

**3R - 390**

---

# **REPORTS**

**DATE:**

**1983**

---

2950  
OFF

C. 2

IT LAS VEGAS LIBRARY

NVO-211

NVO-211  
PNE-G-90

# PROJECT GASBUGGY SITE RESTORATION FINAL REPORT



**JULY 1983**

Prepared by Holmes & Narver Inc.

UNITED STATES  
DEPARTMENT OF ENERGY  
NEVADA OPERATIONS OFFICE

# TABLE OF CONTENTS

	<u>Page</u>
I. INTRODUCTION .....	1
A. Background .....	1
B. Authority .....	1
C. Restoration Objectives .....	3
II. INITIAL SITE STATUS .....	3
A. Lands .....	3
B. Surface Facilities .....	5
C. Subsurface Facilities .....	7
D. Topography .....	8
E. Radiological Conditions .....	8
III. PROJECT PARTICIPANTS .....	9
A. U.S. Department of Energy .....	9
B. Fenix and Scisson .....	10
C. Eberline Instrument Corporation .....	10
D. El Paso Natural Gas Co. ....	10
IV. SITE RESTORATION ACTIVITIES .....	10
A. Mobilization .....	10
B. Decontamination System .....	10
C. Surface Facilities Decontamination .....	11
D. Well Plugging and Abandonment .....	13
E. Facilities Disposition .....	17
F. Solid and Liquid Waste .....	20
G. Land Surface Restoration .....	22
V. FINAL SITE STATUS .....	24
A. Land Surface and Subsurface Rights .....	24
B. Topographical Description .....	24
C. Remaining Facilities .....	24
D. Subsurface Well Configurations .....	24
E. Radiological Conditions .....	27
F. Long-Term Surveillance .....	27

## APPENDICES

A. Primary Citations .....	31
B. Weekly Summary Reports--Surface Work .....	35
C. Daily Reports--Subsurface Work .....	39
D. Permits, Authorizations, Sundry Notices .....	50
E. Available Publications, Project Gasbuggy .....	56
F. DOE Material and Equipment Inventory .....	67
G. Distribution List .....	70

TABLE OF CONTENTS  
(Continued)

	<u>Page</u>
ILLUSTRATIONS	
1. Location Map .....	2
2. Gasbuggy Project Installations .....	4
3. Project Gasbuggy Ground Zero Area--Pre-Cleanup .....	6
4. GB-2RS, Final Status .....	14
5. GB-3, Final Status .....	15
6. GB-1, Final Status .....	16
7. GB-D, Final Status .....	18
8. GB-ER, Final Status .....	19
9. Cattle Grazing in the Reseeded Area .....	23
10. Monument at Surface Ground Zero (GB-ER Well Site) .....	23
11. Current Status of Well 10-36 .....	25
12. Project Gasbuggy Ground Zero (GZ) Area .....	26
13. U.S. Forest Service Sign at Project Gasbuggy .....	28
14. U.S. Environmental Protection Agency Sampling Water at Well 10-36 .....	28
15. Long-Term Water Sampling Network .....	30

## I. INTRODUCTION

### A. Background

Project Gasbuggy was the first joint Government-industry experiment in the United States that utilized a nuclear explosive to stimulate a low productivity natural gas reservoir. The project included the detonation of a 29-kiloton nuclear device on December 10, 1967, at a depth of 4,240 feet in the San Juan basin of northwestern New Mexico, approximately 75 miles east of Farmington (Figure 1). Upon completion of the long-term production testing and pressure monitoring activities in late 1976, it was determined that there was no longer a programmatic need to maintain the Project Gasbuggy site.

The site restoration planning phase began in early 1978 and was completed in July 1978 with the issuance of the operational plan for well plugging and site restoration activities, NVO-195. The field activities were conducted over a six-week period during August and September of 1978. This report summarizes the field activities and describes the final site status, including the disposition of all project facilities and final surface and subsurface configurations.

### B. Authority

Approval from Headquarters, U.S. Department of Energy (DOE), to proceed with the Gasbuggy site restoration project was received in a message dated June 12, 1978, from Hugh D. Guthrie, Acting Director, Division of Oil, Gas and Shale Technology, to R. W. Taft, Assistant Manager for Plans, Engineering and Budgets, DOE, Nevada Operations Office (NV).

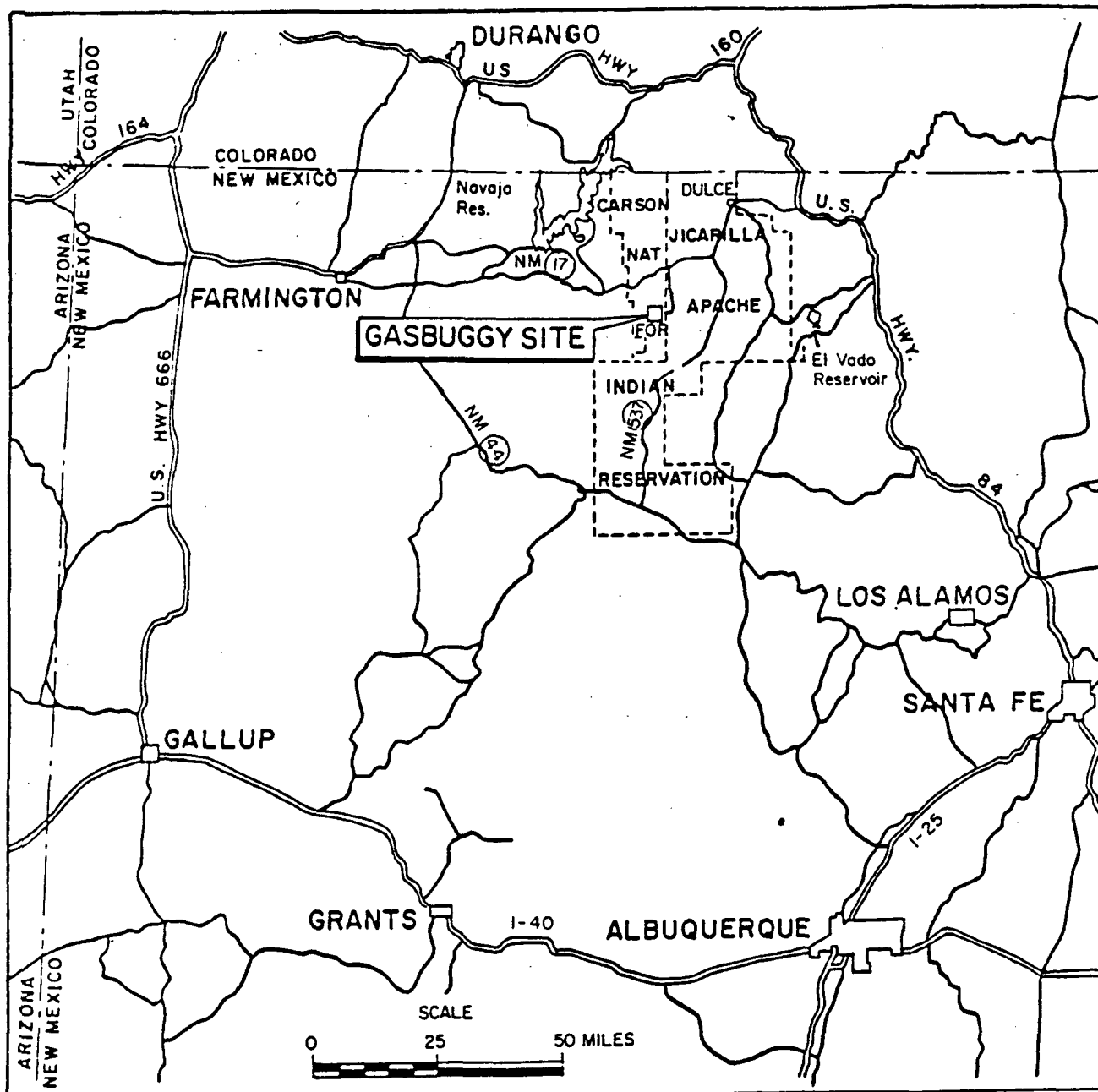


FIGURE 1 LOCATION MAP

The responsibility of DOE to conduct the restoration work is cited in the following applicable documents:

1. Contract AT(04-3)-711, dated January 31, 1967, signed by the AEC (now a part of DOE), Department of the Interior, and the El Paso Natural Gas Co. (EPNG).
2. Memorandum of Understanding, dated March 23, 1967, between the Department of Agriculture's U.S. Forest Service (USFS) and the AEC.

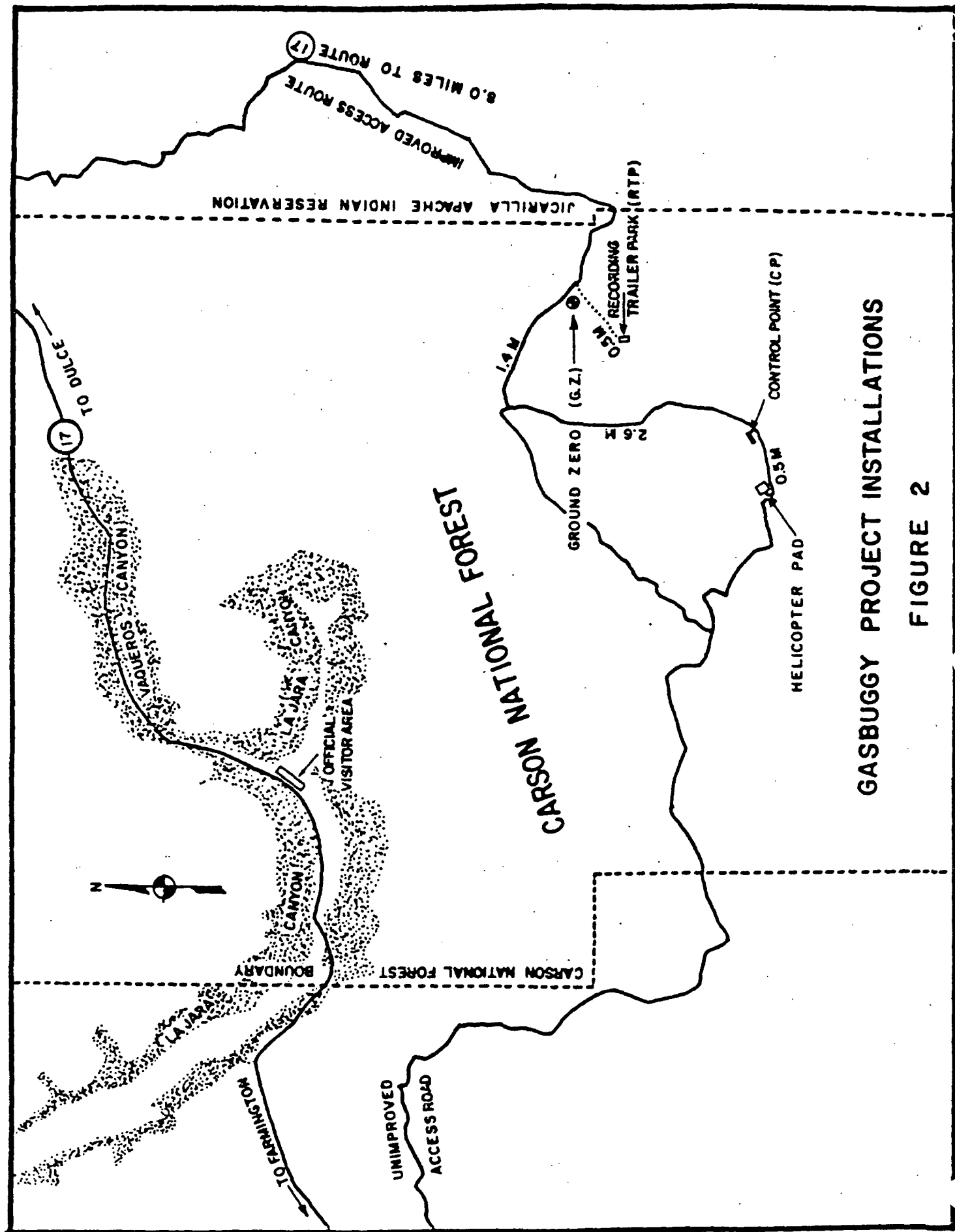
#### C. Restoration Objectives

The general objectives of the restoration were to plug and abandon all project related bore holes, remove surface facilities, perform radiological decontamination as required, return EPNG materials and equipment for unrestricted use, transport solid radiologic waste to the Nevada Test Site (NTS) for disposal, dispose of liquid radiologic waste by injecting into the nuclear cavity, remove existing fences, and reseed areas disturbed by the restoration activities.

## II. INITIAL SITE STATUS

#### A. Lands

The project installations (Figure 2) consisting of the ground zero (GZ) area, the recording trailer park (RTP), the control point (CP), and the helicopter pad were located on lands within the Carson National Forest. The use of these lands for the Gasbuggy Project was established in the previously cited Memorandum of Understanding between the U.S. Forest Service and the U.S. Atomic Energy Commission. Additionally, by land withdrawal action of Public Land



GASBUGGY PROJECT INSTALLATIONS

FIGURE 2

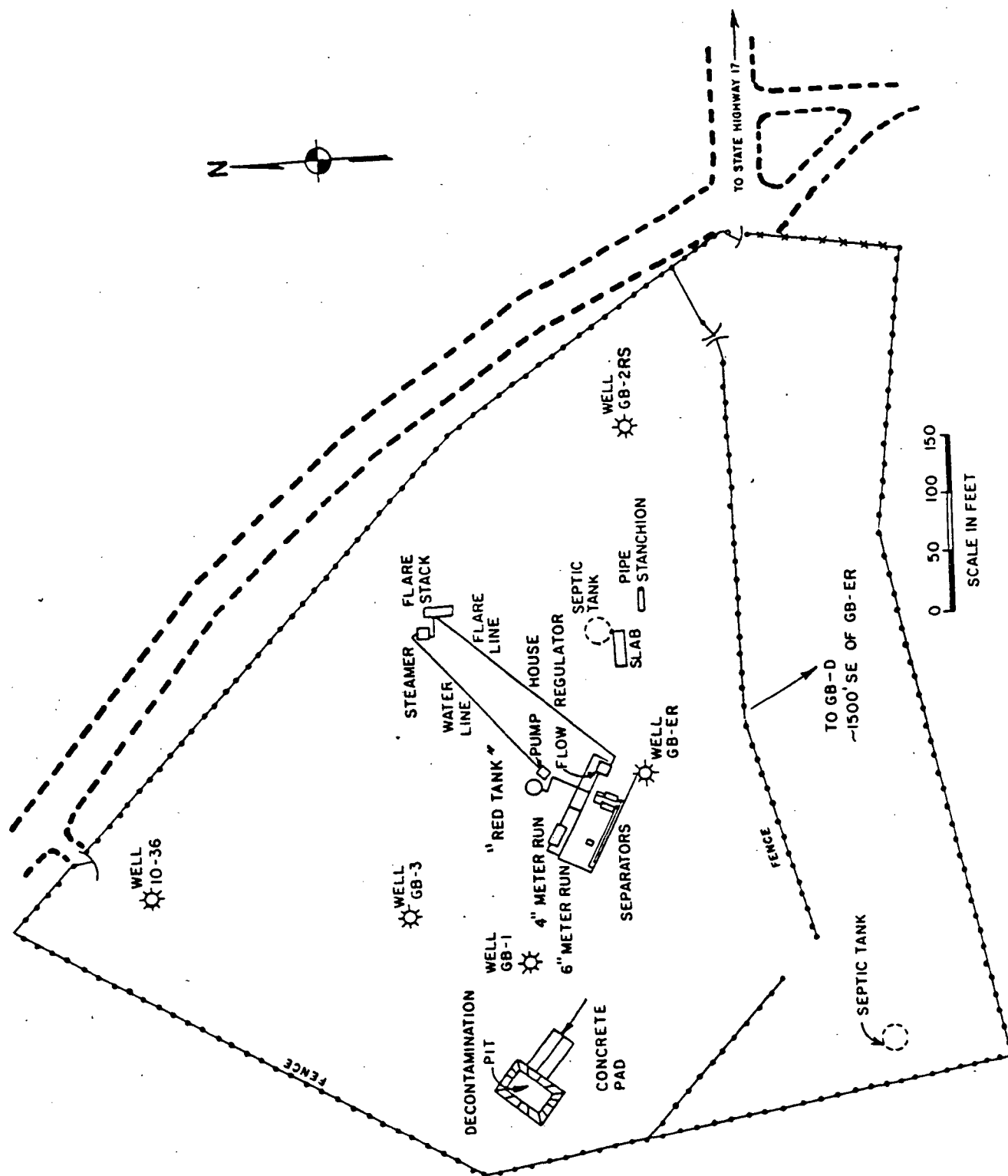


Order 4232, dated June 22, 1967, the Bureau of Land Management withdrew from all forms of appropriation, including mining and mineral leasing laws, and reserved for the use of the Atomic Energy Commission the surface and subsurface of lands within Section 36, T29N, R4W, New Mexico Principal Meridian. Surface and subsurface operating rights to lands within the SW 1/4 of the described section were reserved for the use of the AEC under stipulations of Contract AT(04-3)-711. Access to the project site was by a road traversing the Jicarilla Apache Indian Reservation. Upgrading and extending this roadway was accomplished by the New Mexico State Highway Department through EPNG under stipulations in Contract AT(04-3)-711. This road was provided for Project Gasbuggy use, but the project did not acquire control or responsibility for its maintenance.

#### B. Surface Facilities

All facilities associated with the former control point, recording trailer park, and helicopter pad locations had previously been removed; the areas had been graded, shaped, and reseeded; and existing surface conditions at these locations were considered to satisfy restoration criteria. The areas where work was performed during this site restoration included the fenced area which encompassed Wells GB-1, -2RS, -3, -ER, and 10-36 (see Figure 3), and any area which would be disturbed during the plugging of Well GB-D. The major facilities comprising the fenced area were as follows:

1. GB-ER Production Testing System: Consists of two separators with insulating enclosures, manifold systems, skid-mounted metering runs, flow control equipment, 4 1/2-inch-diameter flare line, flare stack, 100-barrel water tank ("Red Tank"), 6-foot by 4-foot pump shed, steam-spray system in an 8-foot by 10-foot metal shed, plus connecting water and gas lines with associated valves.



