conservation Division Environmental Bureau. In this meeting, other attendees were advised that the DOE Nevada Operations Office would be conducting preliminary site characterization work at our Gasbuggy test site in Rio Arriba County, New Mexico, during August/September 2000. Request your concurrence that mudpit soil material can be managed in accordance with your oil and gas regulations and not as a hazardous waste.

The Gasbuggy test was conducted as a joint venture with the natural gas industry for the purpose of natural gas exploration and production. Our interpretation is that Gasbuggy waste generated from drill cuttings and mudpits qualify for the oil and natural gas industry-specific exclusion found in 40 CFR 261.4(b)(5). This regulatory citation excludes "drilling fluids, produced waters, and other wastes associated with the exploration, development, or production of crude oil, natural gas, or geothermal energy" from the definition of hazardous waste.

The U.S. Environmental Protection Agency further defined excluded wastes in their "Regulatory Determination for Oil and Gas and Geothermal Exploration, Development and Production Wastes" published in 1988 (53 FR 25447). In this publication, drill cuttings, well completion, treatment, and stimulation fluids, and pit sludges and contaminated bottoms from storage or disposal are identified as specific wastes which are exempted from RCRA regulation. The Gasbuggy mudpit sites resulted from the drilling of emplacement and other test-related wells and are "uniquely associated with exploration, development, and production of crude oil and natural gas." The mudpit material meets the RCRA exclusion criteria and, therefore, is excluded from RCRA requirements.

Our plan is to manage mudpit waste as non-hazardous and to dispose of it according to applicable oil and gas regulations. Other wastes (i.e., personal protective equipment/gear, disposable sampling equipment, and decontamination rinsate) are not covered by the RCRA exclusion. These wastes will be characterized and disposed in accordance with applicable hazardous waste regulations.

Your assistance and support on issues related to our upcoming fieldwork is appreciated. For additional information, please contact D. Scotty Afong, of my staff, at (702) 295-1050.

Monica Sanchez

Runore C. Wycoff, Director
for Environmental Restoration Division

ERD:DSA

cc:
Wayne Price, NMOCD, Santa Fe, NM
J. B. Chapman, DRI, Las Vegas, NV
D. C. Stahl, IT, Las Vegas, NV

505-827-8177

Mr. John Kieling
Hazardous and Radioactive Materials Bureau
New Mexico Environment Department
2044-A Galisteo
Santa Fe, New Mexico 87502

Wayne Price
(505) (702)
295-1052

Attn: Scotty Afong

SUBJ: RCRA EXCLUSION FOR GASBUGGY MUDPIT MATERIAL COLLECTED DURING SEPTEMBER 00 FIELD WORK

Dear Mr. Kieling,

This letter is being written to follow-up on a August 3, 2000 meeting attended by representatives from your staff, my staff, and the New Mexico Environmental Bureau Oil and Conservation Division. In this meeting, other attendees were advised that DOE/NV would be conducting preliminary site characterization work at our Gasbuggy test site in Rio Arriba County, New Mexico during August/September 2000. For these operations, request approval to manage mudpit soil material in accordance with your oil and gas regulations and not as a hazardous waste.

The Gasbuggy test was conducted as a joint venture with the natural gas industry for the purpose of natural gas exploration and production. Our interpretation is that Gasbuggy waste generated from drill cuttings and mudpits qualify for the oil and natural gas industry-specific exclusion found in 40 CFR 261.4(b)(5). This regulatory citation excludes "drilling fluids, produced waters, and other wastes associated with the exploration, development, or production of crude oil, natural gas, or geothermal energy" from the definition of hazardous waste.

EPA further defined excluded wastes in their "Regulatory Determination for Oil and Gas and Geothermal Exploration, Development and Production Wastes" published in 1988 (53 FR 25447). In this publication, drill cuttings, well completion, treatment, and stimulation fluids, and pit sludges and contaminated bottoms from storage or disposal are identified as specific wastes which are exempted from Resource Conservation Recovery Act (RCRA). The Gasbuggy mudpit sites resulted from the drilling of emplacement and other-tested related wells and are "uniquely associated with exploration, development, and production of crude oil and natural gas". The mudpit material meets the RCRA exclusion criteria and, therefore, is excluded from RCRA requirements.

Our plan is to manage mudpit waste as non-hazardous and to dispose of it according to applicable oil and gas regulations. Other wastes (i.e. personal protective equipment/gear, disposable sampling equipment and decontamination rinsate) are not covered by the RCRA exclusion. These wastes will be characterized and disposed in accordance with applicable hazardous waste regulations.

Your assistance and support on issues related to our upcoming fieldwork is appreciated. For additional information, please contact D. Scotty Afong, of my staff at (702) 295-150.

Mr. John Kieling
Hazardous and Radioactive Materials Bureau
New Mexico Environment Department
Santa Fe, New Mexico

DRAFT

Dear Mr. Kieling:

The U.S. Department of Energy (DOE) is scheduled to conduct a site investigation this summer at the Gasbuggy test site in Rio Arriba County, New Mexico. The DOE is operating under the premise that site characterization work, future remediation work, and eventual site closure, will be completed under the New Mexico Oil Conservation Division (OCD) regulations for natural gas exploration and production. This is based on the fact that the Gasbuggy test was conducted as a joint venture with the natural gas industry for the purpose of natural gas exploration and production.