PROJECT GAS BUGGY GROUND ZERO (GZ) AREA  
STATUS AS OF DECEMBER 1976 PRE-CLEAN UP

FIGURE 3

2. Decontamination Pad and Pit: A 20-foot by 40-foot concrete pad sloped to an excavated pit approximately 40 feet by 20 feet by 4 feet deep surrounded by a 3-foot-high berm. The pit contains the deteriorated remains of an asphalt-plastic lining.
3. Fence: Approximately 3,500 feet of 6-foot-high mixed four-strand barbed wire and woven wire fence on steel posts with one 16-foot-wide double gate and two 12-foot-wide single gates.
4. Miscellaneous: Three separators, four 6-foot by 4-foot galvanized metal storage sheds, four light standards, three electrical panel boards, one pipe stanchion set in a concrete base, two abandoned septic tanks, three wellhead lubricator platforms, and miscellaneous concrete pads approximately 6 feet by 4 feet in size.

#### C. Subsurface Facilities

Four wells (GB-1, GB-2RS, GB-3, and GB-ER) were drilled for the performance of Project Gasbuggy. A fifth well, GB-D, not related to the objectives of the Project Gasbuggy, was drilled and instrumented as an add-on project for the Advanced Research Projects Agency (ARPA). Well locations are shown in Figure 3. The subsurface configuration of these wells prior to the restoration work is thoroughly described and depicted in NVO-195. Each well included appropriate wellhead equipment which was scheduled for removal during plugging and abandonment work.

An additional well, EPNG No. 10-36, which existed prior to Project Gasbuggy execution, is located within the bounds of the site restoration work limits. Because this well is completed in a water aquifer above the nuclear stimulated gas sand, the DOE determined it

was desirable to maintain it in the long-term monitoring program. Ownership of the well was subsequently acquired by the Government and the configuration of the well was not altered during the restoration effort.

#### D. Topography

The land contours within the site restoration surface work limits or previously described GZ fenced area conformed to the surrounding terrain, which can be described as relatively flat to gently rolling. Mud reserve pits used during the drilling phase had been backfilled and there were no unnatural appearing land features except for the decontamination pit and surrounding berm at the edge of the concrete pad. Natural revegetation has taken place throughout the affected areas. EPNG and DOE had graded and seeded all other project installation areas and no additional grading or seeding was performed except as was required because of surface disturbance during the site restoration work.

#### E. Radiological Conditions

The extent and levels of surface contamination at the Gasbuggy site had been documented by soil and water sampling programs and site surveys by the Environmental Protection Agency (EPA), EPNG, and DOE. Analyses from these surveys indicated that there was no radiological contamination of soil or surface waters which exceeded the following DOE site restoration criteria:\*

---

\*Reference: PNE-3-89, Project Gasbuggy Radiation Clearance Report, Table 8; DOE Appendix 0524, Annex A, Table 2; ANSI 328-1976 (Table 1 of 2); and NVO-195, Project Gasbuggy Well Plugging and Site Restoration Plan, Section V.

### Surface Water

Tritium

300 pCi/ml

1996 DOE proposed NV  
Cleanup levels

looks like same as soil  
see 30.70.

### Buildings, Equipment, and Materials

Tritium (nonremovable)

5,000 pCi/100 cm<sup>2</sup> 5000 dpm (2nci)

Tritium (removable)

1,000 pCi/100 cm<sup>2</sup> 1000 dpm (100pCi)

### Soil

Tritium only

30,000 pCi/ml

30,000/g

Soil Moisture

Beta-Gamma (including worldwide  
fallout)

0.05 mrad/hr

Beta-Gamma

(measured at 1 cm)

Radiological contamination in excess of DOE criteria was expected on interior surfaces of the gas production-testing system from the GB-ER well bore tubing through the flare stack. In addition, tritium-contaminated liquid was contained in the 100-barrel water storage tank ("Red Tank").

### III. PROJECT PARTICIPANTS

- A. The U.S. Department of Energy, Nevada Operations (DOE/NV), developed the restoration plan, provided the contractors to perform the required radiological and general support tasks, and directed and coordinated field activities through on-site project engineering and radiological personnel.

- B. Fenix and Scisson (F&S), an operating contractor for the Nevada Test Site, provided the technical and administrative services to accomplish all well plugging and site restoration objectives except those associated with radiological support.
- C. Eberline Instrument Corporation (EIC), under prime contract No. ET-78-C-08-1582, provided the technical direction and on-site supervision to accomplish all radiological decontamination and monitoring in accordance with DOE radiological criteria.
- D. El Paso Natural Gas Co. provided logistical support to include electrical and gas utilities supply and maintenance and liaison with United States Forest Service and United States Geological Service personnel.

#### IV. SITE RESTORATION ACTIVITIES

##### A. Mobilization

Field activities started during the week of August 13, 1978, with the arrival of the F&S, EIC, and DOE personnel at the Gasbuggy site. Radiological support and office trailers were set in place and connected to a 50-kW natural gas-powered generator provided by EPNG. Mobile phone services were installed and a 400-barrel water supply tank was set and appropriate connections made. The portable well servicing unit and crew arrived on August 18, 1978, to substantially complete the mobilization phase.

##### B. Decontamination System

The first major activity was to provide the capability for radiologically decontaminating various materials and equipment components. This was accomplished by refurbishing an existing steam

generator and fabricating a 35-foot-long by 12-foot-wide steel drip pan with a 400-gallon sump at one end. The decontamination pan was installed on a graded 3° slope adjacent to the steam generator. A controlled area was established around the drip pan by encompassing it with yellow rope attached to steel posts and posting appropriate radiation warning signs.

#### C. Surface Facilities Decontamination

Items of material and equipment were radiologically surveyed in place; when they met the release criteria, they were appropriately marked and placed in one of the clean holding areas. If they did not meet the release criteria, they were moved to the decontamination area, and after a reasonable decontamination effort, another survey was conducted. Pending the results of this second survey, the item(s) of material and/or equipment were moved to the appropriate clean or contaminated holding area for either release for unrestricted use or for disposal as contaminated waste. Within the holding area, items were segregated as to ownership, i.e., DOE or EPNG. A segment of the area was established for the storage of barrels containing solid contaminated material slated for shipment to NTS for burial as low-level radioactive waste.

A log of all material released and stored in this area was maintained. A total of 425 items ranging from boxes of nuts and bolts to gas/liquid separators were checked, found to be below the release criteria, and were released for unrestricted use.

Items of equipment having inaccessible interiors were flushed with steam until the exiting flush water and accessible area swipes of the item were below release limits. As an additional check, water was poured through various tubular goods and the exiting water sample was analyzed for tritium. None of these samples approached

the 5,000 dpm/ml (2,250 pCi/ml) arbitrary limit set as a double check. The 5,000 dpm/ml limit was not selected as a release limit criterion, but on the basis that if the item were used as unrestricted radiologically, "clean" water contacting the surfaces of the item would be unlikely to ever exceed the 10 CFR 20 or State of New Mexico Concentration Guides for water in unrestricted areas (3,000 pCi/ml).

On-site radioactivity measuring equipment during site cleanup consisted of:

- a. A Packard Model 2003 liquid scintillation spectrometer was used for tritium analysis. Channel 1 was gated for maximum sensitivity in the tritium beta energy region, while channels 2 and 3 were both gated for the full range of beta energies. For this system, the LLD was approximately 2 pCi/ml for tritium at 3  $\sigma$  above background.
- b. Portable survey equipment included sensitive gamma detectors (EIC PRM-5 with SPA-2 1x1 NaI probe), general beta gamma detectors (EIC E-520 with HP-177 GM probe), thin window beta detectors 7 mg/cm<sup>2</sup> (EIC MS-2 and PRM 5-3 with HP-210 probes) and gas proportional alpha detectors (EIC PAC-4G with 50 cm<sup>2</sup> AC-21 probe). The thin window beta probe (HP-210) has a sensitivity of 1,800 cpm/mrad/hr.

All personnel participating in Gasbuggy cleanup were required to wear thermoluminescent dosimeter (TLD) badges and to provide baseline and final day urine samples. The exceptions to this were persons who would be on site less than three days, such as casual visitors and delivery people. TLDs were sent to the EIC facility in Santa Fe, New Mexico, for readout. No radiation exposure was detected above normal background on the TLDs. The urine samples were analyzed on site. None exceeded the lower limit of detectability (LLD).



#### D. Well Plugging and Abandonment

Subsurface work, accomplished concurrently with surface efforts, started on August 18, 1978, with the plugging and abandonment of GB-2RS. Details of the plugging operation are contained in Appendix C, and the final status as plugged and abandoned is shown in Figure 4. The general method was to reuse the 2 3/8-inch gas-production tubing string for pumping cement for the required plugs. A total of about 255 cubic feet of cement slurry was pumped to place three plugs in the 7-inch casing. A 12-foot by 4-inch O.D. length of casing was installed in the top plug for a hole marker extending 4 feet above ground level.

Plugging and abandonment of GB-3 was undertaken next. The procedure was similar to that used in GB-2RS by utilizing the 2 3/8-inch gas-production tubing. The plugging details are described in Appendix C, and the final status is shown in Figure 5. Approximately 550 cubic feet of cement slurry was pumped to place three plugs in the 7-inch casing. A 12-foot by 4-inch O.D. length of casing, extending 4 feet above ground level, was placed in the top plug to provide a hole marker.

The next well to be plugged was GB-1. It had been plugged previously from a total depth of 4,306 feet to approximately 2,800 feet. The 2 3/8-inch tubing string extending to 4,254 feet had been cemented in place. (Refer to NVO-195, Figure 4.) This tubing was cut off at 717 feet and removed. A plug was placed in the 9 5/8-inch casing from 618 feet to the surface using approximately 390 cubic feet of cement slurry. A 12-foot long by 4-inch O.D. marker casing was placed in the plug. It extends 4.7 feet above ground surface. Refer to Appendix C and Figure 6 for additional details.