It is DOE's interpretation that waste associated with the Gasbuggy operation (i.e., drill cuttings/mudpit material) qualifies for the oil and natural gas industry-specific exclusion found at 40 CFR 261.4(b)(5). This regulatory citation excludes "drilling fluids, produced waters, and other wastes associated with the exploration, development, or production of crude oil, natural gas, or geothermal energy" from the definition of hazardous waste. EPA further defined these excluded wastes in their "Regulatory Determination for Oil and Gas and Geothermal Exploration, Development and Production Wastes" published in 1988 (53 FR 25447). The Determination lists several wastes that are included in the exemption, such as drill cuttings, well completion, treatment, and stimulation fluids, and pit sludges and contaminated bottoms from storage or disposal of exempt wastes. DOE contends that the mudpit material that resulted from the drilling of the emplacement well and other test-related wells is "uniquely associated with exploration, development, and production of crude oil and natural gas" and therefore meets the criteria for exclusion from hazardous waste regulation.

The DOE requests your review and comment on the application of this regulatory exclusion to waste generated at the Gasbuggy site. If you concur with the Department's interpretation, all mudpit material (soil) managed as waste from investigation activities at Gasbuggy would be managed as solid, non-hazardous waste and disposed of accordingly. Other wastes associated with the investigation, such as personal protective equipment/gear, disposable sampling equipment and decontamination rinsate, are not covered under the above-stated exclusion and will be characterized in accordance with 40 CFR 262.11 (Hazardous waste determination).

Should you have any questions on this matter, please do not hesitate to call me at 702-295-0160 or Scotty Afong of my staff, at 702-295-1050. Thank you.

Sincerely,

Rod + Bell
IT
702-295-1050

ERD (R)
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EM (RF)
MGR (RF)

FILE CODE #

ERD
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SCOPE OF WORK FOR FY 2000 GASBUGGY FIELD WORK

The DOE Nevada Operations Office will be conducting preliminary site characterization work at our Gasbuggy test site in Rio Arriba County, New Mexico, during August/September 2000. Although these efforts were originally not planned for this fiscal year, our office will be able to conduct them as a result of significant cost-savings achieved from our other remedial activities.

Enclosed is our scope of work related to actions being performed under the jurisdiction of the New Mexico Oil Conservation Division Environmental Bureau for your review and comment. Since the geophysical survey, described in the enclosure, does not involve any ground disturbance, and it will help us to identify the mud pit locations. Our plans are to start this work on August 21, 2000. However, no ground disturbing activities will be started until we receive your approval and any conditional requirements are met.

Your assistance and support on issues related to our upcoming field work is appreciated. For additional information, please contact D. Scotty Afong, of my staff, at (702) 295-1050.

Runore C. Wycoff, Director

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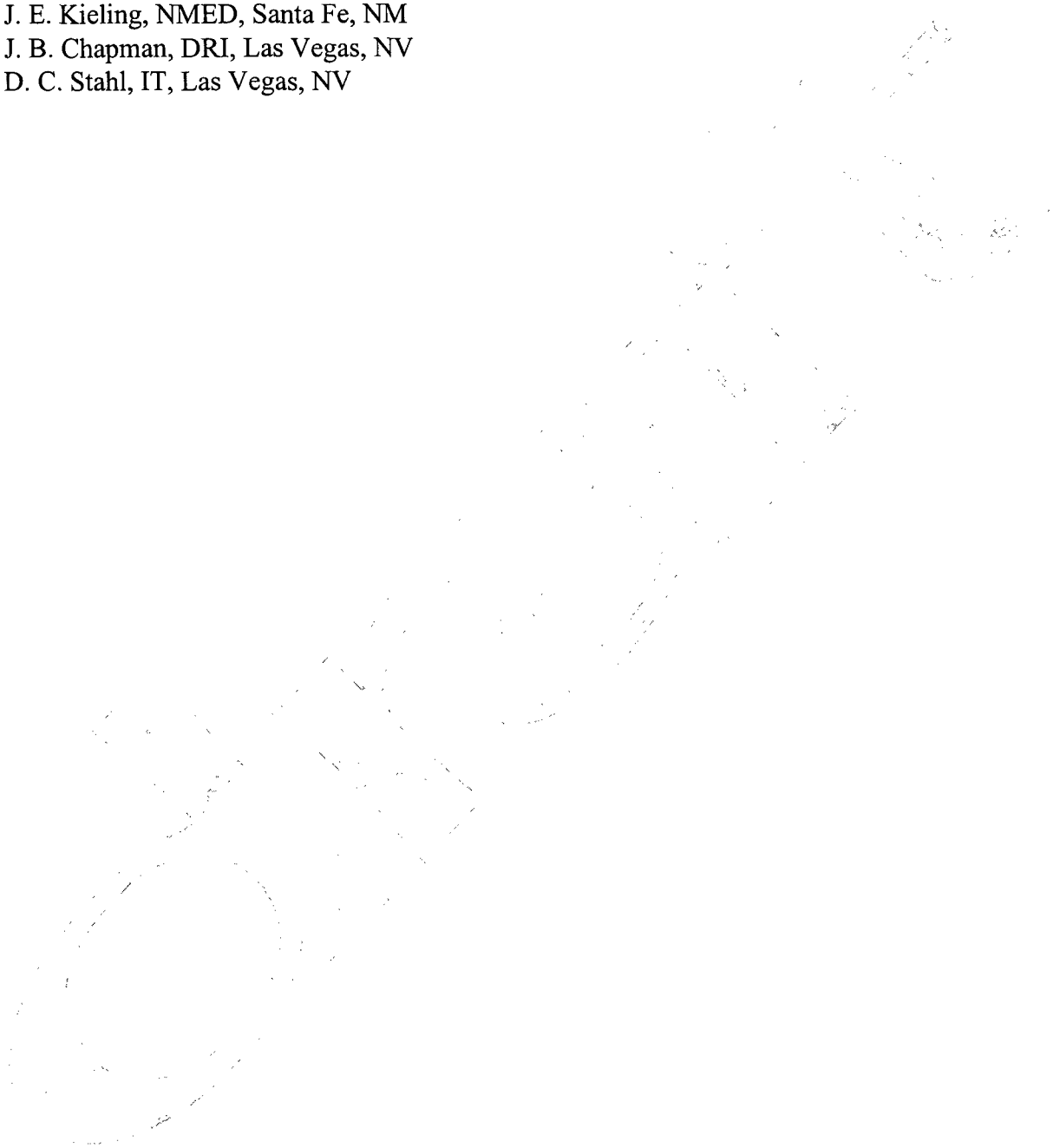
ERD:DSA

Environmental Restoration Division

Enclosure:
As stated

cc w/encl:
J. E. Kieling, NMED, Santa Fe, NM
J. B. Chapman, DRI, Las Vegas, NV
D. C. Stahl, IT, Las Vegas, NV



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Scope of Work
Fiscal Year 2000 Gasbuggy Field Work

This scope of work addresses areas of concern (AOCs) that are regulated by the New Mexico Oil Conservation Division (OCD) at the Department of Energy, (DOE) Gasbuggy Site in New Mexico. DOE will be conducted a preliminary field investigation at the Gasbuggy site during August/September of 2000. The activities described in this Scope of Work have also been communicate to the United States Forest Service Jicarilla Ranger District, the New Mexico Environment Department, and the Jicarilla Apache Tribe. DOE will provide OCD weekly reports on site activities during the course of this investigation.

Background

Project Gasbuggy was a joint government-industry experiment conducted under the Plowshare program to test the effectiveness of nuclear explosives to fracture low-permeability natural gas reservoirs to stimulate production. Project Gasbuggy consisted of one 29-kiloton nuclear device emplaced in a boring at a depth of 1,292 meters (4,240 feet [ft]) below ground surface (bgs) in the Pictured Cliffs sandstone formation and detonated on December 10, 1967. The Gasbuggy Site is located approximately 55 air miles east of Farmington, New Mexico, in Rio Arriba County within the Carson National Forest (see Figure 1). Investigations will be conducted in two operational areas; the surface ground zero (SGZ) area and the Well GB-D area (see Figure 2). At this time there are no known OCD regulated AOCs at the other Gasbuggy operational areas (i.e., Recording Trailer Park, Control Point, or Helicopter Pad).

Six major natural gas production tests were conducted after reentry drilling was completed in January 1968. Long-term production testing was completed in November 1973 and pressure monitoring activities were completed in late 1976. During production testing tritium-contaminated water was brought to the surface with the natural gas. The majority of this water was injected into the gas flare to be vaporized into the atmosphere. Some of this water then condensed and was deposited on the site surface, contributing to low levels of tritium contamination in the SGZ vicinity.

Site restoration activities including well plugging and abandonment, decontamination and disposal of equipment, and soil sampling and analysis were conducted in August and September 1978. No soil moisture samples collected during the 1978 restoration exceeded established release criteria for radioactivity; therefore, no soil was remediated. There is a potential for residual chemical and tritium contamination in the soil.

Objective of Investigation

The goal of this preliminary investigation is to collect data that will allow DOE to focus future investigations to specific contaminants of potential concern (COPCs) and AOCs. This field effort will aid in the planning and refinement of the scope for future field investigations at the Gasbuggy Site. This will be accomplished by completing the following objectives:

- Perform geophysical surveys to identify and define subsurface AOCs such as mud pits.

- Collect soil and groundwater samples that will allow investigation-derived waste (IDW) from this and future investigations to be characterized and refine the list of COPCs for future investigations.
- Determine depth to shallow groundwater and collect shallow groundwater samples if possible using the direct-push method
- Purge and sample El Paso Natural Gas (EPNG) Well 10-36, if feasible, to refine COPCs for future subsurface investigations.

Scope of Investigation
Intrusive activities will be limited to the SGZ area. Depending on time restrictions, results of the investigation, and limits of the direct-push technology, this investigation may or may not include determination of shallow groundwater depth and shallow groundwater sampling. All activities will be done in accordance with approved procedures and the DOE New Mexico Sites Quality Assurance Project Plan.

Geophysical Surveys
Geophysical surveys will be conducted to accomplish the following objectives:

- Locate and delineate the drilling mud pits in the SGZ area.
- Locate and delineate the landfills used to dispose of the drilling fluids generated during well abandonment in the SGZ area.
- Locate and delineate the drilling mud pit in the Well GB-D area.

The results of the geophysical investigation will be used to more accurately define the boundaries of each suspect area and determine areas to be sampled. Historical and geophysical data will be compared to make a determination as to what the geophysical anomaly represents.