# WELL NO. GB-2RS

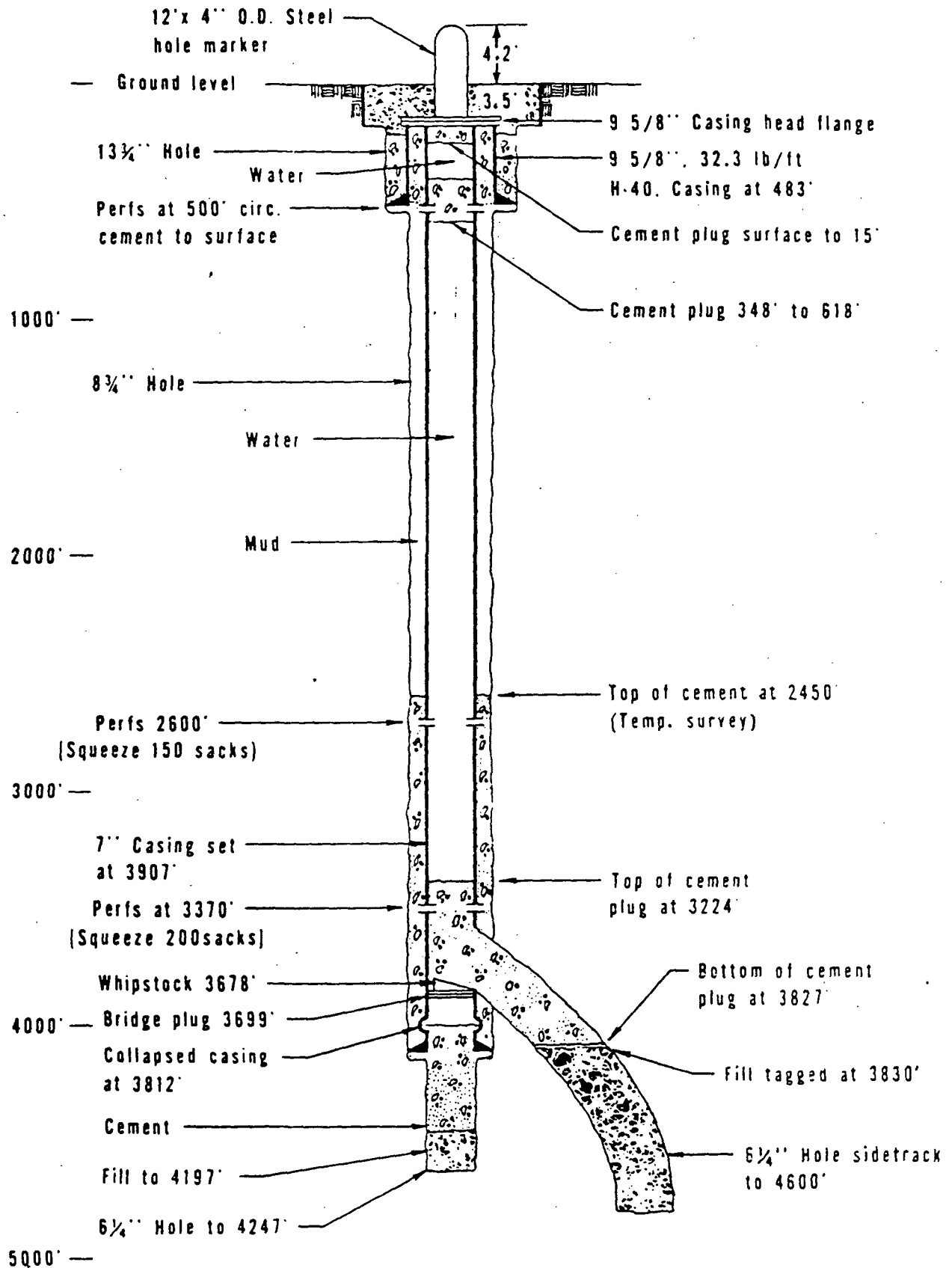


FIGURE 4 GB-2RS FINAL STATUS

# WELL NO. GB-3

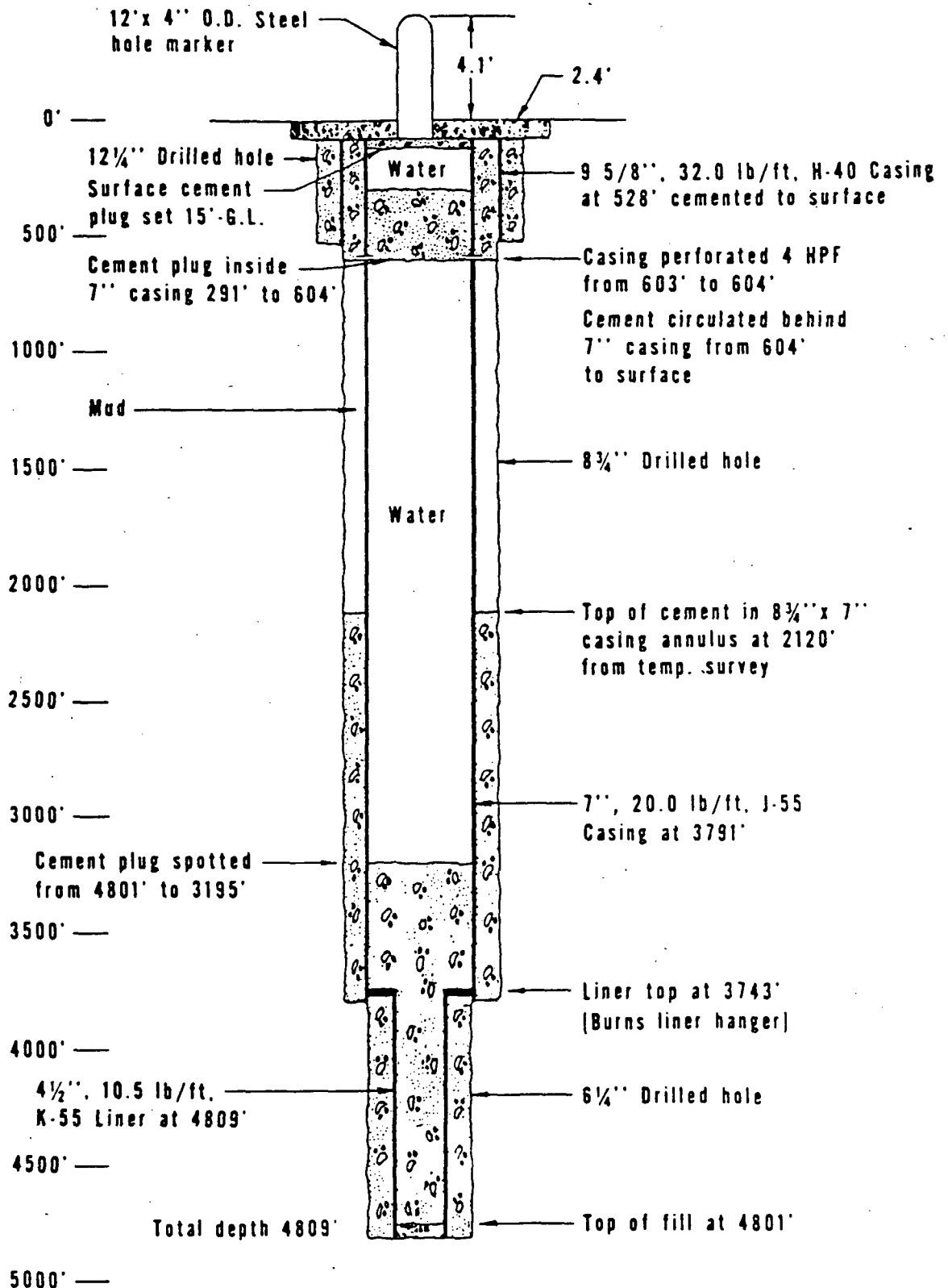


FIGURE 5 GB-3 FINAL STATUS

# WELL NO. GB-1

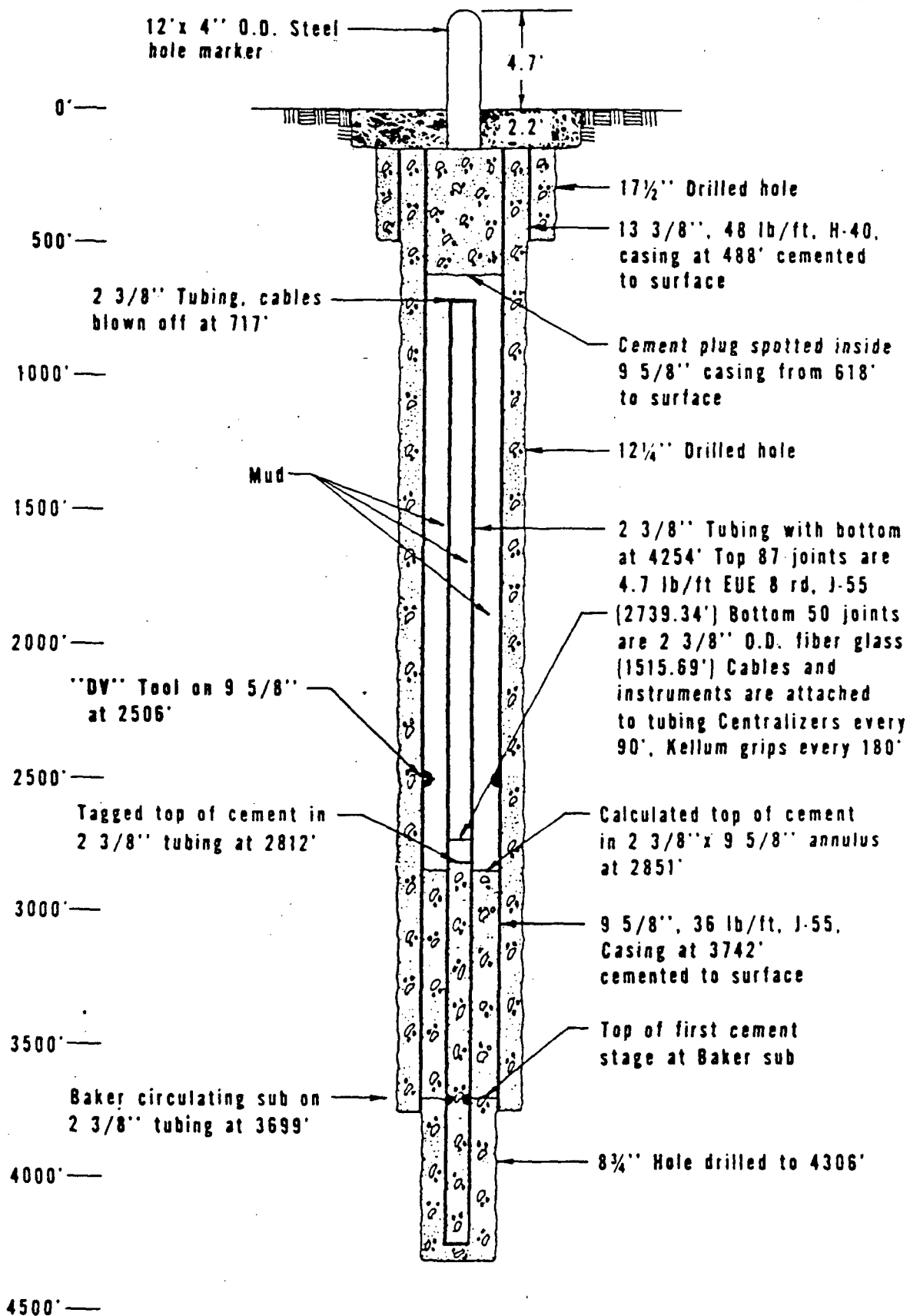


FIGURE 6 GB-1 FINAL STATUS

The next well to be plugged was GB-D, located approximately 1,500 feet S.E. of the emplacement hole (GB-ER). GB-D had been instrumented for the Gasbuggy event. Four instrument packages had been cemented inside a bottom plug that extended from 3,106 feet to total depth of 4,725 feet. The hole was uncased below 432 feet and had been left full of drilling mud. The plugging operation began by running 2 3/8-inch hydril tubing to 600 feet and circulating water to condition the hole. A plug of cement slurry was placed from 600 feet to the surface and a 12-foot by 4-foot O.D. casing, extending 4 feet above ground level, was installed as a hole marker. Refer to Figure 7 and Appendix C.

The device emplacement hole, well GB-ER, was plugged last. The procedures followed were, of necessity, more elaborate and complex due to the presence of obstructions in the hole, continuous radiological surveillance, gas pressures, etc. Work began on August 29 and was completed on September 25, 1978. Prior to plugging, approximately 60.5 barrels of tritium contaminated water and sludge and 7.3 barrels of tritium contaminated water were pumped into the hole and disposed of in the chimney below. After milling out an eight-foot section of the casing, a continuous cement slurry plug was placed in six stages from 3,721 feet to the surface. A total of approximately 1,030 cubic feet of cement slurry was required. Instead of using a 4-inch O.D. casing to mark the location of the well, a monument with metal plaque was installed at the surface in accordance with Section VI.E. of NVO-195. Refer to Figure 8 and Appendix C for additional details.

#### E. Facilities Disposition

Concurrent with the decommissioning of surface and subsurface facilities, a materials sorting task was conducted. After undergoing decontamination (steam cleaning), all materials were measured for radioactivity and all were found to be within the release limit for unrestricted use.

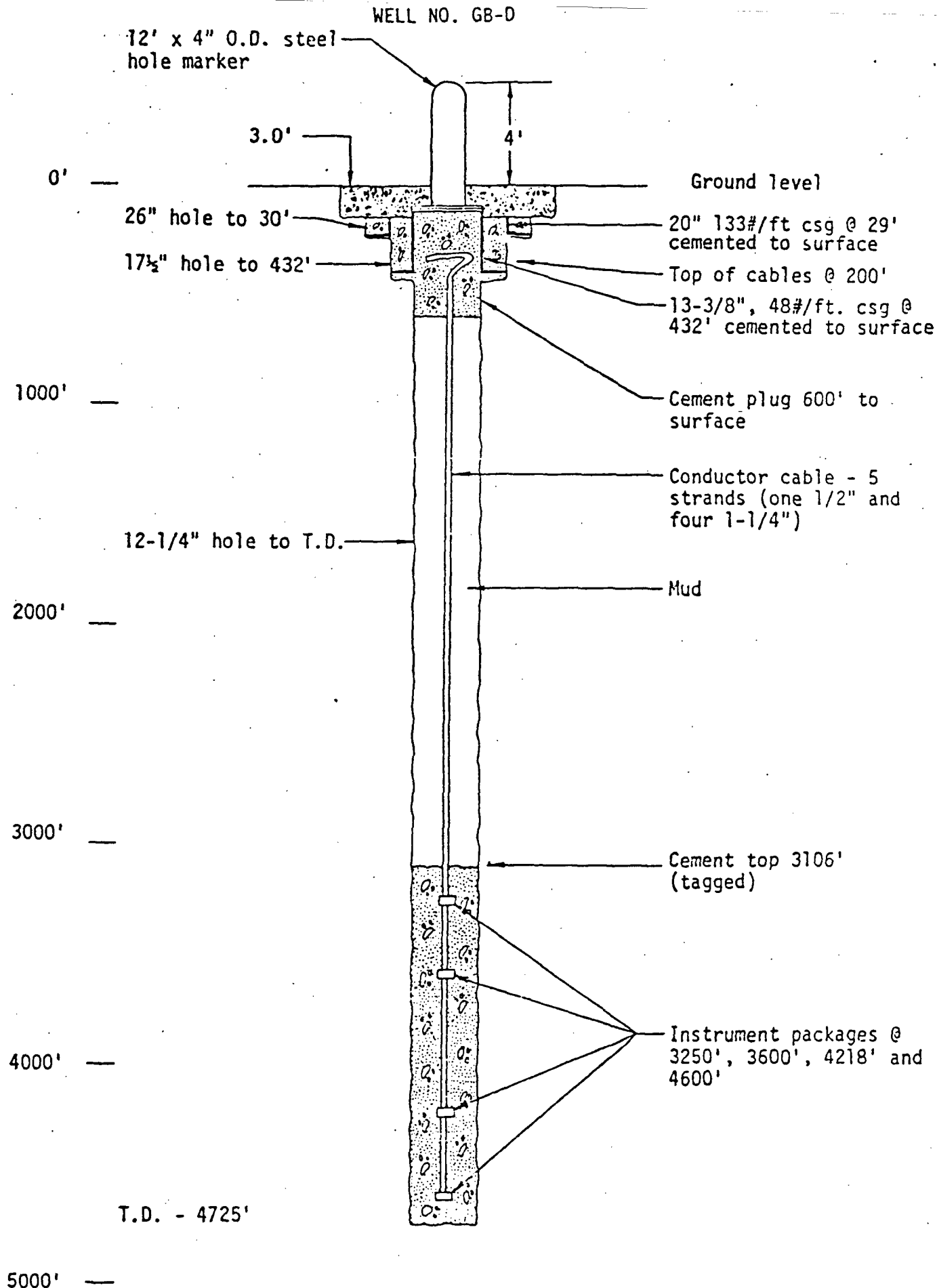
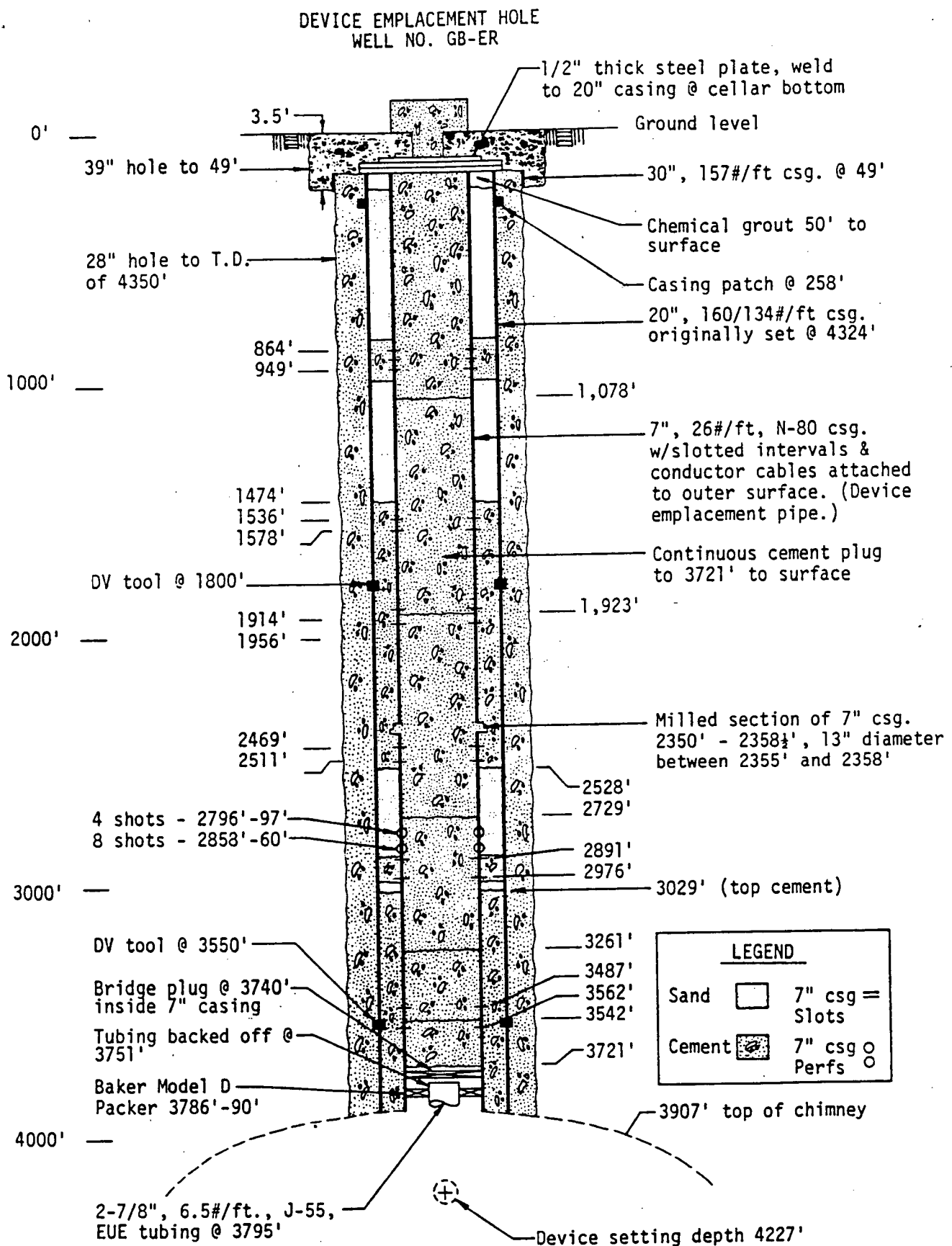


FIGURE 7 GB-D FINAL STATUS



**FIGURE 8 GB-ER FINAL STATUS**

Government-owned materials were loaded on two trucks and shipped to the NTS. Included were: wellhead components from GB-1, GB-2, and GB-ER; 225 joints of 2 3/8-inch tubing; a steam generator; and miscellaneous pipe, hose, fittings, etc. These trucks also returned government equipment used by Eberline and F&S personnel during decommissioning-decontamination activities (see inventory list, Appendix F). On September 12, 1978, approximately 95 percent of the EPNG owned equipment was returned on four flatbed and several pickup trucks to various EPNG warehouses and storage yards in the Farmington, New Mexico, area.

Miscellaneous concrete pads were broken up and placed in the old deepened decontamination pit prior to backfilling and reshaping to a more natural terrain.

#### F. Solid and Liquid Waste

Liquid waste materials consisted primarily of radiologically contaminated sludge and liquids from the decontamination operations. Solid waste consisted primarily of items that were impractical to decontaminate. Included was the McCullough wire line used in the GB-ER hole. It could not be easily decontaminated due to its braided construction. Approximately 5,000 feet of McCullough 3/16-inch braided wire line were placed in a drum and shipped to the NTS. Also, approximately 20,000 feet of old El Paso single-strand wire line were shipped to the NTS for disposal.

Approximately 60.5 barrels of tritium contaminated water and sludge with an average concentration of 1,439 pCi/ml and 7.3 barrels of tritium-contaminated water and sludge with an average concentration of 350 pCi/ml were pumped from the "Red Tank" and decon sump, respectively, and injected into the GB-ER cavity before the reentry well was plugged. The tubing and annulus were then flushed with three annulus volumes (approximately 350 Bbls.) of H<sub>2</sub>O. The total tritium content of the injected fluid was 18.7 mCi.



The water did not contain other radioactive isotopes above detection limits except naturally occurring radioactive elements.

One hundred seventy-five barrels of low-level tritium contaminated water from the steam decontamination operation accumulated in the "Red Tank" after the GB-ER wellbore was sealed. The water was subsequently disposed of by vaporization to the atmosphere using the steam generator. The tritium level in this water ranged from 14.7 pCi/ml to 43.7 pCi/ml, and a total of 1.31. mCi was released to the atmosphere over a period of 25 days in September 1978. During the water vaporization and steam decontamination activities, air moisture samples were collected by molecular sieve units around the site. All of the moisture samples collected were less than the lower limit of detection (LLD)\* for tritium air moisture.

A total of 10 barrels of materials, either known to be slightly radioactive or difficult to make a determination of radioactive content, were sealed, externally steam cleaned, and labeled for shipment as low-level radioactive waste. Dry materials were barreled intact and all fluids were mixed with diatomaceous earth and cement before packaging. Nuclides other than tritium and naturally occurring isotopes were not found to be present. The total tritium content of all 10 barrels was less than 1 mCi.

One sample of mud from the GB-3 abandonment operations initially indicated 6 pCi/ml of tritium. The activity was suspected to be the result of natural thorium daughters, from drilling mud chemicals; however, a second analysis by distillation showed LLD for tritium.

---

\*LLD was 2pCi/Ml at 3 $\sigma$  counting error for tritium.

The mud contained a large amount of paraffin (a 4-inch layer in the mud tank). The entire mix of water, mud, and paraffin was buried on site.

No burial of radioactive material was made at the Gasbuggy site during the cleanup operation.

Rubbish (uncontaminated) was hauled to a dump in Farmington, New Mexico. Septic tanks that had been installed for the Gasbuggy project were backfilled and left in place.

#### G. Land Surface Restoration

Reshaping disturbed areas was accomplished during the last few days of the project. The perimeter fence was removed, and pits excavated for soil sampling and other activities were backfilled. The ground surface was graded to more natural contours. The area was reseeded with a grass mixture that had been developed by the U.S. Forest Service. It consisted of the following:

Crested Wheatgrass	4 lbs/acre
Pubescent Wheatgrass	6 lbs/acre
Ladak Alfalfa	1 lb/acre
Perennial Ryegrass	1 lb/acre

Figure 9 illustrates the results of reseeded. The photograph was taken in May 1983.

A permanent monument consisting of a brass plaque mounted in a concrete base was erected over the GB-ER well site. The plaque wording describes the historical significance of the site and the restrictions that have been placed on future subsurface exploration. Refer to Figure 10 for additional details. The one-mile access



Figure 9. Cattle Grazing in the Reseeded Area

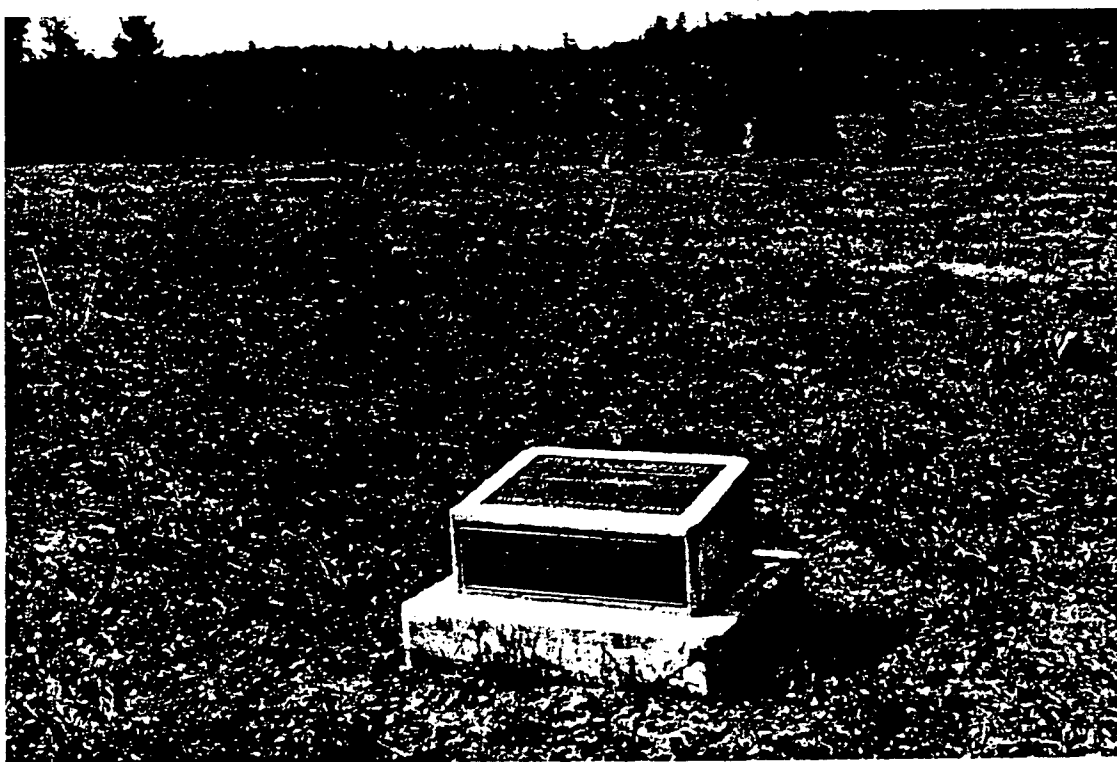


Figure 10. Monument at Surface Ground Zero (GB-ER Well Site)

road extension from the edge of the Carson National Forest boundary to the GZ area was left "as is."