Soil Sampling
Soil sampling will be conducted for the purpose of site characterization, quality control, and waste characterization. The primary objective of the soil sampling effort is to define the nature of potential contamination. Defining the vertical extent of contamination will be a secondary objective. In most instances only a single boring will be advanced within each subsurface feature to be characterized (e.g., mud pit).

Boring locations will be established when the results from the geophysical investigation are available. The Site Supervisor in conjunction with the Site Geologist will choose the boring and sampling locations based on historical site records, field observations, and the results of the geophysical surveys. The total number of borings and samples will depend on field conditions. Upon completion of sampling activities all boreholes will be grouted to the surface in accordance with applicable New Mexico regulations.

Mud Pits
During the 1978 site restoration the mud pits were covered over and graded to the approximate contours of the site prior to disturbance. The base of the mud pits are estimated to be no more than 15 ft below ground surface (bgs). Based on the historical documentation available it is

possible that several of the mud pits overlap or are on top of one another. The results of the geophysical survey together with the historical documentation will be used to determine the locations of each of the subsurface features in the survey area. A single boring will be advanced in the approximate center of each of the mud pits. At a minimum, one sample will be collected from each distinct layer of mud. Additional samples may be collected from thick layers in order to determine if COPCs are concentrated in the top or bottom of layers. Samples will also be collected below the base of each mud pit to approximately10 ft below the mud/native soil interface or until refusal is met.

Mud Landfills

Based on documentation there are three landfills which were used exclusively for disposal of previously containerized drilling fluids used during various milling and plugging operations during the 1978 restoration effort. According to documentation, trenches were excavated and used to dispose of a mixture of water, mud, and paraffin. These landfills will be located based on documented knowledge and the results of the geophysical surveys. The landfills will be sampled in the same manner as the mud pits.

Drilling Pads

The exact locations of drill pads, shaker tables, and mud tanks used during drilling of wells in the SGZ area are not known. Therefore, in order to further refine the location of possible contamination resulting from drilling operations, three boreholes will be advanced within approximately a 20-ft diameter of each well. The exact location of these borings will be determined in the field based on field conditions and the judgment of the Site Supervisor and Site Geologist.

Sampling Methods

The direct-push method penetrates the soil with minimal disturbance using an advancing decontaminated 4-ft core barrel. Acetate, cellulose, or polyvinyl chloride (PVC) liner sleeves will be used to contain the cores. In the event that an additional volume of soil is required to complete the sample, additional cores will be obtained at a radius of not greater than 1 ft from the original boring.

The contents of the liner sleeve will be documented by the Site Geologist. Soil samples will be analyzed for the following parameters:

- Total Volatile Organic Compounds (VOCs)
- Total Semi-Volatile Organic Compounds (SVOCs)
- Total *Resource Conservation and Recovery Act* Metals
- Total Petroleum Hydrocarbons

In addition some of the samples will be analyzed for the following parameters for waste characterization purposes:

- TCLP VOCs
- TCLP SVOCs
- TCLP Metals
- Tritium

Shallow Groundwater

The depth to shallow groundwater at the Gasbuggy Site is not known. The objective of identifying the depth to shallow groundwater and collecting samples is to provide information to refine the scope of further investigations. As time permits, and based on site conditions, an attempt will be made to identify the depth to shallow groundwater at the SGZ. The exact locations of these attempts will be determined based on conditions encountered in the field and the judgment of the Site Geologist. Using direct-push, a continuous core sample will be collected to either the maximum depth of the technology or until shallow groundwater is encountered, whichever comes first. If sufficient water enters the boring, a sample will be collected. Shallow groundwater samples will be analyzed for the following parameters:

- Total VOCs
- Total SVOCs
- Total RCRA metals
- Tritium

Well EPNG 10-36 Purging and Sampling

As part of the ongoing investigation of the subsurface at the Gasbuggy Site, water samples may be obtained from Well EPNG 10-36. This well was originally completed by EPNG in 1956 and served as a natural gas producing well until 1967. In 1967, in preparation for the Gasbuggy Test, the well was stemmed. Efforts to recomplete the well in 1968 to reach the natural gas producing formation were not successful and the well was converted to a groundwater monitoring well. Samples collected annually by the U.S. Environmental Protection Agency have indicated levels of tritium between 100 and 560 picocuries per liter (pCi/L) in the well since 1984. Samples collected in June of 1999 indicated a tritium concentration in the well water of 93 +/- 4.6 pCi/L.

Well EPNG 10-36 historically has very low recharge, therefore, only one well casing will be purged. Upon purging a groundwater sample will be collected from the well if based on field observation it is believed the water in the casing is representative of the Ojo Alamo aquifer. In any case a sample will be collected from the purged water for waste characterization purposes. Both samples will be analyzed for the following parameters:

- Total VOCs
- Total SVOCs
- Total RCRA Metals
- TPH
- Total Dissolved Solids
- Tritium
- Gamma Spectroscopy
- Gross Alpha/Beta

Waste Management and Disposal

The DOE intends to manage and dispose of the wastes associated with the investigation of the AOCs described above (e.g., mud pits, mud landfills, drill pads, and Well EPNG 10-36), under New Mexico OCD regulation as RCRA-exempt exploration and production waste. It is DOE's interpretation that these wastes qualify for the oil and natural gas industry-specific exclusion

found at 40 CFR 261.4(b)(5). This regulatory citation excludes "drilling fluids, produced waters, and other wastes associated with the exploration, development, or production of crude oil, natural gas, or geothermal energy" from the definition of hazardous waste. EPA further defined these excluded wastes in their "Regulatory Determination for Oil and Gas and Geothermal Exploration, Development and Production Wastes" published in 1988 (53 FR 25447). The Determination lists several wastes that are included in the exemption, such as drill cuttings, well completion, treatment, and stimulation fluids, and pit sludges and contaminated bottoms from storage or disposal of exempt wastes. DOE contends that the waste that resulted from the drilling of the emplacement well and other test-related wells and the wells themselves are "uniquely associated with exploration, development, and production of crude oil and natural gas" and therefore meet the criteria for exclusion from hazardous waste regulation. Wastes generated during investigation activities at locations not directly associated with the Gasbuggy test, such as septic waste systems, will not be managed under this exclusion. These wastes, such as personal protective equipment/gear, disposable sampling equipment and decontamination rinsate, will be characterized, managed, and disposed of in accordance with applicable New Mexico Environment Department (NMED) regulations.

Soil sampling activities will result in the generation of a soil waste stream that will require off site disposal. It is estimated that the volume of soil that will be generated in sampling activities will fill a total of 5-8, 55-gallon drums. This material will be managed temporarily on site in Department of Transportation (DOT) certified steel drums or DOT-certified plastic buckets (for smaller volumes of waste). Drums and buckets will be labeled as non-regulated/non-hazardous waste and marked with a unique tracking number. An inventory of drums/buckets and their contents will be tracked through use of a Waste Management Logbook. Waste containers will be stored on site in a locked transportainer (e.g., SeaLand container or Conex box) prior to off site disposal.

The DOE has tentatively identified the following landfarm facilities for the disposal of the soil waste: (1) Tierra Environmental Company, Inc., Farmington, New Mexico and (2) Envirotech, Inc., Farmington, New Mexico. Waste characterization analytical data will be forwarded to the OCD for their review prior to final selection of a disposal facility. Once a facility is selected, the DOE will have the waste transported for disposal.

Sampling of Well EPNG 10-36 will necessitate the purging of approximately 3,000 gallons of groundwater that will require off site disposal. This water will be contained in an above-ground storage tank (e.g., frac tank) and managed under New Mexico Oil Conservation Division regulation as RCRA-exempt exploration and production waste. A sample of the purge water will be collected and analyzed as described above.

The DOE has tentatively identified the following underground injection facilities for the disposal of the purged groundwater: (1) Key Energy, Farmington, New Mexico and (2) Basin Disposal, Inc., Aztec, New Mexico. Waste characterization analytical data will be forwarded to the OCD for their review prior to final selection of a disposal facility. Once a facility is selected, the DOE will have the waste transported for disposal.