## V. FINAL SITE STATUS

### A. Land Surface and Subsurface Rights

Land rights at the conclusion of restoration activities remain as established by the land withdrawal action specified in Public Land Order 4232, dated June 22, 1967, previously described in Section II.A. Additionally, the U.S. Department of Energy acquired well 10-36, also known as San Juan 29-4, Unit #10-36, from the El Paso Natural Gas Company for the purchase price of \$10. Refer to Section II.C, DOE purchase order EW-78-X-08-0033, dated September 18, 1978, and Figure 11 showing the current status of well 10-36.

### B. Topographical Description

Substantially all affected areas have been reshaped to as near the original natural contours as practical. The only related land feature not eliminated was one mile of access road from the Carson National Forest boundary to the GB-ER emplacement hole.

### C. Remaining Facilities

Other than the monument at well GB-ER, abandoned well markers, a concrete slab, and a pipe stanchion, the only remaining facility is well 10-36. This well will be used for long-term hydrological/monitoring at the Gasbuggy site.

### D. Subsurface Well Configurations

The final status of all project related wells that were plugged and abandoned is described in Section D and shown in Figures 4, 5, 6, 7, and 8. Well locations and the post-cleanup status of the Ground Zero are shown in Figure 12.

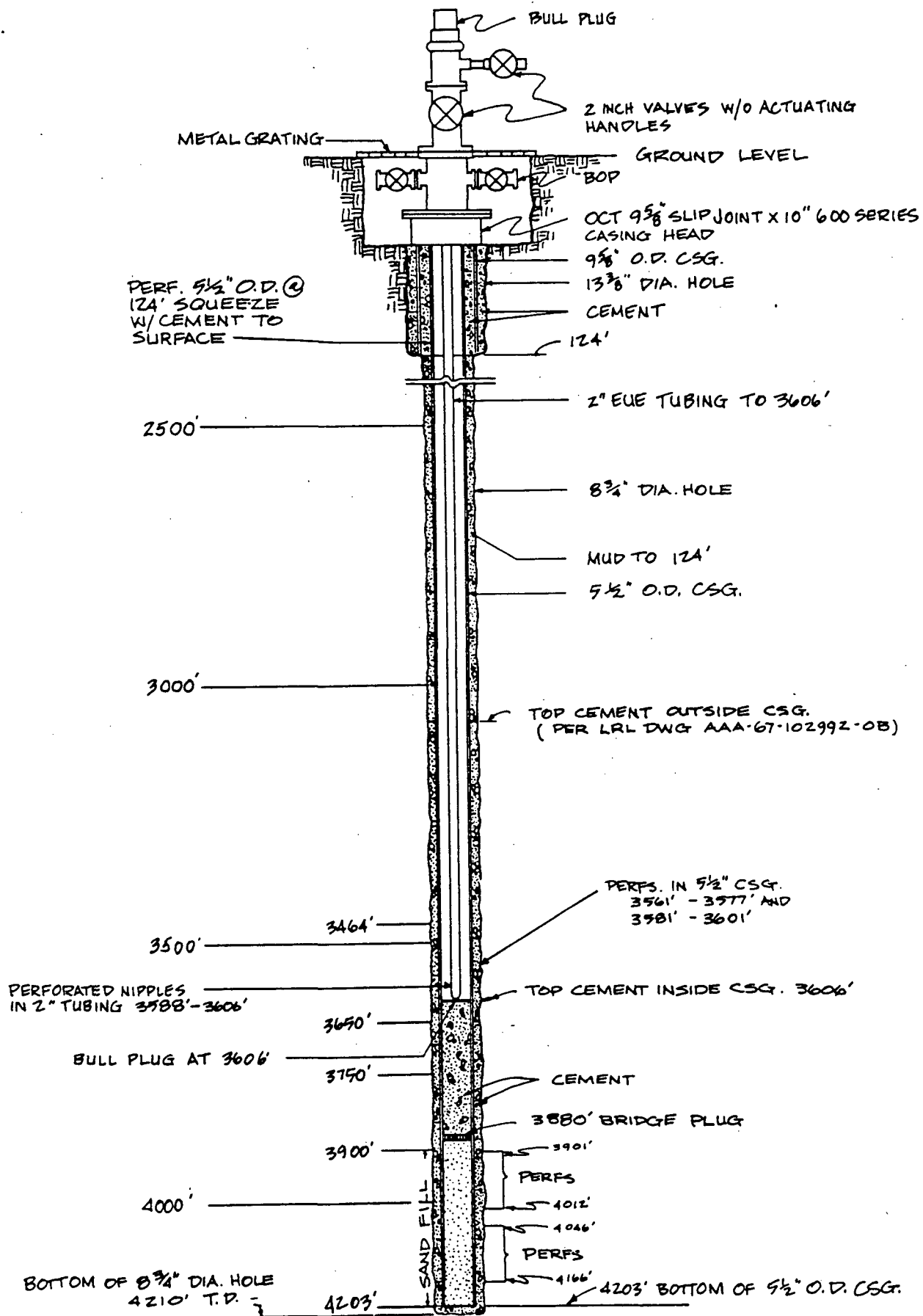
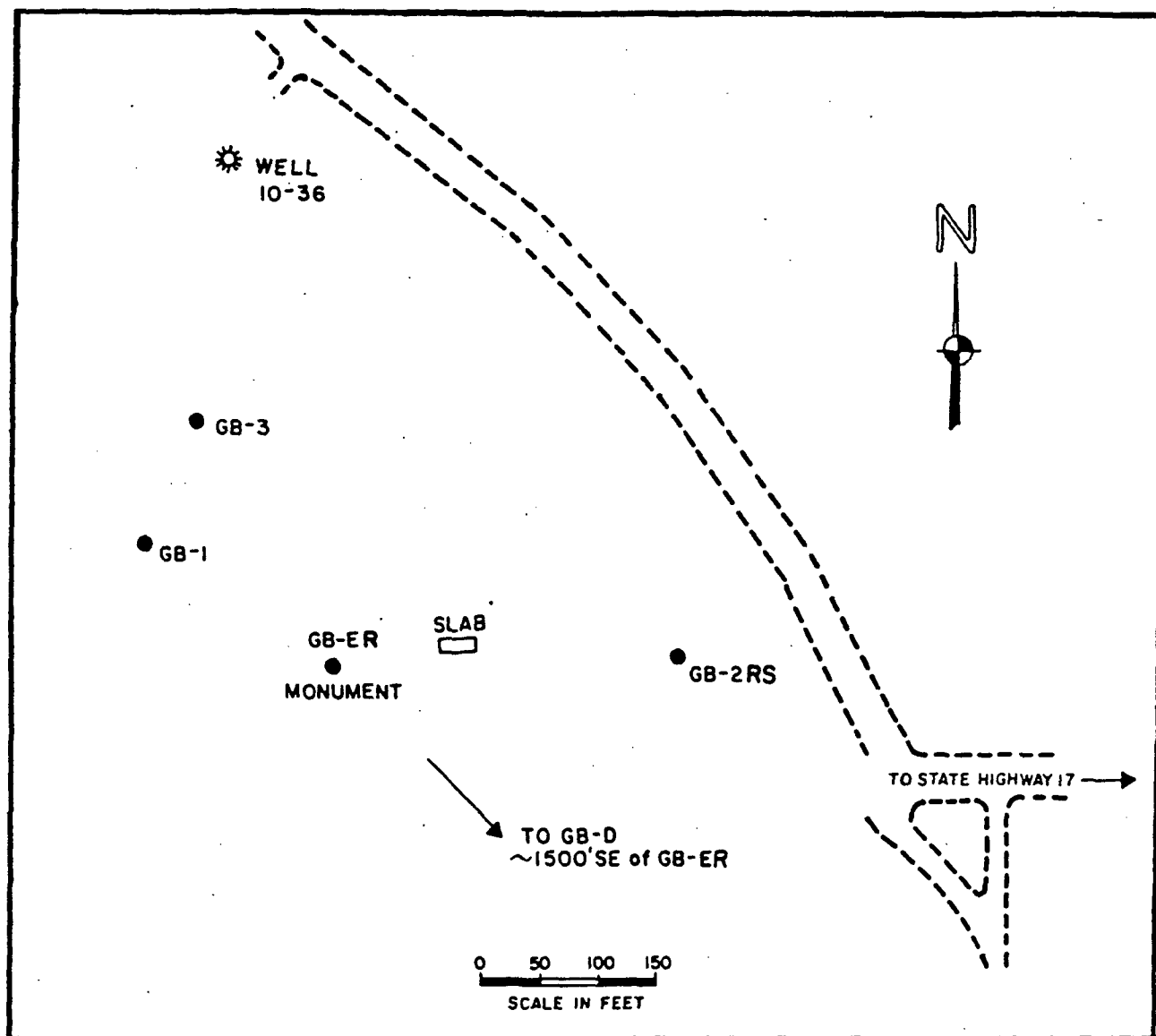


Figure 11. Current Status of Well 10-36



PROJECT GASBUGGY Ground Zero (GZ) Area. Status as of October 1, 1978  
POST-CLEANUP

Figure 12.

#### E. Radiological Conditions

Prior to final site grading, an extensive radiological soil sampling program was conducted with the following results:

- o No beta-gamma radionuclides other than tritium or naturally occurring radioisotopes were found.
- o Only low levels of tritium were detected in soils.
- o The average concentrations of tritium remaining after the cleanup operation are small fractions of the Radiation Concentration Guide levels of 10 CFR 20 and DOE manual chapters. The soil-sampling program and results are described in detail in PNE-G-89, Project Gasbuggy Radiation Contamination Clearance Report by Eberline Instrument Corporation, Santa Fe, New Mexico, dated June 27, 1979.

All equipment contaminated during gas production testing phase and equipment used during cleanup operations were decontaminated to well below release criteria and were released for unrestricted use.

#### F. Long-Term Surveillance

A long-term hydrologic monitoring program has been established for the Gasbuggy site. The ongoing program, conducted by the Environmental Protection Agency (EPA), consists of annual sampling and analyses of water for tritium and other radionuclides in the Project Gasbuggy area. This program is noted in a U.S. Forest Service sign at the Gasbuggy Site (Figure 13). Figure 14 is a photograph taken in May 1983 of the EPA sampling activity. The following sampling points were selected as being representative of water supplies in the Gasbuggy area:

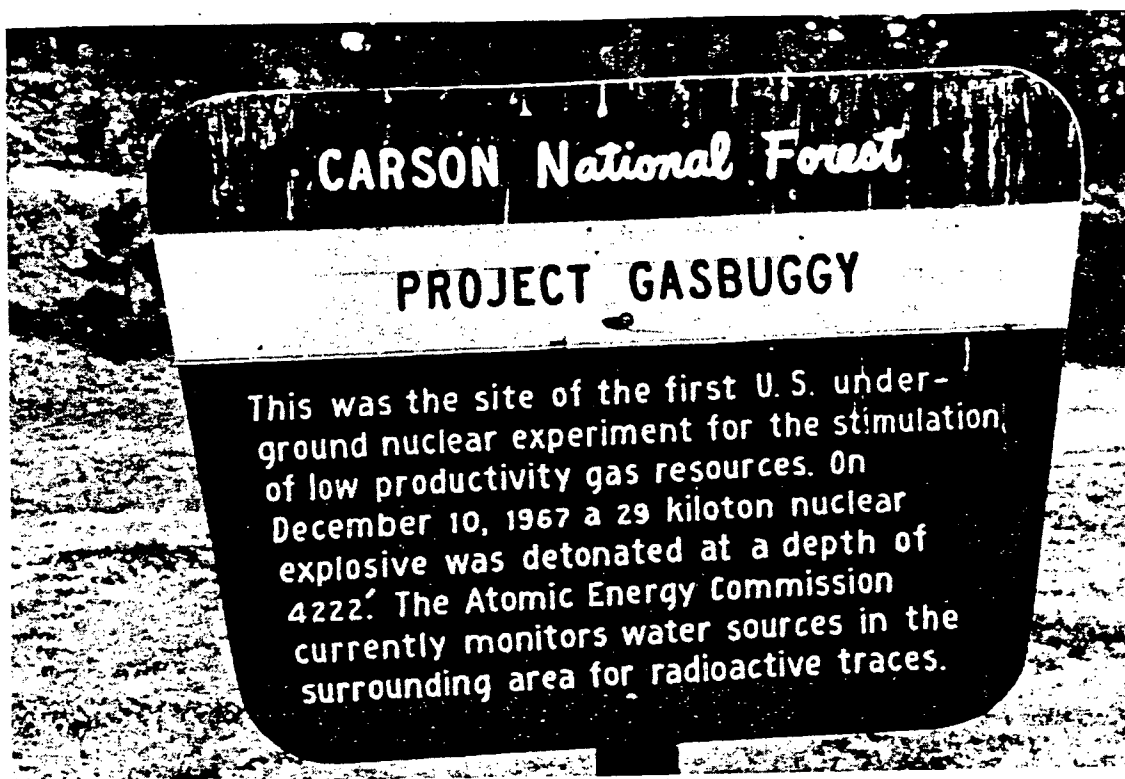


Figure 13. U.S. Forest Service Sign at Project Gasbuggy.

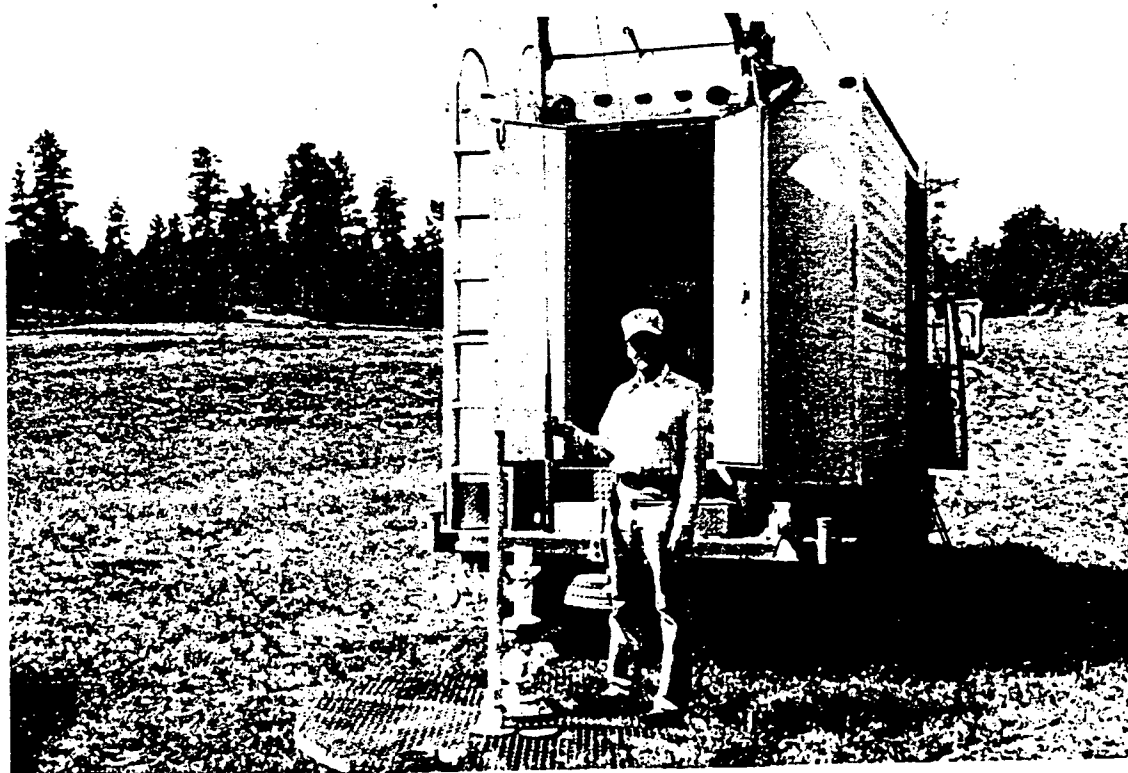


Figure 14. U.S. Environmental Protection Agency Sampling Water at Well 10-36



<u>Wells</u>	<u>Approximate Distance From Subsurface Ground Zero</u>
a. Well 10-36	450 feet (on site)
b. Windmill #2	4 miles
c. Lower Burrow Canyon	7 miles
d. Bixler Ranch	7 miles
e. Jicarilla Apache Rev. (South Well)	6 miles
f. Jicarilla Apache Rev. (North Well)	6 miles

Surface Waters

a. Cave Spring	4 miles
b. Bubbling Spring	5 miles
c. Arnold Ranch	8 miles
d. La Jara Creek	3 miles

Samples are to be collected annually from the above locations. The program is scheduled to continue indefinitely.