V MEXICO STATE LAND OFFICE

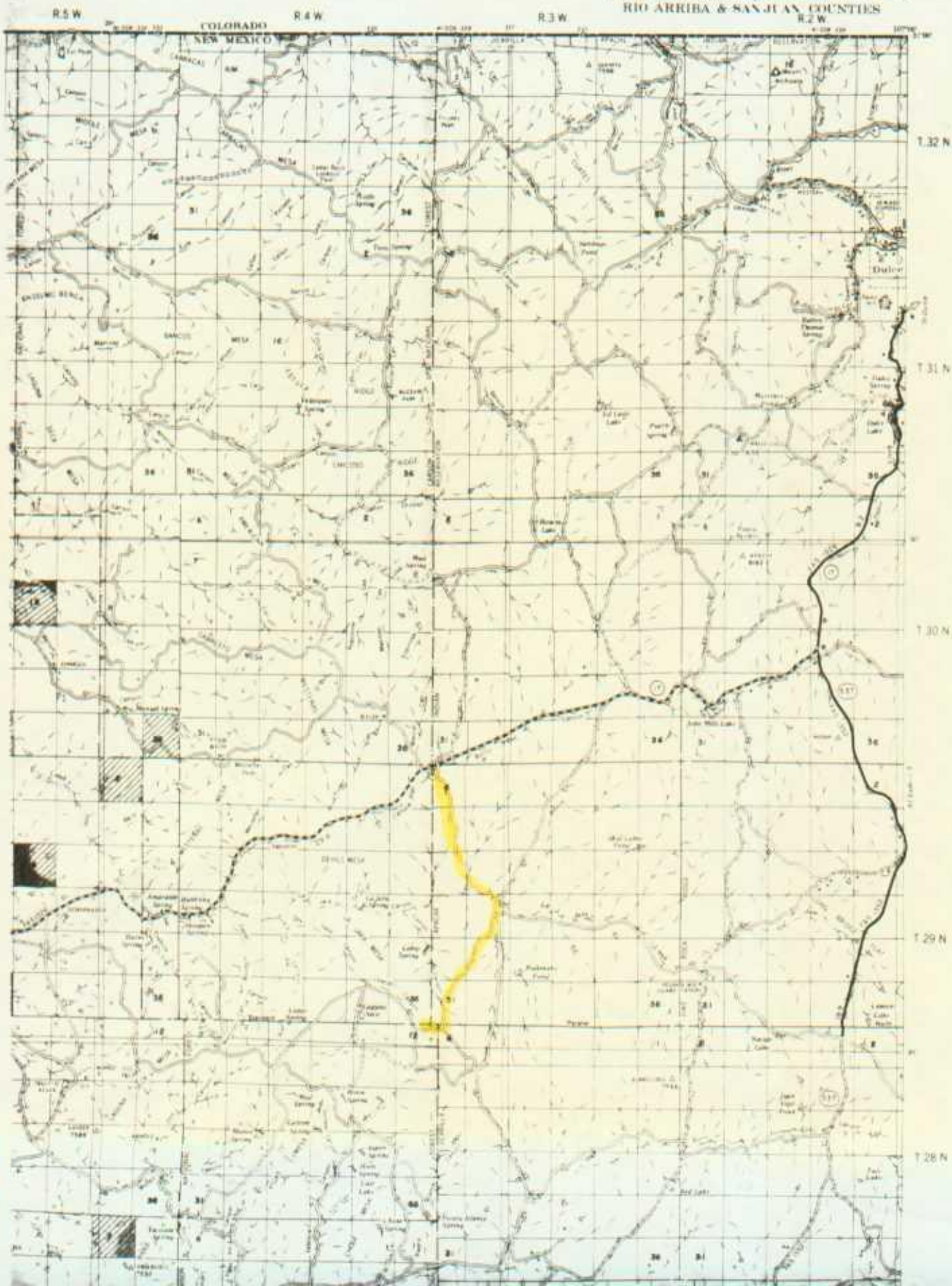
COMMISSIONER OF PUBLIC LANDS

STATE SURFACE AND MINERALS
STATE MINERALS
STATE SURFACE

STATE LAND STATUS MAP

ENT

GOBERNADOR QUADRANGLE – 4
RIO ARRIBA & SAN JUAN COUNTIES



MEMORANDUM

To: Benito Garcia
From: Janice Archuleta
Subject: Trip to Gasbuggy
Date: October 14, 1997

Walter Medina and I traveled to the Gasbuggy Underground Nuclear Test Site on October 8,1997. We were greeted by Stacy Walker of the Forest Service. I informed Mr. Walker why we were there and we had a general discussion of the site. Mr. Walker informed us that there were no endangered species in the area although a pair of golden eagles were nesting in the vicinity. He also indicated that there were some prehistoric sites close to the test area. Mr. Walker said that this area was also favored by grazing cattle and there were plenty of prairie dogs (and holes) present.

Walter and I took hand held survey instruments, a Geiger-Muller (G-M) tube with a thin window and a scintillation counter (Micro-R meter) and walked on the site periphery and then diagonally across the site. Micro-R background readings were 10-12 micro Roentgens (R)/hr and G-M tube background readings were 0.05 - 0.10 milliR/hr. We also surveyed other points of interest, such as the concrete pads. All areas measured approximately background, although the north-western side of the site did read slightly higher (about 17 microR/h) with the scintillation counter. This could be attributed to natural background fluxuations due to the area having more exposed rocks due to run off from the slope nearby. The findings of no obvious contamination correspond to the documentation supplied by Department of Energy (DOE) which had been performed by contractors (however, we did no screening for tritium or alpha particles).

We visually verified the markers at the site indicated in the documents. There was one vertical pipe (about 2 inches in diameter) between Well 10-36 and GB-2 near the road, that had not been present on the site post clean-up maps. One original well, 10-36, was left unfilled and is currently used for water sampling purposes.

One document attached to the site monument said that the monitoring wells in the area were poorly located and that a gas well located 800 feet from the site had tested positive for tritium. This had not been indicated in any of the reports previously supplied by DOE or Environmental Protection Agency.

cc: Walter Medina
Bill Floyd
Stacy Walker

United States Department of Agriculture | Forest Service | Southwestern Region | 517 Gold Avenue SW. Albuquerque, NM 87102-0084

Reply to: 1580/2760 Date: JUN 17 1993

Subject: Withdrawal Review for Public Land Order 4232--6/22/67
Project Gasbuggy

To: Forest Supervisor, Carson National Forest

Enclosed is the withdrawal review rejustification for Project Gasbuggy. We are recommending that the withdrawal for this area as listed in PLO 4232 be continued for a period of 50 years at which time the situation will be evaluated. The recommendation will provide that utilization of National Forest System lands for monitoring purposes will be governed by an Interagency Agreement between the Forest Service and the Department of Energy.

As you know, the terms and conditions for current utilization of the National Forest lands by the Atomic Energy Commission (AEC) and its cooperators is governed by the Memorandum of Understanding dated March 23, 1967 between the Department of Agriculture and AEC. Please prepare a draft Interagency Agreement for utilization of National Forest System lands during the 50 year monitoring phase and submit it for our review and approval. We will forward an executed copy of the withdrawal rejustification and the amended Interagency Agreement to the Bureau of Land Management simultaneously upon approval by the Regional Forester of both documents.

If you have any questions, please feel free to contact Doug Salyer or Marian Aragon of my staff.

RICHARD M. PEDERSON
Director of Lands and Minerals

Enclosure

UNITED STATES DEPARTMENT OF ENERGY
NEVADA OPERATIONS OFFICE

WITHDRAWAL REVIEW

PROJECT GASBUGGY
NEW MEXICO

PLO 4232
(NM 1999)

UNITED STATES DEPARTMENT OF ENERGY
NEVADA OPERATIONS OFFICE

PROJECT GASBUGGY
NEW MEXICO

I. Background Information and Present Situation

By PLO 4232 of June 22, 1967, 640.00 acres of Carson National Forest lands were withdrawn from all forms of appropriation under the public land laws, including the mining laws and the mineral leasing laws and reserved for use of the Department of Energy (DOE) (formerly AEC) for experimental purposes (Project Gasbuggy).

A review of the withdrawal has been made pursuant to the authority contained in Section 204(1) of FLPMA to determine if it should be continued, modified, or revoked.

II. Site Data

Project Gasbuggy is the site of the first United States underground nuclear experiment for the stimulation of low-productivity gas reservoirs. The project consisted of a 29-kiloton nuclear explosion detonated at a depth of 4,227 feet below the surface on December 10, 1967.

Extraction of gas from the area has been found not to be commercially feasible at the present time. Future extraction may transpire with the occurrence of new technology and the principle of supply and demand in future markets.

Experimental activities have been completed. The wells are plugged and site restoration and cleanup activities have been completed to the satisfaction of the Forest Service. Thorough radiological surveys have been conducted over the entire site. Analysis of these surveys indicate no surface contamination. However, radioactive material exists below ground of the emplacement well, and an undeterminable number of fractures exist in the substrata. Hydrologic and certain types of surface monitoring of the site is being continued.

The land is located on the Carson National Forest, Jicarilla Ranger District, Rio Arriba County, New Mexico. Refer to PLO or attached Summary Sheet for legal description Access to the site for sightseeing purposes is via Forest Route 357.

Improvements consist of the following:

1. Improved access road extended onto the site for one mile.

2. Five project wells, plugged and hole marker installed consisting of about 4' of 4" diameter steel pipe protruding above ground level over wells GB-1, GB-2RS, GB-3 and GB-D.

3. A water well, continued in use for DOE hydrologic monitoring.

4. A concrete pad and pipe stanchion.

5. A site identification plat is affixed to the project monument at the emplacement well which publicly posts restrictions on excavation, drilling and removal of subsurface materials from the surface to a vertical depth of 500 feet in the SW1/4.

III. Environmental Assessment

Continuation and modification of the withdrawal is necessary to protect public and employee health and safety. It is essential that patent does not occur on the lands under the authority of the U.S. mining laws as well as disposal under the public lands laws or laws of the Secretary of Agriculture. Leasing must also be prohibited in this very sensitive area as there is an active Forest Service leasing program in the area.

IV. Expected Land use

The Department of Energy will continue to monitor the area to prevent any accidental penetration of subsurface and possible radioactive leakage.

V. Mineral Report

A mineral report for the subject site has been prepared by the USDA Forest Service and is attached.

VI. Justification

The area withdrawn is the minimum size essential to accommodate Project Gasbuggy. A right-of-way reservation or interagency agreement are not suitable alternatives to a withdrawal for this purpose. Any mining activity would pose a threat to public and employee health and safety and to the valuable improvements; therefore, mining and mineral leasing is not compatible with the sensitive and intensive nature of the project. Since no mining disturbance can be permitted, the general public would be misled if the land is opened to mineral location and possible patent under the provision of the surface management regulations (36 CFR 228). Consequently, the land must remain withdrawn from all forms of appropriation under the public land laws and the operation of the mining and mineral leasing laws.

VII. Conclusion/Recommendation

Although the experimental activities in connection with the project have been completed and the project wells plugged, an undeterminable amount of fractures were created by the nuclear explosion and there is permanent radioactive contamination in the substrata and cavity. The withdrawal is necessary in order to monitor the area and prevent any accidental penetration of the subsurface and possible radioactive leakage. Present and future public and employee health and safety, and governmental liability factors are of major concern. Therefore, the land must be kept in withdrawal status.

The withdrawal should be modified and continued for a period of 50 years, at which time the situation will be reevaluated. The land should continue to be withdrawn from all forms of appropriation under the public land laws, the mining laws, and the mineral leasing laws.

The terms and conditions for utilization of the National Forest lands by the DOE (formerly AEC) and its cooperators is governed by the Interagency Agreement between the Department of Agriculture and the DOE (formerly AEC), as may be amended and supplemented.

_____ _____

Forest Supervisor
Carson National Forest

Date

_____ _____

Regional Forester
USDA Forest Service
Southwestern Region

Date

_____ _____

Manager for Administration
U.S. Department of Energy
Nevada Operations Office

Date

SUMMARY SHEET
LEGAL DESCRIPTION

PROJECT GASBUGGY
PLO 4232 (NM 1999)

CONTINUE	REVOKE
T. 29 N., R. 4 W., Section 36 640 Acres	NONE

WITHDRAWAL REVIEW
USDA FOREST SERVICE, REGION-3
MINERALS AREA MANAGEMENT ZONE STAFF
MINERALS REPORT/UPDATE

STATE New Mexico

FOREST Carson National Forest

WITHDRAWAL ORDER AND DATE PLO 4232, NM 1999, 6/22/67

SITE NAME Project Gasbuggy

LOCATION T. 29 N., R. 4 W., Sec. 36: All, NMPM

Check the appropriate box

MINERAL REPORT ACTION

(1) [ ] Original Mineral Report is Adequate (ATTACH ORIGINAL REPORT)
Mineral Report Author
Date

Verification Statement:

"I have reviewed the original mineral report. No new or contrary information regarding mineral interest or mining activity in the area is available and the conclusion reached in the report is still valid."