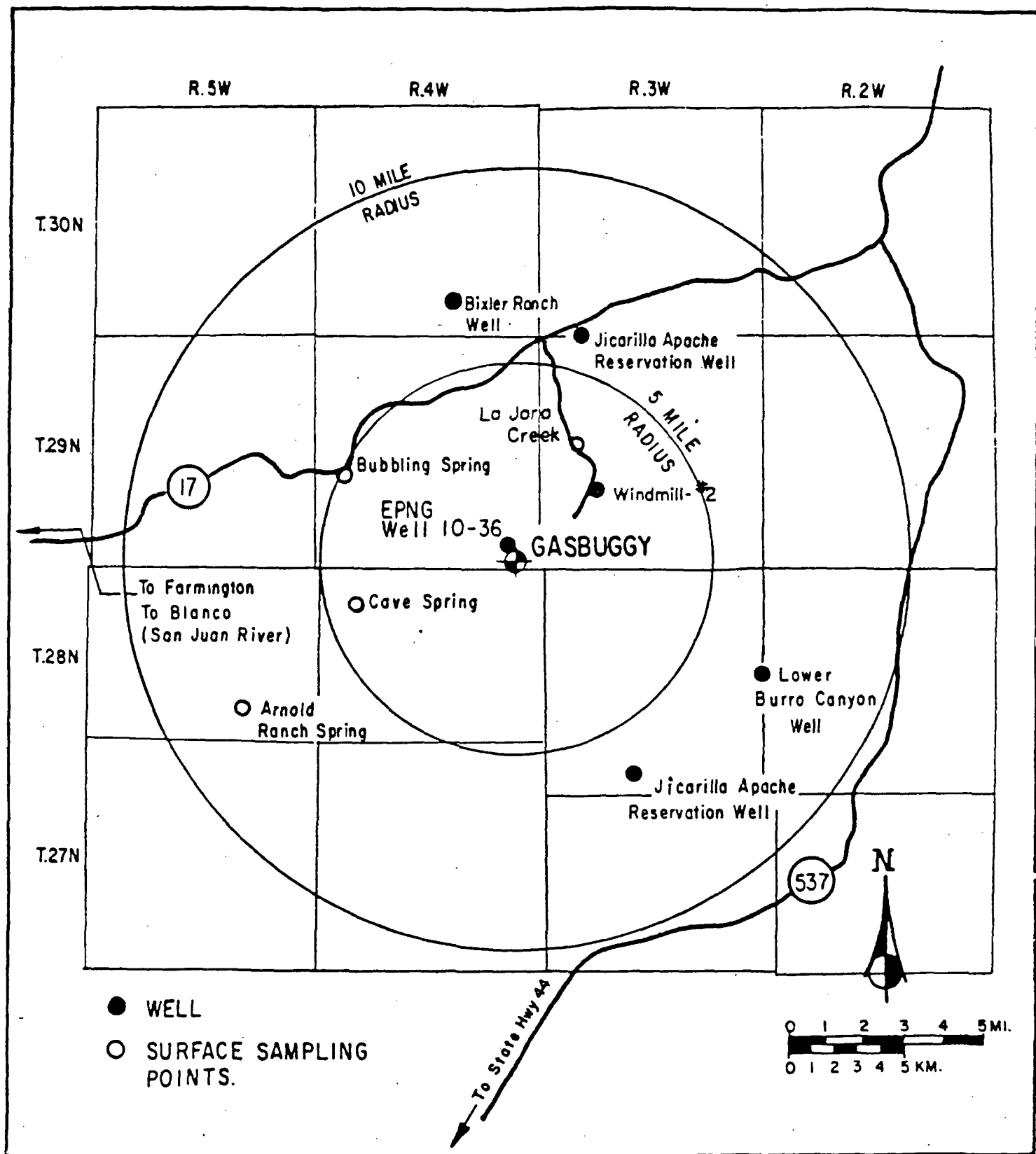


Figure 15. Long-Term Water Sampling Network.

APPENDIX A  
PRIMARY CITATIONS

## APPENDIX A

### PRIMARY CITATIONS

#### 1. References

- a. Contract AT(04-3)-711, dated January 31, 1967, signed by the AEC, Department of Interior, and the EPNG.
- b. Memorandum of Understanding, dated March 23, 1967, between the Department of Agriculture's U.S. Forest Service (USFS) and the AEC.
- c. EPNG letter, dated July 23, 1976; D. N. Canfield to DOE/NV, M. E. Gates.
- d. DOE/NV letter, dated August 11, 1976; to DOE/MA, DOE/OG&ST, LASL, LLNL, and SL.
- e. Responses from all recipients of Reference 1.d. letter.

#### 2. The basic responsibility of DOE to conduct the restoration is contained in the referenced contract and Memorandum of Understanding, with applicable portions shown here as follows:

##### a. Reference 1.a. above, Article II(b):

"Project Gasbuggy, as delineated in this contract, is a cooperative effort between the Government and the Company; each of the parties is assuming responsibility for performing certain specified functions at its own cost and each is, accordingly, prepared to assume responsibility for increases in the cost of performing its functions as may develop during the execution of the project. Each party shall proceed promptly to perform its portions of the work in accord with a jointly

coordinated time schedule to be issued by the Commission. Since the explosion of a nuclear device is involved in the execution of this project, the Commission, because of its responsibilities in connection therewith, must have and is hereby given the right to control the execution of the project in all phases of operations involving the nuclear device, including site preparation, emplacement, detonation, disposition of radioactive substances, and public health and safety."

- b. Reference 1.a. above, Article IV(b)(8)(vi):

"Roll-Up

"Subsequent to detonation, the Company shall remove all trailers, technical structures, construction equipment, testing equipment, and associated material to a point mutually agreed upon which is not more distant than the Gobernador Camp. The Company will also clean and remove surface debris from the area of the emplacement hole, control points, and Recording Trailer Park areas; provided, however, the Company shall have no obligation to remove radioactive or contaminated material or debris."

- c. Reference 1.b. above, paragraph C.9:

"That upon termination of this agreement, the parties shall mutually agree on removal or other disposition of all structures and improvements which have been placed on National forest lands in the exercise of this use."

3. The concurrence of all project participants to proceed with site restoration is contained in responses to Reference 1.d. letter above.

## ORDER FOR PURCHASE OR DELIVERY

Page 1 of 1 Pages

ISSUING OFFICE: U.S. DEPARTMENT OF ENERGY  
Nevada Operations OfficeTHIS NUMBER MUST APPEAR ON ALL PACKAGES, PAPERS  
AND INVOICES RELATING TO THIS ORDER ▼

DATE OF ORDER

9/18/78

ORDER NO.

EW-78-X-08-0033

CERTIFIED FOR NATIONAL DEFENSE  
UNDER DMS REG. 1 D. O. RATING: N/AREQUISITION NO.  
E&EAD:RDC-1305COST SYMBOL  
AC-01-06ALLOTMENT  
NV-83-91APPROPRIATION AND TITLE  
89X0203

TO (Seller)

El Paso Natural Gas Company  
P.O. Box 1492  
El Paso, Texas 79978

SHIP TO (Consignee and Destination)

U.S. Department of Energy  
Nevada Operations Office  
P.O. Box 14100  
Las Vegas, NV 89114

VIA:

P.O. NO.:

DELIVERY F.O.B.  
N/ATIME FOR DELIVERY  
Sept. 30, 1978GOV'T B/L NO.  
N/ADISCOUNT TERMS  
N/A☒ Purchase order per your Bill of Sale

of

Please furnish the following on the terms specified on both sides of this order and on the attached sheets; if any. This purchase is negotiated under the authority of 41 U.S.C. 252 (c) (3).

☐ Delivery order under Contract No.

Except for billing instructions on the

reverse, this order is subject to the terms on this side, term 13 on the reverse, and the above-numbered contract.

ITEM NO.	ARTICLES OR SERVICES	QUAN.	UNIT	UNIT PRICE	AMOUNT
1.	<p>This Purchase Order is issued to cover the purchase price of the San Juan 29-4 Unit #10 which is located 1650 feet from the South line and 1700 feet from the West line of Section 36, T-29-N, R-4-W, N.M.P.M., Rio Arriba County, New Mexico; together with all casing and tubing appertaining thereto.</p> <p>The terms and conditions of this purchase order No. EW-78-X-08-0033 are hereby accepted:</p> <p>El Paso Natural Gas Company</p> <p>By <u>D. J. Canfield</u> date <u>10-10-78</u></p> <p>Title <u>Director Land Dept</u></p>	1	ea.	\$10	\$10

Submit invoices in duplicate (see reverse side for  
billing instructions) TO:U.S. DEPARTMENT OF ENERGY  
Nevada Operations Office  
P.O. Box 14100  
Las Vegas, NV 89114

TOTAL \$10.00

SIGNATURE

(Contracting Officer)

NAME: Robert W. Taft

TITLE: Assistant Manager for Plans,  
Engineering and Budgets

RE P.O. NO.: EW-78-X-08-0033

34

APPENDIX B  
WEEKLY SUMMARY--SURFACE WORK

## WEEKLY SUMMARY OF SURFACE WORK

This weekly summary is based upon daily reports compiled at the end of each workday throughout the field activities phase. The original daily reports are available in the DOE/NV Energy Applications Division files.

### Weekly Period Beginning 8/13/78

DOE, F&S, EIC, and drill crew personnel arrived on site. EPNG installed a 50-kW generator and electrical distribution lines. A support and office trailer arrived and were hooked up. Roads within the site boundary were graded. A sloping grade and trench were established for the decon pan and sump. Decon pan sections were set in place and welded together. Miscellaneous concrete slabs were moved to the old decontamination pit area and the pit was deepened. The flare stack, flare gas lines, and miscellaneous piping were disassembled. Anchors for the workover drilling rig were installed at all five well locations. The steam generator's (steamer) assembly was started. A 400-bbl. fresh water tank was installed and water deliveries began. Started the excavation of buried lines. Miscellaneous broken concrete pads and other debris were pushed into the deepened decontamination pit and were backfilled with a minimum of three feet of earth cover. Utility poles were removed and decontamination of the flare stack and its components was started.

### Weekly Period Beginning 8/20/78

The 100-bbl. "Red Tank" was moved to the decon pad and steam-cleaned. Dismantling of piping, valves, etc., continued. Trenched for and removed 3/4-inch and 2-inch waste fluid lines. EIC laboratory personnel collected samples which were sent to EIC, Albuquerque, New Mexico, for analyses. Samples included flare line water, flare line oil, GB-2R water, GB-ER fluid, and Red Tank sludge. The tri-carb unit and other laboratory equipment were received, assembled, and put into operation. The Red Tank was used to store condensate from steam-cleaning operations.



#### Weekly Period Beginning 8/27/78

Steam-cleaned the Otis wireline, reel, and tools used in GB-ER. Disassembled portions of EPNG's heater/separators and moved them to the decon pan where they were steam-cleaned. Soil samples were taken under the gas-condensate pump shack. The tri-carb unit was loaded for its first automatic run. Fluids from Red Tank and decon sump were injected into GB-ER for disposal. Anti-C clothing was worn by all personnel in GB-ER area. All steam-cleaned materials that measured below the LLD (Lower Limits of Detection) were marked with green paint and moved into a release area. Backfilled the GB-3 cellar. Cut off the GB-D wellhead and steam-cleaned it. Compiled data from approximately 500 tritium samples.

#### Weekly Period Beginning 9/3/78

Established a base line for the soil sampling grid and selected 246 soil sampling locations on 25-foot and/or 50-foot grid line intervals. Started taking soil samples with an auger. Installed piping from the Red Tank to the steam generator to permit evaporation of stored liquids. Molie sieve moisture collectors were fabricated and strategically located in the evaporation area. Steam-cleaned the EPNG separator/preheater and DOE wellhead equipment from GB-1, GB-2R, and GB-3. Removed the roof from a 10-foot x 20-foot metering skid. Uncovered a septic tank in the old trailer park. A general cleanup of the area was performed with rubbish being hauled to a Farmington, New Mexico, dump.

#### Weekly Period Beginning 9/10/78

Continued laying out the soil sampling grid and continued taking soil samples. A backhoe was used to excavate a six-foot-deep trench for profile and sidewall samples. The 3/16-inch braided wire line was removed from the McCullough truck and placed in a decontamination drum for shipment to the NTS. Steam-cleaned the McCullough truck and tools. The steam cleaner was used to evaporate approximately 1,320 gallons of Red Tank fluid. Backfilled the septic tank at the

original office trailer site. Continued to clean the area and hauled rubbish to the Farmington, New Mexico, dump. The U.S. Forest Service delivered 150 pounds of seed for reseeding the site.

Weekly Period Beginning 9/17/78

Continued taking and analyzing soil samples. Vegetation samples were also taken for detailed analyses by EPA, Las Vegas, Nevada. All steam-cleaning was completed except for the interior of the Red Tank. The Acme 100-bbl. mud tank was turned on its side to facilitate removal of sludge and parafin into an eight-foot-deep trench. Dug additional trenches for rad/safe profile sampling. Steam-cleaned the drill rig prior to releasing it on September 23, 1978.

Weekly Period Beginning 9/24/78

Removed approximately 1 1/2 cubic feet of sludge from the Red Tank and steam-cleaned the tank's interior. Approximately 20 gallons of sludge and 40 gallons of fluid in the sump pit were mixed with diatomaceous earth for solidification. The mixture was placed in ten 55-gallon drums and shipped to the NTS for burial. Rad/safe equipment was shipped to EIC, Albuquerque, New Mexico. Backfilled all remaining trenches and graded the area. Cut the decon pan into five sections which were shipped to Carlsbad, New Mexico. EPNG removed the perimeter fence, the Red Tank, the generator, electrical panels, electrical distribution lines, and miscellaneous gas lines. Removed the radiotelephone, office furniture, and office telephone. The rad/safe trailer was taken to Carlsbad, New Mexico. A monument was erected over the GB-ER hole. The area was reseeded on September 28, 1978, and all restoration work was completed the following day, September 29, 1978.

APPENDIX C  
DAILY REPORTS--SUBSURFACE WORK

## DAILY REPORTS

### GB-2RS PLUG AND ABANDON

- 8-18-78 Moved in Farmington Well Service's Cardwell 210A rig #14 and rigged up. Displaced 2 3/8-inch O.D. Hydril tubing with 30 barrels of water. No pressure on casing or tubing. Installed blowout equipment. Laid down 139 joints of tubing, 3 crossover subs, perforated sub, bull plug and collar. Overall length was 4,222 feet.
- 8-19-78 Picked up 2 3/8-inch O.D. Hydril tubing and tagged fill at 3,816 feet. Made trip in hole and installed a notched collar on the bottom for a washover shoe. Circulated hole and washed tubing from 3,816 feet to 3,830 feet. Pulled tubing inside the 7-inch O.D. casing to 3,437 feet.
- 8-20-78 Tagged fill at 3,830 feet. Tubing was run to 3,827 feet. Dowell placed plug No. 1 with 20 barrels of water ahead of 175 feet<sup>3</sup> of class "H" cement. Displaced tubing with 11 barrels of water. Cement in place at 1030 hours. Tagged top of plug No. 1 at 3,224 feet at 1700 hours. Set 14,000# weight on plug and plug held. Hung tubing at 600 feet and set plug No. 2 with 75 feet<sup>3</sup> of class "H" cement. Cement in place at 1900 hours.
- 8-21-78 Tagged top of plug No. 2 at 348 feet. Laid down tubing. Removed blow out equipment and cut off the 7-inch O.D. casing at the top of the 9 5/8-inch casinghead at 3.5 feet. Attempted to set top 15-foot cement plug in the 7-inch casing and was unable to do so. Rigged down.

Fabricated a plug from rags and set it at 15 feet. Hand cemented to the top of the 7-inch O.D. casing. Installed a piece of 4-inch O.D. x 12-foot casing in the cement for a hole marker extending 4.2 feet above ground. Hole plugged.

## DAILY REPORTS

### GB-3 PLUG AND ABANDON

- 8-21-78 Moved in Farmington Well Service's Cardwell 210A rig No. 14 and rigged up.
- 8-22-78 Shut in tubing pressure and pressure on the annulus were 625 psi. Pumped water down the 2 3/8-inch O.D. tubing with 725 psi at three barrels per minute. Bled off pressure in the annulus and pumped 169 barrels of water in hole. Shut in tubing and annulus, no pressure. Rigged up blowout equipment. Laid down 133 joints of 2 3/8-inch O.D. J-55 tubing, perforated pup joint, crossover sub, collar and bull plug. Overall length was 4,239 feet. Started picking up 2 3/8-inch O.D. Hydril tubing.
- 8-23-78 Ran 2 3/8-inch O.D. tubing in the hole and tagged fill at 4,801 feet. Dowell set plug No. 1 with 20 barrels of water ahead of 260 feet<sup>3</sup> of class "H" cement. Cement in place at 1135 hours. Pulled tubing to 2,494 feet and displaced with 10 barrels of water. Waited on cement to 1830 hours and tagged top of plug No. 1 at 3,195 feet. Set 10,000# weight on cement and plug held.
- 8-24-78 Pressure between the 9 5/8-inch O.D. and 7-inch O.D. was 30 psi. Bled off pressure and tested blowout equipment to 500 psi for 5 minutes. Perforated the 7-inch O.D. casing from 603 feet to 604 feet with four shots using McCullough jet gun. Fluid dropped out of casing. Ran 2 3/8-inch O.D. tubing to 122 feet and circulated water between the 9 5/8-inch and 7-inch casing. Set plug No. 2 with 280 feet<sup>3</sup> of class "H" cement and displaced with 7 barrels of water at 150 psi. Cement in place at 1230 hours. Cement circulated to surface between the two casing strings.

- 8-25-78 Tagged top of plug No. 2 at 291 feet inside the 7-inch O.D. casing. Removed blowout equipment. Cut off the 9 5/8-inch and 7-inch casing at 2.4 feet and plugged CMP. Rigged down.
- 8-26-78 Bailed water to 15 1/2 feet inside the 7-inch O.D. casing. Pumped 11 feet<sup>3</sup> of cement inside the 7-inch casing and cement overflowed into the 9 5/8-inch annulus. Both casings were filled to surface. Installed a 4-inch O.D. x 12-foot piece of casing in the soft cement for a hole marker extending 4.1 feet above the ground. Hole plugged.