(2) [ ] Original Mineral Report is not adequate. (ATTACH ORIGINAL REPORT)

Reevaluation Statement

"I have reviewed the original mineral report and am aware of new information regarding mineral interest or mining activity." (See attached information sheet.)

(3) [X] A new Mineral Report is required.

New Minerals Report Statement

"The following information has been researched and analyzed. The conclusion/importance/valuation is my opinion based on the information available."

SIGNATURE:
Donald W. Peters
NM Zone Mining Engineer
Date: 12/17/87

APPROVED:
Roger D. Marion
Regional Minerals Geologist
Date: 12-17-87

3/87

SITE NAME Project Gasbuggy

MINERAL REPORT--SUPPORTING MATERIAL

A. Description of Basic Geology and Mineral Occurrences

The subject site is located in the northeast central portion of the San Juan Basin. The San Juan Basin is a prolific producer of oil and gas. The Navajo mine, located in the northwestern portion of the basin, is a prolific coal producer from the Upper Cretaceous Fruitland Formation. Coal which might be present at the subject site would be too deep for conventional mining techniques.

B. Historic or Recent Mineral Interest, Mining Activity

The subject site was withdrawn in support of project Gasbuggy which was part of the Plowshare Program of the Atomic Energy Commission. Project Gasbuggy is the site of the first United States underground nuclear experiment for the stimulation of low productivity gas reservoirs. On December 10, 1967, a 29-kiloton nuclear explosive was detonated at a depth of 4,227 below the surface. The emplacement hole is plugged first at a depth of 3,740 feet by a steel bridge plug which is capped with a continuous cement plug to the surface. Four monitoring wells were subsequently drilled to evaluate the test. These were plugged and marked with a 4" pipe which protrudes about 4' above the ground.

C. Mining Claims/Mineral Leases --Occurrence, Identification, Maintenance

Mining Claims--None (BLM microfiche, 10/12/87)
Mineral Leases--Oil and gas lease No. SF 079761, issued 11/1/48, includes all of the subject withdrawal (telecom, BLM State Office, 12/16/87) producing leases (NM 18324 and NM 18325) are immediately adjacent to the subject withdrawal.

D. Conclusion/Importance/Valuation

1. Mineral Resource Potential/Commodity

[ ] High
[ ] Moderate
[X] Low - Coal (Fruitland Fm., Upper Cretaceous--too deep)
[X] None - Locatables, Geothermal
[X] Unknown - Petroleum

2. Remarks

In recognition of unknown hazards associated with radiation, this site has been recommended for withdrawal in perpetuity.

E. References

Fassett, J. E., 1977, Ed., Guidebook of San Juan Basin III, Northwestern New Mexico: New Mexico Geol. Society 28th Fld. Conference.

Stone, W. J., et. al., 1983, Hydrogeology and water resources of San Juan Basin, New Mexico: New Mexico Bureau of Mines and Mineral Resources,

5190

2760 - Withdrawals - Carson

PLO 4232 (NM-1999) Withdrawal for Underground Atomic Energy Comm.

PROJECT GASBUGGY

P.9166-9167

4232

[Public Land Order ...]

[New Mexico 1999]

NEW MEXICO

Withdrawal for Underground Atomic Energy Experiment

By virtue of the authority vested in the President and pursuant to Executive Order No. 10355 of May 26, 1952 (17 F.R. 4831), it is ordered as follows:

1. Subject to valid existing rights and the provisions of existing withdrawals, the following described lands, which are under the jurisdiction of the Secretary of Agriculture, are hereby withdrawn from all forms of appropriation under the public land laws, including the mining laws (30 U.S.C., Ch. 2), and the mineral leasing laws, and reserved for use of the Atomic Energy Commission for experimental purposes (Project Gasbuggy):

NEW MEXICO PRINCIPAL MERIDIAN

CARSON NATIONAL FOREST

T. 29 N., R. 4 W.,
Sec. 36.

The area described contains 640 acres in Rio Arriba County.

2. The withdrawal made by this order does not alter the applicability of those public land laws governing the use of the national forest lands under lease, license, or permit, or governing the disposal of their mineral or vegetative resources other than under the mining and mineral leasing laws. However, leases, licenses or permits will be issued only if the Atomic Energy Commission finds that the proposed use of the lands will not interfere with the proper conduct of its experiments.

3. The withdrawal made by this order does not alter the jurisdiction of the Secretary of Agriculture over the national forest lands for purposes other than for Project Gasbuggy. The terms and conditions for utilization of the national forest lands by the Atomic Energy Commission will be governed by the Memorandum of Understanding of March 23, 1967, between the Department of Agriculture and the Atomic Energy Commission, as may be amended and supplemented.

HARRY R. ANDERSON,
Assistant Secretary of the Interior.

JUNE 22, 1967.

[F.R. Doc. 67-7254; Filed, June 27, 1967; 8:45 a.m.]

cc: [illegible] F
1 cc: 2760
1 cy [illegible]
[illegible]
1 cc: [illegible]
Status entered

Entered status 7/12/68
MAL

10
40
400

5 days to haul