## DAILY REPORTS

### GB-1 PLUG AND ABANDON

- 8-25-78 Moved in Farmington Well Service's Cardwell 210A rig No. 14 and rigged up. Made two runs with a sinker bar inside the 2 3/8-inch O.D. tubing and shot off tubing at 717 feet using McCullough plastic explosives. Pulled 2 3/8-inch O.D., EUE tubing, centralizers and cables out of the hole.
- 8-26-78 Recovered tubing, four pup joints and a crossover sub. Overall length was 717 feet. Cut off the 13 3/8-inch and 9 5/8-inch casing at 2.2 feet. Ran 2 3/8-inch O.D. tubing to 618 feet and plugged hole to surface using Dowell with 393 feet<sup>3</sup> of class "H" cement. Pulled CMP. Installed a piece of 4-inch O.D. x 12 foot casing in the cement for a hole marker extending 4.7 feet above ground. Hole plugged.

## DAILY REPORTS

### GB-D PLUG AND ABANDON

- 8-26-78 Moved in Farmington Well Service's Cardwell 210A rig No. 14 and rigged up. Ran 2 3/8-inch O.D. Hydril tubing in the hole, hit fluid at 285 feet and bridges at 200 feet, 600 feet and 630 feet. Pulled out of hole.
- 8-27-78 Rig secured.
- 8-28-78 Cut off 13 3/8-inch casing at 3 feet. Ran 2 3/8-inch O.D. Hydril tubing in the hole, hit bridges at 200 feet, 580 feet and 600 feet. Circulated and conditioned hole with water. Pulled tubing to 394 feet.
- 8-29-78 Ran tubing to 600 feet and plugged hole to surface using Dowell with 566 feet<sup>3</sup> of class "H" cement. Installed a piece of 4-inch O.D. x 12 foot casing in the cement for a hole marker extending 4 feet above ground. Hole plugged.



## DAILY REPORTS

### GB-ER PLUG AND ABANDON

- 8-29-78 Moved in Farmington Well Service's 210A rig No. 14 and rigged up. Worked days only.
- 8-30-78 Shut-in tubing pressure was 610 psi. Rigged up Dowell and pumped 25 barrels of water down the 2 7/8-inch O.D., EUE tubing. Flushed contaminated tank and mud pump with 150 barrels of water and pumped down the hole. Ran McCullough collar locator, top of packer at 3,784 feet and bottom at 3,792 feet.
- 8-31-78 Pumped 10 barrels of water down the tubing at 610 psi to kill well. Perforated tubing at 3,760 feet and 3,761.5 feet with McCullough chemical gun. Attempted to pump through perforations with 79 barrels of water. Pressured up on annulus to 550 psi after 50 barrels.
- 9-1-78 Perforated tubing from 3,760 feet to 3,761 feet with one hole per foot with McCullough jet gun. Pumped 168 barrels of water down the 7-inch O.D. casing with no pressure. Ran gauge ring down the tubing to 3,776 feet. Ran Baker P-1 tubing plug on McCullough setting tool to 188 feet and plug stuck. Could not work free, top of fish at 161.85 feet.
- 9-2-78 Pulled McCullough wire line out of the rope socket. Pumped water in the hole. Ran 2 5/16-inch O.D. overshot in the hole on 1.75-inch O.D. drill pipe and worked over fish. Recovered all of the setting tool.
- 9-5-78 Rig secured from 9-2-78 to 9-5-78. Installed blowout equipment, pumped 63 barrels of water down the annulus and tested to 600 psi. Attempted to release the tubing seal assembly from the Baker Model D packer with no results.

- 9-6-78 Tested blowout equipment to 600 psi. Pumped 30 barrels of water down the 7-inch casing and 2 7/8-inch tubing annulus. Continued attempting to recover tubing seal assembly with no results. Ran 2 1/4-inch bit inside the tubing on 1.66-inch drill pipe. Drilled out 3 1/2-inch of plug and drilled a hole in the tubing at 187 1/2-feet and had communication between the tubing and casing. Pressured up to 700 psi and released pressure on the tubing and casing. Laid down the drill pipe and bit. Pressured up on the tubing and casing again and bled off.
- 9-7-78 Released pressure on the casing and tubing. Shut in and checked pressure buildup. Pumped water down the annulus at 790 psi and cleared plugged perforations from 3,760 feet to 3,761 feet. Pumped 107 barrels of water down the annulus with no pressure. Pressure built up to 610 psi in 1 1/2 hours. Pumped 31 barrels of water down the annulus with no pressure. Pressure built up to 400 psi in 1/2 hour. Pumped 29 barrels of water down the annulus and 10.4 barrels down the tubing with no pressure.
- 9-8-78 Pumped 243 barrels of water down the hole and removed tubing hanger. Ran McCullough outside back off string shot and backed off tubing. Recovered 738 feet of 2 7/8-inch O.D., EUE tubing. Ran 5 3/4-inch overshot in the hole and latched onto tubing at 738 feet. Ran McCullough string shot inside the tubing and backed off tubing at 3,751 feet. Recovered 100 joints of tubing. Pumped water down the annulus at 27 gallons per minute during operations.
- 9-9-78 Pumped water in the hole to kill well. Ran McCullough 5 11/16-inch gauge ring and collar in the hole, tagged top of the tubing at 3,752 feet. Set Baker Model "N" wire line bridge plug at 3,740 feet. Could not release setting tool. Pulled out of rope socket and left 10.55 feet of tool in the hole. Bled pressure off the casing. Ran four joints of 2 7/8-inch O.D. tubing and set in tubing hanger. Shut in hole. The bridge plug was not holding, pressure started building up.

- 9-10-78 Pressure built up to 200 psi. Released pressure and shut in. Pressure built up to 95 psi in 1/2 hour. Release pressure and shut in for 1 hour, pressure built up to 55 psi. Released pressure and shut in for 1 hour, pressure built up to 20 psi. Released pressure and shut in for 3 1/2 hours, no pressure. Ran McCullough fluid probe at 1600, 1630 and 1730 hours, fluid level remained at 1,192 feet. Ran 2 7/8-inch O.D. tubing in the hole to 3,721 feet. Set plug No. 1 using Dowell with 7 barrels of water ahead of 96 feet<sup>3</sup> of class "H" cement. Displaced cement with 14 1/2 barrels of water. Cement in place at 1900 hours. Pulled tubing to 2,973 feet.
- 9-11-78 Ran 2 7/8-inch O.D. tubing in the hole and tagged top of plug No. 1 at 3,542 feet. Mixed up 60 sacks of gel and attempted to pump down the tubing, tubing plugged. Made up 5 3/4-inch Grant section mill on 3 1/2-inch drill pipe and started in hole.
- 9-12-78 Ran 5 3/4-inch mill in the hole and displaced water with 126 barrels of mud with pressures from 100 to 300 psi at 2 barrels per minute.
- 9-13-78 Pulled out of hole and ran 2 7/8-inch O.D. tubing in the hole and tagged plug No. 1 at 3,542 feet. Set plug No. 2 with 63 feet<sup>3</sup> of class "H" cement. Displaced tubing with 33 barrels of water. Hung tubing at 2,662 feet. Cement in place at 1715 hours.
- 9-14-78 Tagged top of plug No. 2 at 3,261 feet. Pressured up on plug No. 2 to 200 psi, pressure held. Set plug No. 3 with 5 barrels of water ahead of 175 feet<sup>3</sup> of class "H" cement. Displaced tubing with 12 barrels of mud. Pulled tubing of 1,905 feet and reverse circulated the tubing with 28 barrels of mud. Cement in place at 1100 hours.
- 9-15-78 Tagged top of plug No. 3 at 2,756 feet. Pressured up on plug No. 3 to 200 psi, pressure held. Pulled tubing out of the hole. Made up 5 3/4-inch section mill on 3 1/2-inch drill pipe and milled out a section of the 7-inch O.D. 26#, N-80 casing from 2,350 feet to 2,355 1/2 feet.

(Cont.)

- 9-16-78 Milled 7-inch O.D. casing from 2,355 1/2 feet to 2,357 feet. Changed out cutters and ran back in hole.
- 9-17-78 Milled casing from 2,357 feet to 2,358 feet and mill wore out.
- 9-18-78 Made up 4 3/4-inch Dotco two bladed mill and milled casing and cables from 2,355 feet to 2,358 feet. Blades extended to a cutting diameter of 13-inches. Pulled out of hole.
- 9-19-78 Made up 5 3/4-inch Grant section mill and milled on the 7-inch O.D. casing at 2,358 feet; milled 4 inches. Laid down mill and ran 3 1/2-inch drill pipe in the hole open ended.
- 9-20-78 Laid down drill pipe and removed blowout equipment. Ran 2 7/8-inch O. D. tubing in the hole, hit bridge at 2,694 feet and worked to 2,725 feet where tubing stopped. Pulled 8 strands of tubing.
- 9-21-78 Ran tubing in the hole to fill at 2,694 feet and washed to 2,725 feet. Rotated and washed tubing to firm cement at 2,729 feet circulating contaminated cement to surface. Set plug No. 4 with 195 feet<sup>3</sup> of class "H" cement. Cement in place at 1500 hours.
- 9-22-78 Tagged top of plug No. 4 at 1,923 feet. Excavated below the bottom of the cellar and installed a gauge on the 20-inch x 7-inch casinghead outlet. The pressure was 25 psi, bled pressure to 5 psi in 20 minutes. Continued bleeding pressure to 30 minutes and pressure remained at 5 psi. Set plug No. 5 with 195 feet<sup>3</sup> of class "H" cement. Cement in place at 1630 hours. Left casing annulus open after cementing.
- 9-23-78 Pressure on the 20-inch x 7-inch annulus was 0 psi. Tagged top of plug No. 5 at 1,078 feet. Set plug No. 6 with 150 feet<sup>3</sup> of class

(Cont.)

"H" cement, pulled tubing to 570 feet and pumped in 100 feet<sup>3</sup> of the same slurry. Circulated good cement to surface. Laid down the tubing and released rig at 1800 hours. Pumped 59 feet<sup>3</sup> of class "H" cement into the 20-inch x 7-inch annulus at 300 psi to a final pressure of 14 psi.

9-24-78 Checked pressure on the annulus at 14 psi. Opened valve and bled pressure from 0800 to 1030 hours.

9-25-78 Checked pressure on the annulus at 6 psi, bled to 0 psi in one minute. Closed valve. Hole plugged.

Installed hole marker on the 20-inch casinghead.

**APPENDIX D**

**PERMITS, AUTHORIZATIONS, SUNDRY NOTICES**

UNITED STATES  
DEPARTMENT OF THE INTERIOR  
GEOLOGICAL SURVEY

## 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 Form 9-331-C for such proposals.)

1. oil ☐ gas ☐ other ☒ Natural Gas Stimulation  
well well Experiment PS Reentry
2. NAME OF OPERATOR  
U.S. Dept. of Energy/El Paso Natural Gas Co.
3. ADDRESS OF OPERATOR  
U.S. DOE, P.O. Box 14100, Las Vegas, NV 89114
4. LOCATION OF WELL (REPORT LOCATION CLEARLY. See space 17 below.)  
1218' FSL, 2070' FWL, Sec. 36, T-29-N,  
AT SURFACE: R-4-W 3678' TVD 15.14' N, 17.14' E  
AT TOP PROD. INTERVAL: of Surface  
AT TOTAL DEPTH: At 4600' MD, 4590.69' TVD, 38.54S &  
76.15' W of Surface
16. CHECK APPROPRIATE BOX TO INDICATE NATURE OF NOTICE, REPORT, OR OTHER DATA

5. LEASE  
Carson National Forest
6. IF INDIAN, ALLOTTEE OR TRIBE NAME
7. UNIT AGREEMENT NAME
8. FARM OR LEASE NAME
9. WELL NO.  
GB-2RS
10. FIELD OR WILDCAT NAME  
Choza Mesa Pictured Cliffs
11. SEC., T., R., M., OR BLK. AND SURVEY OR AREA  
Sec. 36, T-29-N, R-4-W
12. COUNTY OR PARISH 13. STATE  
Rio Arriba New Mexico
14. API NO.
15. ELEVATIONS (SHOW OF, KDB, AND WD)  
KDB-7212', OF-7211', GL-7199'

## REQUEST FOR APPROVAL TO:

## SUBSEQUENT REPORT OF:

TEST WATER SHUT-OFF ☐  
FRACTURE TREAT ☐  
SHOOT OR ACIDIZE ☐  
REPAIR WELL ☐  
PULL OR ALTER CASING ☐  
MULTIPLE COMPLETE ☐  
CHANGE ZONES ☐  
ABANDON\* ☐  
(other) ☐

☐  
☐  
☐  
☐  
☐  
☐  
☒ work started 8/18/78

(NOTE: Report results of multiple completion or zone change on Form 9-330.)

17. DESCRIBE PROPOSED OR COMPLETED OPERATIONS (Clearly state all pertinent details, and give pertinent dates, including estimated date of starting any proposed work. If well is directionally drilled, give subsurface locations and measured and true vertical depths for all markers and zones pertinent to this work.)\*

1. No pressure on casing or tubing. Circulated hole with water.
2. Pull 2-3/8" O.D. Hydril tubing overall length 4222.24'.
3. Travel back in hole with 2-3/8" O.D. tubing and tagged fill @ 3816' and washed down to 3830'.
4. Spotted 175 ft<sup>3</sup> cement plug from 3827' to 3224'. Tagged plug with 14,000# tubing weight.
5. Spotted 75 ft<sup>3</sup> cement plug from 600' to 348'. Tagged top of plug with tubing.
6. Cut 7" O.D. casing off at top of 9-5/8" casing head @ 3.5' below ground level.
7. Spotted a 4 ft<sup>3</sup> cement plug from 15' to surface. Installed a 4" O.D. steel hole marker extending 4.2' above ground level. Backfilled cellar with dirt. Work completed 8-21-78.

Subsurface Safety Valve: Manu. and Type

Set @ Ft.

18. I hereby certify that the foregoing is true and correct

Engr. & Energy Appl. Div.  
DOE/NV

FEB 7 1979

SIGNED

TITLE: I.R.,

DATE

APPROVED

APPROVED BY  
CONDITIONS OF APPROVAL, IF ANY

TITLE

DATE

SEP 17 1979

CARL A. BARRICK

ACTING DISTRICT ENGINEER

\*See Instructions on Reverse Side

UNITED STATES  
DEPARTMENT OF THE INTERIOR  
GEOLOGICAL SURVEY

## 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 Form 9-331-C for such proposals.)

1. oil ☐ gas ☐ other ☒ Natural Gas Stimulation  
well well Experiment Instr. Hole

2. NAME OF OPERATOR

U.S. Dept. of Energy/El Paso Natural Gas Co.

3. ADDRESS OF OPERATOR

U.S. DOE, P.O. Box 14100, Las Vegas, NV 89114

4. LOCATION OF WELL (REPORT LOCATION CLEARLY. See space 17 below.)

T-29-N,

AT SURFACE: 1324' FSL, 1614' FWL, Sec. 36, R-4-W

AT TOP PROD. INTERVAL:

AT TOTAL DEPTH: 113.62' N 60°38' E of Surface

16. CHECK APPROPRIATE BOX TO INDICATE NATURE OF NOTICE,  
REPORT, OR OTHER DATA

REQUEST FOR APPROVAL TO:

SUBSEQUENT REPORT OF:

TEST WATER SHUT-OFF ☐FRACTURE TREAT ☐SHOOT OR ACIDIZE ☐REPAIR WELL ☐PULL OR ALTER CASING ☐MULTIPLE COMPLETE ☐CHANGE ZONES ☐ABANDON\* ☐(other) ☐☒ work started 8/25/78

5. LEASE

Carson National Forest

6. IF INDIAN, ALLOTTEE OR TRIBE NAME

7. UNIT AGREEMENT NAME

8. FARM OR LEASE NAME

9. WELL NO.

GB-1

10. FIELD OR WILDCAT NAME

Choza Mesa Pictured Cliffs

11. SEC., T., R., M., OR BLK. AND SURVEY OR AREA

Sec. 36, T-29-N, R-4-W

12. COUNTY OR PARISH

13. STATE

Rio Arriba

New Mexico

14. API NO.

15. ELEVATIONS (SHOW DF, KDB, AND WD)

KDB-7215', DF-7214', GL-7203'

(NOTE: Report results of multiple completion or zone change on Form 9-330.)

17. DESCRIBE PROPOSED OR COMPLETED OPERATIONS (Clearly state all pertinent details, and give pertinent dates, including estimated date of starting any proposed work. If well is directionally drilled, give subsurface locations and measured and true vertical depths for all markers and zones pertinent to this work.)\*

1. Tied into tubing above tubing hanger.
2. Blew tubing and cables apart with plastic explosive @ 717'. Pulled tubing and cables.
3. Cut 13-3/8" and 9-5/8" casing strings off @ 2.2' below ground level. Spotted a cement plug (393 ft<sup>3</sup>) from 618' to surface.
4. Pulled CMP from cellar and installed 4" O.D. steel hole marker extending 4.7' above ground level. Backfilled cellar with dirt. Work completed 8-26-78.

Subsurface Safety Valve: Manu. and Type

Set @ Ft.

18. I hereby certify that the foregoing is true and correct

Engrg. &amp; Energy Appl. Div.

FEB 7 1979

SIGNED

TITLE

DIR. DOE/NV

DATE

APPROVED

(This space for Federal or State office use)

APPROVED BY

TITLE

DATE

CONDITIONS OF APPROVAL, IF ANY:

SEP 17 1979

CARL A. BARRICK

ACTING DISTRICT ENGINEER

\*See Instructions on Reverse Side



UNITED STATES  
DEPARTMENT OF THE INTERIOR  
GEOLOGICAL SURVEY

## 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 Form 9-331-C for such proposals.)

1. oil ☐ well gas ☒ well other ☐ Natural Gas Stimulation Experiment PS Test Well
2. NAME OF OPERATOR  
U.S. Dept. of Energy/El Paso Natural Gas Co.
3. ADDRESS OF OPERATOR  
U.S. DOE, P.O. Box 14100, Las Vegas, NV 89114
4. LOCATION OF WELL (REPORT LOCATION CLEARLY. See space 17 below.)  
1430' FSL, 1636' FWL, Sec. 36  
AT SURFACE: T-29-N, R-4-W  
AT TOP PROD. INTERVAL:  
AT TOTAL DEPTH: Same as above (Vertical Hole)
16. CHECK APPROPRIATE BOX TO INDICATE NATURE OF NOTICE, REPORT, OR OTHER DATA

## REQUEST FOR APPROVAL TO:

TEST WATER SHUT-OFF ☐  
FRACTURE TREAT ☐  
SHOOT OR ACIDIZE ☐  
REPAIR WELL ☐  
PULL OR ALTER CASING ☐  
MULTIPLE COMPLETE ☐  
CHANGE ZONES ☐  
ABANDON\* ☐  
(other) \_\_\_\_\_

## SUBSEQUENT REPORT OF:

☐  
☐  
☐  
☐  
☐  
☐  
☐  
☒ work started 8/21/78

5. LEASE  
Carson National Forest SF 107761
6. IF INDIAN, ALLOTTEE OR TRIBE NAME
7. UNIT AGREEMENT NAME
8. FARM OR LEASE NAME
9. WELL NO.  
GB-3
10. FIELD OR WILDCAT NAME  
Choza Mesa Pictured Cliffs
11. SEC., T., R., M., OR BLK. AND SURVEY OR AREA  
Sec. 36, T-29-N, R-4-W
12. COUNTY OR PARISH | 13. STATE  
Rio Arriba | New Mexico
14. API NO.
15. ELEVATIONS (SHOW DF, KDB, AND WD)  
KDB-7213', DF-7212', GL-7200'

(NOTE: Report results of multiple completion or zone change on Form 9-330.)

17. DESCRIBE PROPOSED OR COMPLETED OPERATIONS (Clearly state all pertinent details, and give pertinent dates, including estimated date of starting any proposed work. If well is directionally drilled, give subsurface locations and measured and true vertical depths for all markers and zones pertinent to this work.)

1. Circulated hole with water. Pulled 2-3/8" O.D. tubing, recovered 4238.99'.
2. Tagged fill at 4801' and spotted 260 ft<sup>3</sup> plug from 4801' to 3195'. Tagged cement plug with 10,000 pounds tubing weight.
3. Perforated 7" O.D. casing with 4 holes from 603' to 604'.
4. Circulated 7" x 9-5/8" casing annulus with cement and displaced cement plug to 291'. Tagged cement plug inside 7" O.D. casing with tubing.
5. Cut 7" O.D. and 9-5/8" O.D. casing strings off at 2.4' below ground level. Pulled CMP from cellar.
6. Spotted 4 ft<sup>3</sup> cement plug from 15' to surface. Installed 4" O.D. steel hole marker extending 4.1" above ground level. Backfilled cellar with dirt. Work completed 8-26-78.

Subsurface Safety Valve: Manu. and Type \_\_\_\_\_ Set @ \_\_\_\_\_ Ft.

18. I hereby certify that the foregoing is true and correct \_\_\_\_\_ Engr. & Energy Appl. Div.

SIGNED \_\_\_\_\_

TITLE \_\_\_\_\_

DOE/NV

DATE \_\_\_\_\_

OCT 7 1979

(This space for Federal or State office use)

APPROVED BY \_\_\_\_\_

APPROVED

TITLE \_\_\_\_\_

DATE \_\_\_\_\_

CONDITIONS OF APPROVAL, IF ANY:

SEP 17 1979

CARL A. BARRICK

ACTING DISTRICT ENGINEER

\*See Instructions on Reverse Side



UNITED STATES  
DEPARTMENT OF THE INTERIOR  
GEOLOGICAL SURVEY

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 Form 9-331-C for such proposals.)

1. oil ☐ gas ☒ other ☐ Post Shot Reentry of  
well well Emplacement Hole
2. NAME OF OPERATOR  
U.S. Dept. of Energy/EI Paso Natural Gas Co.
3. ADDRESS OF OPERATOR  
U.S. DOE, P.O. Box 14100, Las Vegas, NV 89114
4. LOCATION OF WELL (REPORT LOCATION CLEARLY. See space 17  
below.) 1218' FSL, 1770' FWL, Sec. 36,  
AT SURFACE: T-29-N, R-4-W  
AT TOP PROD. INTERVAL:  
AT TOTAL DEPTH: Same as above (Vertical Hole)
16. CHECK APPROPRIATE BOX TO INDICATE NATURE OF NOTICE,  
REPORT, OR OTHER DATA

REQUEST FOR APPROVAL TO:

- TEST WATER SHUT-OFF ☐  
FRACTURE TREAT ☐  
SHOOT OR ACIDIZE ☐  
REPAIR WELL ☐  
PULL OR ALTER CASING ☐  
MULTIPLE COMPLETE ☐  
CHANGE ZONES ☐  
ABANDON\* ☐  
(other) ☐

SUBSEQUENT REPORT OF:

- ☐  
☐  
☐  
☐  
☐  
☐  
☐  
☐

☒ work started 8/29/78

5. LEASE  
Carson National Forest
6. IF INDIAN, ALLOTTEE OR TRIBE NAME
7. UNIT AGREEMENT NAME
8. FARM OR LEASE NAME
9. WELL NO.  
GB-ER
10. FIELD OR WILDCAT NAME  
Choza Mesa Pictured Cliffs
11. SEC., T., R., M., OR BLK. AND SURVEY OF  
AREA  
Sec. 36, T-29-N, R-4-W
12. COUNTY OR PARISH | 13. STATE  
Rio Arriba | New Mexico
14. API NO.
15. ELEVATIONS (SHOW DF, KDB, AND WD)  
KDB-7227', DF-7226', GL-7211'

(NOTE: Report results of multiple completion or zone  
change on Form 9-330.)

17. DESCRIBE PROPOSED OR COMPLETED OPERATIONS (Clearly state all pertinent details, and give pertinent dates,  
including estimated date of starting any proposed work. If well is directionally drilled, give subsurface locations and  
measured and true vertical depths for all markers and zones pertinent to this work.)

- Backed tubing off 1 joint above packer at 3751'.
- Set wireline bridge plug inside 7" O.D. casing at 3740'. Left  
setting tools on top of bridge plug with top at 3729'.
- Spotted 96 ft<sup>3</sup> cement plug from 3721' to 3542' inside 7" O.D. casing  
and tagged with tubing.
- Spotted 63 ft<sup>3</sup> cement plug from 3542' to 3261' and tagged with tubing.
- Spotted 175 ft<sup>3</sup> cement plug from 3261' to 2729'.
- Milled a section of 7" O.D. casing from 2350' to 2358½'. Extended  
section cut between 2355' and 2358' to a 13" diameter.
- Spotted 195 ft<sup>3</sup> cement plug from 2729' to 1923' and tagged with tubing.
- Spotted 195 ft<sup>3</sup> cement plug from 1923' to 1078' and tagged with tubing.
- Circulated cement to the surface from 1078' using 250 ft<sup>3</sup>, and pumped  
59 ft<sup>3</sup> cement in 20" x 7" casing annulus.
- Pulled CMP from cellar. Cut 7" casing off @ top of 20" casing head  
flange (3.5' below G.L.) and welded 1/2" plate over 7" O.D. casing.  
Backfilled cellar with dirt.
- Installed concrete monument over hole. Work completed 9-25-78.

Subsurface Safety Valve: Manu. and Type

18. I hereby certify that the foregoing is true and correct

Engrg. & Energy Appl. Div.

FEB 1 1979

SIGNED

TITLE

DOE/RV

DATE

APPROVED

(This space for Federal or State office use)

APPROVED BY  
CONDITIONS OF APPROVAL, IF ANY

TITLE

DATE

SEP 17 1979

CARL A. BARRICK

ACTING DISTRICT ENGINEER

\*See Instructions on Reverse Side

APPENDIX E  
AVAILABLE PUBLICATIONS  
PROJECT GASBUGGY

PEACEFUL NUCLEAR EXPLOSIONS (PNE)

REPORTS

PNE-G-1 Project Gasbuggy Feasibility Study. May 14, 1965 (EPNG) (USBM)  
(PNE-1000). NSA-20:470

PNE-G-2 Gasbuggy Preshot Summary Report. November 1967 (UCRL) (PNE-1001)  
(UCRL-50345). NSA-22:8239

PNE-G-3 Gasbuggy Preliminary Postshot Summary Report. January 1968 (UCRL)  
(PNE-1003) (UCRL-50386). NSA-22:18999

PNE-G-4 Project Gasbuggy: A Government-Industry Natural Gas Production  
Stimulation Experiment Using Nuclear Explosives. September 15,  
1967 (EPNG) (USBM). NSA-23:488

PNE-G-5 Nuclear Operation: Project Gasbuggy. October 19, 1967 (UCRL)  
(UCRL-50334). NSA-22:12464

PNE-G-6 Computer Calculations of the Gasbuggy Event. May 10, 1968 (UCRL)  
(UCRL-50419). NSA-22:35966

PNE-G-7 Gasbuggy Postshot Investigations in GB-ER. April 19, 1968 (UCRL)  
(UCRL-50425). NSA-22:45210

PNE-G-8 Project Gasbuggy: Well Test Data, Volume II. September 1967 to  
September 1968 (EPNG) (Specifications). NSA-23:489

PNE-G-9 Drilling and Testing Operations for Project Gasbuggy. 1968 (EPNG)  
(CONF-680926-3). NSA-23:490

PNE-G-10 Gas Quality Investigation Program: Status Report for Project Gasbuggy.  
September 18, 1968 (UCRL) (UCRL-71314, Rev. 1) (CONF-680926).  
NSA-23:495

PNE-G-11 Gasbuggy Postshot Geologic Investigations. November 1968 (UCRL)  
(EPNG) (UCRL-71354) (CONF-680926-2). NSA-23:496

PNE-G-12 Operational Safety Aspects of Project Gasbuggy. September 1968 (NV).  
NSA-23:491

PNE-G-13 Status of Reservoir Evaluation: Project Gasbuggy. 1968 (USBM)  
(EPNG) (CONF-680926-4). NSA-23:492

PNE-G-14 Report of Gas Analyses, GB-1, GB-ER. 1967 (USBM) (Specifications).  
NSA-Not Cited

PNE-G-15 Report of Water Analyses, GB-1, 10-36. 1967 (USBM) (Specifications).  
NSA-Not Cited

PNE-G-16 Core Analysis Results, GB-1, GB-2. 1967, 1968 (USBM) (Specifications). NSA-Not Cited

PNE-G-17 Core Analysis Results, GB-1. 1967 (EPNG) (Specifications). NSA-Not Cited

PNE-G-18 Core Analysis Results, GB-2. 1967 (EPNG) (Specifications). NSA-Not Cited

PNE-G-19 Core Description From GB-1 (Gasbuggy) in the Northeastern Part of the San Juan Basin, Rio Arriba County, New Mexico. 1967 (USGS) (Specifications). NSA-Not Cited

PNE-G-20 EPNG Project Gasbuggy Well Test Data, Volume I, February 1967-September 1967. 1967 (EPNG) (Specifications). NSA-23:493

PNE-G-21 Area Map and Plot Plan--Project Gasbuggy. nd (EPNG). NSA-Not Cited

PNE-G-22 Flowmeter Tests in GB-2RS, June 23, 1968: Memorandum. September 23, 1968 (UCRL) (SDK-68-28) (Specifications). NSA-23:2442

PNE-G-23 Chemical Analysis of Gasbuggy Rock. April 4, 1968 (UCRL) (Specifications). NSA-23-2184

PNE-G-24 Well Test Data, Volume III, 1968, 1969 (EPNG) (Specifications). NSA-Not Cited

PNE-G-25 Inventory of Wells and Springs Within a 10-Mile Radius of Project Gasbuggy, Rio Arriba County, New Mexico. December 1968 (USGS) (Specifications). NSA-23:9535

PNE-G-26 Hydrologic Tests in Hole GB-1, Project Gasbuggy, Rio Arriba County, New Mexico. December 1968 (USGS) (Specifications). NSA-23:9536

PNE-G-27 Hydrologic Tests in Hole GB-2, Project Gasbuggy, Rio Arriba County, New Mexico. December 1968 (USGS) (Specifications). NSA-23:9537

PNE-G-28 Project Gasbuggy Operational Experiences. January 10, 1969 (UCRL) (UCRL-71356) (CONF-690103-2). NSA-23:15998

PNE-G-29 Theoretical and Experimental Studies Relating to the Purging of Radioactivity from a Gas Well Stimulated by a Nuclear Explosion. December 24, 1968 (UCRL) (UCRL-50519). NSA-23:15996

PNE-G-30 Non-Gaseous Radioisotopes--Project Gasbuggy--Chimney Gas. January 15, 1969 (UCRL) (SDK-69-8). NSA-23:21841

PNE-G-31 Preliminary Observations of the Postshot Geologic Effects of the Gasbuggy Nuclear Stimulation, Northeast San Juan Basin, New Mexico. February 20, 1969 (EPNG) (CONF-6902701). NSA-23:26389

PNE-G-32 Seismic Analysis of a Nuclear Explosion: Gasbuggy. December 10, 1967 (C&GS). NSA-23:21842

PNE-G-33 Operational Safety Plan: Project Gasbuggy. October 1967 (NV). NSA-23:31081

PNE-G-34 Specifications for Emplacement Hole GB-E Gasbuggy. May 1967 (F&S) (Specifications). NSA-Not Cited

PNE-G-35 Specifications for Instruments and Stemming: Project Gasbuggy. August 1967 (F&S) (Specifications). NSA-Not Cited

PNE-G-36 Specifications for Cementing Services: Project Gasbuggy. July 1967 (F&S) (Specifications). NSA-Not Cited

PNE-G-37 Specifications for Well Logging Services: Project Gasbuggy. June 1967 (F&S) (Specifications). NSA-Not Cited

PNE-G-38 Specifications for Surveying Services: Project Gasbuggy. June 1967 (F&S) (Specifications). NSA-Not Cited

PNE-G-39 Specifications for Postshot Drilling and Reentry, GB-2: Project Gasbuggy. May 1968 (F&S) (Specifications). NSA-Not Cited

PNE-G-40 Specifications for Drilling, Emplacement, and Instrumentation: Project Gasbuggy. July 1967 (F&S) (Specifications). NSA-Not Cited

PNE-G-41 Planning & Program Directive: Project Gasbuggy. August 1967 (NV). NSA-23:26390

PNE-G-42 Gasbuggy Water Sample Analysis Results, November 4, 1968-April 17, 1969. 1969 (NV). NSA-Not Cited

PNE-G-43 Gasbuggy Experiment. March 10, 1969 (UCRL) (UCRL-71624) (CONF-690312-3). NSA-23:26391

PNE-G-44 Project Gasbuggy: Gas Quality Analysis and Evaluation Program Tabulation of Radiochemical and Chemical Analytical Results. April 22, 1969 (UCRL) (UCRL-50635). NSA-23:31452

PNE-G-44 Rev. 1 Project Gasbuggy: Gas Quality Analysis and Evaluation Program Tabulation of Radiochemical and Chemical Analytical Results. November 17, 1969 (UCRL) (UCRL-50635, Rev. 1). NSA-24:16728

PNE-G-44 Rev. 2 Project Gasbuggy: Gas Quality Analysis and Evaluation Program Tabulation of Radiochemical and Chemical Analytical Results. November 17, 1969 (UCRL) (UCRL-50635, Rev. 2). NSA-25:44476

PNE-G-45 Nongaseous Radioisotopes--Project Gasbuggy--Chimney Gas. April 7, 1969 (UCRL) (UCRL-50634). NSA-23:31451

PNE-G-46 Off-Site Radiological Surveillance Program for Project Gasbuggy. June 1969 (USPHS). NSA-23:40878

PNE-G-47 Project Gasbuggy: On-Site Radiological Safety and Medical Support Services, October 11, 1967 to January 24, 1968. August 1, 1969 (EIC) (NVO-294-1). NSA-24:484

PNE-G-48 Answers to Questions Posed by the Colorado Committee for Environmental Information Relating to the Forthcoming Rulison Underground Nuclear Explosion in Western Colorado. August 27, 1969 (NV). NSA-23:47663

PNE-G-49 Gasfield and Mine Survey: Project Gasbuggy. June 1968 (USBM) (PNE-1011). NSA-24:343

PNE-G-50 Seismic Measurements: Project Gasbuggy. February 29, 1968 (C&GS) (PNE-1014). NSA-24:7537

PNE-G-51 Analysis of Ground Motions and Close-in-Physical Effects: Gasbuggy Event. October 1969 (ERC) (PNE-1010) (NVO-1163-158). NSA-24:11712

PNE-G-52 Gasbuggy No. 1 and Gasbuggy No. 3 Core Display, Farmington, New Mexico. October 1969 (EPNG) (Specifications). NSA-Not Cited

PNE-G-53 Gasbuggy in Perspective. January 14, 1970 (UCRL) (UCRL-72175) (CONF-700101-3). NSA-24:14109

PNE-G-54 Gasbuggy Reservoir Evaluation 1969 Report. December 1, 1969 (USBM) (EPNG) (CONF-700101-7). NSA-24:20926

PNE-G-55 Gas Quality Analysis and Evaluation Program for Project Gasbuggy. December 19, 1969 (UCRL) (UCRL-72153) (CONF-700101-14). NSA-24:20930

PNE-G-56 Behavior of Radionuclides in Nuclear Gas Stimulation Techniques. December 21, 1969 (UCRL) (UCRL-72152) (CONF-700101-15). NSA-24:20878

PNE-G-57 Determining the Explosion Effects on the Gasbuggy reservoir from Computer Stimulation of the Postshot Gas Production History. January 1970 (EPNG) (CONF-700101-13). NSA-24:22830

PNE-G-58 An Evaluation of Water Production from the Gasbuggy Reentry Well. January 1970 (EPNG) (CONF-700101-11). NSA-24:20927

PNE-G-59 Project Gasbuggy: Final Report on Structural Response. November 1969 (JAB) (PNE-1012). NSA-24:16727

PNE-G-60 Hydrology of Project Gasbuggy Site, Rio Arriba County, New Mexico. September 1969 (USGS) (PNE-1013). NSA-24:19084

PNE-G-61 Report of Off-Site Surveillance for Project Gasbuggy, March 1967 to June 1968. February 1970 (USPHS) (SWRHL-99r). NSA-24:22845



PNE-G-62 Gasbuggy Postshot Hydrologic Investigations in GB-3. March 9, 1970 (UCRL) (UCRL-50812). NSA-24:29414

PNE-G-63 Environmental Surveillance for Project Gasbuggy Production Test Phase. June 1970 (USPHS) (SWRHL-100r). NSA-24:41433

PNE-G-64 Instrumentation for Monitoring of <sup>85</sup>Kr and <sup>3</sup>H in Natural Gas. May 26, 1970 (UCRL) (UCRL-50882). NSA-24:41657

PNE-G-65 Project Gasbuggy Off-Site Radiological Safety Report GB-2R Phase I Program. July 1970 (USPHS) (SWRHL-105r). NSA-24:44127

PNE-G-66 Some Seismic Results of the U.S. Gasbuggy and Rulison Underground Nuclear Explosions. 1970 (United Kingdom, Atomic Energy Authority) (PNE-R-36) (AWRE-0-46/70). NSA-24:41458

PNE-G-67 Microfracturing in Postshot Gasbuggy Core GB-3. June 22, 1970 (UCRL) (UCRL-50893). NSA-24:50480

PNE-G-68 The Chemistry of the Gasbuggy Chimney. November 1970 (Applied Nuclear Co., La Jolla, California). NSA-25:8384

PNE-G-69 Petrographic Analysis-Gasbuggy No. 1 and Gasbuggy No. 3. August 1970 (EPNG). NSA-25:8385

PNE-G-70 Permeability of Pictured Cliffs Sandstone: Gasbuggy Preshot and Postshot Measurements. October 7, 1970 (LRL) (UCRL-50946).

PNE-G-71 Project Gasbuggy Hole Histories GB-E; GB-E-R; GB-1; GB 2R and 2RS; GB-D; GB-10-36. nd (F&S). NSA-25:21221

PNE-G-72 Gas Produced From GB-ER. nd (EPNG). NSA-25:21222

PNE-G-73 Gasbuggy Seismic Source and Surface Motion. December 1967 (SC) (PNE-1002). NSA-25:26405

PNE-G-74 Ground Water Safety Evaluation-Project Gasbuggy March 1971 (Isotopes, Inc.) (PNE-1009). NSA-25:26406

PNE-G-75 Weather Predictions and Surface Radiation Estimates for the Gasbuggy Event. March 1971 (ARL) (PNE-1008). NSA-25:37509

PNE-G-76 Hydraulic Testing of the Ojo Alamo Sandstone in Hole GB-3, Project Gasbuggy, Rio Arriba County, New Mexico. 1971 (USGS) (USGS-474-91). NSA-26:22745

PNE-G-77 On-Site Radiological Safety During Production Testing, January 25, 1968 to December 31, 1969. August 20, 1970 (EIC) (PNE-1006).

PNE-G-78 Desert Vegetation Uptake of Tritium From Project Gasbuggy Effluent. nd (WERL/EPA). NSA-26:4742

- PNE-G-79 Project Gasbuggy Manager's Report. November 1971 (NV) (NVO-37).  
NSA-26:28020
- PNE-G-80 Theoretical Evaluation of Consumer Products from Project Gasbuggy.  
Final Report. Tritium Behavior in a Natural Gas Processing Plant.  
July 1972 (ORNL) (ORNL-4775). NSA-26:50539
- PNE-G-81 The Effects of Heat and Radiation on Gasbuggy Chimney Gas.  
October 24, 1972 (LLL) (UCRL-51293). NSA-28:348
- PNE-G-82 Results of Sampling Natural Gas Wells in the Vicinity of Project  
Gasbuggy. February 1973 (NERC-LV) (NERC-LV-539-9). NSA-27:27533
- PNE-G-83 The Effects of Nuclear Stimulation at Project Gasbuggy. 1972 (EPNG).  
NSA-Not Cited
- PNE-G-84 Planning and Operations Directive--Gasbuggy--1973 Production Testing  
Program. September 1973 (NV) (NVO-137). NSA-29:341
- PNE-G-85 Gasbuggy Production Testing. nd (EPNG). NA-29:24154
- Presented at Winter Meeting of American Nuclear Society.  
November 11-16, 1973, San Francisco, California.
- PNE-G-86 El Paso Natural Gas Company. Project Gasbuggy Well Test Data.  
Volume 5. May 14, 1973 to November 6, 1973 (EPNG). NSA-30:263
- PNE-G-87 Final Report of the Radiological Surveillance Program for Project  
Gasbuggy Production Test, May 15, 1973 to November 6, 1973. August  
1974. (NERC) (NERC-LV-539-30). NSA-30:23982
- PNE-G-88 (NVO-195) Project Gasbuggy Well Plugging and Site Restoration Plan.  
(U.S. Department of Energy, Las Vegas, Nevada.) July 1976
- PNE-G-89 Project Gasbuggy Radiation Contamination Clearance Report. Eberline  
Instrument Corporation. Santa Fe, New Mexico. June 27, 1979
- PNE-1012 Final Report on Structural Response: Project Gasbuggy. (Blume,  
John A. and Associates, Research Division, San Francisco, California).  
November 1969
- PNE-3014 Special Report on the Hardcore Costs of Projects Gasbuggy and Schooner.  
Campbell, E. D. (San Francisco Operations Office (AEC) California).  
April 1969

## OTHER REPORTS

- NVO-50      Addendum to Project Gasbuggy Planning and Program Directive Dated August 1967, Covering the Activities Involved in Drilling, Coring, Logging and Testing of Well GB-3. (Nevada Operations Office (AEC), Las Vegas.) August 21, 1969
- NVO-1163-      Observed Ground Motion Data, Project Gasbuggy, Interim Report.  
144 Draft      (Environmental Research Corp., Alexandria, Virginia. May 17, 1968
- NVO-1163-      Summary Report of Predictions: Gasbuggy Event. (Environmental  
124      Research Corp., Alexandria, Virginia). November 1, 1967
- UCID-15132      Acceptability of the Gasbuggy Site. Rawson, Donald E.;  
Korver, John A. (California University, Livermore. Lawrence  
Radiation Lab.) April 12, 1967
- UCID-15132      Addendum Acceptability of the Gasbuggy Site: Addendum. Rawson,  
Donald E.; Korver, John A. (California University, Livermore.  
Lawrence Radiation Lab.)
- UCID-15136      Preoperational Report, Project Gasbuggy: Gas Quality Analysis and  
Evaluation Program. Smith, C. F. (California University, Livermore.  
Lawrence Radiation Lab.) March 31, 1967
- UCRL-50812      Gasbuggy Postshot Hydrologic Investigations in GB-3. Korver, J. A.  
(California University, Livermore. Lawrence Radiation Lab.) March 9,  
1970
- UCRL-72112      Interpreting the Chemical Results of the Gasbuggy Experiment.  
Preprint      Taylor, R. W.; Lee, E. L.; Hill, J. R. (California University,  
Livermore. Lawrence Radiation Lab.). July 11, 1969
- UCRL-50480      Motions of Earth Fill Dams During the Gasbuggy Event. Power, Dean  
V. (California University, Livermore. Lawrence Radiation Lab.).  
August 1968
- SWRHL-100r      Environmental Surveillance for Project Gasbuggy Production Test  
Phase. (Public Health Service, Las Vegas, Nevada. Southwestern  
Radiological Health Lab.). June 1970
- SWRHL-105r      Project Gasbuggy Off-Site Radiological Safety Report GB-2R Phase I  
Program. (Public Health Service, Las Vegas, Nevada, Southwestern  
Radiological Health Lab.). July 1970
- ORNL-TM-      First Quarterly Progress Report on the Theoretical Safety Evaluation  
2427      of Consumer Products from Project Gasbuggy. Jacobs, D. G.; Struxness,  
E. G.; Kelly, M. J. (Oak Ridge National Lab., Tennessee) February  
1969

- ORNL-TM- Quarterly Progress Report on the Theoretical Evaluation of Consumer Products from Nuclearly Stimulated Gas Wells. (Oak Ridge National Lab., Tennessee). February 1969
- ORNL-4646 Theoretical Evaluation of Consumer Products from Project Gasbuggy. Final Report, Phase I: Impact of Hypothetical Releases of Contaminated Gas in the San Juan Basin. Jacobs, D. G., et al (Oak Ridge National Lab. Tennessee). September 1971
- ORNL-4748 Theoretical Evaluation of Consumer Products from Project Gasbuggy. Final Report. Phase II: Hypothetical Population Exposures Outside San Juan Basin. Jacobs, D. G., et al (Oak Ridge National Lab. Tennessee). February 1972
- ORNL-4775 Theoretical Evaluation of Consumer Products from Project Gasbuggy. Final Report. Tritium Behavior in a Natural Gas Processing Plant. Kelly, M. J., et al (Oak Ridge National Lab., Tennessee). July 1972
- ORNL-TM- Theoretical Evaluation of Consumer Products from Project Gasbuggy: 2721 Fourth Quarterly Progress Report. Jacobs, D. C.; Kelly, M. J. (Oak Ridge National Lab., Tennessee). October 1969
- ORNL-TM- Theoretical Evaluation of Consumer Products from Project Gasbuggy: 2513 Second Quarterly Progress Report. Kelly M. J., et al (Oak Ridge National Lab., Tennessee). March 1969
- ORNL-TM- Third Quarterly Progress Report on the Theoretical Safety 2657 Evaluation of Consumer Products from Project Gasbuggy. Jacobs, D. G.; Rohwer, P. S; Cowser, K. E. (Oak Ridge National Lab., Tennessee). July 1969

#### MISCELLANEOUS REPORTS

- AFSWC Air Support for Project Gasbuggy, January 31, 1968: Final Report. (Air Force Special Weapons Center, Kirtland AFB, New Mexico). January 31, 1968
- CGS-E-124 Seismic Safety Net: Project Gasbuggy. (Coast and Geodetic Survey, Las Vegas, Nevada. Special Projects Party). February 29, 1968
- Climatological Data-Project Gasbuggy. (Environmental Science Services Administration, Las Vegas, Nevada. Air Resources Lab). April 1967
- Comparison of Isotopes, Inc. and LRL Results of Gasbuggy Samples. Shutz, Don (El Paso Natural Gas Co., Texas). September 12, 1968
- Gasbuggy Preshot Symposium. (California University, Livermore. Lawrence Radiation Lab.). September 19, 1967
- Gasbuggy Production Test Data. 1968-1969. (El Paso Natural Gas Co., Texas)

Monero, New Mexico (Las Vegas Structure Condition Survey). (Blume, John A. and Associates, Research Division, San Francisco, California)

Petrographic Analysis Gasbuggy No. 1 and Gasbuggy No. 3. Pawlowicz, Richard (El Paso Natural Gas Co., Texas). August 1970

Post-Mortem Review--Gasbuggy Event, Part II, Administration, Support & Financial History. (California University, Livermore. Lawrence Radiation Lab.). May 29, 1968

Preliminary Report: Structural Condition Survey of Mines and Tunnels, Project Gasbuggy (Predetonation). Williams, Frank E. (Bureau of Mines, Denver, Colorado)

Preliminary Safety Study of Gas Wells and Facilities in the Project Gasbuggy Area. Ward, Don C. (Bureau of Mines, Bartlesville, Oklahoma, Bartlesville Petroleum Research Center). September 1967

Preliminary Safety Study of Gas Wells and Facilities in the Project Gasbuggy Area. Ward, Don C. (Bureau of Mines, Bartlesville, Oklahoma. Bartlesville Petroleum Research Center). June 1967

Preliminary Safety Study of Gas Wells and Facilities in the Project Gasbuggy Area. Ward, Don C. (Bureau of Mines, Bartlesville, Oklahoma. Bartlesville Petroleum Research Center). Revised September 1967

Preshot and Postshot Structural Condition Survey of Mines and Tunnels, Project Gasbuggy.. Williams, Frank E. (Bureau of Mines, Tucson, Arizona)

Preshot Symposium on the Gasbuggy Experiment, ELks Club, Farmington, New Mexico, September 19-20, 1967

Project Gasbuggy: Planning & Program Directive. (Nevada Operations Office (AEC), Las Vegas). August 1967

Project Gasbuggy Planning Directive. (Nevada Operations Office (AEC), Las Vegas). February 1967

Project Gasbuggy Planning Directive-PL-1-2-67. (Nevada Operations Office (AEC), Las Vegas). February 1967

Preshot Symposium on the Gasbuggy Experiment, ELks Club, Farmington, New Mexico, September 19-20, 1967. Holzer, F. (California University, Livermore. Lawrence Radiation Lab.) 1967

Project Gasbuggy Summary Logs. (El Paso Natural Gas Co., Texas). Includes:  
No. 1 Schlumberger--Casing Collar Locator.  
No. 2. Birdwell--3-D Velocity Log.  
No. 3. Birdwell--Nuclear Cement Top Locator (NCTL) 2 runs (SC 137 source).  
No. 4. Sperry-Sun-Directional In and Out.

Project Gasbuggy: Technical Program-Reservoir Evaluation. (Bureau of Mines, Washington, DC) (El Paso Natural Gas Co., Texas). September 10, 1965

Project Gasbuggy: Well Test Data. (El Paso Natural Gas Co., Texas). February, September 1967

SC-TM-67-3030 Free-Field and Surface Ground Motion in the Vicinity of Project Gasbuggy: Preliminary Data Report. Perret, William R. (Sandia Labs., Albuquerque, New Mexico). January 1968

Status Report on the Three Nuclear Experiments for Stimulation of Tight Gas Sands. Luetkehans, Gerald R., Joman, John. (CER Geonuclear Corp., Las Vegas, Nevada). 1976

Summary of Geological Data Obtained from Borehole GB-1, Project Gasbuggy. Fassett, James E. (Geological Survey, Albuquerque, New Mexico). nd, 24-27 pp, illustrations

Summary Minutes of the Initial Meeting of the Project Gasbuggy Joint Planning Group, held at the Nevada Operations Office, October 7, 1965. (Nevada Operations Office, Las Vegas). October 7, 1965

Test Group Director's Operational Plan: Project Gasbuggy. (California University, Livermore. Lawrence Radiation Lab.). December 1, 1966 (SDK 66-41)

**APPENDIX F**  
**DOE MATERIAL AND EQUIPMENT INVENTORY**

# APPENDIX F

## INVENTORY PLANT AND EQUIPMENT

Material and equipment received from Eberline Co.--Gasbuggy Project, Farmington, New Mexico, October 5, 1978, and October 8, 1978, respectively.

<u>Item and Description</u>	<u>Unit</u>
Tubing, 2 3/8" 4.7	134 Joints A-23
Tubing, H.D National 12", Series 900 X 8"	1 Ea.
Tubing hanger and sub 8", Series 900	1 Ea.
Shaffer B.O.P., Type 45 Manual with 10" Series 200 Top Flange and 10" Series 600 Bottom Flange with Ells	2 Ea.
Shaffer Tubing HD Type YB 10" Series 900 x 6" Series 900 with 2-4" Series 900 Outlets 45 Degrees	1 Ea.
Shaffer Flow Seal Valves, 4" Series 900 with Wheel, 21"	2 Ea.
Shaffer Flow Seal Valve, 2" Series 600 with Wheel, 14" with 6" x 2" Thd. Studded Bonnet Fl. Series 900	1 Ea.
Cameron 2 1/2" WKM/ACF Upper Master Gate Valve	1 Ea.
2 1/2" WKM/ACF Wing Valve	1 Ea.
Drums (Black) F&S Office Supplies	2 Ea.
Tubing 2 7/8" 6.5 # J-55 Eve	91 Joints
Steam Generator Texsteam Corp. Serial No. 590 YR1969 Houston Tex USAEC 76746	1 Ea.
1" Galv. Pipe, Fittings (4 Valves)	250' Approx.
ACME Fresh Air Blowers Model 4107 USAEC 168011/167927	2 Ea.



Hose with Fittings, 50' lengths	4 Ea.
Full Face Respirators	4 Ea.
Hose, Red High-Pressure 1" x 8' 1" x 16' 1" x 18'	1 Ea.
Spool, 10" Series 900 Top Flange x 10" Series 900 Bottom Flange (attached to Shaffer B.O.P.)	1 Ea.
GB-ER Wellhead Components 10" Series 900 Double Studded	1 Ea.
10" Series 900 x 10" Series 600 Flanged Spool	1 Ea.
10" Shaffer Single Gate B.O.P.	1 Ea.
Cameron Type "F" Tubing Head 6" Series 600 x 10" Series 600	1 Ea.
Tubing Head Bonnet 6" Series 600 x 2 1/2" Series 600	1 Ea.
Cameron Type "FBA" Tubing, Hanger with 2 1/2" EVE 8 RD Threads Top and Bottom	1 Ea.
Upper Tree Assembly 2 1/2" x 29/16" Cameron Type "F" Master Gate Valves	2 Ea.
Steam Gen. Pump--Cat Pump Model 0500	1 Ea.
Drums, Metal (Black) (to burial at NTS--contaminated soil)	9 Ea.
Tubing 2 5/8" 4.7 8 RD Thread	22 Joints

## APPENDIX G

### DISTRIBUTION LIST

K. N. Frye, Dir., Office of Oil, Gas & Shale (FE-30)  
T. R. Clark, Mgr., NV  
R. D. Duncan, Deputy Mgr., NV  
R. C. Amick, Chief Counsel, NV  
R. W. Taft, AMEC, NV  
J. R. Gilpin, AMA, NV  
R. M. Nelson, AMD, NV  
J. H. Dryden, Dir., NTSSO  
D. F. Miller, Dir., OPA, NV  
G. M. Plummer, OPAT, NV (20)  
B. W. Church, Dir., HPD, NV (2)  
P. J. Mudra, Dir., OSD, NV  
J. B. Cotter, Dir., EAD, NV  
D. N. Canfield, EPNG, El Paso, TX  
C. E. Matthews, EPNG, EL Paso, TX  
J. A. Cross, Mgr., F&S, Las Vegas Branch (2)  
A. E. Doles, Eberline Instr. Corp., Santa Fe, NM (2)  
J. Crellin, Forest Supervisor, Carson National Forest, USFS, Taos, NM (2)  
J. Long, USGS, Durango, CO (2)  
W. Green, District Ranger, Jicarilla Ranger Sta., Gobernador Route, Blanco, NM (2)  
L. B. Ballou, LLNL, Livermore, CA (2)  
C. F. Costa, EPA-EMSL, Las Vegas, NV  
TIC, Oak Ridge, TN (27)